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National Policy Councils for Science, Technology and Innovation: A scheme for structural definition and implementation

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Abstract

National Policy Councils for Science, Technology and Innovation have become a common institutional arrangement in supporting governments to overcome the problems of coordination derived from the complexity of National Innovation Systems. These organizations are expected to involve stakeholders with strategic capacity in defining long-term goals for science, technology and innovation, to coordinate efforts and to monitor execution. However, governments face several options to devise the proper council for their purposes, and the absence of a common framework may induce theoretical and analytical difficulties. This exploratory and descriptive study proposes a scheme for defining the structure of such a council and a comprehensive approach that is based on a novel OECD database; analyzing the results obtained for thirty-one countries. The results obtained from the index confirm heterogeneity, while the clustering suggests three types of councils. The proposed scheme provides a standard tool for the study and implementation of these councils.

Keywords: science policy, technology policy, innovation policy, governance, councils, scheme

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1. Introduction

Governments have tried to steer and foster the development of science, technology and innovation (STI) for many years and through many mechanisms, to improve directly or indirectly the wellbeing of their constituents. These efforts are commonly framed as science policy, technology policy, or innovation policy.¹ Even when these concepts are somehow entangled and frequently used together or merged, each has a life of its own. Their objectives span from enhancement and augmentation of knowledge to fulfilling the practical need to develop the communities of a country (Lundvall & Borrás, 2005). Despite this overarching interest, the governance of these policies is commonly assessed as an understudied subject (Borrás & Edler, 2014). To champion this governance, one of the recurrent formal types of organizations that are appointed is the broad family of National Policy Councils (NPCs) for STI (OECD, 2012). However, this definition is often presented in a general way as an unproblematic black box. Since governments devise these organizations, their authorities are in the position to decide and define these organizations' scopes, aims, management, boundaries, and resources. There are therefore multiple interpretations of what constitutes an NPC for STI, which poses difficulties in the theoretical construction of their role in the governance of STI. Analysis of the object thus remains fuzzy, and the practitioners do not have a universal source for their devising. The overarching aim of this article is to complement the existing stock of studies on organizations for STI, focusing on the governance and the strategical level, by addressing the NPCs for STI.

The academic literature of Science Policy and Innovation Studies (SPIS) and that of Science and Technology Studies (STS) agree about the absence of ideal types of National Innovation Systems (NIS) to use as a template when developing a particular nation's system (Edquist, 2005). Since the aims of NISs are standard goals for almost every government, governments usually strive to steer their performance. The NIS approach 'emphasizes the active role played by government policy and specific institutions' (Furman, Porter, & Stern, 2002) and 'government policy is a major enabling factor in the generation of linkage mechanisms and incentives' among different components of a system (Galli & Teubal, 2006). In the field of STI, policy formulation has transcended from a 'governmental or state concept to one of public' interest, increasing society's involvement in the process (Dutrénit, Natera, Puchet Anyul, Vera-Cruz, & Torres, 2018). However, in the context of more deliberative democracies – a concept tied with the more horizontal approach of the idea of governance (Lynn, 2012) – there is also a perspective of not having enough information about the design of these institutions (Löfbrand, Pielke, & Beck, 2011), which is confronted with the prescriptive nature of a relevant share of innovation policy studies (Flanagan & Uyarra, 2016). More specifically, the strategic level of STI policy definition is facing increased social concern and pressure –related to responding to the Grand Challenges (Kuhlmann & Rip, 2018), Missions (Mazzucato, 2018a; Mazzucato, 2018b), and the Dimensions of Responsible Innovation (Stilgoe, Owen, & Macnaghten,

¹ There is also literature that refers to *Research Policy*, a concept that seems to merge the Science and Technology Policies and is sometimes used as a synonym for Science Policy. In the same way, the concept of a Research Council is not clearly defined when aimed at science policy and technology policy.

2013), among other demanding definitions– on the design and implementation of the concerning tasks and activities by the organizations and their capacities, in a context in which, as pointed out by Breznitz *et al.*, ‘(facing the missions) there is no single blueprint for an effective organization’² (Breznitz, Ornston, & Samford, 2018:893).

Despite the relatively understudied subject of organizations for STI, most of this research has been linked, following Braun’s conceptualization, to the *hardware* – understood as the ‘formal rules and regulations’- rather than to the *software* – ‘norms, scripts, causal stories and structures of consensus-building’ – of this policy domain (Braun, Benninghoff, Ramuz, & Leresche, 2003:7). Following this, recent publications focus in the operational layer of STI policy -agencies for research (Lepori & Reale, 2019) or innovation (Breznitz et al., 2018)- and there is a scarce but growing amount of scholarly and policy-making-oriented literature on the strategical and political layer; e.g., national and international reports that have studied the characteristics of subsets of existing NPCs for STI (Borowiecki & Paunov, 2018; Escobar & Valenzuela, 2015; OECD, 2009; OECD, 2018b) and a few country-specific research cases (Edquist, 2018; Pelkonen, 2006). The reports mainly focus on the characterization of these organizations’ structures, and the research cases deepen current characteristics and processes for specific organizations; following the classic differentiation in organizational theory between their *formal structure* and *daily work activities*, made more than forty years ago by Meyer and Rowan (Meyer & Rowan, 1977). Due to this, there is a gap of a general framework for both implementation and analysis of these NPCs. The purpose of this exploratory and descriptive article is to address this gap, in a twofold way: providing a general scheme for defining NPCs for STI, i.e., their structure and therefore the policy options for every dimension that are faced by the authorities when defining these organizations; and proposing a qualitative and quantitative approach for assessing these definitions and analyzing the results observed, by answering the following research questions:

- 1) What structural characteristics are considered to devise and identify an NPC?
- 2) How to integrate these dimensions to characterize, classify and analyze NPCs for STI according to their structural characteristics?

The scheme is a step towards bridging the prescription of councils with their implementation, by building an analytical tool with heuristic value for the characterization of NPCs for STI and the policy options derived from it. Also, within the devising process, it maximizes its usefulness for policy implementation while synoptically simplifying complex arrangements. Therefore, as an empirical paper, while introducing some concepts and a scheme this article aims to address one of the setbacks identified in the academic literature regarding the research about the governance of Science and Technology³ (Borrás, 2012), by providing a common ground for analysis, in this case for these particular organizations and how they relate to other participants of the systems – specifically with the state.

² This quote is probably complemented by the well-known phrase of world renowned author Peter F. Drucker ‘The best structure will not guarantee results and performance. But the wrong structure is a guarantee of non-performance’ (Drucker, 1973:519).

³ Arguably this setback is also extendable to the policy domain of innovation policy.

The article is organized as follows. Section 2 introduces some of the definitions and theories that support this study and position it theoretically. Section 3 divides into three subsections: the first (3.1) deepens the dimensions of the analysis and integrates them into the proposed scheme; the second (3.2) operationalizes the scheme as an index, and the last (3.3) presents the analysis of the results obtained. Section 4 presents our conclusions and some avenues for future research.

2. Concepts and definitions

This section divides into two subsections: Subsection 2.1 relates NIS theory to its specific feature of governance, and Subsection 2.2 deepens to include the particular organization of the NPCs for STI.

