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RELATIONSHIP BETWEEN SCIENCE AND PUBLIC POLICY: MECHANISMS AND BOUNDARY ORGANIZATIONS WORKING ON ADAPTATION TO CLIMATE CHANGE

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KEY POINTS

- ✔ A meaningful participation of all the parties involved in a topic is an essential condition for the credibility, relevance and legitimacy of the knowledge generated through working in the interface between science and public policies.
- ✔ The role of facilitating and articulating actions with all the parties involved is key to the effectiveness of providing a link between science and public policies.
- ✔ An effective link between science and public policies is manifested in the development and use of certain types of products (risk maps, alert systems, protocols, etc.) that are benchmarks for the actors from both sides of the science-policy boundary, and from which they can interact and coordinate efforts.
- ✔ A greater institutionalization of the organizations and mechanisms for linking science and policy helps to strengthen the continuity of these spaces beyond a change of government.

Executive summary

This policy brief identifies and analyzes some key aspects of the design and functioning of organizations and mechanisms working in the interface between science and public policy. The report reviews the comparative literature on this issue and briefly analyzes two experiences of boundary organizations working on climate adaptation issues in the Latin American context: the Brazilian Panel on Climate Change and the Argentinean network of scientific-technical organizations for integral risk management.

The report concludes by stressing some key aspects or ideas to consider in the design and management of boundary mechanisms or organizations in the field of climate change adaptation.

Resumen ejecutivo

Este resumen para políticas (o *policy brief*), identifica y analiza algunos aspectos clave del diseño y gestión de los organismos y mecanismos que cumplen funciones de articulación y vinculación entre ciencia y política pública. Para ello, se realiza una revisión de la literatura comparada sobre estos temas y se analiza brevemente dos experiencias de organismos de vinculación ciencia-política en temas de adaptación al cambio climático en el contexto latinoamericano: el Panel Brasileño de Cambio Climático y la Red de Organismos Científico-Técnicos para la Gestión Integral del Riesgo de Argentina.

El informe concluye planteando algunos aspectos o ideas clave a tener en cuenta en el diseño y gestión de mecanismos y organismos de vinculación en materia de adaptación al cambio climático.

Introduction

How to facilitate the interaction between actors of the scientific-technical world and actors of management and public policies in terms of adaptation to climate change? What characteristics should the mechanisms or organizations that intend to carry out this work have? These are some of the questions we try to address in this brief report. To do this, we reviewed the specialized literature on modalities, mechanisms and institutional spaces that work in the science-policy boundary, and analyzed two concrete experiences of organizations that develop this function of providing a link on issues of adaptation to climate change in the context of Latin America.

Mechanisms and boundary organizations

There is a growing amount of research and studies on institutions and parties that act at the interface between science and public policy, especially on issues of climate change. In English we talk about boundary organizations or boundary work, while in Spanish we refer to "bridge" organizations or work, to emphasize their role of bonding. Beyond the differences of emphasis and terms, the literature states that boundary organizations or boundary work have three distinctive attributes or characteristics (1,2,3,4):

i) Significant participation of actors from the scientific-technical world and the world of policies, in the preparation of the agenda and the production of knowledge. This component of participation and collaborative production of knowledge is particularly relevant, so we will analyze it in more detail in the next section of the report.

ii) Governance schemes that guarantee that boundary organizations or boundary work are accountable for their actions, both in the field of management and public policy and in the field of science and technology. These organizations or mechanisms, act at the interface of these two relatively different areas, but they are related and have responsibilities with each of them. These characteristics also tell us about the coordination and boundary functions that boundary organizations or boundary work fulfill. Boundary work facilitates the interface between various actors in the world of science and public policy (coordination), while establishing appropriate forms of interaction that protect the roles and fields of action of each of them (boundary) (3).

iii) Production and use of boundary objects. This concept refers to certain tangible products that result from bonding science and policy, and that function as a point of reference and of shared interest for the different actors that participate in these processes, both from the scientific world and from public policies (4). The specialized literature identifies a range of possible boundary objects linked to climate change, such as risk maps, indicator systems, conceptual matrices, climate scenarios, reports, among others (2,3). Effective boundary work between science and policy is usually expressed in these types of products, from which the actors involved can interact and coordinate efforts.

