Collegial Forms of Implementation of Directionality in National Innovation Strategies

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Abstract

The normative turn that occurred as a result of radical reforms in science, technology, and innovation policies in various countries has sparked a broad discussion around the "directionality-neutrality" dilemma in science, technology, and innovation (STI) development strategies. However, despite a number of recent publications and science and innovation policy programs, the relationship between these two principles, including the practice of their application by government agencies, remains understudied. A representative analysis (using qualitative methods) of the two national STI councils and their role in strategy development, focusing on the process of approach selection and its value orientation, will fill this gap. On the basis of the collected information and scientific literature, the connection with different policy options is identified. It is shown that the role of the councils is determined by their powers and resources and the boundaries of relevant practices and directions for further research are outlined.

Keywords: directionality; STI strategy; national policy councils; innovation policy; research policy

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Introduction

Organizations commonly aim to fulfill long-term objectives by defining strategies, sticking to the path they defined, and after a few years, they assess their advances and refresh their goals. These strategies are a customary step in positioning the definitions of medium to large companies and non-governmental organizations. However, experiences with different outcomes have shown that for many reasons, ranging from ideological to practical, it is not evident that countries and their successive governments should create and follow a strategy for their development. However, one of the fields emerging more clearly in the past century to be steered by a strategy is industrial policy[1] (Borrás, Edquist, 2019). This domain has seen a revival in the past decades and is currently considered mainstream, reaching its fourth wave (Andreoni, Chang, 2019). In this context, directionality – understood in this field as the ability to identify strategically oriented areas of opportunity for progress, while positioning, devising, and acting toward their achievement – of the innovation systems seems to emerge as part of a third wave of industrial policy, which highlights the relevance of internal competition and cooperation, institutions for policy implementation, and producers' learning processes (Andreoni, Chang, 2019).

The discussion on directionality has recently become the focus of Science, Technology, and Innovation (STI)[2] Policy. When approaching these three ideal types of policy domains, though, their definitions have not necessarily affected them in the same way. Science policy has demonstrated a mostly neutral approach regarding specific areas or sectors, and technology policy has experienced a highly directional basis, while innovation policy has shared different realities between countries and times (Lundvall, Borrás, 2005). These definitions put a new burden on governments' capacity to call for a broad exercise of governance to enhance their strategic, inspiring, and coordination roles (Boon, Edler, 2018). In particular, for the case of specific strategies, this process is reinforced by addressing rationales that could be defined as systemic and evolutionary, due to the role of policymakers as *organizers* rather than *planners*, with a specific approach to networks and sectors (Laranja et al., 2008).

The relevance of studying the specific STI strategies that countries develop to foster progress lies at the roots of the National Innovation Systems approach. Since knowledge is a *fundamental resource* embedded in the institutions of a given country, and these institutions and systems are inherited and evolve with them, these new strategies provide fresh guidelines for the system and the development of its components (Acs et al., 2017). In the definition of STI strategies – under the umbrella of '*isomorphic pressures*' (Irwin et al., 2021) – National Policy Councils (NPCs) for Science, Technology and Innovation (STI) are becoming one of the common responses that governments have implemented to achieve better levels of societal coordination and governance for STI policy. Strategic definition often has to address prioritizing among different lines of work, either by their nature, objectives, instruments, or outcomes. One of these definitions, regarding a non-neutral approach toward an object or subject, is commonly termed '*directionality*'. Following this notion, the science, technology, and innovation strategies[3] for specific areas, sectors, or regions are becoming a mandatory policy instrument for countries and territories in the context of increased attention to directionality. Some efforts are underway to define Missions[4] (Mazzucato, 2018), or Grand Challenges (Kuhlmann, Rip, 2018), or address the dimensions of Responsible (Research and) Innovation (Stilgoe et al., 2013), and in some cases also to identify their potential and develop strategies for smart specialization (Capello, Kroll, 2016), among other discussions and challenging the current trends about the governance of socio-technical systems and the role(s) of the state (Borrás, Edler, 2020).

However, there is some academic consensus that this governance is an understudied subject (Borrás, Edler, 2014; Edler, Fagerberg, 2017). Meanwhile, despite some individual efforts, the role of councils within this governance has not appeared to gain scholarly attention yet. In this context, despite the increasing interest in NPCs, there is little evidence about how these organizations relate to one another within their national innovation systems, and how the councils shape (or are shaped by) the national strategies for STI definition. The definition of strategic priorities is commonly highlighted as one of the more common tasks of an NPC for STI. For instance, 74% of the OECD countries have councils (Borowiecki, Paunov, 2018). However, given the highly prescriptive nature of the innovation studies field (Flanagan, Uyarra, 2016) and STI policy's description of the *modus-operandi*, the implementation stage of these processes typically falls short (Breznitz et al., 2018). This happens even when the definitions surrounding the aforementioned topics challenge the different levels of STI policy and their coordination profoundly (Lindner et al., 2016).

[1] There is some scholarly discussion about how and whether the concepts of innovation policy, industrial policy, science policy, technology policy, or research policy address different topics (Edler, Fagerberg, 2017). Disentangling this problem lies beyond our scope here, but we recognize that most of them are policy domains on their own and overlap among them is evident.

[2] Treated commonly together, in the last few years this was defined as Research and Innovation Policy in most countries, STI policy has been considered a common and unique policy domain (Edquist, 2018).

[3] These strategies may share some commonalities with the renowned concept of *clusters* developed by Michael Porter (Porter, 1998), recently addressed in this context by Wilson et al. (Wilson et al., 2022), but should not be confused with this since critical features of the latter concept – such as its advantages, the concentration of actors, or the focus on productivity – may or not be active in the areas defined in this case.

