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GOVERNING WITH EVIDENCE

Councils, Advisory Systems, and Evaluation

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A WORD TO THE READER

Policymakers have always had to decide under uncertainty. What might have changed over the years is the expectation that they should actively work to reduce it on the basis of sound evidence. There is irony, then, in the thought that the domain of policy for science might not live up to the expectation. After all, isn't science supposed to produce the very evidence others rely on to reduce uncertainty?

In Austria, the ambition to improve our basis of knowledge when it comes to policy for science is embodied in two institutions that recently became one. In 2023, the former Wissenschaftsrat and the Rat für Forschung und Technologieentwicklung were merged into FORWIT, bringing together their respective traditions of evidence production and strategic policy advice. The latter had long been a member of the fteval platform, where evaluation practices are cultivated and shared across the community. That shared history made the idea of a joint special issue feel less like a project and more like an overdue conversation.

This issue sets out to explore how two distinct orientations towards evidence – the prospective, advisory perspective that councils bring and the retrospective lens of the evaluation community – can complement and inform each other, and how the institutions that embody them might usefully reimagine their roles and relationship. The call for papers reflected this ambition, and the contributions gathered here take it seriously.

The collaboration also gave us a welcome occasion to do something we rarely do: go to print. We took the opportunity to redesign our layout from scratch – with the reader holding the journal in hand and the reader navigating it on a screen equally in mind. We hope the result makes for a pleasant experience in either mode. As always, the full issue and all individual articles are available open-access in the fteval Repository, and you are welcome to print any of them at home. We are also exploring ways to make on-demand ordering of the complete journal possible in the future.

We are delighted by how this collaboration has come together, and we hope it enriches the ongoing conversation in the FTI policy community.

Isabella Wagner, Plattform fteval

EDITORIAL

SCIENCE, POLICY, AND ADVICE. LASTING TENSIONS IN A SYMBIOTIC RELATIONSHIP

Rupert Pichler, Thomas König, Paul Buntfuß, and Isabella Wagner
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In recent years, discussions around scientific expertise and its relevance for policy making have heightened. In Austria, too, significant steps have been taken to address the role of scientific advice and its relation to science and innovation policy as well as sectoral policies. Austrian legislators have been restructuring science and innovation policy advice by merging two existing councils into FORWIT. At the same time, European efforts to better understand, and improve, science-for-policy ecosystems have begun to resonate across various policy fields. And last year, when we started to think about this special issue more concretely, the then-new government in Austria announced its plan to conduct a system evaluation of the Austrian research and innovation policy landscape.

These developments affect what we call (as a general umbrella term) the science-policy-interface, that is all instances and spaces where science and policy come together with the ambition to utilize (scientific) knowledge for political decision-making. To us, these developments also provide an opportunity to examine how some of the most relevant and frequent emanations of this interface – namely, advisory councils and evaluation institutions – have been affected by these developments, how actors involved in maintaining and innovating them have reacted to them, and whether these pushes to be more effective in informing policymaking are showing results. The fteval platform and FORWIT therefore decided to explore how prospective policy advice and retrospective evaluation can

complement each other in the Austrian context and beyond and also aim at understanding underlying historical and institutional trajectories.

When we set out this special issue, we foresaw to combine contributions from three intersected strands of science-policy-interface.

- Concerning the transformation of science advice, traditional advisory bodies (including councils and expert panels) remain central to evidence-informed policymaking, yet their roles, independence, and impact are continuously evolving. These shifts are driven by new governance frameworks, changing political priorities, and increasing demands for responsiveness and transparency.
- The evolving interplay between knowledge production, advisory functions, and policy implementation highlights the need for robust, adaptive, and reflexive advisory mechanisms. Therefore, also evaluation practices and methodologies are adapting to meet the growing complexity of policy challenges.
- Beyond traditional advisory structures, the broader science-for-policy ecosystem is being redefined by novel advisory formats, interdisciplinary knowledge production, and new institutional arrangements. This includes the rise of mission-oriented policy advice, foresight-driven strategies, and co-creative approaches that engage a wider range of stakeholders. However, these developments raise critical questions about the legitimacy, accountability, and effectiveness of advisory processes.

Our open call for papers was successful regarding two of those three broad topics: we solicited contributions that deal with deep analyses of scientific advisory bodies, as well as more systemic perspectives on (mostly national) science-policy-interfaces. However, one strand of our interest is not represented explicitly, that is the role of evaluation. This might appear strange for a journal specifically dedicated to that topic; we still decided to move forward with this special issue, because we believe that policy advice structures at least implicitly entail evaluative elements as giving advice logically includes an assessment of the subject of advice. Hence, we also realized that evaluation of policy instruments is, of course,

an important tool in the workbox of advisory bodies and one that is often deployed to also assess science-for-policy ecosystems.

Even though this strand of our initial call is not as explored in depth as we had wished for, it is still implicitly present. The relative absence of evaluation as an explicit theme in the contributions to this volume is itself telling. Advisory and evaluative functions tend to be institutionally separated, operating on different time horizons and answering to different logics of accountability. Yet that separation conceals a logical dependency: every advisory recommendation implies a theory of change – a claim, however implicit, about what intervention will produce what effect under what conditions. Testing those claims is precisely what evaluation does. The feedback loop between recommendation and evidence of effect is, in most science-for-policy systems, the missing infrastructure.

There may also be an epistemological reason why evaluation sits uneasily in this debate. Most contributions in this volume embrace models of advice that are iterative, co-productive, and deeply context-specific – and such models are, in a certain sense, evaluation-resistant. The counterfactual logic at the heart of rigorous evaluation – what would have happened otherwise? – becomes difficult to apply when advice and policy are co-constituted rather than sequentially ordered. This is yet another reminder that the methods of evaluation need to match the complexity of what is being assessed. Carol Weiss's early insight that social research often works through an "enlightenment function" – gradually shifting how problems are framed rather than directly informing discrete decisions (Weiss, 1977) – remains underexplored in its implications for evaluating advisory work specifically.

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complexity of what is being assessed. Carol Weiss's early insight that social research often works through an "enlightenment function" – gradually shifting how problems are framed rather than directly informing discrete decisions (Weiss, 1977) – remains underexplored in its implications for evaluating advisory work specifically.

The system evaluation of the research and innovation policy landscape stipulated in the coalition agreement of Austria's present federal government offers a rare opportunity to close this loop in practice. A system evaluation must – and will – engage advisory bodies as FORWIT not only as objects of evaluation but also as co-definers of the normative framework against which achievements are measured. That double role – simultaneously evaluated and evaluator – is productive precisely because it is uncomfortable. It also surfaces what may be the most difficult question in this context: not how advice is given, but whether it matters – and whether and how it is taken up. While some of the contributions to this volume address this question, none comes up with a definite answer.

With these more general remarks in the background, this special issue covers the following topics addressed in the call for papers:

- The development of advisory councils in historical perspective: why and how did advice bodies and councils come into being? How did these structures develop over time, and which organizational models developed?
- The evolving role of advice bodies and councils: How have councils adapted their advisory functions to meet new policy demands? Did changing governance frameworks lead to the reorganization, abolishment or introduction of advice bodies?
- Institutional settings and governance models: What structures facilitate best an effective interplay between advisory bodies, evaluation institutions, and policymakers?
- Science-for-policy ecosystem: How do different national systems integrate both advisory and evaluative functions to support evidence-informed policymaking?

1. STATE OF RESEARCH

Assessing and conceptualizing modes of scientific policy advice has become a focal point of academic interest from different disciplinary perspectives. If we track the literature on the subject, we can identify a few distinct results that also inform the different contributions to this special issue, and that also helps us to (broadly) organize them below. It should be stated that this literature overview is far from exhaustive, or even systematic. It builds on a separate working paper one of us has been putting together and focuses on areas that we deem of particular interest in the context of this special issue (Buntfuß, 2026). First, we briefly state important shifts in the academic assessment of utilization of scientific knowledge for policymaking, and how those have impacted the way we think about expertise and evidence. Then we briefly touch on different frameworks that have been developed to conceptualize scientific policy advice more analytically. We conclude this section with insights informing the way we have organized this volume.

Shifts in the science-policy-interface

We start this section with stating notable shifts in the science-policy-interface over the past two decades. Up until the early 2000s, a linear model of knowledge utilization predominated, conceptualizing science as a neutral provider of facts and policy as their applicant (e.g., Weiss, 1977). Over the past two decades, however, this model of "speaking truth to power" was increasingly replaced by relational and process-oriented approaches that emphasize the interplay between the two spheres. Instead of advocating strict separation, more recent literature emphasizes the necessity to understand the science-policy-interface as a communicative interplay between politicians and experts. Hoppe (2005) distinguishes patterns of interaction at the science-policy-interface, describing different dialogue models. Introducing an iterative discourse on available knowledge, political decisions, and value judgments (Weingart, 1999; Falk et al., 2019), this approach explicitly distances itself from the ideal of value-free science—a principle that has been strongly

criticized from both a philosophy of science perspective (Brown, 2020; Douglas, 2009, 2021) and an empirical one (e.g., Jasanoff, 2004). Instead, it emphasizes the intertwinement of knowledge and values within the communication process, as reflected, for example, in the value-based commissioning of scientific advice (Fleischer et al., 2010).

Another conceptual shift emerged with the turn toward transdisciplinarity and the co-production of knowledge (Jasanoff, 2004; Nowotny et al., 2003). These approaches view science as an integral part of political processes in which actors from science, policy, and civil society jointly generate and apply knowledge. Particularly influential in this context was the concept of "Mode 2" science (Gibbons et al., 1994), which supplements traditional, discipline-based research ("Mode 1") with context-sensitive, problem-oriented, and participatory knowledge production. More recent work also critically reflects on power asymmetries in knowledge generation (e.g., Turnhout et al., 2013), such as when certain actors or forms of knowledge are systematically excluded or strategically ignored (McGoey, 2012).

Expertise and evidence

As a result of this more realistic (and empirically founded) understanding of the science-policy-interface and the utilization of knowledge for policymaking, we can highlight two important concepts that are at central stage when we talk about utilization of knowledge for policymaking. One relates to the term expertise and deals with the role of experts in a time of its crisis, with the "honest broker" being the idealized version. The other one relates to the term evidence and deals with what counts as relevant facts for policymaking, with the movement for an "Evidence-based Policymaking" at its core. Both concern the expectations towards knowledge utilization for more informed policymaking.

It's long been stated that expertise is in a sort of crisis, while at the same time being in more demand than ever (Eyal, 2019). The most prominent attempt to tackle the inherent tensions of expertise is probably Roger Pielke's "honest broker" model. It describes a role for scientists that extends beyond mere knowledge production while avoiding the risk of

scientists becoming advocates. The "honest broker" integrates scientific knowledge with the concerns of political stakeholders and presents alternative policy options without committing to a specific position. This role is particularly relevant because it addresses the tension between (alleged) scientific neutrality and normative positioning, bridging the gap between purely analytical knowledge production and political decision-making. Honest brokers acknowledge that there is no single scientific answer and present different policy alternatives, conditional to decision-makers' values. The significance of this model lies in its assignment of a role to scientists that goes beyond mere knowledge production while avoiding the danger of scientists becoming one-sided advocates for a particular political position. Thus, the model becomes an important tool for understanding and shaping the complex relationship between science and policy.

Despite its appeal, the "honest broker" model has not been without criticism. As noted above, complete value neutrality on the part of scientists is deemed impossible in much of the social scientific literature on the matter, as scientific work is always shaped by certain values, assumptions, and normative positionings that cannot be fully balanced (e.g., Jasanoff 2004, Douglas, 2009). Discussing the role of the "honest broker" in the context of climate science and the IPCC, Havstad & Brown argue that complex issues cannot be reduced to a set of neutral conditionals that work as equal alternatives, subject to the value-laden choice of decision-makers (Havstad and Brown, 2017). As they stress, this image re-introduces the ideal of value-free science. In a more pragmatic argument, Havstad & Brown emphasize that the attempt of 'putting all alternatives on the table' is unfeasible in practice. Nevertheless, the model of the honest broker can serve as – imperfect but practical – reminder that scientific knowledge is inevitably shaped by normative assumptions. The challenge lies in making those (often implicit) assumptions transparent and reflecting on them in discourse without this being misinterpreted as lobbying or advocacy.

Just like expertise, the notion of evidence has become almost omnipresent in today's discourse about the science-policy interface.

Through examples such as industry-led suppression of research on the effects of fossil fuels, Justin Parkhurst vividly demonstrates the relevance of evidence for policymaking—and the unintended consequences of its neglect. His conclusion: "Evidence matters" (Parkhurst, 2016, p. 3f). Yet the conceptual idea of Evidence-Based Policymaking (EBP) to simply supply politics with knowledge and apply the methodological rigor of scientific evidence to policy-relevant knowledge seems faulted. As Simons and Schniedermann (2021) emphasize, EBP must not be confused with a neutral description: it is, rather, a theory about how politics works on the one hand, and a normative goal for how it should work on the other.

EBP is first and foremost the political idea that political decisions lead to more effective problem-solving and generally function better when they are as far as possible based on evidence. At its core, EBP therefore differentiates different forms of knowledge, introducing a hierarchy of knowledge, with randomized control trials or other highly standardized methods placed at top. The EBP approach thus targets the entire political process, which is to become more professional through the integration of scientific evidence, which is considered the most valuable knowledge (Straßheim, 2023). Inspired by the success of evidence-based medicine and the appeal of seemingly ideology-free evidence, this idea was first articulated by Tony Blair's government in 1990s' Britain under the slogan "what counts is what works." In 2001, it was adopted by the OECD and shortly thereafter by the EU, linked to the hope of achieving "better regulation" through more rational policy (Simons and Schniedermann, 2021). Due to its popularity and widespread adoption, EBP can be described as a movement—a characterization its proponents also embrace (Parkhurst, 2016).

However, like all scientific knowledge, evidence is contingent on its conditions of production—and thus inextricably linked to political and normative questions. The discourse on evidence-based policy creates the impression that debates over normative questions become superfluous due to the clarity of the evidence. As Holger Straßheim succinctly puts it: "The irony of evidence is that, in a performative contradiction, it must conceal its own conditions of validity in order to

claim obviousness and clarity." (Straßheim, 2023, p. 84, own translation). Katharina Paul expresses a similar critique: "Evidence-based policy must therefore be understood as a process in which knowledge and strategic non-knowledge play important roles. For this reason, evidence-based policy must not become the sole maxim." (Paul, 2019, own translation) The movement seems to assume that political and normative disputes could be replaced by purely methodological, or scientific questions—and resolved through the corresponding methods. This assumption itself is to be understood as "neglected politics behind EBP" (Simons and Schniedermann, 2021, p. 523).