2.1. National Innovation Systems and Governance

As recognized by Bengt Ake Lundvall, the concept of ‘Systems of Innovation’ was developed coincidentally both in the US and in Europe in the late 1980s, by Freeman and Lundvall (in a ‘seminal application’ and ‘conceptual prototype’ for each case, according to Park (Park, 1999)). The adoption of the concept by international economic cooperation organizations such as The World Bank and the OECD helped to make it widely used, providing a unique lens for both scholars of the field and policymakers focusing on the systemic view of STI (Lundvall, 2007). Among the features of the NIS approach is that it is nation-specific; it recognizes the cultural and political dimensions of states, and their differences in the degree of cultural homogeneity and political centralization (Lundvall, 2016). In the same direction, given that the systems are inherited and have the potential to evolve, the coherent efforts needed to govern and receive the benefits of coordination of the STI system are focused at the national level (Acs, Audretsch, Lehmann, & Licht, 2017). This systemic coordination among the actors of an innovation system is expected to promote competitiveness and, therefore the wellbeing of the inhabitants of a country (Schot & Steinmueller, 2018). For that purpose, extensive reviews of Innovation Policy (that commonly includes Science and Technology Policies) have been developed by the OECD and other international organizations for their associated countries. These assessments aim to recommend direct actions of governments, particularly regarding the context in which they are produced, such as NIS governance and the complex, changing nature of the institutional and economic relations between agents (The World Bank, 2010).

The concept of *governance* has received significant scholarly interest in the past decades, given the complex process of hybridization of the institutional arrangements of control and order related to the state (Levi-Faur, 2012). Governance embraces relations between institutions and actors, beyond the boundaries of traditional government and with a shift in the forms through which power is executed (Stoker, 1998). The OECD has defined governance for STI, highlighting the role of innovation:

[T]he definition of STI governance is limited to the set of publicly defined institutional arrangements, including incentive structures and norms, that shape the ways in which various public and private actors involved in socio-economic development interact when allocating and managing resources for innovation. The emphasis on interaction naturally raises issues of coordination, and

‘failures’ in governance are, more often than not, related to failures of coordination. (OECD, 2012:149)

As part of a complex system – with multiple actors, mechanisms, norms, and levels – the governance of STI policy is an issue of the utmost importance for expected outcomes. This complexity has been addressed empirically by the OECD, specifically by the MONIT project (OECD, 2005) and by studies devoted to small regions, such as the Basque Country (Magro, Navarro, & Zabala-Iturriagagoitia, 2014). Moreover, The World Bank has spoken of ‘building blocks of a strong governance framework for innovation’ in terms of the following: clarity of vision, objectives and strategy; clear jurisdiction and mandates over objectives, strategy and programs complemented with budgetary and human resource capacity; coordination mechanisms (within the government and between the government and non-public participants of the national innovation system); accountability mechanisms, checks and balances on decision making; transparency and openness to support accountability; and periodic and systemic evaluation and related adjustment mechanisms (The World Bank, 2008). The aims commonly defined by governments for the NPCs address most of these building blocks; however, when exercising governance in public organizations, the processes for making decisions matter –it is not just about the ‘what’ but also about the ‘how’ (Bovaird & Löffler, 2009).

The organizations, following Edquist differentiation between institutions and organizations, in charge of the design and implementation of STI policy have been subject to pressures from different directions. In the early definitions of the NIS framework, B.A. Lundvall promotes the sharing of national experiences between countries, also advising against the *naïve copying* between them (Lundvall, 2016). This notion, also related to the concept of *mainstream models* (Dutrénit & Puchet, 2017) coined by scholars interested in the Global South⁴, have impacted the definitions surrounding the organizations for STI policy, also due to the context of *institutional isomorphism* (DiMaggio & Powell, 1983) that shapes policy domains heavily exposed to international experiences comparison such as the ones that have been previously mentioned.

2.2. National Policy Councils for Science, Technology and Innovation

According to Braun, the NIS approach fails to explain how the coordination of policies and innovation will occur, and governments should increase the interfaces and networks for gathering the actors (Braun, 2008). The NPCs and other arrangements –such as STI ministries- emerge as part of the process of specialization of policies for STI to elevate the political relevance of the subject (Rivas, Rovira, & Scotto, 2014), according to their observed experience in developing countries specifically in Latin America, and as stated in the STI Outlook 2012 Report developed by the OECD, High-Level Policy Councils are among the preferred arrangements for STI policy coordination (OECD, 2012) and are also part of the system in a few Non-OECD countries (UNCTAD, 2017). Research

⁴ This concept “is one of a family of terms, including “Third World” and “Periphery,” that denote regions outside Europe and North America, mostly (though not all) low-income and often politically or culturally marginalized.” (Dados & Connell, 2012: 12).

and Innovation Councils are commonly recommended for addressing more and better coordination –by researchers, as a ‘suggestion for achieving more coordination in innovation policy’ (Edler & Fagerberg, 2017); and by policymakers, as ‘a policy response to have a more effective innovation governance’ (Foxley, Saez, & Valenzuela, 2015)– and also highlighted as a means to enhance the strategic orientation of policies (OECD, 2005). Conscious of their potential and current contests, a subset of NPCs founded an organization to define better practices and share views about their challenges. This organization – the Global Forum of National Advisory Councils on Science, Technology, and Innovation – has already had three consecutive annual meetings and hosts sixteen member countries (Center for International Affairs, Korea Institute of S&T Evaluation and Planning (KISTEP), 2016).

As mentioned in the introduction, the literature on NPCs is scarce but has been rapidly growing in the last decade. In this article, the idea of NPCs for STI will be considered as an overarching concept then differentiated from Research Councils, Innovation Councils and STI Councils. The concept *National* is used to geographically and legally frame the organization’s scope, and the concept *Policy* is aimed to stress the difference between these councils and the *Funding* councils that have the mission to make the calls and allocate funding on STI initiatives, such as the UK’s former Research Councils. Following the publication of the MONIT project, the OECD characterized a few ‘Science and Innovation Councils’⁵ regarding their establishment, membership and activities (OECD, 2009). VINNOVA’s⁶ 2015 report developed a similar analysis for ‘National Innovation Councils’ for a partially different subset of countries while defining these categories as the ‘most notable differences’: mandate/task, focus, anchoring, composition, resources, and output (Schwaag-Serger, Wise, & Arnold, 2015). These categories are critical for the characterization of these councils, but some of them are a direct result of the previously defined ones, i.e., the type of outputs is highly dependent on the mandate and focus that a council has. CIEPLAN’s⁷ 2015 report, focusing on the output of the councils, analyzed direct and indirect measures of productivity of ‘national authorities for the promotion of innovation’, some of them labeled as ‘National Innovation Councils’, in a thorough study that considered fifty-one countries (Escobar & Valenzuela, 2015). For the year 2018, the OECD developed a new database focusing on the ‘governance of public research policy for 35 OECD countries from 2005 to 2017’ and including some descriptive and comparative cross-country analysis (Borowiecki & Paunov, 2018). Some of the results obtained are also highlighted in the 2018 version of the periodic OECD publication *OECD Science, Technology and Innovation Outlook* (OECD, 2018b). Concerning NPCs, this report stresses that 89 per cent of the countries have councils, and within this subset 90 per cent of the councils provide advice and 74 per cent develop strategic priorities. In 48 per cent of the countries, the councils are mandated to develop coordination between government and stakeholders.