In summary, according to the specialized literature these elements include - i) participation in the production of knowledge; ii) governance and dual accountability; iii) production of "boundary objects" - are attributes that characterize boundary organizations or boundary mechanisms in science and policy. In a more ambitious theoretical approach, these elements are considered not only as distinctive features of this type of mechanisms or organizations, but also as conditions for a more effective work of linking science and policy (2).

Participation in knowledge production

As previously mentioned, studies on boundary organizations and boundary mechanisms emphasize the relevance of the involvement of different actors in the production of knowledge. This emphasis is based on the idea that if knowledge is generated with the participation and involvement of potential users, the information produced is more likely to be relevant and useful for decision-making processes.

Specialized literature refers to "co-production of knowledge". Beyond the different uses and meanings of this term (5), co-production of knowledge processes tend to be characterized by sustained and iterative interactions between researchers and stakeholders, focused on the production of usable knowledge for decision-making, open to interdisciplinary approaches and other types of knowledge (e.g. practical knowledge, knowledge of local communities, native peoples, etc.) (6,7). In this way, these processes allow us to consider and include the different positions, priorities, and knowledge needs of the different relevant actors in a public policy process, as well as the knowledge accumulated by these actors.

One of the key issues in the design and specific management of this type of collaborative processes between science and policy is to discern who should be considered the "relevant actors". In other words, who should be involved as participants in the process of co-production of knowledge. This is a critical issue, because it makes the knowledge generated by these collaborative processes legitimate, and therefore impacts its acceptability and receptivity by the different actors involved or affected by a public policy process (see table I).

The answer to this question of who are the "relevant actors" in co-production of knowledge processes, clearly depends on the context of each case in particular. However, if we look at research papers on this topic (2), some guidelines can be raised in the form of questions. For example: who would have to change their opinions, positions, or behaviors based on the knowledge generated?, who could promote actions (in our case of adaptation) based on the knowledge generated, and who can strengthen the credibility of knowledge for those actors? These are just some suggested criteria that can help identify and select key participants to be involved in a process of collaborative production of knowledge, between actors of the field of science and those of public policies.

Table I

How to evaluate the effectiveness of boundary work between science and policy?

A fairly widespread argument in the literature on the relationship between science and policy is that knowledge is more likely to be included in management and public policy processes when the actors involved in these processes perceive that knowledge has the following three characteristics (8,9,2):

- **Credibility;** Has it been generated in a methodologically appropriate manner? Has the evidence been managed and analyzed adequately in technical terms?
- **Relevance;** Is it valuable or relevant for the decision to be made, or for the policy being discussed?
- **Legitimacy;** Is it impartial? Has it been generated according to procedures that consider the different relevant actors?

It is important to clarify that these characteristics do not ensure that knowledge is effectively used in decision-making processes (there may be other factors, for example, changes in the political context that affect the appropriation and use of specific knowledge in a public policy process). What this argument raises is that appropriation and use is more likely to happen if knowledge is perceived as credible, relevant and legitimate by the actors involved. From this perspective, these characteristics can be used as criteria to evaluate the boundary work between science and public policy. In other words, to what extent does boundary organization or boundary work generate credible, relevant and legitimate knowledge?

Institutional design, management and context importance

Comparative literature in this area indicates that there is a wide range of different institutional arrangements and designs that meet (or intend to fulfill) this type of boundary work between science and policy in the field of climate change (10, 11, 12, 4). This diversity is also present in the Latin American context. The following tables briefly describe the cases of the Brazilian Panel on Climate Change (table II) and the Argentinean Network of scientific-technical organizations for comprehensive risk management (table III). These two cases exemplify some of the different thematic areas of action, type of activities, and institutional designs that can be assumed by the organizations that link science and policy in terms of adaptation to climate change.