[4] For a detailed approach to the concepts of missions, challenges, and responsible research and innovation, please refer to (Flink, Kaldewey, 2018).

In such a context, this article aims to shed light on how National Policy Councils, a specific type of organization for STI, conduct one of their canonical tasks: to provide advice for STI strategies. From an inductive perspective, as is customary in this academic field (Martin, 2012), we face some challenges encountered by others in the Innovation Studies field regarding the directionality of innovation (Martin, 2016). The specific objectives of this document are:

- To illustrate the role of two different types of National Policy Councils for STI in the strategy-making process for research and innovation areas derived from a strategic selection process.
- To compare the policy options derived from the governance process within which the NPCs participate, stressing the relevance of the NPCs' organizational design for their role in the strategy-making process.

An exploratory and descriptive comparative case study between two NPCs for STI was conducted to fulfill our research aims. The chosen cases were Chile and Spain due to their councils' participation in the definition of their specific STI strategies for Risk Disaster Resilience and Artificial Intelligence, respectively. The methodological approach included interviews with the members of both councils and a secondary data review.

Definitions and Theory

In this section, we present the theoretical frameworks underpinning this research. These frameworks are divided between the object approach of the National Innovation Systems and NPCs for STI and the intra-disciplinary approach of the study of strategies and their focus in science, technology and innovation.

National Innovation Systems and the National Policy Councils for Science, Technology and Innovation.

The complexity involved in the National Innovation Systems, derived from the number of actors and interconnections (Edquist, 2005), implies a need for coordination. The common objectives for science, technology, and innovation require a long-term coordinated strategy to approach their potential. Moreover, governments and innovation policies are increasingly concerned about how to address societal challenges and no longer exclusively focused on economic goals (Fagerberg, 2017). Following this, the canonical organization of National Policy Councils for Science, Technology, and Innovation has often been presented as means for more coordination in innovation policy (Foxley et al., 2015; Edler, Fagerberg, 2017), particularly for the objective of setting long-term direction and coordination (Fagerberg, Hutschenreiter, 2020).

STI policy organizations require more in-depth understanding. Previous works have established the foundations of modern research on the types of organizations for STI. At an operational level, the classification of research agencies according to their position within the state, their task distribution, and their organizational forms has been proposed (Lepori, Reale, 2019). Similar work has been performed on the innovation agencies and the scope and nature of the innovation fostered by them (Breznitz et al., 2018). Further, a taxonomical study of Public Research Organizations according to organizational dimensions such as structural characteristics, resource niches, and claims of identity, has been performed (Cruz-Castro et al., 2020). On a strategic level, an empirical map and a classification based on the structural characteristics of NPCs for STI, built on some of the characteristics highlighted in previous classifications, have been proposed (Schwaag-Serger et al., 2015; OECD, 2009; OECD, 2018), while addressing the black-boxed and unproblematic approach commonly developed for NPCs (Cevallos, Merino-Moreno, 2020). On the other hand, qualitative approaches have been discussed for case studies based on the experience of the former Finnish Science and Technology Policy Council (STPC) (Pelkonen, 2006), the Swedish National Innovation Council (NIC) (Edquist, 2018), and partial looks at other councils of Finland and Sweden (Fagerberg, Hutschenreiter, 2020). Further, a case study focusing on a comparison between the councils of Chile and Spain was conducted (Cevallos, Merino-Moreno, 2021).

Strategy and Directionality

As mentioned in the introduction, NPCs commonly participate in STI strategy definition for their countries. The objectives of an STI strategy were defined by the OECD a few years ago:

> '*First, they articulate the government's vision regarding the contribution of STI to their country's social and economic development. Second, they set priorities for public investment in STI and identify the focus of government reforms (e.g., funding of university research, evaluation systems). They also mobilize STI actors around specific goals (…) Third, the elaboration of these strategies can engage stakeholders (the research community, funding agencies, business, civil society, regional and local governments) in broad consultations that will help building a common vision of the future and facilitate coordination within the innovation system.*' (OECD, 2014)

These strategies may have different scopes of action, such as geographic focus (supranational-national-regional-local), economic level (overall, industries-based, technologies-based), impact level (overall, scientific, technological, economic, social), sources (supply-oriented, demand-oriented, or both), timeframe (based on past experiences or future expectations), and other features. In line with the second characteristic mentioned by the OECD, the STI strategies come to prioritize some activities over others, either explicitly or implicitly, with this non-neutral approach being called 'directionality' (as has been presented in previous sections). Directionality has been regarded by scholars of the field such as Mariana Mazzucato as one

of the two main characteristics of innovation policy, affirming that "Innovation has not only a rate but also a direction" (Mazzucato, 2018) that allows governments to develop innovation-led growth (Mazzucato, 2015) which is "smarter", "inclusive", and "sustainable". At the same time, directionality has been indicated as one of the potential failures that drive the most recent feature of innovation policy, *transformative change* (Weber, Rohracher, 2012).

In this sense, directionality has often been linked with the notion of collective priorities by Schot and Steinmuller in their review of the frameworks of innovation policy, saying that "the transformative change frame takes the question of direction as a starting point and requires a process for setting collective priorities" (Schot, Steinmueller, 2018), as well as by Chaminade et al. when they said "directionality refers to the need to articulate collective priorities and the direction of change" (Chaminade et al., 2018). This definition of the collective priorities may be either based on the selection process for the areas to be addressed by specific STI strategies, or in the definition of the aims and expected outputs of these strategies. Furthermore, the relationships and definitions of the directionality concept are broad enough to aim for multiple target dimensions of interest, such as priorities between areas, sectors, levels, processes, populations, or organizations, among others.