⁵ Mostly European councils of top tier developed countries.

⁶ VINNOVA is a Swedish governmental agency for research and development funding.

⁷ CIEPLAN is a Chilean academic institution for research on public policy and political economy in Chile and Latin America.

More specific research cases have been developed by Charles Edquist, based on his participant observation while appointed to the Swedish National Innovation Council (NIC) (Edquist, 2018), and Antti Pelkonen, based on reflections and interviews about the Science and Technology Policy Council of Finland (Pelkonen, 2006). In his article, Edquist addresses the issues of making the NIC more holistic and questions its potential as a role model for other countries. Meanwhile, Pelkonen focuses conceptually on the council's move towards a more horizontal innovation policy and goes deeper into the functioning of the council. The Chilean Council (CNIC) was thoroughly assessed in its early years by both the OECD and The World Bank (OECD, 2009; The World Bank, 2008), who complemented their analyses with recommendations for future improvements and have been considered in the global reports produced by these organizations in this regard.

In the previously highlighted literature, two definitions for this type of organization – that share a significant basis – emerge. These definitions are presented in Table 1, and they rely heavily on the councils' functions instead of other types of characteristics. For this research, NPCs for STI will be considered as VINNOVA's core definition indicates, as considering experts and/or stakeholders (otherwise they will be regarded as just internal inter-governmental bodies) that are commanded to the functions depicted by the OECD (OECD, 2018a). As a summary, NPCs for STI could be defined as organizations commanded by governments to enhance policy coordination and drive the strategic role of society for science, technology and/or innovation policy. Councils are characterized for being horizontal organizations – with low levels of hierarchy within them – that involve several parties from various backgrounds, in order to improve their execution and coordination capacities. These improved capacities are difficult to measure since they cannot be monitored by specific outputs, only in terms of overarching outcomes. In this context, NPCs emerge as a 'consensus device' among stakeholders, either with the mandate of producing outputs and outcomes due to this consensus or to give a 'seal of approval' of legitimacy to work performed by other governmental departments. In this process, trust is generated among the councillors helping the decision-making process and assessing the development of the initiatives either mandated by the council or commanded to evaluate. By making a parallel with previously stated concepts such as 'soft instruments' (Borrás & Edquist, 2013), due to the formerly characterized features, NPCs could probably be understood as a meta-instrument in itself, to promote governance from a 'soft organization'; since they entail unique features that differentiate them from other organizations in terms of their summoning of actors, operation and performance, in which governance has the potential to become flesh for strategic and coordination purposes.

Table 1. Definitions of Councils in the literature

VINNOVA 2015	OECD 2018
<p>National councils for innovation or for science, technology and innovation are non-temporary bodies composed of experts or high-level stakeholders (or a combination of both), explicitly (e.g., by law) tasked by government with doing one or several of the following:</p> <ul style="list-style-type: none"> a) producing reports b) overseeing policy evaluation c) giving advice d) coordinating policy areas e) driving change f) making policy decisions (sometimes including decisions regarding budget allocations). 	<p>Research and Innovation Council, i.e., a non-temporary public body that takes decisions concerning Higher Education Institutions (HEI) and Public Research Institutions (PRI) policy, that has explicitly mandated by law or statutes to do one or several of the following:</p> <ul style="list-style-type: none"> a) providing policy advice b) overseeing policy evaluation c) coordinating policy areas relevant to public research (e.g. across ministries and agencies) d) setting policy priorities (i.e., strategy development, policy guidelines) e) joint policy planning (e.g., joint cross-ministry preparation of budgetary allocations)

Source: Authors, based on VINNOVA (2015) and OECD (2018).

3. A scheme to understand national policy councils for science, technology and innovation

This section divides into two subsections: the first (3.1) presents the process of defining a scheme for structuring NPCs; then, the second (3.2) proposes an index regarding this scheme and discusses the results obtained from its application.

3.1. Defining a scheme for national policy councils for science, technology and innovation

Following the inductive nature of research on STI policies (Morlacchi & Martin, 2009), the methodology performed in this subsection is a revision of the existing literature on NPCs, stressing the perspective of governmental authorities' decision-making processes and catalyze it into a scheme for their definition and categorization. These decisions are not independent; they require significant interdependence to remain coherent. The studies described in the previous section outlined the main characteristics of a set of existing councils in a subset of countries. These studies are complemented by the authors' observations on other councils, e.g., Chile and Spain, their interviews with councillors of these councils -presenting them drafts of the scheme for their comments-, discussions on the subject with councillors of other countries' councils, reviewers, scholars, staff and experts, and a process of conceptual rearrangement also improved by the process of filling in the gaps for potential policy intentionality and options.

Initially, a first dimension was easily recognized when addressing the NPCs, the domains involved in the (1) Scope of the councils differ significantly among countries in terms of the policy domains considered and also in their combinations. Then, from the already mentioned structural dimensions highlighted by VINNOVA's report, their

observed characteristics were differentiated by considering their rationales into the ones that foster the (2) Executive or the (3) Coordinative capacities of a council. For the second dimension, the scheme consolidates the *mandate/task* and *focus* characteristics of VINNOVA into the definition of the Council's Role, since they appear highly intertwined and could also be defined as two levels of the same dimension. Following this, the characteristics of *anchoring* defined by VINNOVA is broadened to consider the more holistic approach of the Executive's Role that embraces more than just the 'highest sit' involved, but the potential of *whole-of-government*⁸. Regarding the third dimension, the features of Composition and Resources were kept from VINNOVA's report. The *output* characteristics identified by VINNOVA was discarded for this scheme, due to the causality expected between the definition of the council's role and the output expected from it. The options within the scheme were defined from the differentiation made by the observation of the profiles studied by the OECD and VINNOVA, later complemented by the input of the already mentioned interviews. Once differentiated these features, through the above-mentioned process of integration based on their rationales, the following three overarching dimensions were defined:

1. the Council's scope, to set its policy domains;
2. the Council's Executive Capacity, constructed by (2.1) the Council's role, characterized by the activities commanded to the council by the government, and (2.2) the Executive's role to determine the level of involvement of the executive regarding the council; and
3. the Council's Coordinative Capacity, which considers (3.1) the Composition, i.e., the designation of the sources and persons that will constitute the council and in what capacity, and (3.2) the Resources, detailing the types of resource that the council can devote to fulfilling its mission.

These dimensions follow a two-step configuration: the first regarding the council's scope, and a second regarding the structural features of the council (executive capacity and coordinative capacity). These latter dimensions are expected to thoroughly incorporate the underlying structural rationales of councils as identified by OECD and VINNOVA reports. An in-depth revision of the aspects considered follows, after which these aspects will be addressed and aggregated in the resulting scheme presented at the end of this subsection.