Frameworks for scientific policy advice

With these cautionary reflections on two important and prominent conceptual ideas directly related to the science-policy-interface, we turn to two conceptual frameworks that pursue different approaches to structuring the science-policy interface. One key element here concerns the role of organizations. Specifically, advisory organizations, while providing scientific expertise, do not belong solely to the scientific subsystem but also fulfill a specific function for the political system. From this perspective, advisory organizations are "boundary organizations" that ensure the coupling of the two distinct systems and their logics (Lentsch, 2016). This involves them repeatedly finding themselves caught between contradictory demands.

A practical implication for advisory work is that advisors must actively engage in this process (whether defined as being caught between different functional logics or not). Some literature refers to this as "brokerage" (Pštross et al., 2025), building on the previously discussed role ideal of the "honest broker" (Pielke, Jr, 2007). This term has gained significant popularity, particularly among some practitioners of scientific advice (see, e.g., Gluckman 2014; Gluckman et al., 2021). While it represents a role model for individuals—rather than an analytical perspective on the organization and practice of scientific advice, a strand of literature, however, extends this concept by introducing the term "knowledge brokering organizations" (KBOs) (MacKillop et al.,

2020). KBOs are understood as organizations for which the articulation of evidence for political application is a central part of their work; they maintain specialized structures, practices, and personnel and have proximity to the respective government without being part of it. Since the late 2000s, there has been a noticeable increase in KBOs, which is attributed to a perceived lack of advisory capacity (MacKillop and Downe, 2023).

The approach of viewing advisory organizations as KBOs emphasizes how these organizations ensure the legitimacy of their work and advisory products. MacKillop & Downe (2023) observe different strategies in this regard. Some rely on academic practices and quality standards, such as peer-reviewed research, rigorous methodology in their own procedures, or an emphasis on the academic background of their content-focused staff. At the same time, however, the work of KBOs must also be relevant and adapted to the temporality of political processes, leading KBOs to present their work as both evidence-based and useful.

This perspective emphasizes that evidence is actively processed within KBOs (often described as evidence synthesis, translation, or evidence review) rather than being homogeneous facts that are simply "pushed" unchanged into a political process. MacKillop et al. (2020) criticize such a "push approach" as naive and idealistic, advocating instead an understanding of knowledge brokering that focuses on narratives and power practices that frame and permeate the interplay between scientific knowledge and politics. This includes, for example, a closer examination of the legitimacy narratives that KBOs constantly construct and reconstruct in their work (MacKillop and Downe, 2023).

The Policy Advisory Systems (PAS) approach (Halligan, 1995; Capano, Craft, et al., 2025b) offers another perspective on the political contexts of scientific advice. According to the prevailing definition, a Policy Advisory System is an "interlocking set of actors, with a unique configuration in each sector and jurisdiction, who provide information, knowledge, and recommendations for action to policymakers" (Craft and Howlett, 2017, p. 217). These systems are characterized by the fact that advice comes from multiple, often parallel-acting sources, which may also compete with

one another. PAS are thus situated at a meso-level, typically examining advisory systems within specific policy fields and their capacity to provide actionable recommendations (Brans et al., 2022).

The motivation behind the PAS approach is to understand the variations in the forms and structures of scientific policy advice across different policy fields and states, with comparative analyses often at its core (Capano, Craft, et al., 2025a). Traditionally, the variability of PAS is analyzed through the influence of different actors within an advisory system, conceptualized in terms of their (institutional or personal) proximity to government and a distinction between internal and external actors. According to (Capano, Casula, et al., 2025), this distinction has significantly influenced the design of advisory committees in many OECD countries, with a general trend toward greater involvement of external actors, which also brings more interest groups into the respective PAS (Brans et al., 2022).

Another key question concerns the government's ability to exercise control over advisory actors – specifically, whether and how governments can ensure that the advice they receive aligns with their own priorities and goals. However, this is typically framed only in terms of short-term (crisis management) versus long-term (proactive, forward-looking) considerations, without exploring how such substantive congruence might be conceptualized (Craft and Howlett, 2017). More recent approaches place greater emphasis on this substantive aspect. For example, Capano, Casula, et al. (2025) analyze expert committees not only in terms of the origin of experts (internal or external to government) but also their disciplinary homogeneity. This shifts the focus from the government's control function to the question of what the composition of expert committees reveals about the political backgrounds and preferences of decision-makers.

Despite the high degree of formal variability, a common function of PAS can be identified: providing assessments, evidence, and arguments for solving political problems (Brans et al., 2022). In this way, the approach emphasizes that the stage of the policy cycle in which an issue or proposal is situated is crucial for advisory practice (Brans et al., 2022). This accounts for the temporality of expertise better than other approaches do. A

strength of the PAS approach is that it conceptualizes scientific policy advice from the outset as part of the existing political and institutional environment.

An even broader, and more politically driven variation is the "Science-for-Policy Ecosystem" concept, which describes the science-policy interface as a complex, dynamic, and multi-layered system encompassing diverse actors, institutions, processes, and forms of knowledge (Pedersen, 2023; Scharfbillig et al. 2024; Almeida et al., 2025). This framework is particularly employed by the European Commission's Joint Research Centre (JRC) and in the work of Gluckman (2014) to capture the diversity of actors, the plurality of knowledge sources, and the institutionalization of interfaces between science and policy.

Despite their differences, the KBO and the PAS models aim to help understand the role of scientific expertise in political processes, thereby always providing an image of the interplay between science, policy, and politics. Yet while academic literature has refined and critically appraised the realm of scientific policy advice with increasing lucidity and conceptual innovation, the tension of utilizing scientific knowledge for political decision-making will not go away. One way to understand that tension of utilizing scientific knowledge for policymaking is that two distinct forms of justification must be addressed at the same time:

> "On the one hand, epistemic robustness, which pertains to the justification of knowledge claims, and, on the other hand, political robustness, which refers to aspects of responsiveness and political justification." (Pedersen 2014, p. 549)

This immanent tension of political and epistemic robustness affects the science-policy interface as a whole. And it is enforced, in practical as well as organizational matters, for example by neglecting, or ignoring, the specificities of advisory work, which leads to de-contextualization of knowledge for policymaking, or the tendency to turn a blind eye on norms, values and interests that are determining what serves as relevant knowledge and the way it is put forward. In addition, there is a trend to depoliticize political questions by reframing them as questions of

knowledge as the "epistemization of the political" (Bogner, 2021). We usually assume that, with the push for professionalizing policy advice structures in both organizational and institutional settings, these tensions will be alleviated. Certainly, this has contributed to the various developments in policy advice described in the following articles. And yet we have to be cautious, as we do not (yet) see strong empirical evidence that supports this assumption.

2. ORGANIZATION OF PAPERS IN THIS VOLUME AND GENERAL OBSERVATIONS

When it comes to this special issue, we see the two frameworks outlined above as a first opportunity to cluster the contributions: The first section addresses the development of advisory councils from an institutional perspective, and here specifically councils that are primarily directed towards science and research policy. Broadly, then, this follows the framework of individual knowledge brokerage organisations. The second section deals with broader (eco-)systems of scientific advice comprising multiple institutional arrangements and sector policies as addressees of advice, thereby roughly following the idea of looking at entire policy advisory systems.

However, whether organizational or systemic, two elements can be found in all contributions. The first concerns the weighing of independence particularly in relation to accountability and relevance, and the second the various and changing functions scientific advice can adopt and the different – if not contradicting – effects this can have on the role of advice. These two, then, can be seen as the central themes across all contributions: the meaning of independence spans liberty of topic selection, procedural autonomy, to organizational self-governance. At the same time, the expectations in advice continue to shift, encapsulating diverse, sometimes contradictory, functions ascribed to scientific advice from justification posturing to real impact. While science and research policy advisory councils ultimately also shape the policy framework for science, advisory structures within specific sector policies provide knowledge for policy implementation. Yet in which ways this feeds back on the science system is hardly ever at the centre of considerations.

Author(s), short title	Key characteristics describing advisory systems	
	Significance of independence of advice structures	**Functions of advice within policy frameworks**
Councils: Trajectories of Science and Research Policy Advice		
Pichler: History of advisory councils in Austria	Development from legally dependent councils with predominantly institutional memberships and without resources to councils with their own legal personality, staff and budget as well as a personal membership led to greater impact	Development from a mere sounding board to a coordination platform for science and research policy, eventually to a "real" advisory body devising opinions and strategies as well as recommendations on the allocation of extra-budgetary funds
Banda/Sanz-Menéndez: Science, technology and innovation advisory council in Spain	Increasing independence and shift towards predominantly meritocratic composition of membership weakened impact on science and research policies and responsiveness to political requirements	Accompanying transition to democracy; coordination and design of science and research policy, originally entrenched in the national governance system; change to a more detached external perspective of advice
Heinze/ Jappe: German Wissenschaftsrat	The Wissenschaftsrat is not really independent; it is deeply embedded in a multi-layered federal governance system; there is an increasing tension between its formal structure and actual actions	Coordination between the federal and state governments in higher education and science policy matters; advice on reform proposals and the promotion and evaluation of scientific excellence
Buntfuß/König: Quality management	Relatively high independence does not replace the need to establish practices for quality assurance.	Different and diffuse expectations in role of FORWIT requires the council to calibrate its practices for quality assurance on case-by-case basis
Ecosystems: Institutional Structures and System Dynamics		
Faßmann: Scientific policy advice in Austria	Independence (autonomy) of advice bodies and agencies is most effective when relating to clearly defined areas, otherwise advice may lose link to policymaking; dedicated resources are key	Science for policy: enabling the apt implementation of a broad range of sector policies (e.g. fiscal, social, health, climate); policy for science: advice on the design of science and research policies
Zollinger: Scientific advisory network in Switzerland	Existing policy advice institutions proved inept during the Corona crisis due to their self-referential setup and the resulting unstructured use of scientific advice; a new network is intended to overcome institutional boundaries and lead to more yet formalised openness	Utilizing scientific advice systematically in the federal government's crisis management; establishing coordination processes between the bodies involved and clear communication with policy; joint planning of evidence-based policy

Wise/Wilson/ Schwaag Serger: Place-based science-for-policy	Co-creation of advice structures in specific (e.g. thematic or local) settings; science-policy interaction works both ways and is highly context-specific; organization must be flexible and challenge-driven; stable funding is beneficial	Integration of advisory and evaluative functions, governance of transformation; policy learning, more interactive relationship between knowledge and policy, strategic coordination, trans-disciplinary approach, turning knowledge into practice
Kahn/Ralphs/ Mustapha/Borel-Saladin: Policymaking and advice in South Africa	Long-lasting impact of autonomy paradigm; tensions and lacking communication between academic and state-directed approaches leads to failure in the face of challenges; convergence can provide opportunities	Providing evidence, particularly scientometrics, for informed policymaking; sounding board for dealing with HIV/AIDS crisis; joint planning of big science and developing complex technosystems
Allegra: Scientific Advice in EU institutions	Advisory bodies in EU-specific sectoral policy domains: separation of advice and regulation to keep scientific independence as legitimation; development of more general advice structures towards a quasi-council embedded in the EU institutional framework	Informing and legitimizing sectoral policymaking while balancing tensions between scientific expertise and democracy, thereby providing spaces of co-production; strategic cross-cutting scientific advice to coordinate more generally across the science-policy boundary

Table 1: Organization of papers and key characteristics
Source: authors' own compilation

Along these categories, we can summarize the following observations:

(1) In the context of scientific policy advice, the paradigm of the autonomy of science is often translated into (and confounded with) organizational independence[1], which, however, is no guarantee for impact. Always depending on the political, historical and cultural context, overly independent councils may not be sufficiently embedded in the policy cycle so that they lose the capability to link up with those addressed. While in one system, a high degree of independence heightens credibility, in another it symbolizes the ivory tower. Relating to that, the terms of membership of an advice body reflect this dichotomy: personal expertise or institutional representation as the members' legitimation influence

1 Here, autonomy means epistemological and methodological freedom from undue interference, while independence means organizational (and also financial) freedom from institutional restraints that would apply otherwise.

their capacities to act as interlocutors with the policy system – one way or another. Personal membership reflects that scientific knowledge is not a disembodied structure, but institutional identities still shape a person's expertise even if they are not an institutional representative. Another aspect present throughout various settings is the availability of resources (e.g. budget and staff), which arguably broadens the room for manoeuvre, and thus factual independence, an advisory body enjoys. Even though the contributions yield no general evidence, it is safe to assume that there may be a certain trade-off between the independence of a council and its relevance where extreme high or low degrees of independence may both hamper relevance.

(2) The functions of scientific advice analyzed in this issue span a broad spectrum, ranging from science for policy to policy for science. On one end, advice involves providing governments or ministries with the scientific knowledge they need to fulfill specific tasks. This is most common in science-driven sectoral policies, such as health or environmental policy. In science and research policy, too, such advice is typically sought for concrete issues – like legislative proposals or funding allocation. More often, however, advisory bodies serve as coordination platforms or sounding boards. This is true particularly in cross-cutting policies where domain boundaries are blurred, and advice feeds less directly into the policy cycle. Science and research policy tends to align with this pattern, focusing on how policies should be designed to promote science and research. Actual policy planning as a form of advice is rare and usually limited to distinct challenges, such as managing a pandemic, developing big science initiatives, or addressing transformation processes.

(3) The question of independence of advisory bodies relates differently to the functions of advice according to their respective characteristic. Where advice is given as an element required in course of a defined policy process, independence may come in handy as justification for decisions taken, or put differently, to delegate responsibility. In case of coordination or serving as a sounding board as main roles, independence may compromise a council's ability to profoundly involve itself into political decision-making procedures. Even more so, advice taking the form of joint planning for

science-related projects requires an iterative approach where the needs of both policy and science are mutually taken into account. Usually, when the potential of science-for-policy is fully exploited, it is the result of co-creation rather than being developed in a black box.

3. CONCLUSION

Unsurprisingly, the historical development and institutional as well as organizational settings of scientific policy advice structures and bodies are context-dependent and, therefore, vastly different among the cases covered in this special issue. The tensions between science and policy as societal subsystems are lasting and must continuously be rebalanced. There is not one best-suited approach neither in analytical nor in normative terms. And yet, all cases share certain historical trajectories, such as the progress from a more linear understanding of the science-policy relationship to arrangements where mutual involvement gains greater importance, and a push for increasing professionalization. This may be interpreted as a consequence of the increasing complexities of both scientific developments and the challenges that the realm of policymaking faces.

Within that broader setting, the articles collected in this special issue follow distinct analytical approaches, thereby reflecting different functions of advice that vary along policy domains. When it comes to analyses of the institutional development of science and research policy advisory councils, it appears that scientific advice is focused on providing institutional capacities to shape science and research policies, if only in a rather generic way. Here, we can detect varieties of the KBO approach in the respective analyses. On the other hand, where scientific advice is expected to supply evidence in the sense of applicable knowledge in problem-solving contexts of (often multi-layered) sector policies, systemic frameworks and ecosystems seem to be a relevant point of departure for the analysis, contributing to varieties of PAS.