This diversity highlights the difficulty in identifying or raising distinctive institutional design criteria for this type of boundary organization between science and policy (4). Likewise, this variety of organization forms and arrangements highlights the importance of contextual factors and aspects in the processes of institutional construction of boundary organizations and boundary work, and therefore of the different resulting institutional designs.

In this sense, the experience of the Brazilian Panel (see table II) shows the importance of the institutionalization of these spaces and mechanisms for linking science and policy in the field of climate change. This greater institutionalization is a way to strengthen the continuity of these spaces of connection beyond changes in government or changes in the political context.

Table II

The **Brazilian Panel on Climate Change** (known as PBMC for its acronym in Portuguese) was created in September 2009 by a joint resolution of the Ministry of Science and Technology and the Ministry of Environment of Brazil (13). According to the creation norm, the Panel aimed to provide decision-makers and society in general, with an integrated and objective evaluation of technical and scientific knowledge about the causes, effects and forecasts related to climate change that are relevant to Brazil. Although in 2019 the PBMC was dissolved by a decision of the Government of Brazil (14), the experience of the Brazilian Panel proposes an interesting format of a mechanism for linking science and policy in the field of climate change.

The organizational and operational design of the PBMC was based on the experience of the Intergovernmental Panel on Climate Change (IPCC) (15).

Like the IPCC, the PBMC did not intend to develop its own research, but to review and systematize existing knowledge in relation to different aspects of climate change. The results of the review and systematization work was published in reports and summaries for decision makers. In 2014, the PBMC published its First National Evaluation Report, which consisted of three volumes prepared by the Working Groups on climate science (GT1), impact, vulnerability and adaptation (GT2) and mitigation (GT3). More than three hundred researchers from different universities and research centers in Brazil participated in the preparation process (16).

Every volume of the Evaluation Report also includes a Summary for Decision Makers, that in a non-technical language presents the main and most relevant contents and conclusions of the report for the development of public policy, and also identifies gaps in the available knowledge. The PBMC also published special reports on cities and climate change (2016), coastal cities (2016) and low carbon disruptive technologies (2017), among others (16).

These reports, and in particular the Summaries for Decision Makers, are typical examples of boundary products which characterize organizations working in the interface between science and public policy. The processes of preparation and approval of the Summaries for Decision Makers are also the more intense spaces for interaction between researchers and public policy actors. Both the proposal for the contents of the Abstracts and the final documents of the PBMC were analyzed and approved by the Board of Directors of the Panel, in which representatives of national government ministries and institutions of science and technology participated (16,17).

As previously noted, in mid-2019 the government of President Bolsonaro passed a decree dissolving several agencies created by administrative resolutions of the federal government, including the PBMC (14). Beyond the specific political context of Brazil and the challenges currently faced by the climate and environmental agenda in that country, the dissolution of the Panel by an exclusive decision of the Executive Power highlights the importance of these boundary spaces having the highest level of institutionalization possible according to the legal framework of each country.

Regarding the management of boundary organizations and boundary mechanisms, one aspect to highlight is the relevance and centrality of the facilitation work developed by this type of organizations (1). This work implies both the articulation of the different needs, expectations and logics of the actors involved, as well as their different resources and capacities (e.g. the GIRCyT Network, in table III). This also shows the adaptive capacity that this type of boundary organizations must present (in terms of operation, activities and products) to respond to changing contexts and variations in the demands of their different stakeholders (communities of researchers, employees and public bodies, etc.). From this perspective, it is stressed that the "authority" and legitimacy of a boundary organization depends on the assessment of the interface space and its performance by the different actors involved (4).