3.1.1. Scope

The first stage in the decision process is to define the scope, framing the discussion and expected results. Defining the scope between science policy, technology policy and innovation policy, jointly or exclusively, is of the utmost importance. On the one hand, it will probably catalyze in the name and brand of the council, and therefore will have a signalling effect on the different stakeholders. On the other hand, it will define the *ethos* of the council, and then the array of discussions that will host. As summarized by

⁸ The *whole-of-government* approach as a coordinated and coherent effort from the governments has been defined as a requisite for the higher impact of innovation (OECD, 2007). It is an idea that seems conceptually linked with the modern idea of *holistic innovation*.

Lundvall and Borrás, these policy domains may share some perspectives but differ significantly in their motivations and objectives (Lundvall & Borrás, 2005). As a result, this first decision will set the stage for defining the next dimensions (Subsections 3.1.2 and 3.1.3).

The boundaries regarding STI policy have changed over time (Martin, 2012), making it a difficult task to delineate this scope. The term ‘science and technology policy’ is usually used as just one concept in the academic literature. However, some authors, such as Lundvall & Borrás (2005), have made attempts to define each term on its own. The authors stress that these are ideal types, but that they serve their analytical purposes, and also the purposes of this article. The objectives of science policy are recognized as mixed for different countries, in a span that covers national prestige, cultural values, social and economic goals, and national security. For this purpose, within the innovation system, science policy is in charge of the strategies, mechanisms, and assessments of funding allocation for science, the institutions and organizations, and their relations, while Technology Policy aims to address ‘policies that focus on technologies and sectors’ with a more instrumental focus on nations’ objectives for their economies. Expectedly, a Research Council or a Science and Technology Council will address the domain of science policy and in some cases, at least partially, the domain of technology policy.

Meanwhile, in the literature regarding Innovation Policy, there are currently different approaches to the concept of innovation and, therefore to Innovation Councils. As cited above, the OECD and more recently Schot and Steinmuller (Schot & Steinmueller, 2018) consider that innovation policy includes research policy (or science and technology policy). On the other hand, authors such as Charles Edquist advocate for innovation and science and technology (S&T) being two different domains that deserve their own mechanisms of coordination, albeit with alignment and coordination between them; however, stress that being in the company of science and technology cements the notion of a linear model in devising innovation policy (Edquist, 2018). Moreover, these views have to deal with Fagerberg’s ‘narrow definition’ of innovation policy as against a broader understanding of the concept (Fagerberg, 2017). All of this polysemy surrounding ‘innovation’ as a term (Edler & Fagerberg, 2017) implies that before we can begin to define the scope of a council, we must first define innovation clearly as a concept, i.e., do we understand it in a broad or narrow sense, and does it include research policy? This process could lead to a definition of either an Innovation Council or a Council for STI that will commonly capture research policy and promote a linear model of innovation. However, innovation policy is concerned with economic and welfare objectives (de la Mothe, 2004) and this relevance has shifted the direction of some former NPCs for S&T to include the concept of innovation, e.g., Spain shifted its Advisory Council for ‘Science and Technology’ to ‘Science, Technology and Innovation’; while Finland did something in the same direction by converting its world-renowned Science and Technology Policy Council into the Research and Innovation Council.

As seen in this subsection, these policy domains may partially overlap among themselves or even with other policy domains such as education policy and healthcare policy, but their defined boundaries could mean significant differences for councils’

focus. It follows that defining the dominant policy domain(s) is essential for councils' input–output configuration and their expected executive and coordinative capacities.

3.1.2. Executive Capacity

Executive capacity relates to the potential of the councils to enforce given their government-assigned activities and the involvement of the executive within the council. For the purposes of this research, it will be addressed from the perspective of the government's mandate to the council's, and also from the position that the government itself will have. This synoptic table summarizes the concepts that will be presented in the following subsections.

	Council role	Joint planning	Coordination	Advice
Executive capacity	Executive role	Involvement of the top level (President / Prime Minister)	Involvement of the ministries level	Involvement of the upper management level

Council's role

Following the OECD classification, governments have to choose the role and structure of councils from among three broad types (OECD, 2009): 1) the joint planning model, where the council acts as a new ministry that encompasses other ministries' STI efforts; 2) the coordination model, where the council communicates between ministries to align them with policies, though not always bindingly; and 3) the advice model, where the government is not bound to accept the advice of the council. As the advice model does not bind governments, or more specifically ministries, to council resolutions, it has diluted coordinative and strategic value; the council must depend on the will of the authorities to enforce its suggestions. The OECD approach is nuanced in this research by considering as the critical factor the involvement of the Council in specific types of activities, and not in the binding quality of their mandates to the governments.

Executive's role

Governments have to decide which council position best fulfils their objectives. A new decision for authorities is whether to participate directly on the council or to receive its inputs. This decision can be seen as a dichotomy of *governance with/without the government* (Lynn, 2012). In the first direction, there are three possible levels of engagement: at the top government level, e.g., president/prime minister, at the ministries level, or the upper public management level. For some countries, involving the top level of the government has ensured an arena for direct discussion of the subjects related to the Council with the president or prime minister (Edquist, 2018). There is a flip side to involving government at such a high level, though, because if the executive's decisions are not on par with the council's expertise, it may have to face criticisms of not matching expectations. In the context of the new strengths gained by 'directionality' (Martin, 2016), having a council to rest in these decisions and bargain a socially agreed

‘seal of legitimacy’ would be a satisfactory result for a government. This commitment fades out with a lower level of interplay. A subsequent question is who is going to chair the council when the top government level is not leading it? In cases where the president has the mandate to set the council’s agenda, the government would likely want to keep control of the council. A weaker binding comes from the government not participating directly in the council; in this case, a specific office or cabinet has to be designated the council’s official counterpart.

3.1.3. Coordinative capacity

In this research, the coordinative capacity is defined as the capacity to gather different resource types in order to put initiatives into practice through strategic coordination, by considering both the composition and the resources of the council. The following table will be explained and described in the next paragraphs.

Coordinative capacity	Composition	Government officials	Outstanding personalities	Representatives of society (stakeholders)
	Resources	Funding for external capacities	Funding for internal capacities	Funding for logistics

Composition

Definitions of councils’ composition have to deal with at least three dimensions: the number and sources of the councillors to be appointed and the representation that is expected from them. Regarding the number of councillors, giving more representation to different stakeholders should increase the number of councillors, on the one hand, but make it more challenging to reach an understanding and necessitate lengthier discussions, on the other. The capacity in which councillors act should be viewed as a matter of analysis, too; will they act on their behalf or as representatives of a guild, sector, group, or community⁹

Once the number and the capacity of councillors have been decided, their sources should be assigned. STI policy has been defined as ‘multi-stakeholder’ (Dutrénit & Suárez, 2018), meaning that there are potentially abundant sources for council participants. To gain political leverage, and according to how involved in decisions they are, governments commonly participate in councils with a share of the councillors related to cabinets such as economy, industry, and education. These councillors act on behalf of their organization and may help to enhance horizontal coordination, in concordance with the definition of the council’s role. Following the objective of gaining the support of society in general and some factions in particular, outstanding personalities of various sources – e.g., science, industry, academia – are often named councillors as well. This representation may be as individuals or as

⁹ As highlighted by Pelkonen (2006) in Finland’s research case, a corporatist representation.

representatives of their backgrounds, which will depend on the scope defined for the council. To have the chance of integrating the visions and support of collectives – e.g., the Universities Guild and vocational schools in Chile, the business associations and labour unions in Spain – councils also incorporate councillors that act on behalf of society stakeholders. Finally, some councils have a few ‘guest’ councillors who can be either international, to provide an outside perspective, or national, to push through specific objectives, e.g., Chile’s council invites the STI agencies’ chairperson to meetings to help achieve vertical coordination. These guests may be considered full councillors with all the rights, or with partial rights or no rights, or as part of the council but not councillors. All of these categories are enriched by the ‘evolutionary paths’ of the actors (Dutrénit et al., 2018), ‘seated on different chairs’ such as government, universities and/or companies.