However: whatever the institutional models and analytical approaches, science and policy must understand each other's standards of credibility

and accountability to transgress the science-policy boundary so that they can become (and remain) "resources for one another" (Ash, 2002). For the time being, this balancing requires our attention and, occasionally, careful recalibration.

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COUNCILS

TRAJECTORIES OF SCIENCE AND RESEARCH POLICY ADVICE

A BRIEF HISTORY OF SCIENCE AND RESEARCH POLICY ADVISORY COUNCILS IN AUSTRIA

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ABSTRACT

Austria was a latecomer in developing a fully-fledged set of institutions for the implementation of science and research policy. The potential role of an advisory body always figured prominently in the post-war debate, but institution building in the 1950s and 1960s focused on building funding institutions. It was not until 1967 that two proper research funding organisations came into being. The "Research Council" *(Forschungsrat)* established together with them was merely a co-ordinating body of those two organisations. In the 1970s, the shift towards a more active science and research policy resulted in the first introduction of a dedicated ministry for science and research in 1971. Yet the virtual absence of a "real" science and research policy advisory council proved increasingly problematic, as challenges grew more and more complex. The eventual creation of a broader science and research council in 1981 had almost no visible impact as its capacity and resources were limited. The technocratic turn at the beginning of the 2000s led to an entirely new research council with its own office and staff. After its merger with the universities' "Science Council" *(Wissenschaftsrat)* in 2023 there is now a more comprehensive advisory body designed to span the whole spectrum from university research to company innovation. Over time, we see a shift in the councils' legitimation from a representative to a meritocratic logic. This article analyses the underlying historical trajectories of science and research policy advice in the Second Austrian Republic.[1]

Keywords: *Advisory Bodies, Research Council, Science Council, Council History, Science and Research Policy.*

1 Some of the findings presented here are also being published in a forthcoming volume on the history of the Austrian ministries of education and science, edited by Johannes Feichtinger et al.

1. INTRODUCTION

This article investigates the development of science and research policy advisory councils in the Second Austrian Republic. It starts with the introduction of a heuristic framework providing an analytical approach to the subject. Then the paper describes the sequence of events and their drivers in the respective historical context. In the conclusion, the various advisory councils that developed over time are characterized utilizing said framework.

First of all, however, a terminological clarification is needed: in historical perspective, the term "research council" has adopted a variety of meanings, yet always with counselling as the key element. If science and policy are understood as different subsystems of society, councils act as intermediaries between science and policy: "Evidently, ... the political system does not intend to, nor can it produce the knowledge necessary for its own functioning and that of other systems. It needs the co-operation of scientists to overcome the implicit lack of knowledge or, in other terms, the 'information asymmetry' inherent in functional differentiation." (Braun, 2003, p. 210).[2] Such cooperation through research councils can range from advice on political strategies to advice on the allocation of budgets. Not least because one of the most important instruments of public research policies is the provision of financial resources, research funding institutions have often been termed research councils. One of the most recent examples of this is the *European Research Council*.

This article is about the development of research councils in the sense of advisory bodies for science and research policy, and not about funding institutions that may have the term "council" in their name because they advise governments on how to spend public money. Neither does it deal with advisory structures that support sectoral policies where scientific knowledge is instrumental, such as in health or environmental policies.

2 See also Braun (1997) pp. 47-55, and König & Stampfer (2025) pp. 2-3, summarizing the state of research on the interplay between scientific evidence and political decision-making.

2. ANALYSING THE ROLES OF ADVISORY BODIES: A HEURISTIC FRAMEWORK

When delving into the account of how, why, and when science and research policy advisory councils developed in Austria, it may be useful to apply a typology characterizing such councils. In its 2018 Innovation Policy Review of Austria, the OECD (2018b, pp. 189-190) – based on earlier studies (OECD, 2018a) and Schwaag Serger et al. (2015) – presented four types of science and research policy advisory councils defined by their roles and structures:

1. An advice model, where the council actively advises the government.
2. A joint planning model, where the government uses the council as a virtual "horizontal ministry of innovation".
3. A "sounding board" model, where the council serves as a validation platform without substantial resources and an explicit mandate to plan and co-ordinate policy.
4. A co-ordination model, where the council provides a platform for horizontal communication across ministry responsibilities to align policies.

"Both the role a council is assigned to play in the innovation system and its structure represents a deliberate choice of the government" (OECD, 2018b, p. 189), the OECD furthermore states. Depending on which choices governments make, the ways to implement them differ accordingly. The most important methods governments thereby employ is providing resources and the legal basis. These instruments shape a council's role and structure along two essential dimensions: the degree of independence a council is given, and how representative a council's composition is for the science and research system. Figure 1 groups the OECD typology along these two dimensions, thus providing a heuristic framework for the analysis of the development of science and research policy advisory councils in their historical and political context.

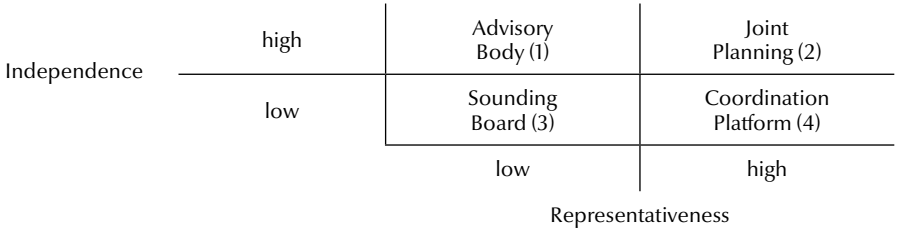

Figure 1: Heuristic framework for the role of advisory councils
Source: own compilation based on OECD (2018b, pp. 189-190)

The choice of the legal status and the provision (or not) of dedicated resources (such as an office with its own staff) determine how independently a council can pursue its mission. The composition of a council's membership determines to which extent and in what way it represents the science and research system and its stakeholders. Whether the members exercise their mandates in a personal or institutional capacity can influence both dimensions. Personal membership is likely to strengthen independence while institutional membership may lead to a stronger commitment of those represented to a council's advice. Whether or not a council can fully execute its mandate mostly depends on these factors irrespective of how comprehensive or limited it formally is.

Governments choose from options along these lines according to their needs within a specific framework of institutional (and other) traditions. Therefore, as the OECD found, various models can exist in parallel in different countries at any one time. However, they can also follow one another over time in a single country. Such a sequence may stand for a certain historical development, which we now investigate in the Austrian case.

For clarity's sake, we introduce here the names of the advisory bodies discussed below in the order of their historical appearance. In the following sections we will use the abbreviations of the respective names in German:

ÖFR	Austrian Research Council *(Österreichischer Forschungsrat)*
FFR	Research Funding Council *(Forschungsförderungsrat)*
ÖRWF	Austrian Council for Science and Research *(Österreichischer Rat für Wissenschaft und Forschung)*
ÖKWF	Austrian Conference for Science and Research *(Österreichische Konferenz für Wissenschaft und Forschung)*
RFTE	Council for Research and Technology Development *(Rat für Forschung und Technologieentwicklung)*
WR	Science Council *(Wissenschaftsrat)*
FORWIT	Austrian Council for Sciences, Technology, and Innovation *(Forschungs-, Wissenschafts-, Innovations- und Technologieentwicklungsrat)*

3. DEBATING THE INTRODUCTION OF A "RESEARCH COUNCIL" IN POST-WAR AUSTRIA

Also in the Austrian case, we can observe the terminological ambivalence mentioned above. Shortly after the end of World War II, the first political debates on the creation of a comprehensive institutional science and research policy framework in Austria began. In these discussions, the term research council *(Forschungsrat)* was generally used for a framework covering both policy advice and research funding, which also figured in a first government bill in 1949 (Pichler et al., 2007). This term may have been familiar to some of the protagonists from personal experience: The physicist (and communist) Engelbert Broda had held a position funded by the Medical Research Council while in exile in Britain, and the German "Reichsforschungsrat" (Flachowsky, 2008; Wagner, 2021), a potential source of funding during the Nazi period, may also have played a role for the familiarity with that term.

All grand coalition governments up to 1966 failed to establish anything called research council by law, partly because the Social Democrats (SPÖ) wanted to assign a strong political, and thus advisory role to such a research council. This was to be reflected in a significant representation of non-academic parts of society in its structures. The People's Party (ÖVP), which was strongly based in the universities, preferred any research council to be primarily a funding body and rejected the SPÖ's ideas as state-interventionist, unduly limiting the autonomy of science (Pichler et al., 2007; Pichler & Stampfer, 2017). The latter argument had already let collapse Werner Heisenberg's plan for a "German Research Council" (Trischler, 2024; Orth, 2011). In Austria, the Academy of Sciences (ÖAW) continued fighting the "spectre of state control of science" (Feichtinger & Geiger, 2022, p. 301). In face of the political deadlock by the end of the 1950s, the ÖAW, together with the universities and endorsed by the ÖVP-led ministry of education, founded an association as a bypass solution for the allocation of public funding in 1960. This institution, even though solely meant to distribute money, was nonetheless named the "Austrian Research Council" (Feichtinger & Geiger, 2022).

It was not until the ÖVP had gained an absolute parliamentary majority in 1966 and was therefore able to form the government alone that research funding in Austria was institutionalized by law in 1967. Still, the ÖVP – successfully, in the end – sought to pass its Research Funding Act also with the votes of the SPÖ and was therefore willing to make, yet very moderate, concessions to the SPÖ in terms of a council reaching beyond mere funding: "Without the introduction of a high-level body, the SPÖ will not be won over to the law."[3] The Research Funding Act did indeed create such a high-level body, albeit in a very limited form: The so-called "Austrian Research Council" (ÖFR) was merely a relatively weak umbrella body co-ordinating the two research funding organisations (one for academic and industrial research each – FWF and FFF) that the law had established. Its remit set out by the law appeared quite comprehensive

3 Report on a meeting of the (ÖVP-)Akademikerbund on 16 June 1964, Archives of the Republic in the Austrian State Archives (*Archiv der Republik, Österreichisches Staatsarchiv* – AdR), Federal Ministry of Education (*Bundesministerium für Unterricht* – BMU, 24-Gesetze F, 1966-1969, 1112, file no. (*Geschäftszahl* – GZ) 79.422-I/6/64.

and comprised advising the federal government, the provincial governments, and the legislative bodies. In reality, as the ÖFR consisted only of the presidents and vice-presidents of FWF and FFF, it mainly dealt with co-ordinating funding matters between the two funds, from time to time complemented by some reflections on research policy. The chair rotated annually between the presidents of FWF and FFF, whose offices took care of the ÖFR's affairs accordingly.[4] In fact, it had nothing in common with the Research Council of the Swiss National Science Foundation, for example, one of the most influential international models at that time (Fleury & Joye, 2002).

4. THE KREISKY ERA

Still, the Research Funding Act can be seen as the beginning of an institutional modernization that accelerated in the 1970s and found its most striking expression in the first establishment of a Federal Ministry for Science and Research (*Bundesministerium für Wissenschaft und Forschung* – BMWF) by the SPÖ minority government under chancellor Bruno Kreisky in 1970. In the parliamentary debate on the law establishing the BMWF, member of the National Council Karl Blecha explained why the SPÖ now preferred direct political control by a ministry to an intermediary body as in its earlier research council concepts: "And a ministry of this kind ... has, after all, an incredibly greater and more important position as an intermediary not only between industry and science, but also as an intermediary between the population and science, the population that is supposed to pay the money for it, than a research council, the board of trustees of some fund or any other institution." Blecha concluded, "that in modern industrial societies one can only shipwreck with all these mechanisms of self-regulation."[5]

4 Federal Law Gazette *(Bundesgesetzblatt)* No. 377/1967, § 17.

5 Stenographic Protocols of the National Council (*Stenographische Protokolle des Nationalrats* – Sten. Prot. NR), XII. legislative period (*Gesetzgebungsperiode* – GP), 11th session 8 and 9 July 1970, pp. 538-541.

The question of a proper policy advice body thus still lingered and was raised again by the OECD, which performed a review of Austria's science and research policy in 1969/70 and therefore provided important points of reference for the SPÖ government, backed by an absolute majority since 1971 (Wirth, 2023, p. 141). In the course of the review, the OECD suggested "intensifying the activities of the Research Council [ÖFR]" and pointed out that it was not the task of the newly created BMWF to fulfil the function of a broad-based Research Council.[6] In the "confrontation meeting" with the OECD delegates, the topic was discussed at length. The delegation recommended an administratively independent structure, where "advisory and executive functions should be kept apart", the members should broadly represent science and research and be appointed ad personam. Neither the existing ÖFR nor the BMWF showed any great interest in changing the status quo that had been painstakingly achieved only a few years earlier. The ÖFR did not want to expand its focus beyond the funding business and referred to the BMWF, which – in its opinion – held the responsibility for strategic planning. The latter, in turn, announced that it would set up a "science forum" that would adhere to the OECD proposals to a certain extent.[7]

The published report on the "confrontation meeting" described in detail the discussion on a broader scope of the ÖFR. It reveals how the OECD delegates tried in vain to convince the Austrian representatives that the ÖFR should be neither an executive nor a supervisory body but advise the Ministry on planning and implementation (BKA/BMWF/Austrian Research Council, 1971). The OECD reviewers' report "urgently" recommended "expanding and deepening the activities of the Research Council [ÖFR] so that it, as a central advisory board for science policy, can advise the government ... and examine and assess the overall situation of research and development". In addition, the ÖFR should be involved in science policy planning and be given a broader membership. The OECD

6 Draft answer to the OECD auditors' questions of 2 October 1970, AdR, BMWF, Hauptreihe 2, 230, GZ 128.396-I/SL/4/70.

7 Report on the outcome of the confrontation meeting on 3 and 4 November 1970, AdR, BMWF, Hauptreihe 2, 230, GZ 162.198-I-4/71.

also proposed concrete measures and addressed a crucial point: In order to be able to meet these demands, it would be necessary to give the ÖFR "a number of full-time employees as well as provide it with the necessary resources" (BKA/BMWF/Austrian Research Council, 1971, pp. 29-30). However, this was to remain wishful thinking for a long time.

The Science Forum announced by the BMWF was established in 1971, but not on a statutory basis, and thus only as a less formal commission to advise the Federal Minister. The Science Forum had over 50 members from science, industry and society (so-called "social partners"), and also the members of the ÖFR were part of it.[8] However, this forum did not really correspond to the science councils in Germany (Bartz, 2007) and Switzerland (Hafner, 2015) referred to by the OECD delegation, amongst others, as models. Nevertheless, it was to consider the German and Swiss experiences when contributing to the 1972 "research conception" (BMWF, 1973, p. 46; Pichler et al., 2007, p. 218). As a matter of fact, the ÖFR itself barely represented the system it addressed and had almost no resources at hand to fulfil its mission. As a result, it was, if at all, no more than a sounding board.