As presented by Daimer et al., in the context of the *normative turn*, challenge-driven innovation activities should be characterized as displaying features such as socio-technical, systemic, transition-oriented, experimental, *glocal*, transdisciplinary, and participatory elements, in order to fulfill the new requirements of these orientations (Daimer et al., 2012). In this scenario, the connections between NPCs for STI – as a device to implement governance for STI – and STI strategies are multiple, since as highlighted by Borowiechi and Paunov, from the evidence in the RESGOV database, 74% of OECD countries considered in the survey that have a council and answer positively to the question regarding the participation of the council in developing national strategic priorities.[5] Furthermore, in this subset of countries, these documents may have a specific focus to address the current issues of directionality:

> *'Science, technology, and innovation (STI) strategies or plans are in place in most countries (33 of 35, 94%). These commonly define STI strategies to address major societal challenges (30 of 33, 91%). Key themes include sustainable growth, health, and effi-*

Table 1. **Evidence of directionality in national STI strategies or plans for OECD countries**

2.6. Does the national STI strategy or plan address any of the following priorities? Specify whether another more dedicated strategy (e.g. a specific plan) covers these topics?*	Number of positive answers	Percentage of the respondents
a) Specific themes and/or societal challenges (e.g. Industry 4.0; 'green innovation'; health; environment; demographic change and wellbeing; efficient energy; climate action)	30	86%
a_2) Demographic change (i.e. ageing populations, etc.)	14	40%
a_3) Digital economy (e.g. big data, digitalisation, industry 4.0)	25	71%
a_4) Green economy (e.g. natural resources, energy, environment, climate change)	27	77%
a_5) Health (e.g. Bioeconomy, life science)	28	80%
a_6) Mobility (e.g. transport, smart integrated transport systems, e-mobility)	16	46%
a_7) Smart cities (e.g. sustainable urban systems urban development)	16	46%
b) Specific scientific research, technologies and economic fields (e.g. ICT; nanotechnologies; biotechnology)	31	89%
b_2) Agriculture and agricultural technologies	18	51%
b_3) Energy and energy technologies (e.g. energy storage, environmental technologies)	27	77%
b_4) Health and life sciences (e.g. biotechnology, medical technologies)	29	83%
b_5) ICT (e.g. big data, digital platforms, data privacy)	29	83%
b_6) Nanotechnology and advanced manufacturing (e.g. robotics, autonomous systems)	24	69%
c) Specific regions (e.g. smart specialisation strategies)	23	66%
d) Supranational or transnational objectives set by transnational institutions (for instance related to European Horizon 2020)	20	57%

* Part of the answers to the question 2.6 of the REGOV questionnaire: '2.6. Does the national STI strategy or plan address any of the following priorities? Specify if another more dedicated strategy (e.g. a specific plan) covers these topics. Please refer to the main STI strategy. If additional strategies address the following issues, please provide further information on them. a) Societal challenges a_1) Which priorities b) Scientific research, technologies, and economic fields b_1) Which priorities c) Regions c_1) Which priorities and regions d) Supranational or transnational objectives d_1) Which priorities e) Quantitative targets for monitoring and evaluation

Source: OECD RESGOV DATABASE. https://stip.oecd.org/resgov/, accessed 02.09.2022.

[5] Broadly, the role of Councils in STI strategies for specific areas can help to cope with at least three of the transformational system failures defined by (Weber, Rohracher, 2012), 'directionality' in order to aim for a specific position of transformative change, 'policy coordination' regarding the alignment of efforts that governments can enact with their policies and instruments, and 'reflexivity' as the capacity to monitor and assess the development of the initiatives for transformative change.

cient transportation systems. STI strategies and plans also define specific scientific research, technologies or economic fields of national priority (31 of 33, 94%). In 23 of 32 countries (72%), STI strategies address specific sub-national priorities for specific federal states or regions, reflecting for EU member states and partner countries Smart Specialisation Strategies.' (Borowiecki, Paunov, 2018).

More detailed information of the responses is available in Table 1.

Methodology and Case Selection

In this section, the first subsection will illustrate this study's methodology and the next two subsections will present each of the selected NPC cases and their roles in the development of specific STI strategies.

Methodology

This methodology coincides with that of Yin, following the COSMOS Corporation vision of a research design about an organization and a source for data collection from individuals (how the organization works) and the organization (organization outcomes) (Yin, 2003). The case selection process follows a *polar types* criteria (Eisenhardt, Graebner, 2007), also known as *two-tailed* (Yin, 2003) or *diverse* (Seawright, Gerring, 2008) criteria, by using the differences among the subjects to identify their features. This is based on the empirical results obtained from the iNPC index (Cevallos, Merino-Moreno, 2020), selecting one *strong* council with a high level of potential according to their structural capacities and one *agile* council with a low level of potential due to their capacities complying with the extreme versions of this type of organization for STI.

The selected councils are the National Council of Innovation for Development (CNID) of the Republic of Chile as a representative of a potential[6] transformative council, and the Advisory Council for Science, Technology and Innovation (CACTI) of the Kingdom of Spain as a representative of a potential agile council. To compare these councils, their information is synoptically consolidated in Table 2. The development of these strategies coincided in both cases with governments with a center-left political orientation. Furthermore, the STI strategies selected are different in terms of the area under consideration but also in their scope of action. Respectively, these are local initiatives in Chile for an initially endemic challenge that has the potential to position the country on the international stage, and global in the case of Spain for a widespread opportunity that is being tackled by several countries around the globe. This strategy selection process followed a selection was based on their representativeness for the STI Strategy for Natural Disasters Resilience (NDR) of Chile, and also for the unique case of the STI Strategy for Artificial Intelligence (AI) of Spain. For comparison purposes, while it would have been ideal to review the same strategy in each country[7], due to the timing, the idiosyncratic nature of this definition, and the value embedded in the comparison of these two extreme types of councils, different sectoral strategies were considered. This information is summarized in Table 3.