Resources

This feature involves different types of resources, including funding to commission studies to external experts, managing an organizational structure that provides support – administrative, professional or both – to the council, branding, publishing, and *per diems*, among other expenses. For analytical purposes, we propose three broad options. The first, the most agile, acknowledges that the council has sufficient available resources to allow its councillors to meet regularly in proper conditions to fulfil its objectives. The intermediate, recognizes the relevance of organizational learning within the council, by having internal capacities such as administrative and professional staff to support the councillors, mostly as a Secretariat or equivalent, which is particularly relevant for councils that are mandated to assess agencies, devise future scenarios, and organize civil society, among other time-consuming functions; recognizing the relevance of developing specific organizational capacities. According to the OECD’s last report, 47 per cent of the OECD countries that have councils have dedicated staff for accomplishing their purposes (OECD, 2018b). The third option of funding is related to resources to commission studies by external experts in order to comply with the council’s information requirements. These last two characteristics acknowledge that councillors mostly devote their time to the council freely, of their own will rather than because of any competitive compensation, and at the same time the necessity of administrative and analytical independence that these organizations require for organizational learning and independent forecasting, among other activities.

3.1.4. Scheme for national policy councils on science, technology and innovation

The way in which councils are setup and developed is systemic and intertwined. For example, if the role involves joint planning activities, then the executive’s role will be to lead, or if the scope of the council is to address science policy, the composition must consider some outstanding personalities or representatives of this sector. In the same way, if a council is being deployed in part to improve coordination, defining its characteristics seems critical. Obtaining vertical coordination requires a different mechanism than the needed to obtain horizontal coordination (OECD, 2005). If the role chosen includes joint planning activities or coordination, having representatives from various ministries is likely to help in achieving horizontal coordination with the government; having representatives from the private sector would assist in achieving horizontal coordination with society, and having agency representatives would ensure vertical coordination.

That said, there are some instrumental considerations to bear in mind while using this scheme. Any definition of a council is likely to be summative of the options available at a given time. Moreover, given the dynamic nature of these domains, there is also the possibility that any definition made at a specific moment in history could be replaced with newer versions. The choices made at a particular time by a government are not expected to last forever, so room for a periodic process of assessment of the council should be incorporated when installing it. The previous categories could be integrated into the scheme presented in Table 2 for profiling NPCs for STI.

Table 2. Scheme for profiling National Policy Councils for Science, Technology and Innovation

Stage 1: Defining a scope

Scope		
Science Policy	Technology Policy	Innovation Policy

Stage 2: Defining a structure for the council

NPC scheme				
Executive capacity	Council role	Joint planning	Coordination	Advice
	Executive role	Involvement of the top level (President / Prime Minister)	Involvement of the ministries level	Involvement of the upper management level
Coordinative capacity	Composition	Government officials	Outstanding personalities	Representatives of society (stakeholders)
	Resources	Funding for external capacities	Funding for internal capacities	Funding for logistics

Source: Authors, with adaptations from OECD (2009) and VINNOVA (2015).

This scheme could be filled following either of two paths with different sources: 1) by reviewing the legal and administrative information to shade the corresponding cells, in an interpretative exercise by the researchers, or 2) by surveying the NPCs with questions related to each of the cells in order to profile them in a self-reported way. The resulting matrix could be easily interpreted in terms of heuristic value by looking at the resulting visual pattern: a darker matrix will represent an NPC with a strong structure while a lighter matrix will represent an agile structure, and, given the order of the policy options, a vertical pattern will indicate more or less coherence by their alignment.

3.2. Developing an index to characterize national policy councils for science, technology and innovation

The information collected and applied in the scheme explained above could be easier to understand from a quantitative measure rather than using the matrix and visual patterns. We thus propose an index in order to quantify the potential¹⁰ of NPCs' structural characteristics. The index has the explicit purpose of characterizing policy options, avoiding the assessment of NPCs' performance. This index, from here on called iNPC¹¹, moves on a scale of one to twelve, with the range of policy options for an agile NPC having lower scores and a strong NPC having higher ratings. Both extreme cases, highest and lowest scoring cases (Bailey, 1994), have their advantages and setbacks. A strong and coherently designed NPC is expected to have more executive and coordinative capacity but to involve higher costs and potentially be harder to gather and implement. On the other hand, an agile and coherently designed NPC could be easier to reunite and less costly, but its capacities may be nuanced.

The index considers scoring each shaded cell with a magnitude of one; adding the sub-dimension scores will deliver the score by sub-dimension, with every sub-dimension scoring up to a magnitude of three. The options that are not present in the scheme are not scored. Then, adding the scores of the corresponding sub-dimensions will give the sub-index per dimension. Following the same idea, the sub-indexes are scored to respond to the two sub-dimensions of the NPCs' structure, their executive and coordinative capacities. Both sub-indexes can obtain a magnitude of up to six with the higher scores indicating stronger characteristics and the lower scores indicating a more agile organizational approach. Finally, adding the sub-indexes will give the iNPC scoring up to a magnitude of twelve. The iNPC aims to summarize the structural characteristics of a given NPC synoptically. The final score ranges from one point to twelve, where lower scores indicate a more agile NPC, and higher scores are a demonstration of stronger NPCs. This magnitude could be understood as a proxy of the effort –involving different types of inputs– that a given country's government is doing in involving and capturing the approaches of their stakeholders to enhance coordination and improve the strategical foresight and governance of their STI policy.

In order to operationalize this index, this research used the OECD-RESGOV database; specifically, the answers provided by the different governments to the questions 2.1 to 2.4 of the questionnaire (OECD, 2018a). This database was collected by the OECD for the information of the year 2017 and covered thirty-five countries concerning their policies for higher education, research and innovation policies. Regarding the options defined in the previous subsection about the sources of the information, in this case, this is self-reported by each country. Questions 2.1 to 2.4 were directed to Research and Innovation Councils, and their answers are quantitative. Most of them could be straightforwardly assigned to the corresponding policy option of the index. However, the sub-dimension Resources are not as abundant in answers as the

¹⁰ The concept of potential is repeatedly used regarding the NPC, since the proposed approach does not consider an analysis of the results just on part of the observable inputs, recognizing that the outputs and outcomes may not be a linear result of the mix of inputs.

¹¹ iNPC means "i" for index and "NPC" for National Policy Council.

scheme requires, so, with the available options, a proxy is considered to supplement this shortage. A synoptical view of the obtained results of the survey for the questions of interest for the universe of the sample can be reviewed in Table 3, and also a detailed matrix which aims to explicitate the decisions of matching between the analytical level of the scheme and the operational level of the survey is available at the annex¹². From the results to the survey, at a first glance, the most common features arise, expectedly a mandate of advisory, participation from the governments at a ministerial level and a composition based on stakeholders; while the main differences are based on more complex mandates, the participation of the head of state and the availability of resources.