Table III

The Network of Scientific-Technical Organizations for Comprehensive Risk Management in Argentina (GIRCyT Network) represents a boundary organization model quite different from that of the PBMC, both in terms of its scope of action and in its design and operation. Thematically, the Network focuses on comprehensive risk management, which includes risks linked to climate events, but also to other non-climate events (e.g., earthquakes, volcanic eruptions, technological emergencies, etc.).

The GIRCyT Network as it is today was established in October 2016, with the passing of Law No. 27,287 on the creation of the National System for Comprehensive Risk Management and Civil Protection (SINAGIR). According to the law, the Network aims to link and make available to the ministries and agencies of the national government and the national, provincial and City of Buenos Aires civil protection agencies, the capabilities, knowledge and information developed in the scientific and technical field. The Network is made up of 14 national scientific-technical organizations, and may invite universities and other science and technology institutions. The Network Coordination is under the responsibility of the Ministry of Science and Technology (18).

It is important to note that the GIRCyT is part of a process of building a space for linking science and policy in risk management issues in Argentina, which has been developing for several years (19). A relevant stage of this process began in 2012 with the Risk Management Work Commission. The current GIRCyT continues the work that was being developed, although now in the framework of the national SINAGIR system.

During these years, the work of the GIRCyT Network has focused on the development of inter-institutional information management protocols to address certain threats or events. Basically, the protocols aim to articulate the capacities of the scientific-technological organizations and the information they generate, in order to contribute to the decision-making processes of the competent public bodies, given the possible occurrence of different risks or threats. The protocols also contain different types of informational or technological products aimed at facilitating decision-making, and which vary according to the type of threat (e.g. floods, early warning systems, forest fire hazard zoning maps, etc.). To date, 15 protocols have been developed, several of them referring to climate events or risks related to climate change (drought, sudden urban floods, floods in the Plata basin) (20). These protocols are another typical example of boundary objects mentioned in the specialized literature.

The coordination role carried out by the Network Coordination with employees of the Ministry of Science and Technology is key to operating the GIRCyT. The Coordination plays a central role, not only in linking scientific-technological organizations and government agencies (Ministries, civil defense organizations, etc.), but also and fundamentally, in facilitating and promoting the articulation of capacities, resources and information between the different scientific organizations that make up the network (19). In this sense, the process of elaborating and operationalizing the protocols is a clear example of this task of linking and articulating the different organizations involved in each topic.

Conclusions

Based on the review of specialized literature and the brief analysis of the experiences of the PBMC and the GIRCyT Network, four key ideas are raised to take into account in the design and management of organizations and mechanisms working in the interface between science and public policy in terms of adaptation to climate change:

The interaction and meaningful participation of all relevant actors is an essential condition for the development of collaborative processes of knowledge production. In this type of process, the different participating actors interact and “negotiate” what information is necessary and relevant, what evidence is acceptable, while articulating and complementing resources and capabilities. In these processes therefore, the credibility, relevance and legitimacy of the knowledge generated is not only a property of that knowledge, but also depends on the characteristics of the co-production process.

The role of facilitation and articulation between the different actors is key to the effectiveness of working in the interface between science and public policies. The exercise of this role is manifested in the processes of collaborative construction of knowledge, which require the articulation of the needs, resources, and capacities of the different actors involved, and imply the ability to understand the interests and logic of the actors in the world of science and technology and the actors in the world of management and public policy.

The production of boundary objects is a fundamental result of the effective work in the link between science and public policies. The elaboration and use of this type of products (maps, reports, protocols, etc.) form reference points from which the actors of the scientific-technological world and those of public policy can interact and coordinate efforts. An effective link between science and policy is manifested in these types of products.

A higher level of institutionalization of boundary mechanisms and boundary organizations contributes to the continuity of these spaces for linking science and policy when moving from one administration to the next. A greater and more solid institutionalization expresses certain levels of political and social consensus on the value and relevance of these boundary mechanisms and spaces, as well as being a way of strengthening the permanence and continuity of the work of linking science and policy in the field of climate change, beyond the administration in power and the political situation.

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