5. THE REORGANIZATION OF THE ADVISORY BODIES IN THE 1980s

The BMWF had been planning a reorganisation of the institutional framework for research and a proposal of a corresponding bill since 1973, but it did not tackle its implementation until after the university reform in 1975 (Wirth, 2023, p. 180). For this purpose, the BMWF launched an extensive participatory process in preparation of the "Research Organization Act", including surveys, polls, interim reports and an enquête in 1977. A questionnaire sent to over 100 stakeholders also raised the need for a reorganization of the "advisory system". The answers revealed widespread dissatisfaction with the existing situation, with many respondents calling for genuine advisory structures and, to

8 Cf. Structure of the research organization in Austria (overview), December 1977, AdR, BMWF, Hauptreihe 1, 46, GZ 28.511/80-21/77.

this end, "the establishment of a comprehensive advisory body" along the lines of the Swiss Science Council founded in 1965 (BMWF, 1978, pp. 18-19).

As a result, the BMWF regarded "a central advisory body ... worth considering", which would advise the federal government on the conception, prioritization and financing of research. It also recognised the independence of the members and the need for a separate secretariat (BMWF, 1978, p. 30). In fact, the first draft of the Research Organization Act proposed a new council, yet in addition to the existing ÖFR (Pichler et al., 2007). However, the structure envisaged for it was criticized already during the review of the ministry's bill, mostly because the members of the council were not to be appointed in a personal capacity rather than as representatives of institutions, and because no secretariat was to be provided. The Chamber of Commerce, the Federation of Austrian Industries and the FFF also criticized the low number of business representatives.[9] The final ministerial bill, however, did nothing to mend these points, so that also the heavily criticized chairmanship by the Minister of Science was left unchanged, rendering the idea of independent advice to the government pointless.[10]

The Research Organization Act finally adopted in 1981 newly introduced the "Austrian Council for Science and Research" (ÖRWF). It had eight to twelve members appointed by the Minister of Science, five of whom held institutional mandates, namely from the ÖAW, the Rectors' Conference, the Federal Conference of Scientific and Artistic Personnel, the FWF and the FFF. It was chaired by the Minister of Science. The tasks were similar to those previously assigned to the ÖWR yet reduced by advising legislative bodies. In addition to the first draft, the law also put the Science Forum on a legal basis as the "Austrian Conference for Science and Research" (ÖKWF). Its membership was made up of representatives of the parliamentary parties, the social partners, the federal ministries,

9 Preparation of the new legal regulation of research organization in Austria, statements within the preliminary review procedure, 4 January 1979, AdR, BMWF/II, Box 58/78, GZ 28.511/30-21/78.

10 Draft Research Organization Act, review, comments received, May 1979, AdR, BMWF/II, Box 273/79, GZ 28.511/80-21/79.

the federal states, the scientific institutions, the two funds, university professors, and students, among others. The members of the ÖRWF were also members of the ÖKWF, which, in total, had up to 58 members. All of them exercised their mandates in an institutional rather than personal capacity. The main task of the ÖKWF was to recommend to the federal government or federal ministers on which matters the ÖKWF itself, or the ÖRWF should provide their advice.[11]

While, according to Minister of Science and Research, Hertha Firnberg, the ÖRWF "functions as a kind of council of elders", "the conference [ÖKWF] [serves] the participation of science, research and the state within the research policy decision-making process".[12] The ÖRWF was supposed to meet at least once a year, which it actually did not much more often. It did not dispose of its own resources in terms of a staffed office and a budget, instead only a secretariat taking the form of a unit in the BMWF was set up.[13]

The ÖFR was renamed the Research Funding Council (FFR). Its remit was limited to the joint affairs of FWF and FFF and proposals to the ÖRWF, but it was otherwise left unchanged.[14] The FFR met by far most frequently of all now three advisory bodies, every two to four months, and continued its former activities practically unchanged under the new – actually much more fitting – name. In retrospect, the FFR considered it a key achievement to have ensured the combination of basic and applied research.[15] In view of the unusual twin structure the two funds it represented, this was undoubtedly true, particularly at a time when FWF and FFF were practically the only research policy instruments available.

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11 Federal Law Gazette No. 341/1981, §§ 2-5.

12 Minutes of the 1st meeting of the Science Conference on 15 January 1982, introduction by Hertha Firnberg, AdR, BMWF/II, Box 446/82, GZ 2.801/1-21/82; 46 people were present in addition to the Minister.

13 Report on the first working session on 16 November 1981, AdR, BMWF/II, Box 41/81, GZ 28.511/65-21/81.

14 Federal Law Gazette No. 341/1981, Art. II Z. 11.

15 Minutes of the 62nd meeting of the Research Promotion Council on 30 September 1981, AdR, BMWF/II, Box 446/82, GZ 2.779/1-21/82; it was decided to continue the numbering of the meetings of the Research Council.

Since 1970, however, the range of topics and instruments had begun to expand massively. The newly created advisory bodies were hardly able to meet the corresponding expectations placed in them. Of the twelve members of the ÖRWF, only three were not university members, one of whom was the President of the FFF and an ex officio member of the ÖRWF.[16] This meant that the range of expertise remained limited. As a result, these bodies apparently played no relevant role in the research policy changes of the 1980s and 1990s (Biegelbauer, 2013).

On the occasion of the 1988 OECD review of science and technology policy, the OECD's verdict on the follow-up of 1971 recommendations was downright scathing: The ÖRWF that had been established in the meantime, "is ... not independent. It has no budget of its own and the outside world is hardly aware of its existence; rather it acts as an internal advisory body for the Minister and the Government." (OECD, 1988, p. 54). The OECD was no less critical of the ÖKWF: "the Conference [ÖKWF] seems to have no more than a formal existence and any initiative within it comes largely from the representatives of the Government. Because of its membership and the way it operates, ... the conference can be no more than an audience." According to the OECD, both bodies should therefore be able to act more actively and independently, have an adequate information base and be allowed to publish recommendations. Moreover, industry should be more strongly represented so as to reflect the trend towards a knowledge-based economy (OECD, 1988, pp. 73-74).

The consequences drawn in Austria from OECD review probably did not go in the direction that had been imagined by the OECD: the ÖKWF was abolished without further ado in 1991, "for reasons of administrative efficiency" at the request of the ÖKWF itself, as the parliamentary committee report put it.[17] As far as the ÖRWF was concerned, nothing changed. In the wake of the enormous structural changes of the time, the

16 Until the mid-1980s, the other two industry representatives were the directors Bildstein (Plansee) and Kellermair (Chemie Linz). After that, there is no documentation.

17 Federal Law Gazette No. 407/1991, Z. 1; Sten. Prot. NR, XVIII. GP, 161 of the enclosures (der Beilagen - d.B.).

Federal Government obviously preferred to rely on other, project-based forms of policy advice.[18] Even though the 1980s' and 1990s' councils (and the conference) expanded their representativeness for the science and research system compared to the 1960s and 1970s, they were still lacking the resources necessary to launch their own initiatives. That left the role as a co-ordination platform at best instead of being among the drivers of change.

6. EXPERTISE INSTEAD OF REPRESENTATION: THE PARADIGM SHIFT IN THE 2000s

The coalition government formed by the ÖVP and the Freedom Party (FPÖ) in 2000 continued the expansion of science and research policy, namely in terms of budget increases, which had already been initiated by its predecessor "grand coalition" government. However, in the wake of New Public Management this government broke with some of the long-standing traditions of policymaking through social partnership. In that vein, the government swiftly established a new advisory body to support the setting of research policy priorities. The legislation necessary was submitted to the National Council as a committee motion rather than as a government bill entailing a review procedure, thus speeding up things.

The new legislation abolished the ÖRWF as well as the FFR and replaced them by the "Council for Research and Technology Development" (RFTE).[19] This Council differed significantly from the previous bodies in two main aspects: firstly, all eight members were appointed in a personal capacity not bound by any institutional affiliation. The federal minister for Education, Science and Culture and the federal minister for Transport, Innovation and Technology appointed four members each. Secondly, the RFTE had a staffed office, initially set up as an independent department of the Federal Ministry for Transport, Innovation and Technology (BMVIT).

18 Cf. Pichler et al. (2007) pp. 302-304, on the TIP (Technology, Information, Policy Advice) program 1992-1999.

19 Federal Law Gazette I No. 47/2000, Z. 3; Sten. Prot. NR, XXI. GP, 136 d.B.

The parliamentary committee report stated that this would "support research policy more effectively than before through expert opinions."[20] The tasks partly resembled those of the previous councils but also included the development of a long-term strategy and guaranteed the autonomy of the council in making proposals.

The legitimation of the members of the RFTE was now exclusively their personal qualification. They represented a broader range of expertise, despite the smaller number of members. The new legal provisions required a balanced representation of university, non-university and company-related research. The establishment of the office, in which eight to ten people usually worked in the following years, gave the RFTE certain operational capacities. Almost thirty years after the first OECD recommendations in this respect, an independent advisory body had almost suddenly come into being. Now there was not only an office with its own staff and budget (which alone "sends a strong message of independence": OECD, 2018b, p. 191), but also regular publications of strategies, recommendations and reports, which are still fully documented and available on the Internet today.[21]

However, the rapid establishment of the RFTE must be seen also in another context that would have a lasting impact on the RFTE's position in the Austrian science and research system. In fact, the Ministry of Finance had linked the budget increase for research to the condition that it would make the additional funds available only based on an opinion of the RFTE. Consequently, the ministries responsible for research had to submit proposals to the RFTE for evaluation. The government hoped that this would lead to innovative approaches that would be more effective than the ministry routine, which was supposed to prevail otherwise. The extra budgets allocated in that manner amounted to over 1.1 billion euros

20 Technically, die RFTE replaced only the Research Funding Council: Federal Law Gazette I No. 48/2000, Z. 11; Sten. Prot. NR, XXI. GP, 164 d.B. In addition to these eight members, the two ministers responsible for the RFTE as well as the ministers of economics and finance or – which was the rule – representatives delegated by them were consultant members. However, the ministers seldom attended any of the meetings.

21 https://forwit.at/archive/ (last accessed on 5th March 2026).

from 2001 to 2006.[22] This meant that the budget available in this period almost doubled.

As a result of this setting, the RFTE took part in making decisions on the distribution of large sums of money from its very beginning. Because the ministries, together with the implementing agencies, had to apply to the RFTE for the funds, it held considerable power over them and thus in research policy in general. However, as the Council got directly involved in the process of budget allocations, it had rather become, as it were, a bargaining platform comprising some joint planning elements as it provided a forum for the ministries' interaction. This, in turn, reduced its capabilities to provide actual strategic advice to the federal government. The establishment of the National Foundation for Research, Technology and Development even aggravated that effect. The foundation was a source of additional budgets provided by the National Bank and the ERP Fund since 2004. The foundation's board of trustees had to obtain an opinion from the RFTE before allocating the funds.[23] While the system of extra-budgetary capital gains became obsolete following the international financial crisis in 2008 and was replaced by other financing mechanisms, the RFTE (and its successor from 2023) continued to make de facto decisions on amounts of 125 to 140 million euros per year until 2025.

Even though the heavy involvement of the RFTE in these financial decisions caused a certain tension with its actual advisory tasks, this strengthened the position of the RFTE in the Austrian science and research system even more. In the course of the reform of the Austrian research funding system in 2004, when, among others, the Austrian Research Funding Agency (FFG) was established, the position of the RFTE also changed. It was incorporated as a statutory body in order to guarantee its independence.[24] The corresponding legal regulations expanded the

22 In retrospect: R&D Supplement to the Federal Budget 2007/2008 (https://service.bmf.gv.at/BUDGET/budgets/2007/beilagen/Fu_E_Beilagen.pdf, last accessed on 5th March 2026), p. 108.

23 Federal Law Gazette I No. 133/2003, Art. 1.

24 Sten. Prot. NR, XXII. GP, 510 d.B., 15.

organizational provisions considerably; the BMVIT remained as the only source of funding for the council itself.[25] Within five years, the RFTE had gained considerable standing and a high degree of independence. The RFTE also used its standing to strive for a stronger role in the procurement of evaluations. The ministries though dismissed this idea, claiming evaluation as their political responsibility.[26]

The number of members of the RFTE was not only a third smaller than that of the former ÖRWF, but also – as was the intention of the law – much less academically bred. In the first two five-year terms of office (2000-2010), university members accounted for half of the members or less. In this period, Böhler-Uddeholm board member Knut Consemüller was elected chair, with Innsbruck chemist Günther Bonn as his deputy. During the following two periods (2010-2020), Hannes Androsch, former Finance Minister (1970-1981) during the Kreisky era, chaired the Council, with the former Rector of the Vienna University of Technology, Peter Skalicky, as deputy until 2015, then followed by Markus Hengstschläger, geneticist at the Medical University of Vienna. During this time, members with a university background made up at least half of the members. There were always some internationally based members. Table 1 shows the distribution of the members' background.

Period	Academia	Industry	Other public sector	Other private sector	Of which international
2000-2005	4	4	-	-	1
2005-2010	2	4	2	-	1
2010-2015	5	1	-	2	2
2015-2020	4	3	1	-	4

Table 1: Predominant professional background of RFTE members
Source: own compilation
Notes: other public sector = agencies, intermediaries; other private sector = research associations, consultancies; international = located abroad, irrespective of nationality

25 Federal Law Gazette I No. 73/2004, Art. 2, § 119.

26 Author's personal recollection as a regular attendee of the council's meetings.

Given these capabilities, the RFTE was the first council to gain a real advisory function and make a difference. Compared to its predecessors, it could exercise its task highly independently thanks to the absence of institutional tickets in its membership and the availability of dedicated resources.

Beside the RFTE, another science policy advisory body came into being in the early 2000s, namely the "Science Council" (WR) in 2004 as part of the university reform introduced by the Universities Act of 2002.[27] Its task was to advise the federal minister, parliament and the universities themselves and to "analyse the Austrian university and science system". The WR had twelve members (serving three or six years' terms) appointed by the federal government, four of whom were nominated by the science minister and eight members "from different areas of society" (in fact, predominantly professors) nominated by those four members. The law did not assign an explicit legal form to this council; it is therefore safe to assume that it had no legal personality. The Ministry of Science had to provide it with staff and an office. Remarkably, this council had not figured in the original government bill but was only amended by a committee motion in course of the parliamentary proceedings.[28] This maybe indicates that originally the RFTE was meant to be the sole council at that time. Wolfgang Mantl, a political scientist and lawyer from Graz, was elected as the founding chair, followed in 2005 by Jürgen Mittelstraß, a philosopher from Constance, for the next ten years. Then, Antonio Loprieno, an Egyptologist from Basel, took over. The WR had followed similarly tasked yet differently composed committees based in earlier versions of the university law dating back to 1955.[29]

27 Federal Law Gazette I No. 120/2002, § 119. The documentation of the activities of the Science Council is available at https://forwit.at/wr/archive/ (last accessed on 5th March 2026).