TThe data collection methodology used to gather the presented information comprises primary data obtained in individual semi-structured recorded interviews of CNID and CACTI councilors (more information in Table 2) regarding the general operation of NPCs and directionality and, in some cases, addressing the role of the NPC regarding the specific strategy explicitly. These interviews were conducted between the years 2018 and 2019 and were complemented by secondary data reviewed from relevant documentation such as laws, decrees, and reports regarding each of the councils. The interviews consisted of ten councilors from CNID and five from CACTI, and were performed in Santiago de Chile and Madrid (more information in Table 4).[8] The choice regarding the councilors as a primary source is based on the information they have as part of the organization and the fact they are familiar with its internal operations and also have a background as part of the community sensitive to the outcomes and products of the council. These insights make the councilors ideal sources for the aims of this research, illustrating the NPCs' role in the process of a specific strategy and comparing the policy options derived from different organizational settings.

The Chilean Council of Innovation for Development and the STI Strategy for Natural Disasters Resilience

The Chilean Council of Innovation for Development (CNID)[9] was established in the year 2005 by Presidential Decree as an advisory council for the Chilean presidency.[10] Since then it has had five clearly defined stages of development with unique compositions and mandates. The first stage lasted only for a few months and set the organizational and conceptual basis for the Council starting in March 2006 with the newly elected government. In this first complete presidential term, the Council had two stages (2006-2008 and 2008-2010)

[6] The notion of 'potential' rests on the fact that the classification is based on empirically observable structural characteristics and not on the councils' actual performance, since there are no obvious strategies with which to measure their results.

[7] At document closing time, the Presidency of the Republic of Chile mandated the New Ministry of Science, Technology, Knowledge, and Innovation to have a discussion on the Artificial Intelligence STI Strategy, following a very similar path as that demonstrated by Spain.

[8] The design of the data collection process did not force the interviews to be held in capital cities, but due to the availability of the councilors, they ended up occurring there.

[9] Formerly Innovation for Competitiveness (CNIC) until 2014.

[10] Ministerio de Hacienda de la República de Chile, 2005. *Decreto n°1408: Crea comision asesora presidencial consejo de innovacion para la competitividad*. https://vlex.cl/vid/asesora-presidencial-competitividad-241643950, accessed 15.04.2022.

Table 2. **Comparison of the Structure of CNID and CACTI**

Chilean Council of Innovation for Development (CNID)			
Executive Capacity			
Council´s Role	Joint Planning	Coordination	Advice
Executive´s Role	Involvement of the Top Level	Involvement of the Ministries Level	Involvement of the Upper Management Level
Coordinative Capacity			
Composition	Government Officials (4) Ministers of Finance, Economy, Education, and Agriculture, or their representatives.	Outstanding Personalities (14) One of them is appointed President of the Council by the government with partial dedication.	Representatives of Society (Stakeholders) (2) One vice- president for research from the universities and one expert in vocational training from the Vocational Schools, both in consultation with the Ministry of Economy.
Resources	Funding for Institutionalization	Funding for Studies	Funding for Logistics
Spanish Advisory Council for Science, Technology and Innovation (CACTI)			
Executive Capacity			
Council´s Role	Joint Planning	Coordination	Advice
Executive´s Role	Involvement of the Top Level	Involvement of the Ministries Level	Involvement of the Upper Management Level
Coordinative Capacity			
Composition	Government Officials	Outstanding Personalities (10) One of them is elected President of the Council by the councilors	Representatives of Society (Stakeholders) (4) Two representatives of the central business confederations and two of the main Unions.
Resources	Funding for Institutionalization	Funding for Studies	Funding for Logistics

Source: authors.

characterized by the definition of a National Strategy for STI and strategic selectivity.[11]

The next phase (2010-2014) coincided with a new government that had a different political orientation, and this was a time of revisionism and future thinking. The final stage of CNID spans between the years 2014 and 2017, again under a different coalition government (the same one that established the CNIC), when it became a Council for Development rather than Competitiveness, with the purpose of explicitly social innovation for national welfare. In the year 2018, a new governmental institutionalization for STI was approved, under the same administration as in 2010-2014, leaving the Council partially on hold until the new organizations were to be deployed in the year 2020.

CNID has a mandate over the policy domains of science, technology, and innovation, aiming to encompass efforts toward these goals. The Executive Power is involved at the highest level in leading the Council, not by participating in the discussions but rather by defining the overarching goals and expected advice from the Council. The presidency scheduled a few meetings with the whole Council during the presidential term and mostly developed a fluid connection with the President of the Council, who was appointed and trusted by the government with access to its capacities and political vision. The role of the Council is to advise the Presidency, and its aims are divided among specific products (such as reports on relevant issues) and the creation of a social currency that goes beyond the government and the Council concerning themes of interest. CNID is composed of ministries, outstanding personalities from the fields of science, technology, innovation, education, and socially oriented NGOs, representatives of stakeholders, and finally government agency chair-people as guests. This composition of the Council is supported by a Secretariat with funding to provide administrative and professional support, and also with a mandate to command a few external studies per year.