¹² The scores on the annex represent the positive answers declared by the corresponding country to the RESGOV survey. For the cases that consider one of multiple questions (one OR another), the score of one is computed if any of those questions is positively answered; and the cases that consider all of the multiple questions (one AND another) requires having all of them at the same time positive answered to compute the score of one.

Table 3. Survey results showing a summary of positive answers (PA)

Question	Results									
2.2. Does the council's mandate explicitly include:	a) Policy coordination		b) Preparation of strategic priorities		c) Decision-making on budgetary allocations		d) Evaluation of policies' implementation		e) Provision of policy advice	
	17 PA		26 PA		7 PA		18 PA		34 PA	
2.3. Who formally participates in the council?	a) Heads of state	b) Ministers	c) Government officials	d) Funding agency representatives	e) Local and regional government representatives	f) HEI representatives	g) PRI representatives	h) Private sector	i) Civil society	j) Foreign experts
	13 PA	23 PA	16 PA	10 PA	8 PA	35 PA	30 PA	31 PA	18 PA	6 PA
2.4. Does the council have its own staff and/or budget?	a) Own staff					b) Own budget				
	16 PA					12 PA				

Source: Authors, based on (OECD, 2018a).

The database initially considered thirty-five countries, but four of them declared not having a Research and Innovation Council (Ireland, Italy, Norway, and New Zealand). Due to the national scope of this research, the results for regional councils were not considered (four of Belgium and two of the United States of America). A couple of countries (Germany and Portugal) declared having more than one council that fulfils the definition of the survey, so all of the cases were considered for each case (Germany's three councils and Portugal's two councils). Finland, due to its transitioning between councils, declared both of them; however, the acting council was not considered given that it did not answer positively to any of the questions regarding the primary activities of the councils. As a result of this process, thirty-four councils of thirty-one countries were considered for the index calculations. The results obtained from the scoring are presented in Table 4.

Table 4. Scores and index results

COUNTRY / INDICATOR	Council	Executive	EXEC	Composi	Resources	COORD	iNPC
AUSTRALIA (AUS)	1	2	3	3	0	3	6
AUSTRIA (AUT)	1	1	2	3	3	6	8
BELGIUM (BEL)	1	0	1	2	0	2	3
CANADA (CAN)	1	1	2	3	3	6	8
CHILE (CHL)	2	2	4	3	3	6	10
CZECH REPUBLIC (CZE)	3	0	3	1	0	1	4
DENMARK (DNK)	1	0	1	2	3	5	6
ESTONIA (EST)	1	3	4	3	0	3	7
FINLAND (FIN–(86'–16'))	2	3	5	3	1	4	9
FRANCE (FRA)	2	3	5	3	0	3	8
GERMANY (DEU–CSH)	2	1	3	3	1	4	7
GERMANY (DEU–ECRI)	2	0	2	1	3	4	6
GERMANY (DEU–ID)	2	2	4	3	3	6	10
GREAT BRITAIN (GBR)	2	1	3	3	0	3	6
GREECE (GRC)	1	0	1	2	1	3	4
HUNGARY (HUN)	3	0	3	2	0	2	5
ICELAND (ISL)	2	2	4	3	0	3	7
ISRAEL (ISR)	2	1	3	2	3	5	8
JAPAN (JPN)	3	2	5	3	3	6	11
LATVIA (LVA)	2	3	5	3	0	3	8
LUXEMBOURG (LUX)	1	1	2	3	0	3	5
MEXICO (MEX)	3	3	6	3	0	3	9
NETHERLANDS (NLD)	1	0	1	2	3	5	6
POLAND (POL)	2	1	3	1	0	1	4
PORTUGAL (PRT–NCEI)	1	2	3	3	0	3	6
PORTUGAL (PRT–NCST)	1	1	2	3	0	3	5
SLOVAKIA (SVK)	2	3	5	3	0	3	8
SLOVENIA (SVN)	1	1	2	3	0	3	5
SOUTH KOREA (KOR)	2	2	4	3	0	3	7
SPAIN (ESP)	2	2	4	2	0	2	6
SWEDEN (SWE)	1	2	3	3	0	3	6
SWITZERLAND (CHE)	1	0	1	1	3	4	5
TURKEY (TUR)	3	3	6	3	0	3	9
UNITED STATES OF AMERICA (USA)	1	0	1	2	1	3	4

Source: Authors

3.3. Results of the iNPC

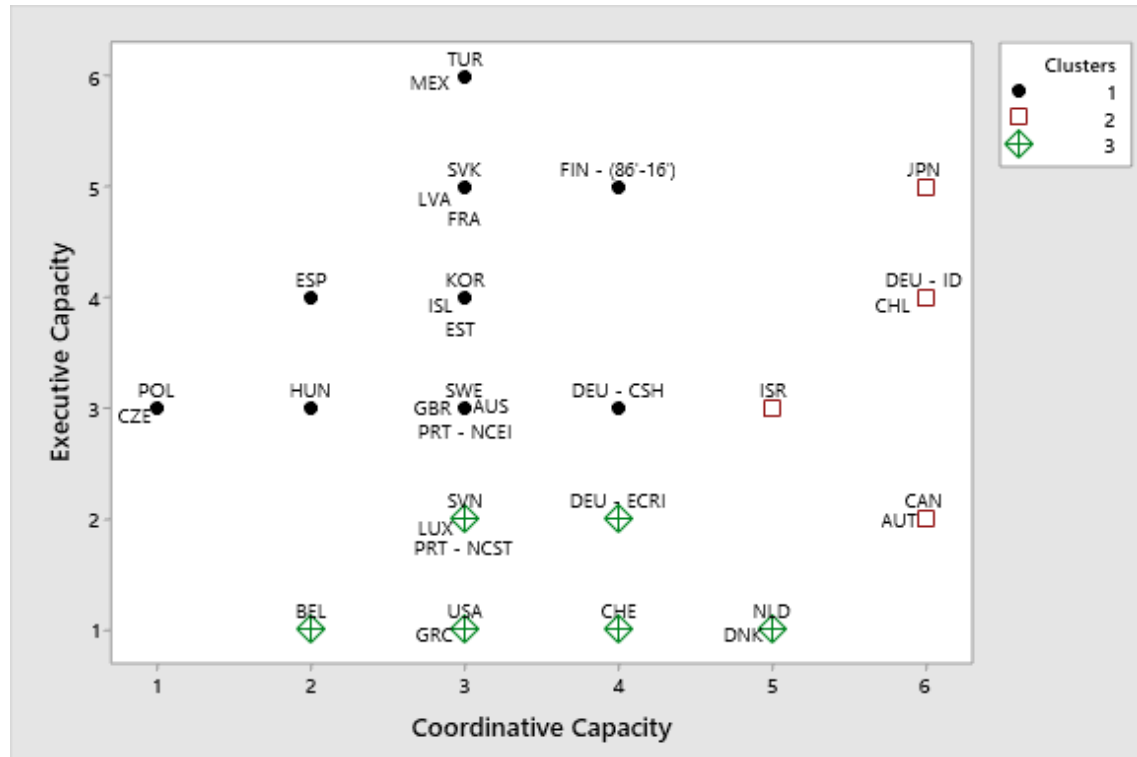
The iNPC delivered scores for the thirty-four councils that met the requirements established above. The scores highlight the Japan Council as having the strongest potential and the Belgium Council as having the most agile. As explained before, these positions are not desirable or undesirable per se but are expected to lead to different outputs and outcomes. Between the span of scores, there is a slight concentration on the right of the distribution. The distribution proves that the extreme positions are less observed than the more central ones.