28 Sten. Prot. NR, XXI. GP, 1224 d.B., p. 12 f.

29 Cfr. Federal Law Gazette No. 805/1993, § 83; Federal Law Gazette No. 258/1975, § 108; Federal Law Gazette No. 154/1955, § 69. See also König, 2012.

7. A COMPREHENSIVE COUNCIL: THE COUNCIL FOR SCIENCES, TECHNOLOGY, AND RESEARCH

As an autonomous organization of independent experts, the RFTE achieved a degree of independence that its predecessor institutions had not been able to enjoy. Particularly from 2010 onwards, this became highly visible due to the public impact of Hannes Androsch as chair. Nonetheless, its actual influence on political decision-making remained limited as it obviously lacked continuous feedback loops to policy makers. Meantime, the WR almost dropped out of public sight.

By the late 2010s, the RFTE seemed to have reached the limits of its scope. From 2013 to 2019, the ministry of science had additionally set up the "ERA Council Forum"[30] to advise on European research policy issues, and from 2017 to 2021, the BMVIT had established an expert council for robotics and artificial intelligence, which was hosted by the RFTE office.

This constellation was considered increasingly inadequate, so that the 2017 government program proposed the merger of the existing councils into a new body (Bundesregierung, 2017, p. 78). Because of the collapse of the government in 2019 this never materialized. The program of the subsequent government then only declared that "the institutional reorganization of the councils in the field of science and research" should be evaluated (Bundesregierung, 2020, p. 311), even though still in 2018 the OECD had once again suggested such a reform in its Innovation Policy Review of Austria: "Unlike in other countries (e.g. Finland), there has not been any review or evaluation of any of the Austrian councils", it stated. In a way, the OECD now had carried out such an evaluation itself and, as a result, proposed two options for the future: either a strengthened expert committee with sufficient resources and a clear mandate, or a political co-ordination platform as in Finland or Sweden chaired by the prime minister (OECD, 2018b, pp. 187-191). Austria, however, had less positive experiences with that approach, even if this intends to ensure political commitment like in Sweden (Edquist, 2019). The viability of a particular organizational model always depends on

30 ERA: European Research Area

the specific political and institutional context (Schwaag Serger et al., 2015; OECD, 2018a).

The Covid-19 pandemic shifted political priorities before the federal government that took office in 2020 was able to devote itself to reorganizing the councils. Yet the pandemic was extremely significant for scientific policy advice because it drastically revealed the lack of functional interfaces between science and politics: "nation states have different institutional arrangements to organize the nexus between scientific expertise and policy making. The pandemic was a stress test to those institutional arrangements, stimulating retrospective inflections and evaluations." (König & Stampfer, 2025, p. 3; König, 2020).

Amid the Covid crisis, the mandates of the RFTE members expired in September 2020. The two chairpersons could not be reappointed as they had already served two terms on the Council. The remaining members were provisionally reappointed until the finalization of the reorganization of the advisory structures. Klara Sekanina (Managing Director of the Swiss Study Foundation) was elected Chair, after her resignation in 2022 followed by Sylvia Schwaag Serger, among others Professor at the School of Economics and Management at Lund University. Sabine Herlitschka, CEO of Infineon Austria, served as deputy chair during that time.

The new law finally passed in 2023. It established the "Council for Sciences, Technology, and Research" (FWIT-Rat, referred to as "FORWIT" in public communication)[31] and abolished the two previously existing statutory councils. Like the RFTE, the FORWIT is a corporation under public law. Furthermore, its twelve members' legitimation is their expertise and not an institutional capacity. The members are appointed by the Federal Government rather than single ministers, but at their proposals, of which six from the science minister, four from the innovation minister, one from the minister of economy. Their ministries also provide the budget. The Chair is appointed (and therefore no longer elected) by the Federal Chancellor in agreement with the Vice-Chancellor. The deputy chair is still elected by the council. The term of office is four years.

31 Federal Law Gazette I No. 52/2023.

The larger number of members, the broader width of their background (science, active research and research-based companies) as well as their appointment by the Federal Government are intended to increase the Council's relevance. The law expresses this also in a list of objectives for the Council, which the law comprises for the first time: Essentially, the FORWIT's advice to the federal government should contribute to the positive development of science and research itself, but also to their positive impact on society, the economy and the environment. The FORWIT is also assigned a role in the context of the Research Financing Act (*Forschungsfinanzierungsgesetz* – FoFinaG) passed in 2020. This law introduces a comprehensive budgetary framework for publicly funded research based on three years' recurring budget cycles. The FORWIT's task is to advise on the priorities during these periods.[32]

Computer scientist Thomas Henzinger, founding and long-time president of the Institute of Science and Technology Austria, was appointed Chair of the FORWIT, which elected the last RFTE Chair, Sylvia Schwaag Serger, as his deputy.[33] Table 2 shows the overall distribution of the FORWIT members' background.

Period	Academia	Industry	Other public sector	Other private sector	Of which international
2023-2027	7	3	-	2	2

Table 2: Predominant professional background of FORWIT members
Source: own compilation
Notes: see table 1

The FORWIT office and staff resulted from merging the respective RFTE and WR structures, which were streamlined further in course of fully

32 Federal Law Gazette I No. 52/2023, § 2. However, the FORWIT does not figure in the university law although it otherwise succeeded the science council.

33 During the finalization of this article, Sylvia Schwaag Serger announced to withdraw from FORWIT by 31st March 2026. Uwe Cantner, former chair of the German expert commission on research and innovation, was appointed her successor. Theresia Vogel was elected deputy chair.

implementing the law. As a special organizational feature, the FORWIT also has a supervisory board, which is made up of representatives of the ministries entitled to make proposals for the members, the ministry of finance and the chancellery. This board – like in other statutory bodies – shifts governmental supervision away from the immediate ministerial level to a setting where ministerial representatives are not bound by instructions. While this is primarily meant to avoid time-consuming interministerial coordination procedures – given that more than one ministry is responsible – it also strengthens FORWIT's independence as an organization.

The FORWIT took its predecessor's achievement in terms of independence and capacities as a real advisory council further. It enjoys a broader commitment of the government and covers a broader field of expertise among its members, but still without institutional mandates.

8. CONCLUDING OBSERVATIONS

It took several decades to develop stable and relatively independent advisory structures in Austria, later than in other developed countries often referred to in the debate such as Switzerland, Germany, Sweden or Finland. This does not mean that the position of the current Council will remain unchallenged. Yet examples from other countries such as Germany show that once established, advisory structures remain stable over a long period of time and can even have structurally conservative effects (Heinze et al., 2019).

Even if the developments leading towards today's council started in the 1960s, we can observe a succession of different institutional models until one of them became settled enough to last for a longer time and achieve some lasting impact on the science and research policy stakeholders. Table 3 summarizes the characteristics of these various councils. The last column categorizes them along the typology introduced at the beginning of this article, using the relating heuristic framework.

As a very light version of a research advisory council, the ÖFR first emerged from the 1960s' political debates. Despite its comparatively

Name	Time period	Legal entity	Max. no. of members	Member-ship	Term (years)	Own resources	Type (see figure 1)
ÖFR	1967-1981	N	4	I	3	N	3
FFR	1981-2000	N	4	I	3	N	3
ÖRWF	1981-2000	N	12	I+P	4	N	4
ÖKWF	1981-1991	N	58	I	4	N	4
RFTE	2000-2023	Y*	8	P	5	Y	1
WR	2004-2023	N	12	P	3/6	Y	1
FORWIT	2023--	Y	12	P	4	Y	1

Table 3: Characteristics of statutory Science and Research Councils in Austria
Source: own compilation
Notes: N=no, Y=yes, I=institutional mandate, P=personal mandate, *=since 2004

comprehensive formal mandate, it busied itself mostly with funding matters and was, if at all, only a sounding board in terms of policy advice. Shortly after that, the new ministry for science and research attracted most of the stakeholders' attention, more than any council could possibly have done at that time. Yet the ministry's role was fundamentally different from the one of an advisory body, as, not least, the OECD criticized. Eventually, the 1980s saw the introduction of the ÖRWF as a broader council. Even though its mandate was limited and resources were lacking, this new council could potentially have served as a more powerful coordination platform, given its more representative membership. Still, it had no visible impact most of the time, partly because it was the result of policy layering as the former council continued to exist as the FFR under a different name and another body – the ÖKWF – was added.

The technocratic turn at the beginning of the 2000s led to a massive change of the institutional environment of science and research policy. As an entirely new council, the RFTE replaced its predecessors, disposed

of its own office and staff and lasted for more than 20 years. Yet again, we can observe policy layering, producing additional formal and informal advice structures over time. After the merger of the RFTE and the WR in 2023 there is now a comprehensive advisory body intended to span the whole spectrum from university research and higher education to company innovation. The councils of the 2000s were designed as "real" advisory bodies with their own resources and independent members.

Based on the heuristic framework proposed in this article, we can identify a shift in the councils' legitimation and function over time: The membership of the councils from the 1960s to the 1990s followed a corporatist logic and was largely based on the representation of stakeholders and other institutions somehow involved in science and research. After that, following a meritocratic approach, membership was based primarily on personal expertise, thus strengthening the councils' independence, but potentially weakening its ties to other sectors of society. Contrary to the pre-2000 councils, these councils were given their own staff and budget, which enabled them to act more independently and achieve greater impact. Overall, this progress from a "sounding board" model through "coordination platform" to "advisory body" models reflects international trends as well as Austria's catching-up process in science, research and innovation.

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INDEPENDENT ADVICE IN RESEARCH AND INNOVATION POLICY: THE ROLE OF THE SPANISH SCIENCE, TECHNOLOGY AND INNOVATION ADVISORY COUNCIL (CACTI)

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ABSTRACT

This article analyses the trajectory of the Spanish Science, Technology and Innovation Advisory Council (CACTI) as a central component of the national science, technology and innovation policy system. It examines how institutional design shapes the integration of expertise into policymaking within a continental administrative tradition marked by strong bureaucratic dominance and limited policy evaluation practices.

Between 1986 and 2011, the Advisory Council operated as a hybrid body integrating external stakeholders, experts and senior public officials, which facilitated proximity to decision-making but did not generate a strong evaluation culture. The 2011 reform transformed it into an autonomous and formally independent body composed exclusively of external members. While this change aligned with prevailing European practices of independent advice, it weakened institutional embeddedness and reduced its effective influence on policy design.

The Spanish case illustrates a broader governance dilemma: independence alone does not guarantee advisory impact. In administrative systems where bureaucrats play a central advisory role, effectiveness depends on sustained institutional linkages, political demand and integration into the policy cycle. Persistent weaknesses in policy evaluation, fragmented multilevel coordination and rhetorical Europeanisation without institutional consolidation further constrain advisory capacity.

The article concludes that strengthening policy advisory systems requires not merely autonomy but effective articulation between expertise, bureaucracy and political decision-making. The Spanish experience offers comparative lessons for countries adapting international advisory models to domestic administrative traditions.

Keywords: *Policy for Science, Scientific Advice, Research Evaluation, Policy Advisory Bodies, Cacti, Science and Innovation Policies, Spain.*

1. INTRODUCTION

This paper examines the role and evolution of the Science, Technology and Innovation Advisory Council (CACTI) within the Spanish research and innovation policy system. It analyses how this body operates in the design and evaluation of science, technology and innovation (STI) policy.

Referring to the classical divide between science and policy (Brooks, 1964), the analysis focuses on "policy for science" within the STI policy cycle. The governance of science, innovation and their associated public policies in Spain has been shaped primarily by two legislative milestones: the 1986 Science and Technology Act and the 2011 Science and Innovation Act (partially amended in 2022). Although several minor reforms have been introduced over the years, these two Acts constitute the foundational framework of the national science, technology and innovation system and the regulations governing its operation.

Although Spain is often described as an almost federal country (Sala, 2014; Colino, 2020), this analysis focuses on the national level of STI policymaking and, specifically, on the role and changing operation of the Science, Technology and Innovation Advisory Council (CACTI)[1] as the institutionalised advisory and participatory body in the Spanish science, technology and innovation policy arena. Currently the Advisory Council is supported by the administrative structure of the Ministry of Science,

1 The Science, Technology and Innovation Advisory Council (CACTI) is the current name of the advisory body. Since its formal inception in 1986, the council has changed its name, mission, structure and composition. For ease of reference, we use Advisory Council or CACTI.

Innovation and Universities, but legally reporting to the Scientific, Technological and Innovation Policy Council (CPCTI).

Originally established under the 1986 Science and Technology Act (Ley 13/1986, art. 9) as the Science and Technology Advisory Council (CACyT), the Advisory Council was legally assigned several advisory functions to the government, as well as responsibilities for defining objectives and STI instruments, promoting policy evaluation and fostering the participation of research and innovation actors in policymaking. These functions have remained largely unchanged, but the composition of the Advisory Council and its degree of embeddedness in the STI policy process have evolved over time. Under the 2011 Science, Technology and Innovation Act (Ley 14/2011, art. 9), the Advisory Council was renamed CACTI.

Although the Advisory Council has enjoyed a long institutional existence -it will celebrate its 40th anniversary in 2026-, its contributions, visibility and effectiveness, both past and present, have been far from optimal. The aim of this paper is not merely to describe the structure and functions of the Advisory Council, but rather to offer a self-critical reflection on the role it has recently played, and could potentially play, in the development of Spanish STI policy.

Good policymaking depends, among other factors, on an adequate supply of knowledge, information and expertise. Policy legitimation and social acceptance among key actors are also crucial for the successful design and implementation of STI policies. Accordingly, the effectiveness of public policy and the quality of STI governance are assumed to depend on the strength of the policy advisory system in place (Capano et al., 2025). A policy advisory system is understood here as "formal or informal advisory units and practices, inside and outside government, that exist at a given time and with which governments and other actors engage for policy-making purposes" (Craft & Halligan, 2020).

While a robust advisory system is essential for high-quality policymaking, there is no single formula that can be applied uniformly across countries and policy domains. Each country and policy sector has developed its

own traditions and understandings regarding the organisation of advice, the provision of expert knowledge and the participation of actors in the policy process.

2. CHARACTERISING THE POLICY ADVISORY SYSTEM

Over recent decades, the literature on science advice (Smith, 1992; Golden, 1993) and policy advice for science (Halligan, 1995, 1998) has followed different trajectories and reference points. However, both traditions share a common feature: the dominance of Anglo-Saxon scholarship, which has shaped debates while often downplaying the extent to which country-specific features of policymaking processes and public bureaucracies condition the operation and outcomes of policy advisory systems.

The Spanish model of government and public administration is closer to continental "Napoleonic" administrative systems. In such contexts, the main source of policy (and political) advice typically lies within the bureaucracy itself, notably among senior officials directly involved in the policymaking process (Brans et al., 2025; Shafran, 2022) or minister cabinet members.