Since its reconfiguration in 2014, the CNID received a presidential mandate to discuss a new regime for STI broadly. Among the definitions of the strategical agenda, the Commission highlighted the need to 'Concentrate efforts in prioritized areas' and suggested that three areas be prioritized during that presidential term.[12] This was a shift compared to policy in recent years, since a 2017 study on Chilean national investment in STI highlighted the prior ten-year period, in which government spending had a neutral approach

[11] For this definition process, CNID (at that time CNIC) hired the assistance of the Boston Consulting Group (BCG). After the delivery of the BCG reports, including an iteration process and involvement of CNIC, CNIC started the implementation of this selectivity as a National Cluster Policy (Benavente et al., 2017). This strategy of introducing neutrality of interests due to the incorporation of an external party was followed by other Latin American countries (Fernandez-Arias, Stein, 2014). However, this process did not last long because of the end of the presidential term and the change in government, with a new government focused on neutral policies (*Ibid.*). Despite the long-term strategic perspective that is intended to be given to these areas, the role of different administrations' political orientations do not seem innocuous in these definitions.

[12] http://www.sur-austral.cl/comision-presidencial-ciencia-para-el-desarrollo-de-chile-entrega-informe-un-sueno-compartido-para-el-futuro-de-chile/, accessed 15.04.2022.

of 70% on average, with the remainder mainly associated with a sectoral focus in lieu of a strategical one (Balbontín et al., 2018). For analytical purposes, in the remainder of this document, we will focus only on the Resilience for Natural Disasters proposal due to its uniqueness and the relevance of the field for the country, which has highlighted its position on the subject as a Natural Laboratory (NL) (Guridi et al., 2020).

For the timeframe relevant to defining the strategy, the CNID was located on the strategic level of public organizations for STI policy. At the same time, the Education and Economy ministries mainly occupied the political level. Finally, the operational level of STI policy encompassed a research agency, *Comisión Nacional de Investigación Científica y Tecnológica (National Commission for Scientific and Technological Research, CONICYT)*, an innovation agency, *Corporación de Fomento de la Producción (Production Development Corporation, CORFO)*, a myriad of independent public research and/or technological institutes, and several autonomous public universities (considerably fewer than private universities), largely covering the regional gradient and with a slight concentration on the metropolitan area (as the population is also concentrated).

The Spanish Advisory Council for Science, Technology, and Innovation and the STI Strategy for Artificial Intelligence

The Spanish Advisory Council for Science and Technology (CACT) was established in line with the Law for the Promotion and General Coordination of Scientific and Technical Research.[13] In this law passed well over thirty years ago, the Spanish state acknowledged the relevance of the bond with stakeholders for science and technology, specifically those from the private sector and scientific communities, and their work toward the socially desirable development of their activities. Regarding the composition of CACT, as specified in the law it was first chaired by the Minister of Industry and Energy and then by the Minister of Science and Technology, and as defined by successive modifications in Royal Decrees[14], councilors from public and private research organizations, innovative enterprises, business confederations, unions, and government officials. The studied Spanish Advisory Council for Science, Technology, and Innovation[15] was considered in the Law for Science, Technology, and Innovation promulgated in 2011.[16] This law crystallized the position of the Council[17], with the possibility provided for them to intervene in the strategical process of STI and act as a bridge for society to influence these policy domains (Díez-Bueso, 2013).

CACTI has been mandated to coordinate the policy domains of science, technology, and innovation. The role of the government is at a low commitment level, acting as a counterpart for the Council by giving it inputs and receiving their outputs. The hierarchy within the Council is defined by the conforming councilors, who elect a president in charge of coordination with the executive branch and a vice-president to provide support. The aims of the Council mainly concern carrying out their advisory role on specific products, such as the National Plan for Research and Innovation, the National STI Strategy, specific calls, and other policies and instruments. The official composition of the Council lacks governmental representatives and guests, since it exclusively considers outstanding personalities and stakeholders' representatives from businesses and unions. The Council does not have administrative and professional support but has the resources of the Ministry if needed since, in practice, a government official acts as the secretary of the council.

The Spanish STI strategy designed for the 2013-2020 period stressed the importance of being aligned with European STI efforts, specifically by supporting the objectives of the Innovation Union, the European Research Area, and the Framework Program Horizon 2020. This strategy defined as one of its objectives the 'STI support towards the societal challenges', outlining eight grand challenges that encompass research and innovation and intersectoral and multidisciplinary collaboration to receive societal returns in the medium and long term.[18] Coincidently, Artificial Intelligence has also been in the sights of the European Commission[19], highlighting it as one of the most strategic technologies of the century, and recognizing the need for a coordinated approach among European nations to face its challenges (European Commission, 2018).

For the time period in which the aforementioned strategy was defined, the strategic and political levels of the STI policy were blurred, with the renewed Ministry of Science, Innovation, and Universities acting as a *pri-*

[13] Jefatura del Estado. Ley 13/1986, de 14 de abril, de Fomento y Coordinación General de la Investigación Científica y Técnica. 1986 Apr 14. https://www.boe.es/buscar/doc.php?id=BOE-A-1986-9479, accessed 15.04.2022.

[14] Ministerio de Industria y Energia del Gobierno de España, 1987. *Real Decreto 834/1987, de 19 de junio, de regulación del Consejo Asesor para la Ciencia y la Tecnología* (https://www.boe.es/eli/es/rd/1987/06/19/834, accessed 15.04.2022); Ministerio de Industria y Energia del Gobierno de España, 1990. *Real Decreto 1213/1990, de 28 de septiembre, por el que se modifica la composición del Consejo Asesor para la Ciencia y la Tecnología* (https://www.boe.es/buscar/doc.php?id=BOE-A-1990-24507, accessed 15.04.2022); Ministerio de Ciencia y Tecnologia del Gobierno de España, 2001. *Real Decreto 413/2001, de 20 de abril, por el que se regula el Consejo Asesor para la Ciencia y la Tecnología* (https://www.boe.es/buscar/doc.php?id=BOE-A-2001-7796, accessed 15.04.2022).