As explained in the above sections, the variables defined in the scheme were considered in previous studies and have been enriched by the testimonies collected and the authors' experience to comply with what could be understood as a cognitive approach in choosing these variables (Ketchen & Shook, 1996). Due to their scale, the variables have not been standardized, and, after testing them, they do not present a significant correlation between them. Following a k-means – non-hierarchical – method for clustering, the results obtained are steady in defining three groups (Chart 1): Cluster 1 for medium-high executive capacity and low-medium coordinative capacity NPCs with eighteen observations, Cluster 2 for low to high executive capacity and high coordinative capacity with six observations, and Cluster 3 for lower potential but easier to steer NPCs, low executive capacity and low to high coordinative capacity, with ten observations. The concept of potential is used to stress the fact that what is measured in these variables are capacities that may or may not permit the NPCs to achieve higher standards of execution and/or coordination. Theoretically, more homologous behaviour of the clustering between capacities would have been expected. In this sense, agile councils present more homogeneity than the stronger councils, given the dimensions evaluated.

On a more conceptual approach, by defining and differentiating the quadrants of the chart, having high capacities –both executive and coordinative– leads to sketch a potentially transformative council (four observations on the upper-right quadrant), that encompasses a high level of all the features currently considered to foster new strategies in a *whole-of-society* approach. Meanwhile, a council with high executive capacity and low coordinative capacity points to a potential driver council (nine observations on the upper-left quadrant), with an orientation still based on the enactment potential of the governments (almost like another governmental office) and not taking advantage of the grasp that stakeholders can foster. On the contrary, a council with a low executive capacity and a high coordinative capacity could be seen as an orchestrator council (eight observations on lower-right quadrant), with the concern that while gathering relevant knowledge from the stakeholders, it does not have the means to enforce them into strategical and coordinative actions. Finally, a council with low capacities suggests an advisory or consultant council with a more traditional *bounded rationality* due to their councillors approach on the matters. This type of council is the more abundant in the reviewed subset, with fourteen observations in the lower-left quadrant. The theoretical typology of the quadrants does not coincide with the observed distribution of the subset of councils considered in RESGOV. The empirical distribution is concentrated on councils with combinations of lower to medium capacities, casting doubts on the management of the high potential councils and their policy implications. The concepts regarding the quadrants should not be confused with the sub-dimension of the council's

role, which is initially mandated by the governments, but with the expected impact of the council due to the coherence of its design. As usual, these differentiations should not be seen as canonical, but rather as a continuum.

Chart 1. Scatter plotting of the sub-indexes



Source: Authors.

The results of this study face several limitations that are important to consider and keep in mind. First, the study aims to understand the official structure of the councils in a quantitative approach; this may seem naïve since these are live organizations that sometimes have an unofficial structure more relevant than the former, and further qualitative analysis needs to be developed to address that. Second, the results of the index are part of a subset of institutions that are part of a system and are thus probably not representative of the whole governance for STI of a country. Third, the obtained results are entangled between different policy domains, each having a complex institutionalization. Fourth, the survey was self-reported by each country, and that may bias the answers due to the selection of the specific council or to the understanding of the available answers. Fifth, the policy options of the scheme are translated into indicators that may have different interpretations in different contexts. Sixth, utilizing proxies when the answers were not directly observed in the questionnaire also limited the obtained results. Finally, this is a cross-section analysis for variables that are expected to deploy their impact in the long run; this could be enriched with new waves of the survey. Despite the previously observed limitations, the results remain relevant in the already described context of having a type of organization that is presented in the theory and practice monolithically, while there are several differences, and requires more research in order to identify which designs and conditions are closer to comply with the expectations built on them.

4. Final Reflections

The theoretical goal of this research was to partially unpack the black box of the NPCs, regarding their structure, in order to present a common ground for analysis and discuss the implications of the observed structures. In the process, this article presents a contribution on the analytical level, an operationalization of this contribution into results, and a theoretical contribution regarding these results, as well as identifying new paths for future research. In the following paragraphs, these contributions will be described in detail.

Firstly, this document presents a novel tool for researchers and practitioners in the field of STI policy as it integrates previous literature in an attempt to operationalize the bridge between the theoretical understanding of the high-level governance for STI and its implementation. The process acknowledged the difficulties observed in the literature among broadly used concepts regarding STI. The need for consensus on these concepts remains urgent in order to frame the research objectives of NPCs for STI. In the absence of a unique understanding of these terms, a specification is needed for their analytical and practical use. The councils have been installed by governments to enhance the coordinating capabilities within and outside of the state. However, the councils are organizations that require coherence in their devising and implementation regarding their defined purposes. The absence of this coherence in the definition of such councils seems like a potential threat to their ability to deploy strategic capacity and coordinating efforts. Therefore, the effectiveness of these councils may be jeopardized by governments' decisions. For example, the choices made by a government could accidentally change the proposed orientation of an innovation policy based on a holistic perspective or the chain-linked model shift to a linear model, with the policy implications that this has.

Current literature regarding the object of this research corresponds either to a general view on the structural characteristics of subsets of countries (Borowiecki & Paunov, 2018; Escobar & Valenzuela, 2015; OECD, 2009; OECD, 2018b; Schwaag-Serger et al., 2015) or to country-specific research cases for ongoing NPCs for STI (Edquist, 2018; Pelkonen, 2006). This article consolidates the features of this literature by providing a general scheme and also adding new analytical tools. The scheme offered in this paper is presented in a synoptic form to integrate and summarize the structural characteristics of NPCs addressed by the previous literature, conceptualizing them in three dimensions: scope, executive capacity and coordinative capacity. For each of these dimensions, there is a set of non-exclusive options to be determined according to the literature findings and filling in the gaps of potential options as well. Each of these options has policy implications that should be considered by governments while planning to establish an NPC. Since these options may seem independent but share an interconnectedness component, devising a coherent organization should align the scope of the council; the executive capacity, i.e., the activities mandated to the council and the role of the government concerning the council; and the coordinative capacity, i.e., the composition of the council and the availability of resources provided for its performance.

Among the richness of functions of the proposed tool, first, the scheme provides a framework to organize the options that constitute a council. At this stage, the user of the tool can define a profile either to assess one organization or to parallel it with others.

The former function should be useful for defining specific research cases – because it provides dimensions to select them – for a national or even a regional level, and the latter should be particularly valuable for future comparative reports – by clustering according to the profiles – often developed by international organizations. Having the information for each organization under the same scheme makes them comparable; differences can be stressed in order to obtain a complete assessment. Further, having these organizations under the same frame makes the scheme useful in assessing how these councils are configured in an orderly fashion, and then analyzing and evaluating their internal coherence regarding these policy options. On a different level, regarding NPCs' performance, the outcomes and outputs of the councils are now comparable while being assessed on the same basis. These analyses would complement the assessments that could be performed regarding every dimension, e.g., whether the aim of the council was oriented to specific products, or whether it fulfilled its specific tasks.