Scientific expertise is central to some processes of resource allocation in STI policy, but science or research evaluation follows its own specific procedures (Sanz-Menéndez, 1995), and its primary purpose is not the design of policy but the management of policy instruments and the allocation of resources for science.

The focus here is on advice to STI policymaking at any stage of the policy cycle —from design to evaluation— but in institutionalised forms. Early contributions to the analysis of the policy advisory systems examined where policy advisers are located, how close they are to decision-makers, and how different systems of policy advice are organised (Plowden, 1987; Halligan, 1995). Subsequent research has broadened this perspective to include the situational and socio-political contexts in which policy advice is produced, to consider specificities of policy domains and to incorporate a comparative dimension (Craft & Wilder, 2017).

From this literature on policy advice (Capano et al., 2025), several insights emerge that are relevant to STI policy:

- First issue is the location of advice, and the extent to which it is "internal" or "external" to government. In other words, to what degree are advisory functions and institutionalised bodies integrated into decision-making processes? Should advisers and advisory bodies be situated within policymaking structures, or should they operate as externally located actors?
- Second issue is the membership and composition of institutionalised advisory bodies. Who occupies these roles: senior officials, independent experts from outside the public administration, or representatives of organised interest groups (for example, trade unions or business associations)?
- Third, and related to the previous issues, is whether advisory bodies should have a relatively homogeneous composition or a "mixed" or "hybrid" one, bringing together decision-makers, bureaucrats and external experts.

Institutionalised policy advice usually pursues multiple missions, but two are particularly important: a) defining policy objectives, choices and designs, and b) evaluating policies and instruments as part of the policy cycle and learning processes. Both advisory functions —setting policy objectives and supporting policy evaluation— were formally included, as will be shown, in the mandate of the Spanish Advisory Council.

In the Anglo-Saxon tradition, there is a strong emphasis on "independent advice" provided by external experts to governments (Craft & Howlett, 2025). By contrast, in Spain and in several continental European countries, particularly those with corporatist traditions, the prevailing model has stressed the participation of actors in the policy process and the role of bureaucracies as knowledge and advice providers to policymaking. In Spain, the level of "independence" from government of the institutionalised advisory body, once appointed, was relatively low. However, the presence of policymakers and senior officials responsible for

STI policy within the Advisory Council, alongside experts and organised interests, ensured a stronger degree of integration of deliberation into policymaking processes.

In this view, our hypothesis is that recent reforms have tended to weaken traditional patterns of interaction between advisory bodies and the bureaucracies responsible for designing and implementing policies. Bureaucracies in the past have seen the Advisory Council member's as actors directly involved in the policy making. Where institutional design does not provide direct links between external advisers and political or administrative decision-makers, additional operational problems are likely to arise. The administrative location of an independent advisory body -its position within the governmental structure- and the way it connects with officials responsible for designing, implementing and evaluating public policies are therefore crucial determinants of its effective operation. These are the issues explored in the remainder of the paper.

3. THE EUROPEANISATION OF SCIENCE, TECHNOLOGY AND INNOVATION POLICY IN SPAIN

In a quasi-federal country, the National and Regional Governments have their own STI policies and the institutionalised multilevel coordination mechanism is the STI Policy Council, that includes representatives from all Governments. The governance of the Spanish STI system is structured around the Spanish STI Strategy (EECTI) and the State STI Plan (PECTI), which, according to the legal framework, are the main instruments through which Spain defines objectives, programmes and tools in the fields of science, technology and innovation. However, neither the strategy nor the plans are supported by binding budgets and, at best, contain only indicative spending references. In recent years, the EECTI and the PECTI have increasingly aligned with —or, in some cases, directly replicated— the EU Framework Programme for R&D; the current period is framed as a seven-year strategy (2021–2027), divided into two State Plans and periods: 2021–2023 and 2024–2027.

Spain's science, technology and innovation policies have undergone a sustained process of Europeanisation since 1986, when Spain joined the European Communities (Sanz Menéndez, 1997), characterised by the progressive alignment of national discourses, strategic frameworks and policy narratives with those promoted by the European Union (EU) (Cruz-Castro & Sanz-Menéndez, 2022). This alignment has facilitated Spain's integration into EU research agendas and reinforced the legitimacy of science and innovation policies as a lever for socio-economic development (Lundvall & Borrás, 2005). Yet, as in other member states with less mature innovation systems, discursive convergence has not consistently translated into robust domestic institutional learning or adaptation (Kuhlmann & Rip, 2018), and the Spanish case illustrates a persistent tension between rhetorical Europeanisation and the limited transformation of underlying governance structures (Cruz-Castro & Sanz-Menéndez, 2021).

Despite improvements in aggregate scientific output and international collaboration, Spain continues to display structural weaknesses in its STI system, including limited degrees of high-quality research (Rodríguez-Navarro & Brito, 2022), governance fragmentation (Sanz-Menéndez & Cruz-Castro, 2005), instability in public funding and research positions (Cruz-Castro & Sanz-Menéndez, 2016), divisions regarding research careers models (Sanz-Menéndez & Cruz-Castro, 2019) and a persistent lack of systematic policy evaluation (Sanz-Menéndez, 1995). These limitations suggest that the simple replication of European templates is unlikely to generate the institutional resilience required for sustained performance. Others have advertised that adopting successful models from other countries does not guarantee success by the adopter (Manski, 2013). A more context-sensitive approach would instead focus on designing policy instruments tailored to Spain's structural characteristics and institutional capacities (Borrás & Jordana, 2016), leveraging national strengths —such as internationally competitive research groups and dynamic regional innovation ecosystems— while directly addressing entrenched weaknesses. The Advisory Council has frequently issued opinions along these lines, although its capacity to influence policy has remained limited.

4. CHANGES AND ADAPTATION OF THE ADVISORY COUNCIL IN SPAIN

Following Spain's transition to democracy in the late 1970s, the advisory function for science and technology policy was formally recognised and institutionalised with the enactment of the first Science and Technology Act (Ley 13/1986). This Act established a distinctive governance model for science and technology policy, ruled by an Interministerial Commission responsible for designing the main policy instrument: the National R&D Plan, conceived in parallel with the structure of the EU Framework Programmes (Sanz-Menéndez & Borrás, 2001). The Interministerial Commission for Science and Technology (CICYT) was supported by a General Secretariat for the National R&D Plan, a permanent administrative body which, although formally reporting to the Ministry of Education and Science (the Minister of Education and Science was the CICYT chair), operated with an unusually high degree of scientific and budgetary autonomy within the Spanish public administration.

The institutionalisation of science policy advisory functions in the late 1980s took place in a context marked by the constitutional endorsement of the "social market economy", which emphasised the participation of scientific, economic and social actors in policymaking. Consequently, "scientific advice"—and advice provided by scientists—for the formulation, monitoring and evaluation of R&D policies emerged closely linked to the representation of organised interests, initially those of trade unions and employers' organisations and later those of academic and other corporate actors.

The 1986 Act defined the purpose of the Advisory Council as follows:

> "In order to promote the participation of the scientific community and economic and social agents in the preparation, monitoring and evaluation of the National Plan (...), an Advisory Council for Science and Technology is hereby set up, the composition of which shall be established by regulation and which shall be chaired by the Minister designated by the Government"
> (Ley 13/1986, art. 9.1).

It also set out its functions:

"a) To propose objectives for incorporation into the National Plan.

b) To advise the Interministerial Commission in the preparation of the National Plan.

c) To report, prior to its submission to the Government, on the National Plan drawn up by the Interministerial Commission, as well as on the degree of its fulfilment, especially with regard to its social and economic impact.

d) To submit to the Interministerial Commission proposals for modifications to the National Plan.

e) To issue any reports and opinions requested by the Interministerial Commission or by the bodies responsible for scientific policy in the Regional Governments"
(Ley 13/1986, art. 9.2).

The functions of the Advisory Council were therefore primarily associated with the preparation, design, monitoring and evaluation of the main policy instrument, the National R&D Plan. Its main interlocutor was the Interministerial Commission, the highest decision-making body in R&D policy at the time, although the framework also allowed for potential collaboration with regional governments that started to develop their science and innovation policies (Sanz-Menéndez & Cruz-Castro, 2005).

The organisation and composition of the Advisory Council were subsequently regulated through a Royal Decree (RD 834/1987). Reflecting the longstanding distribution of responsibilities between the Ministries of Education and Science and of Industry and Energy, the presidency of the Advisory Council was assigned to the Minister of Industry and Energy. Alongside councillors proposed by various institutions, senior officials from the main ministerial science and technology policy bodies were also included.

By design, between the mid-1980s and the late 1990s, the Advisory Council was deeply embedded in the decision-making processes and influencing the bodies responsible for defining Spanish R&D policy

(the Interministerial Commission and the General Secretariat for the National R&D Plan). Its activities focused predominantly on defining policy objectives and policy design, while policy evaluation —a practice with little tradition in Spain— remained largely underdeveloped and marginal, both as a mechanism for assessing results and impacts and as an instrument for organisational learning (Sanz-Menéndez, 1995).

By the late 1990s, the concept of "innovation" and the broader innovation policy agenda consolidated within European debates (EC, 1995; OECD, 1999), and begun to reshape Spanish R&D policy. This shift, occurring alongside a change in the governing party, prompted a restructuring of governance arrangements. Most notably, the Ministry of Science and Technology was created in April 2000, building on the historical structure of the Ministry of Industry and integrating R&D policy units that had traditionally operated with considerable autonomy and close ties to the research community. The newly established Ministry brought together policy initiatives related to R&D, innovation and digitalisation. These governmental changes were accompanied by a modification of the Advisory Council's structure and composition through a Royal Decree (RD 413/2001).

Although the Advisory Council's core functions remained unchanged, its composition evolved with the inclusion of *ex officio* political representatives from other ministries. This shift transformed the Advisory Council not only into a body for the participation of scientific, economic and social actors, but also into an emerging interministerial coordination forum. During this period, the advisory and participatory body was structurally and functionally integrated into science and technology decision-making, with a mixed or hybrid composition that combined representatives of scientific, economic and social sectors with high-ranking officials from ministries with responsibilities for Science, Technology and Innovation Policy (STIP).

In 2004, responsibility for STIP was again divided, although the Public Research Organisations remained under the Ministry of Education and Science, and the Council was reassigned. In 2008, responsibilities were once more concentrated under the Ministry of Science, Universities

and Innovation, which promoted a reform of the general regulatory framework for science, technology and innovation policy, submitting to Parliament the 2011 Science, Technology and Innovation Act.

Changing into an "independent" and "external" body to the policy process

The 2011 Act (Ley 14/2011) slightly redefined the nature and functions of the Advisory Council —whose acronym, CACTI, persists today— by incorporating innovation, as it had previously occurred in the National R&D and Innovation Plan.

> "The Advisory Council on Science, Technology and Innovation is created as a body for the participation of the scientific and technological community and economic and social agents in matters related to science, technology and innovation"
> (Ley 14/2011, art. 9.1.).
>
> "The functions of the Advisory Council on Science, Technology and Innovation shall be as follows:
>
> a) To advise the Ministry of Science and Innovation in the preparation of, and reporting on, proposals for the Spanish Science and Technology Strategy and the Spanish Innovation Strategy.
>
> b) To advise the Ministry of Science and Innovation in the preparation of, and reporting on, proposals for the State Plan for Scientific and Technical Research and the State Plan for Innovation.
>
> c) To propose, on its own initiative, objectives and modifications for their incorporation into these instruments (...), and to monitor their subsequent development through annual reports.
>
> d) To advise the National and Regional Governments and the Scientific, Technological and Innovation Policy Council in the exercise of their functions, and to report on the matters determined by them.
>
> e) To promote the introduction, in the Spanish System of Science, Technology and Innovation, of rigorous evaluation mechanisms

> that make it possible to measure the social effectiveness of the public resources used"
> (Ley 14/2011 art. 9.2.).

The new Act brough new functions to the Advisory Council and redefined its formal adscription to the Scientific, Technological and Innovation Policy Council (CPCTI), a body including national and all regional governments that is formally responsibility of the multilevel STI policy coordination.

The Act did not radically alter the participatory role of stakeholders and interest groups; rather, it clarified its scope. It removed direct evaluative responsibilities regarding STIP from the Advisory Council's remit, while assigning it a more general role in promoting mechanisms to evaluate and measure the social impact of public expenditure. At the same time, its composition was revised, transforming the Advisory Council into an "independent" body capable of electing its own president and operating according to "the principles of quality, independence and transparency" (Ley 14/2011 art. 9.4), excluding representatives of public administrations and requiring it to develop its own working dynamics, including the adoption of internal rules of procedure.

Nonetheless, the appointment of members (with the exception of representatives of trade unions, employers' organisations and Rectors association) remained a discretionary prerogative of ministerial authorities, who formally forward nominations to the Policy Council for approval. The Royal Decree (RD 1024/2015) governing the Council's composition and operating procedures —previously endorsed by the Advisory Council in 2013— was finally issued four years later, under a different government, political party and Ministry (at the time the Ministry of Economic Affairs), after an economic crisis that had diverted attention from STI policy. In 2023, a new internal agreement of the Advisory Council modified this Royal Decree and it was partially amended (RD 1014/2023), further reinforcing the Council's autonomy and capacity for self-organisation; the decree also introduced formal procedures for selecting independent councillors through an open call for expressions of interest managed by the responsible Ministry.

Internal functioning and operation of the Advisory Council in recent years

Since 2011, the new legal framework has granted CACTI formal independence and autonomy from the government and policymakers: it sets its own agenda, determines its internal organisation and decides on meeting schedules and working methods. Additionally, the Advisory Council could legally be commissioned to conduct analyses, issue opinions and produce policy briefs. Despite the fact that CACTI could in principle work for the Policy Council, the Advisory Council has not been requested to undertake any specific task during these years.

In terms of its relationship with policymakers, the Ministry provides administrative support for the drafting of minutes but no resources for substantive support activities, such as the preparation or commissioning reports or analyses. The Advisory Council meets, on average, every two months and policymakers and officials are invited to present their areas of responsibility to the Advisory Council, and interaction tends to occur through informal exchanges. The Advisory Council continues to perform only one mandatory role established by law: issuing a (non-binding) opinion on the government's proposal for each new State Research, Technology and Innovation Plan prior to its approval.

During the last eight years, there has not been a single occasion on which it has been necessary to resort to a formal vote on any issue; the usual working method is consensus. One explanation for this mode of operation is that draft reports are thoroughly debated among members and it is taken for granted that, in such a diverse group, differing views will exist and should be accommodated. In other words, reports may contain non-coinciding opinions or ambiguity regarding some issues; seeking full consensus would likely result in documents reduced to minimal common denominators.

In 2025, CACTI has twenty-two members, reflecting steady growth over the years. Five are nominated by stakeholder groups, while the remaining members are appointed by the Policy Council, following a ministerial proposal after a selection, based on a public expresion of interets from the candidates.