[15] The concept of *innovation* was added to the Council definitions on this Law.

[16] Jefatura del Estado, 2011. *Ley 14/2011, de 1 de junio, de la Ciencia, la Tecnología y la Innovación. https://www.boe.es/buscar/act.php?id=BOE-A-2011-9617,* accessed 15.04.2022.

[17] Regarding the position of the former Council considered in the previous institutional arrangements.

[18] Ministerio de Economia y Competitividad del Gobierno de España, 2013. *Estrategia Española de Ciencia y Tecnologia y de Innovacion 2013-2020.* https://www.ciencia.gob.es/Estrategias-y-Planes/Estrategias/Estrategia-Espanola-de-Ciencia-Tecnologia-e-Innovacion-2021-2027.html;jsessionid=E9804D291B82B99A578A80C845349989.2, accessed 15.04.2022.

[19] This is part of the complexity faced in the STI policy domains in EU countries and attests to the need for coordination derived from this (Magro et al., 2014).

Table 3. **Case Studies**

Country	Chile	Spain
Type of Council	Strong	Agile
Council	CNID	CACTI
STI Strategy	Natural Disaster Resilience	Artificial Intelligence
STI Activities	Specific activities	
Scope	National	
Problem	Supply, Demand and Interactions	
Source	Top-Down	
Aims	Proposal of a new policy	
Position	Open	
Power	Symmetric relationships	
Temporality	Limited period	

Source: authors, partly following the scheme proposed by (Dutrenit et al., 2017) for dialogue processes about STI.

mus inter pares among the ministries with a prominent role played by the Ministry of Economics, Industry, and Competitiveness. They received the advice of CACTI and coordinated the STI policy with another council, Consejo de Política Científica, Tecnológica y de Innovación (Council for Science, Technology and Innovation Policy). This council is not considered a National Policy Council for STI since it is has a national-regional focus. The high-level government officials and the officials who acted as the representatives of each Autonomic Community participated. The operational level of the STI policy included an agency mainly oriented toward research and development, *Agencia Estatal para la Investigación (State Agency for Research)*, an agency focused primarily on innovation, *Centro para el Desarrollo Tecnológico Industrial (Center for Industrial Technological Development, CDTI)*, several public research and/or technological institutes mainly under the umbrella of *Consejo Superior de Investigaciones Científicas (Superior Council of Scientific Investigations, CSIC)*, and numerous independent public universities (considerably more than private universities).

Results

Following the qualitative methodology supported by the literature for this type of research and explained in the previous section, the results will be presented in three analytical pillars, each a subsection. The first aim is to shed light on the ideological positions of the councilors regarding directionality, which is a relevant input for the two subsections which are more directly related to the objectives of this document: first to illustrate the process of defining the strategies and then to compare their design processes. Finally, one subsection will summarize the topics with an overarching view.

Councilors' positions on directionality

To frame the object of study, the initial analysis involved getting acquainted with the councilors' positions on their ideological definitions regarding directionality. While more specific research could be developed on this subject alone, an initial distinction emerges on approaches to directionality, which remain political for the Chilean councilors but saw a more pragmatic logic of compliance-and-profiting for the Spanish councilors.

> *'I believe that the philosophy of having as a base that a Council will be able to determine 'the five most important things to do' is an incorrect approach and leads to entrenchment'.*
> Chilean Councillor #5

> *'We had a discussion in the context of the report about the state's plan (for STI). Indeed, one of the guidelines is to identify strategic lines, but we did not consider it a priority within the Council'.*
> Spanish Councillor #1

From the previous quotes, the Chilean councilor illustrates the position of some of their Council peers that were not convinced about the role played by a council regarding directionality. Meanwhile, the Spanish councilor presents a new scenario, which is not necessarily choosing which sectors matter – considering the role of the Council – but may be among other levels of interest. In the next quotes, for the case of Chile, the feature of directionality emerges as a possibility with the existence of the Council, albeit in a dilettante approach. At the same time, for Spain it appears to be strongly related to the supra-order of the European

Table 4. **More information about the interviewed councillors**

Councillor	Date of Interview
CNIC/CNID, Chile	
#1	07 Aug 2018
#2	13 Aug 2018
#3	17 Aug 2018
#4	21 Aug 2018
#5	22 Aug 2018
#6	21 Dec 2018
#7	26 Dec 2018
#8	26 Dec 2018
#9	27 Dec 2018
#10	05 Jul 2019
CACTI, Spain	
#1	10 Oct 2018
#2	26 Feb 2019
#3	15 Mar 2019
#4	08 Apr 2019
#5	24 Apr 2019

Note: In case of CNIC/CNID all interviews are taken at Santiago, Chile; and in case of CACTI – in Madrid, Spain.

Source: authors.

Commission regarding the STI matters and its political and economic influx and incentives.

'Before the existence of the Council, prior to 2004, in the public discussion the opportunity to propose strategical areas was vetoed, it had no chance (…) despite some particular projects, when it was raised to some degree of public discussion, you encountered really strong reactions. (…) Basically it (the Council) came to legitimize one governmental choice about those areas, (…) the logic was, well, how the citizens define this area prioritization'.

Chilean Councillor #3

'What is sought (in Spain) is to bring as much as possible of what Europe is willing to put in more quantity, therefore their elections are always telling us they are mediated by what Europe has said'.