This general scheme provides a broad tool to devise, categorize, compare, and assess NPCs for STI. As stated in the previous sections, there is a vast array of structural characteristics and policy options that affect the understanding and comparability of these already complex organizations, and thus any analysis of them. The fuzziness – or hybridization – of key concepts nuances the general knowledge of relevant features of governance for STI policies, affecting the theoretical underpinning of the field, its empirical analysis and the consequent policy implementation. In this direction, this scheme provides a unique lens for understanding complex organizations in terms of their structural characteristics, regardless of their background or location. The requirements to achieve this are related to the need for official definitions and documents, and also a certain degree of field involvement with the councils. However, this approach first requires a more profound understanding of the complexity of NPCs, and this relies on the research and analytical skills of the researcher.

As a summary of the scheme applications, the proposed tool is aimed to be useful in two dimensions. First, for analytical purposes, the approach introduces a tool that could be used to harmonize the comparability of NPCs, either to define subsets of them to parallel in more homologous conditions or to consider these dimensions as nuances of their studies. Second, in terms of policy application, the scheme can provide elements to consider when devising a council for countries that are in search of new organizations for STI governance – or of new paths for their current organizations – or can be used as an auditing tool for governments that aim to assess the coherence of their organizations, among other possible uses.

Secondly, this research presents the results obtained for a subset of countries on the calculation of the index resulting from the scheme. However, if further enhancement and accuracy of analysis and recommendations on this research object are required, endeavours such as the RESGOV database should be scheduled regularly, as with other OECD indicators, and opening up some questions to give more detailed answers should be considered. Following on from this, in order to frame the discussion, it may be a good idea to ask governments to identify the policy domains considered for every reported council instead of an *ex-ante* definition of these. This decision process deals with the tension of differentiating between National Innovation Councils and Councils for STI and criticisms of the latter by promoting a linear model of innovation instead of a more holistic approach (Borrás & Edquist, 2019; Edquist, 2018). In this sense, to

increase the reliability of results, it is suggested that the self-reported questionnaire is compared with an independent panel review every couple of waves to assess the quality of the responses given by every participant country.

Thirdly, the results obtained suggest a significant variance of designs regarding NPCs. From the evidence gathered, there was no prevalent model of NPC, but some characteristics were systematically found. This is not trivial due to the known signaling effect that a few canonical experiences, or *mainstream models*, have had in the development of NPCs, granting credit on Lundvall's notion within NIS for policy learning and escape from *naïve copying* among countries. However, more evidence on the longitudinal perspective of these characteristics would help in defining if convergent or divergent patterns in time can be observed. This finding questions the potential sources of *institutional isomorphism* and the legitimacy derived from it, giving a lead for further research on this direction, including –due to the increasing categories of organizations for STI- the research on the puzzle¹³ resultant from the *organizations-mixes* for their corresponding *policy-mixes*. Recognizing the expected impact of the NPCs points to the question of which designs may be better oriented for the roles mandated by the governments on one side, but also by the definitions that the society expects to catalyze through them; again in a context of increasing demands, which model is the better fit for which conditions and expectations. Conceptual differentiations regarding the potential that the capacities endorse to the councils are presented in this document –transformative, driver, orchestrator, advisory-, but the alignment of these potentials into action requires further research on the operation of the councils, and also more and better evidence, in order to make prescriptions more accurate for policy and theoretical constructs more sound for the field.

Finally, even though we have provided this scheme as a result of thorough and extensive analysis, we are confident that, in the future, this could be improved. That said, this study is a valuable step in the right direction, and is expected to provoke further research either to complement it or to replace it with better frames for analysis and implementation. It is likely that a similar exercise could be performed in policy domains other than STI ones, which would give an analogous scheme for their purposes. However, the structural characteristics of NPCs should be considered only as a 'blueprint' for their operation; because of their 'social' features, more research is needed in order to complete a thorough understanding of these organizations. Further ongoing research is needed to assess the concept of NPCs for STI among different countries and to bridge the gap between the potential *decoupling* between the theory and practice of their devising, functioning and reinvention.

¹³ Complementing the work of Breznitz et al. (2018) and Lepori & Reale (2019), this article can help on defining meta-typologies or profiles of organizations for STI to assess the performance of countries on the subject, which can incorporate the research agency/ies, the innovation agency/ies and the NPC.

Annex

Analytical Level - Scheme	INPC											
	Executive capacity						Coordinative capacity					
	Council Role			Executive role			Composition			Resources		
	Joint planning	Coordination	Advice	Involvement of the top level	Involvement of the ministries level	Involvement of the upper management level	Government officials	Outstanding personalities	Representatives of society (stakeholders)	Funding for external capacities	Funding for internal capacities	Funding for logistics
Operational Level - Survey	Does the Council's mandate explicitly include?			Who formally participates in the Council?			Who formally participates in the Council?			Does the Council have it own staff and/or budget?		
	Decision-making on budgetary allocations	Policy coordination	Preparation of strategic priorities OR Evaluation of policies' implementation OR Provision of policy advice	Head of State	Ministers	Government officials OR Funding agency representatives	Head of State OR Ministers OR Government officials OR Funding agency representatives	Private sector OR Civil society	HEI representatives OR PRI representatives OR Local and regional government representatives	Staff AND Budget	Staff	Budget
AUS			1	1	1		1	1	1			
AUT			1		1		1	1	1	1	1	1
BEL			1					1	1			
CAN			1			1	1	1	1	1	1	1
CHE			1						1	1	1	1
CHL		1	1		1	1	1	1	1	1	1	1
CZE	1	1	1						1			
DEU - CSH		1	1			1	1	1	1		1	
DEU - ECRI		1	1						1	1	1	1
DEU - ID		1	1	1	1		1	1	1	1	1	1
DNK			1					1	1	1	1	1
ESP		1	1		1	1	1		1			
EST			1	1	1	1	1	1	1			
FIN - (86'-16')		1	1	1	1	1	1	1	1		1	
FRA		1	1	1	1	1	1	1	1			
GBR		1	1			1	1	1	1			
GRC			1					1	1		1	
HUN	1	1	1					1	1			
ISL		1	1	1	1		1	1	1			
ISR	1		1		1		1		1	1	1	1
JPN	1	1	1	1	1		1	1	1	1	1	1
KOR	1		1		1	1	1	1	1			
LUX			1		1		1	1	1			
LVA		1	1	1	1	1	1	1	1			
MEX	1	1	1	1	1	1	1	1	1			
NLD			1					1	1	1	1	1
POL		1	1		1		1					
PRT - NCEI			1		1	1	1	1	1			
PRT - NCST			1		1		1	1	1			
SVK		1	1	1	1	1	1	1	1			
SVN			1		1		1	1	1			
SWE			1	1	1		1	1	1			
TUR	1	1	1	1	1	1	1	1	1			
USA			1					1	1		1	

Source: Authors, based on (OECD, 2018a).

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