The Advisory Council has at times operated through working groups. For example, in 2024 three groups were established to address topics considered to be of high priority: evaluation of the science system and research careers, knowledge transfer, and dual-use technologies and technological sovereignty. The Advisory Council worked on these topics and issued analysis and recommendations, but no mechanism exist for monitoring implementation. The Council also uses a basic but important tool: inviting key actors from the science, technology and innovation system to participate in its meetings in order to clarify crucial aspects of the issues under discussion. These invitees range from senior government officials to professionals from the private sector.

From a self-critical perspective, it must be acknowledged that the Advisory Council is barely known within the STI system. Whether this is due to its internal working methods or to a lack of resources is open to debate, but the fact remains that the substantial work being carried out is not being fully capitalised upon. From the authors' point of view, it is particularly important to stress that coordination with the Scientific, Technological and Innovation Policy Council, the body to which the Advisory Council formally reports, has been practically non-existent. To the best of our knowledge, the Advisory Council has never been asked for advice by regional governments, which represents a missed opportunity to improve coordination and exchange of practices and policy learning in a multilevel STI system. This detach may partly reflect the shift from including senior officials among the members to excluding them altogether; since the Advisory Council became an "independent body", it appears to occupy a position in the policy chain that has not been effectively activated.

In the context of an autonomous and independent body with a self-elected chair, several potential drivers may enhance or hinder the Advisory Council's efficiency and political impact:

a) The organisational linkage to the highest political authority can favour visibility and potential influence. For many years there has been no direct institutional link or administrative dependence on the Minister's cabinet; the formal link of the Advisory Council

in the Ministry has recently changed (from Technical General Secretariat of the Ministry to the Directorate-General responsible for STI policymaking). This change potentially increases the direct influence of the Advisory Council in the STI policy making, because of a more direct connection with the managers and policymakers responsible of the STIP that directly depend on the State Secretary (Junior Minister). Reducing this potential influence are bureaucratic dynamics within the Ministry that tend to resist "uncontrolled" high-level access that might compete with internal advisory roles. Nevertheless, even without a direct link to the Minister's cabinet, it should be noted that, until two years ago, the Minister was present at almost all Advisory Council meetings.

b) The Advisory Council President's reputation and ability to access high-level political actors in the STI system, together with his or her willingness -and that of Council members- to devote time and personal effort to an unpaid task, are also crucial. As the Council lacks its own resources and its activities rely on members' efforts, the commitment to invest in its work depends heavily on their interests and incentives. This driver is, in turn, conditioned by the degree of politicisation of the advisory system; for instance, if the Council Chair (whose four-year mandate may be renewed once) was elected under a previous minister, political access may be weakened. Under these constraints, and in the absence of ministerial resources, the entrepreneurial capacity and leadership of the Advisory Council Chair can play a key role in promoting efficient and impactful behaviour.

c) The explicit demand by policymakers for reports and advice in the course of STI policymaking is another central factor. Without a clear demand for advice, the willingness of Council members to work is likely to diminish rapidly. Such external demand inevitably competes with internal advisory capacities -spaces that bureaucrats typically seek to protect- but may nonetheless emerge if internal actors perceive that engaging the Council will provide allies, resources and additional legitimacy in the design of STI policy. Furthermore,

growing external and formal requirements for evaluating policy results may also increase demand for the Advisory Council's input.

5. A CHANGING ECOSYSTEM FOR POLICY ADVICE

The policy advisory system is also facing environmental pressures from changes in the broader context of public administration and the relation between science and policy. The two most significant changes emerge from European influences on the government, revitalised in the context of the EU Recovery and Resilience Plan[2] and the commitments established by the Spanish government.

The first is the promotion of a new general policy evaluation system, which led to the approval of the Act on institutionalising the evaluation of public policies in the national government administration (Ley 27/2022). Despite the increasing prominence of evaluation and evidence-based policy in government rhetoric, and the formal creation of the Spanish Agency for the Evaluation of Public Policies (AEEPP), their statutes have been approved only recently (RD 65/2026).

The Spanish Agency for the Evaluation of Public Policies may represent an important step towards addressing one of Spain's most persistent deficiencies: the absence of independent, rigorous and systematic evaluation of public interventions. If effectively implemented, the new Agency could provide the analytical infrastructure necessary for evidence-informed policymaking, supporting learning processes across government and, specifically, strengthening STI policy design. However, its potential impact remains uncertain and will depend on its operational autonomy, the methodological robustness of its evaluations, and the willingness of political and administrative actors to integrate evaluative evidence into decision-making processes (OECD, 2020).

As noted earlier, Spain has no strong tradition of evaluating R&D and innovation policies, although some previous exercises can be mentioned

2 https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/spains-recovery-and-resilience-plan_en#whats-in-the-plan)

over the years, almost always driven by external pressures (OECD 2007; ERAC 2014; OECD 2021). In general, these efforts have been sporadic, lacking continuity or direct effects beyond mentions in plans. Indeed, one of the criticisms in the Preliminary Report on the State Plan for STI (2024–2027), issued by CACTI in January 2024, was the absence of any evaluation of previous and current plans to enable learning, reorientation and rethinking.

The second government initiative to enhance the role of science in public policies (Cañibano & Real-Dato, 2024) – aligned with the European initiatives such as science for policy (S4P) – is the creation of a system of scientific advisers in ministries (including a scientific advisor at every minister's cabinet) and a coordinating department at the Prime Minister's office (the National Office for Scientific Advise – ONAC).[3] Even if ONAC appears to be a "competitor" to the Advisory Council, its initial effect has been to increase demand for advice and stakeholder participation in the science, technology and innovation policymaking process.

In conclusion, the expansion of evaluation activities within the national government and the growing opportunities for scientific advice to improve policy quality may foster a more favourable ecosystem that could boost demand for the Advisory Council's work in the next round of designing Spanish STI policy.

6. CONCLUSIONS AND BALANCE

This article has analysed the trajectory of the Spanish Science, Technology and Innovation Advisory Council (CACTI) as a key component of the national STI policy system, examining how institutional design conditions the integration of expertise and knowledge into policymaking. The Spanish case illustrates how advisory arrangements are embedded in administrative traditions, corporatist practices and Europeanisation dynamics, and how reforms inspired by external models may produce unintended effects when insufficiently adapted to domestic realities. Several conclusions emerge.

3 https://www.onac.gob.es/Paginas/index.aspx

First, institutional design shapes influence. Between 1986 and 2011, the Advisory Council operated as a hybrid body combining representatives of scientific, economic and social interests with senior officials directly involved in STI policy. This mixed structure ensured proximity to decision-making and facilitated interaction with those drafting and implementing the National R&D Plan. Although its evaluative role remained limited, the Advisory Council was embedded in the policy cycle and institutionally connected to core STI policymaking arenas.

The 2011 transformation of the Advisory Council into an autonomous and independent body composed exclusively of external members -with enhanced self-organisation and the capacity to elect its own president- marked a decisive departure from this model. This reform appears to have reduced the effectiveness of advisory input in the policy design process. In the Spanish administrative context, independence has translated less into greater influence than into weaker institutional embeddedness and diminished access to decision-making arenas.

Second, independence without integration risks marginalisation. Effectiveness depends not only on autonomy but also on institutional positioning and access to politicians, policymakers and bureaucrats. In systems where bureaucrats are central providers of policy advice, excluding senior officials from advisory bodies may weaken key linkages. CACTI's current configuration has reduced systematic coordination with ministerial officials and communication with the system coordination institution, the Scientific, Technological and Innovation Policy Council (CPCTI), to which it formally reports.

This is particularly problematic in a decentralised polity such as Spain. Limited interaction with regional governments represents a missed opportunity to provide integrated multilevel advice and support exchanges and policy learning in a multilevel system.

To the best of our knowledge, the Advisory Council has never been formally requested to advise regional governments, representing a missed opportunity to benefit from the federal nature of the Spanish STI system. This detach illustrates how institutional redesign unintentionally

weakened multilevel advisory linkages between advisory input and multilevel policymaking.

Third, evaluation remains the structural weakness of Spanish STI governance. Despite recent legislative initiatives, STI policy continues to be designed with limited systematic assessment of previous outcomes. After 2011, CACTI no longer holds direct evaluative responsibilities, and its capacity to contribute to learning processes has been constrained. Without robust evaluation, policy cycles risk becoming rhetorical exercises aligned with European templates rather than grounded in domestic performance evidence. Persistent structural issues such as funding instability in the past, fragmented governance, precarious research careers, limited excellence in research and private R&D expenditure, require clearer prioritisation supported by reliable evaluative information and careful examination of previous policies and instruments.

Fourth, advisory effectiveness depends on political demand. Advisory bodies do not operate in isolation. Their impact depends on explicit demand from policymakers. In recent years, CACTI has mainly fulfilled its mandatory function of issuing a non-binding report on the State STI Plan, but it has rarely been formally commissioned to undertake broader strategic tasks. Combined with limited resources, this weak demand reinforces its peripheral role.

The advisory ecosystem, however, is evolving. New evaluation structures and scientific advisory mechanisms within ministries signal growing rhetorical commitment to evidence-informed policymaking. These developments may create opportunities for CACTI, provided that institutional linkages are clarified and its outputs are integrated into routine decision-making processes.

Fifth, Europeanisation has generated discursive convergence without full institutional consolidation. Spanish STI policy increasingly mirrors European frameworks in language and planning cycles, yet domestic governance capacities have not strengthened proportionally. The trajectory of CACTI reflects this pattern: adoption of independent advice as a norm has not been matched by stable evaluation practices, effective

coordination or multilevel integration. A gap persists between rhetorical modernisation and institutional consolidation.

Strengthening CACTI does not require reversing its independence, but reinforcing its institutional connections, particularly with the STI Policy Council, ministerial cabinets and regional authorities. Clearer procedural channels for requesting advice, improved access to evaluative data and greater visibility within the STI community would enhance both legitimacy and impact.

The Spanish case highlights a broader comparative lesson: reforms inspired by international models must be adapted to national administrative traditions. Independence and transparency are necessary but not sufficient. Without integration, coordination and political activation, advisory bodies risk becoming peripheral.

These governance shortcomings are particularly problematic in light of persistent misdiagnoses of Spain and Europe's STI challenges. The widespread adoption of the "European paradox" narrative has contributed to an overemphasis on innovation deficits while obscuring deeper structural problems. In the Spanish case, the priority lies less in correcting innovation performance per se than in strengthening the quality, stability and institutional foundations of scientific research. Sustained investment, predictable career trajectories and supportive organisational environments are prerequisites for innovation outcomes. In addition, the limited involvement of the private sector in R&D remains a major unresolved weakness that advisory mechanisms have so far failed to address effectively.

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EVIDENCE-BASED POLICY ADVICE? THE GERMAN COUNCIL OF SCIENCE AND HUMANITIES.

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ABSTRACT

This article examines the evolving role of the German Council of Science and Humanities (Wissenschaftsrat, WR) and assesses whether it can be regarded as an evidence-based advisory body. Drawing on historical, sociological, and organizational analyses, the paper traces how the WR's mandate has shifted from post-war planning and federal coordination toward evaluation, accreditation, and support of national excellence policies. Despite these substantial changes, the WR's committee structures – deeply embedded in Germany's federal multilayered governance system – have remained largely unchanged. Three case studies illustrate the consequences of this institutional inertia: the 1968 recommendation to abolish professorial chairs, the 1988 proposal to expand structured doctoral training via graduate research schools, and the 2005/2012 selection decisions within the Excellence Initiative. The cases show that the WR's recommendations were shaped by political consensus-seeking among federal and state executives and major non-university research organizations, leading to diluted reform proposals and limited systemic impact. The Excellence Initiative case further highlights legitimacy concerns, including extreme selectivity, path-dependent funding outcomes, and the persistence of structural size-based inequalities between universities. The article concludes that the WR primarily functions as a coordination and consensus-building body rather than an independent source of evidence-based policy advice. It argues that this arrangement fosters an "illusion of excellence" – a narrative suggesting substantial improvements in international competitiveness without

commensurate structural or financial reforms. The article proposes establishing an independent expert council for higher education and science policy – potentially by expanding the mandate of the Expert Commission for Research and Innovation – to enable more rigorous, evidence-based policymaking for Germany's university system.

Keywords: *German Council of Science and Humanities, Evidence-Based Policy, Multilevel Science and Higher Education Governance, Historical Institutionalism, German Excellence Initiative.*

1. INTRODUCTION

This paper examines the Council of Science and Humanities (Wissenschaftsrat, WR) in the context of Germany's multilevel science and higher education governance. Drawing on the history of the WR we discuss the problem of its lack of institutional independence and the consequences that follow from this condition. The *first section* provides a brief history of the substantial transformation of the WR's mission and interprets these changes using the perspective of Historical Institutionalism. We show how the WR initially formulated an ambitious policy agenda for structural university reform, but later became an agency for policy coordination, research evaluation, and excellence funding, while its committee and decision-making structures remained unchanged. The *second section* introduces the WR's recommendations and activities selected for this paper, which serve to illuminate the problem of its lack of independence and the resulting consequences. The *third section* uses an early, reform-oriented recommendation by the WR – namely, its call to abolish the professorial chair system – to demonstrate that such a reform could not be implemented within Germany's politically intertwined field of science and higher education policy. The *fourth section* draws on the WR's recommendation to establish graduate research schools to illustrate how its decision-making structures operate. Representatives of the federal and state governments in the WR committees weakened the financial commitments needed to implement the recommendation, with the result that such graduate schools became structurally significant only

at a small number of mainly large universities. The *fifth section* discusses the WR's activities in the so-called "Excellence Initiative". Given the very small number of university subject fields that received funding and the high rate of reproduction between the first and second funding phases, the selection practices – developed jointly under the WR's responsibility – appear questionable. Another problematic aspect is that the WR actively contributed to creating the political illusion that the "Excellence Initiative" has effectively strengthened the international competitiveness of the German university system. In *the sixth section*, we call for a politically independent council of experts for higher education and science policy. Such a body could help develop evidence-based proposals for the institutional renewal of the German university and science system and communicate innovative ideas directly to political decision-makers.

2. BRIEF HISTORY OF THE GERMAN COUNCIL FOR SCIENCE AND HUMANITIES

This section provides a brief history, including the substantial transformation of the WR's mission, based on historical, sociological, and legal-administrative studies (Bartz, 2007; Braun, 1997; Heinze et al., 2019; Möller, 2017; Röhl, 1994; Schönstedt, 2024; Seckelmann, 2016; Stucke, 2006, 2011; Trute, 1994; Trute et al., 2007; Wolff, 2015). The WR was founded in 1957 to prepare planning for the expansion of universities. In accordance with the administrative agreement between the federal and state governments, its task was to develop an overall plan for the promotion of science and to coordinate the corresponding plans of both levels of government. Thus, it had not initially been established to provide as strategic policy advice. However, the mandate was sufficiently broad that strategic issues could indeed be understood as part of the overall planning remit. The WR's committee structure – comprising a plenary assembly, a scientific commission, an administrative commission, and an executive office, reflects a federal coordination of planning tasks. It is designed to coordinate the interests of the federal and state governments and to involve representatives of university and non-university research in this process. In this sense, the WR functions

primarily as a body of science-policy federalism in Germany. Against this background, it becomes necessary to examine how the tasks assigned to the WR have changed over nearly seventy years of its existence.