Spanish Councillor #5

However, despite their differences, the evidence gathered for this pillar from both councils' positions seem to agree on the role of the council as a consensus device regarding the STI policy, where stakeholder perspectives were discussed and modulated, giving a stamp of legitimacy for the political process related to these matters.

The role of the council in the strategy selection process

Regarding the selection process, for the Chilean case, to comply with the suggestion made by the Commission in 2015 – mentioned in the previous section – the Presidency mandated that CNID propose agendas regarding two highly sensitive issues for Chile: Natural Disaster Resilience and Hydric Resource Sustainability. On the other hand, the Minister for the Economy attended one of the meetings of the Council to ask for a proposal regarding Ports and Tourism. The Mining Ministry also asked the Council to continue with a proposal developed by social organizations and business confederations regarding mining. In Spain, on the other hand, following the roadmap defined by the European Commission to establish a new common platform (i.e., the European AI Alliance) and as a member country, the council was requested to develop its national strategy for Artificial Intelligence before July 2018.

'Once the report about science and development was handed to the President, in that exact same act she acknowledged that there are two big issues that concern us as a country, and we are interested in what science and technology have to say on the subject. The themes of Hydric Resources and of Natural Disasters'.

Chilean Councilor #10

'The Ministry has the commitment, I believe for June or July (2019), to present Europe a strategy for Artificial Intelligence for the country as a member state of the Union. (…) A first document was written and they asked for CACTI's opinion, I do not know if others' opinions were asked'.

Spanish Councilor #4

From the dispositions presented in this pillar, it became clear that despite being part of previous discussions that addressed the topics defined by both governments to enact STI strategies, both councils were not directly part of the definitions, nor did they even engage in the final conversations about the shortlist of themes to prioritize in the domain of STI policy. This secondary level of involvement raises questions about the expected versus real design of the councils' structure and operation, and how the potential benefits in the strategic level of STI policy that these organizations were supposed to bring are exploited.

Council's role in the design process of the strategy

The Chilean CNID broadly convened society to participate in a new commission to develop a National Strategy of STI for Resilience for Natural Disasters (CREDEN). This strategy could be initially labeled as *defensive* since Chile is the OECD country most exposed to natural disasters and one of the most affected nations in terms of casualties and losses of material resources, but their purpose is to use this exposure as a source for innovation. The commission was divided into a central committee and four subcommittees. The initiative was championed by a councilor of the CNID, who worked for several months and delivered a final report by the end of 2016.[20] The document comprised the strategy, policy, and instruments to implement the defined efforts, as well as the definition of the required budget to be used to implement the strategy.

'The commission about natural disasters (…) had an ample discussion, because it is a particular challenge for Chile. (…) In this case, what was heavily employed was the science involved in this regard; because for a big part of the (previous versions of) Innovation Councils the science portion was mainly about natural sciences or engineering, but that I remember the social sciences were not that present (…) however they led the discussion regarding natural disasters, there were many scientists from that background, and also governmental offices (…) it was multidisciplinary, multi-technical'.

Chilean Councilor #7

The Spanish STI Strategy for Artificial Intelligence was developed by the Working Group on Artificial Intelligence (Grupo de Trabajo en Inteligencia Artificial, GTIA) appointed by the General Secretariat of Science Policy Coordination of the Ministry of Science, Innovation, and Universities, outlining the strategic priorities on the subject to be implemented with specific

[20] Comisión Nacional Para La Resiliencia Frente A Desastres De Origen Natural (CREDEN), 2016. *Hacia un Chile Resiliente frente a Desastres: Una Oportunidad*. Santiago de Chile. https://www.cr2.cl/wp-content/uploads/2017/01/INFORME-DESASTRES-NATURALES.pdf, Accessed 03.09.2022..

instruments to be defined in the STI annual plans.[21] According to the report, the comments provided by CACTI were considered in developing the document for this strategy. Resource constraints were indicated as the main restriction limiting a higher degree of involvement in the process.

> *'As a councilor, (…) I contribute to this, but who has to do the charts is not me, because this has to do with some minimal conditions (…) It does not exist, each one collaborates according to their personal inputs (…) we contribute with personal experience but without a structure, so it is really difficult to work. Because you are assessing artificial intelligence documents and, if you do not give me a few days, then I do not have any clue'.*
>
> Spanish Councilor #3

> *'If I have a doubt related to artificial intelligence, given that I am not a specialist, I have plenty of resources to ask experts (…) about their vision. The same thing happens with the rest of the councilors'.*
>
> Spanish Councilor #2

> *'We could not make a document about artificial intelligence because, truth be told, only three or four members of the Council had the capacities and time to form an opinion. (…) It is right that the Ministry did this because we would not have the capacity since we do not have a Secretariat or anything to catch all those people'.*
>
> Spanish Councilor #4

From this pillar, coordination capacity differences emerge as a distinctive feature of the councils' involvement in designing their strategies. The broadly understood deployment of resources on the councils or at other organizations related to STI policy (such as ministries or agencies) may have a particular effect on processes developed by these councils, such as the broadness of the consultation process with outsider stakeholders or the depth in which the strategies are assessed in a timely way.

Summary

According to the testimonies gathered, the *ex-ante* position for the councilors regarding directionality was not a consensus. The reasons concerning the partial refusal to select areas for strategical development mainly had to do with the uncertainty involved in this forecasting exercise, and the need for more resources – broadly understood – to develop such decisions. However, if directionality was a mandate of the Council or, even better, was partially or fully defined in other governmental bodies, and therefore their participation was an *ex-post* position, the councilors were in place to support the predefined aims. In other words, it seems that in this context, the councilors preferred to enhance definitions rather than making them. This suggests that the issues of responsibility and resources are highly connected with the councils' capacities to comfortably work on the area of directionality.

For the cases of interest, the process of the councils' participation in directionality efforts could be illustrated according to Figure 1. From this figure, the depicted process for the Spanish Council appears more complex than the process of the Chilean Council. In the same fashion, the processes developed by the Chilean Council seem deeper (championing the process) than the processes of the Spanish Council (exercising their advisory role) given that in the latter, the Ministry complements some of the activities developed by the Council, specifically regarding the relationship with stakeholder communities. In sum, while in Chile the mandate of the specific strategy came directly from the Presidency, in Spain the mandate was first supranational, and then the Presidency identified the best institutional way to address it. Furthermore, for the Chilean case, the design of the strategy was broadly developed by the council. In Spain, the Ministry had to perform that task, and after that a consultation process involved the council.

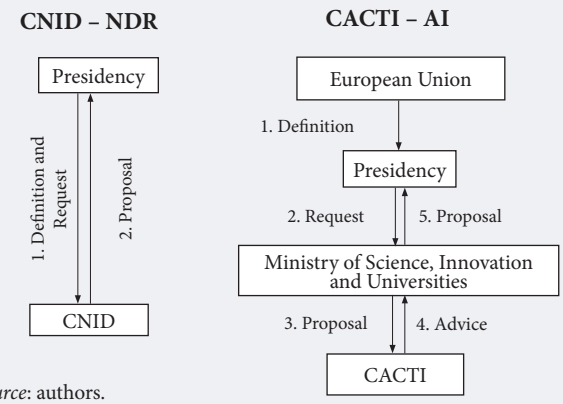
The roles played by each of the councils also seem somehow related to the expectations of their design, regarding their executive and coordinative capacity, and specifically the resources involved. The latter is a controversial issue since it may seem enough for some councilors or insufficient for others, the questioning of what is an appropriate level of resources for the definition of strategies that are aimed to shape the future of a country in a given direction. However, these inquiries help stakeholders determine whether their actions meet contemporary STI policy requirements and the proper scope of activity.

Final Reflections

Following the rationale of increasing demands for STI policy depicted in the introduction of this document, the obtained results unpack the issue of *the process* and the actual role of governments, which is complementary to the theoretical approach depicted by (Boon, Edler, 2018), and that of the stakeholders. Despite the fact that National Policy Councils seem to be aligned with the notion of related communities' involvement in definitions regarding the directionality of efforts in STI policy, it does not seem evident that every NPC configuration will be suitable for developing this task while complying with the mandates. On the other hand, leaving this process as the exclusive responsibility of the governmental departments jeopardizes stakeholders' expected role in the definition process, making it potentially partisan and thus either a shortsighted or dilettante effort.

[21] https://www.cr2.cl/wp-content/uploads/2017/01/INFORME-DESASTRES-NATURALES.pdf, accessed 14.08.2022.

Figure 1. **Comparison of CNID and CACTI Mandate of STI Strategy**



Source: authors.

Expectedly by design, both the resources and the councils' role were indicated as the main reasons for the difference in the involvement of the two studied councils. However, this difference draws attention to the reality of the prescriptive nature of STI policy scholarship highlighted by (Flanagan, Uyarra, 2016). In this context, the directionality issues characteristic of the framework of transformational change should also consider the specific features of the councils mandated to develop certain tasks. Furthermore, the implications of these decisions remain an issue since the *raison d'etre* of the councils seems strongly related to their strategical capacities and, therefore, to the general directionality that these organizations can imprint upon discussions about STI policy. This approach questions the links between the councils and the *normative turn*, how they relate to their mandates and STI priorities. Do councils foster and enhance discussions about normativity and directionality? Are the councils focused on pre-made definitions regarding these subjects? Or, is there a continuum in which every country has to find and define their position?

The nature of these discussions is also affected by the overall STI configuration of organizations and their relations, following the studies (Lepori, Reale, 2019; Breznitz et al., 2018; Cruz-Castro et al., 2020) on the operational level and (Cevallos, Merino-Moreno, 2020) on the strategical level. Bearing in mind the potential configurations of the political level as well, i.e., which ministry or ministries will be in charge of the STI policy domain(s), STI policy also faces the *puzzle of organizations*. This notion calls into question the organizational and institutional setting and how the different types for each of these organizations and relationships raise a more difficult challenge to tackle the aforementioned demands, or positively, producing a multiplicity of potential answers due to the different configurations of organizations and their types.

In the process of this research, several avenues were found that could be complemented by future studies. Regarding the specific object of the councils, addressing how these organizations are formed more specifically (on an individual level), equipped, and assessed remains a challenge for both academia and governments. Moreover, regarding the relationship between councils and their activities, the ideological approach to directionality seems to deserve more scholarly attention, despite the gained momentum in the policy-making arena. To define how to cope with neutrality or disbelief among councilors is a question that appears at the core of how strategic decisions are expected to be made. The role that the councils are expected to play in efforts aimed at directionality seems to depend upon agreements and positions that may not have the clarity needed to embark on great challenges and missions, such as the STI policy seems to require. Therefore, the definitions surrounding directionality, including their rationales and implementers, remain a moving object, along with the roles that different actors have to play in this process (*who is in charge of what*). Finally, the assessment of directionality definitions appears to remain scarce. While there is much evidence on the will to make it happen and succeed in it, more research on the past results of these situations – and intermediate assessments for ongoing projects – would be necessary to address directionality and therefore partially support the framework of transformational change.

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