Andreas Stucke, who worked at WR for three decades, most recently as head of the evaluation department, offers an internal organizational perspective on this question (Stucke, 2006, 2011). Based on the predominant activities in each period, he distinguishes three phases: "reconstruction and growth" (1957-1975), "stagnation" (1975-1989), and "evaluation and reform" (after 1989). The last phase includes the evaluation of the former GDR academy institutes and the Blue List institutes (since 2001: Leibniz Association), the system evaluation of the Helmholtz Association, and the coordination of the selection process for the "Excellence Initiative" (2019: Excellence Strategy). The WR's organizational structure and decision-making processes remained formally unchanged, even though its concrete responsibilities and the political and social environment evolved considerably.

Heinze et al. (2019) and Schönstädt (2024) provide an external historical-sociological perspective. According to Heinze et al. (2019), the WR briefly functioned in the 1960s as a political arena in which representatives from academia and politics negotiated higher education reforms in the Federal Republic. The two WR chairmen, Ludwig Raiser (1961–1965) and Hans Leussink (1965–1969), shaped the WR's reform agenda and in this way expanded its mandate toward reform-oriented policy advice. During the 1960s, the WR published four statements explicitly addressing structural weaknesses in the German higher education system (WR, 1965, 1966, 1967, 1968). This phase of higher education policy ended in 1969/1970 with the creation of competing federal coordination bodies, which called into question the WR's planning authority and its institutional raison d'être. However, the WR was not dissolved; instead, its remit was refocused on administrative coordination and harmonization of science and higher education policy, as well as consensus-building across governance levels within the federal system.

Following a new administrative agreement, the WR was assigned responsibility beginning in the mid-1970s for evaluating institutions

jointly funded by the federal and state governments. Since the 1980s, the WR has focused on evaluation and accreditation, including the former academy institutes of eastern Germany (Schönstädt, 2024). With the reform of federalism in the mid-2000s, its mandate was expanded once again to include ensuring the international competitiveness of science in Germany. This includes working with the German Research Foundation (DFG) to perform a nationwide coordination function in the selection process for "excellence funding." Despite these additional tasks, the WR continued to publish recommendations on structural issues in the German higher education and science system at irregular intervals. However, these do not aim at substantial reforms of institutional structures but rather mark the zone of consensus between the political executive (federal and state governments) and the major science organizations in the federal system.

From the perspective of *Historical Institutionalism* (Mahoney & Thelen, 2010, 2015; Streeck & Thelen, 2005; Thelen, 2003), the change in the WR's tasks appears as a process of *layering* in which the original tasks of political coordination aimed at expanding higher education institutions were increasingly supplemented by tasks of reform recommendations, evaluation, and ultimately the promotion of scientific excellence. This raises the question of why the WR's committees and decision-making structures have remained virtually unchanged despite the substantial transformation of its tasks. The political and scientific environment surrounding the WR has also changed significantly since its founding. In institutionalist terms, the persistence of the WR's structures appears to reflect *drift – an increasing gap between formal structure and the context of action*. The social mechanism that creates this situation is referred to by the authors of Historical Institutionalism as *deliberate neglect*: key actors (in this case, the federal multilevel governance system, i.e., the political executives of the federal and state governments and state-funded non-university research organizations) have no interest in adapting the formal structures to changing societal conditions. This in turn raises the question of the long-term consequences of this development for the institutional renewal of the higher education and science system in Germany.

3. WR RECOMMENDATIONS AND ACTIVITIES EXAMINED

We address this question in relation to the fundamental tension between, on the one hand, the WR's role in issuing recommendations on science and higher education policy and, on the other hand, the lack of institutional independence due to its committee and decision-making structures. This tension cannot be analyzed comprehensively here, i.e., in the sense of a retrospective evaluation of the WR's entire activities and the consequences for the federal science and higher education system in Germany but rather based on selected topics and issues. The examples were chosen because they arguably concern core issues of university system performance in Germany and cover different phases of the WR's activities. Specifically, the following WR recommendations and activities were examined:

- Recommendations on structure and administrative organization of universities (WR, 1968).
- Recommendations on the promotion of graduate research schools (WR, 1988).
- Selection decisions within the framework of the "Excellence Initiative" (DFG & WR, 2015).

The two recommendations were selected because they can be closely linked to the analysis of the German university system by Ben-David (1960, 1971). Around the same time as the first WR recommendation considered here (WR, 1968), Ben-David published a comparative analysis in which he examined, among other things, why Germany had ceded its global scientific leadership to the United States at the beginning of the twentieth century. Ben-David identified the hierarchical structure of chairs and institutes and the lack of comprehensive, research-oriented graduate training as major causes of the performance deficits in the German university system. The lack of graduate training is addressed directly in the second recommendation considered (WR, 1988). More recent research by Hollingsworth (2006), Jappe and Heinze (2016) and Heinze

et al. (2020) on the conditions for research breakthroughs in the United States and Germany, as well as Münch (2007, 2014) on the German and global reform debate, builds explicitly on Ben-David's work.

The third case study concerns selection decisions made within the framework of a federal funding program in the design and implementation of which the WR played a key role. The selection process for the so-called "Excellence Initiative" (ExIn) illustrates the shift in the WR's tasks using a case highly significant for German science and higher education policy. At the same time, the ExIn's selection results raise serious questions about the legitimacy of the selection process, particularly in light of the personnel and financial resources involved, as well as questioning the rhetoric of excellence associated with the whole program, which contributed to an illusion that the initiative effectively strengthened the international competitiveness of the German university and science system. The third case therefore concerns the legitimacy, and cost-effectiveness of decisions for which the WR bore substantial responsibility.

4. STRUCTURE AND ADMINISTRATIVE ORGANIZATION OF UNIVERSITIES

The Recommendations on the Structure and Administrative Organization of Universities (WR, 1968) essentially call for abolishing the professorial chair system in favor of the introduction of departments modeled on the U.S. system. Administrative authority of the institutes and chairs was to be transferred to the departments. In addition, the WR advocated greater administrative autonomy for universities. This recommendation was selected as a case study here because it corresponds to a core argument by Ben-David (1960, 1971), who maintained that the chair system hinders German universities in establishing new areas of teaching and research. According to Ben-David, the organizational structure of German universities had already proven to be an obstacle to disciplinary specialization by the late nineteenth century, as the growing number of emerging research fields could no longer be adequately accommodated within the existing chair and institute structure. A decisive factor was that the small regional states in Germany were unable to bear the high costs associated with

elevating these new fields to the status of fully staffed and equipped chairs and institutes. As a result, many emerging fields of research and teaching remained confined in the less well-resourced associate chairs established outside the chairs and/or were represented by private lecturers.

Retrospectively, the abolition of professorial chairs and the introduction of departments in German universities remain yet to be implemented. Although the Higher Education Framework Act (HRG), which came into force in 1976, contained a passage stating that research assistants could be directly subordinate to the departments rather than to the professorships, no comprehensive tenure-track procedure was introduced at that time (or later), meaning that young academics remained personally dependent on the chair holders as reviewers of their habilitations and mentors for their careers. Two amendments to the HRG in 1985 and 1998 reversed the 1976 reforms. In 1985, responsibility for assistant and research assistant positions was reassigned to the professorships, and in 1998, departments were formally abolished as organizational units of universities. The political context in which these amendments occurred was shaped by concepts such as competitiveness and deregulation (Kühler, 2012). The WR did not issue statements or policy recommendations regarding these two amendments.

According to Heinze et al. (2019), the recommendation of the WR (1968) is an example of the reform-oriented phase of the WR, during which it functioned as a political arena. This phase ended in the mid-1970s at the latest. Thus, this recommendation is not typical of the WR's later activities and was not pursued further in substantive terms. According to current legal opinion, the professorship constitutes the fundamental scientific unit of higher education in Germany (Coelln, 2017). Moreover, the growing number of researchers without tenure (doctoral students, post-docs, research assistants) per unit of professorship indicates a quantitative strengthening of the chair principle: At the time of the WR recommendation to abolish chairs, the average ratio between professors and non-professorial research staff was approximately 1 to 4. After an interim phase in which this ratio fell to 1 to 3, it increased to roughly 1 to 7 by the early 2020s (Jappe & Heinze, 2025).

The conclusion on the first case study is as follows: The WR recommendation addressed fundamental structural problems within German universities, was not typical of the WR's subsequent recommendations, and was not implemented. The professorial chair system has, in fact, been strengthened in recent decades, both legally and in terms of staffing patterns.

5. RECOMMENDATIONS ON THE PROMOTION OF GRADUATE RESEARCH SCHOOLS

The WR recommendation on the promotion of graduate colleges (Graduiertenkollegs, GKs) is conceptually related to the recommendation published twenty years earlier calling for the abolition of professorial chairs. It proposed that doctoral students should not be trained solely within the framework of individual doctorates supervised by chairs, but that professorships should instead coordinate doctoral training collaboratively – analogous to departmental doctoral programs in the U.S. system. This reform idea is also highly consistent with the analysis by Ben-David (1960, 1971). The DFG was subsequently entrusted with the implementation and incorporated the GKs in its funding portfolio. From an organizational sociology perspective, the GKs can be understood as a compromise solution: on the one hand, they embody the principle of jointly organized, structured doctoral training – similar to departmental programs in which doctoral candidates are grouped into cohorts and attend supplementary coursework; on the other hand, the chair system remains structurally intact, as professors continue to serve simultaneously as supervisors, examiners, and mentors of individual doctoral candidates. The WR describes this organizational compromise solution with the term "research-oriented doctoral training". From 2005 to 2017, graduate research schools were also part of the ExIn.

Heinze et al. (2019) examine the process of developing WR recommendations, as coordinated by the WR office, by comparing various draft versions with the final published version. In addition to the WR recommendation discussed here (WR, 1988), the authors also consider other WR recommendations, all of which concern the personnel structure of universities (Heinze et al., 2019, Appendix A). The 1988

recommendation touched on the personnel structure insofar as it raised the question of additional professorships. Specifically, a proposal was discussed whereby professors involved in GKs would have two semester hours per week credited to their individual teaching load. The proposal initially included a provision that the federal states should compensate for the reduced teaching capacity by creating additional professorships. To this end, the 1988 recommendation produced a model calculation of the estimated costs that would be incurred by the federal government for the establishment of 80 GKs, putting the figure at DM 40 million per year. Although the document did not specify the corresponding costs for the states, the authors calculated these at DM 27 million per year (Heinze et al., 2019, Appendix D). The federal government agreed to the WR's 1988 recommendation in the committee meetings only on the condition that no binding financial commitments were attached to it. This greatly weakened the substance of the recommendation and can be interpreted as an expectable consequence of the WR's lack of political independence in the deliberation of higher education policy reform.

This interpretation is also supported by the supplementary analysis of the WR recommendation (WR, 2008), in which the creation of additional professorships was once again the subject of discussion. Although the recommendation referenced guidelines in place in Switzerland at the time regarding maximum student-faculty ratios, these ratios were ultimately not used as the basis for the model calculation. Heinze et al. (2019, Appendix D) calculated that applying the Swiss guidelines at the time of the 2008 recommendation would have justified the creation of nearly 18,000 additional professorships – representing an increase of around 90 percent over the actual number of professors at that time. However, the adopted WR recommendation only contained a significantly weaker demand for a 33 percent increase – or, alternatively, 10 percent – with neither option further substantiated by argument. Even then, the recommendation was included in the final version only on the condition that no binding financial commitments by the federal government would accompany it. The authors therefore conclude that the WR, in terms of its internal working structure, is deemed to function as a conservative advisory body in which any reform proposals are reduced to the lowest

common denominator in science policy during negotiations between the federal and state governments (Heinze et al., 2019, p. 284).

Heinze et al. (2019) examine how many GKs were created over time. The number of GKs rose from 56 in 1990 to 330 in 1998, before declining significantly and stabilizing at around 250 from the mid-2010s onwards (DFG, 2024, p. 227). It is noteworthy that in its first assessment of GKs as a funding instrument, the WR recommended a target of 600 GKs (WR, 1995). In its second assessment, it no longer specified a target figure, but recommended GK-based doctoral training not as a standard model, but explicitly as a model of "scientific excellence" (WR, 2002).

To assess the structural impact of GK funding on doctoral training in Germany, Heinze et al. (2019) examined the distribution of GKs across the German university landscape. In the period from 1990 to 2015, about one-third of GK years were concentrated at 10 universities and more than half of GK years at 20 universities. Only the top 10 universities offered research training groups across a broad spectrum of disciplines during this period. The authors conclude that GK funding had a long-term structuring effect only at a small number of universities. Since the 1990s, a pattern of federal funding for "top universities" has emerged – one that later became an explicit funding principle in the ExIn.

Our conclusion for the second case study is as follows: With the GKs, the WR designed a funding instrument that, despite the responsibility of the constituent states for university funding, allows federal funds to be used for doctoral training within the framework of joint funding for science and research. While initially designed for the entire university landscape, the program evolved into a scheme that concentrates funding at certain universities. The investigation into how recommendations are made also reveals that the WR's draft recommendations were already toned down during the formulation process, particularly regarding the financial commitments for the federal and state governments.

6. SELECTION DECISIONS WITHIN THE "EXCELLENCE INITIATIVE"

The selection decisions for the so-called "excellence funding" are closely related to the funding of graduate research schools (GKs). In the report by the joint commission of WR and DFG (2015), the ExIn is described as a "joint effort" by the federal and State governments, which also includes the "Higher Education Pact" and the "Pact for Research and Innovation" (DFG & WR, 2015, p. 6). In its first two phases (2007 to 2015), the Higher Education Pact amounted to roughly €14.7 billion, the Pact for Research and Innovation (2006 to 2015) to just under €3.0 billion, and the ExIn (2006-2017) to €4.6 billion.

The objective of ExIn in the context of these three measures is described as a "strategic reorientation towards significant quality improvement", an objective not addressed by the other two programs (DFG & WR, 2015, p. 6). As is often the case in Germany's federal multilevel governance of science and higher education, its legal basis is an administrative agreement between the federal and state governments. "Its stated goal is to strengthen Germany as a center of science in the long term, improve its international competitiveness, and make peaks of excellence in the university and science sector more visible" (DFG & WR, 2015, p. 7). Of the €4.6 billion in funding, 75 percent was provided by the federal government and 25 percent by the state of the respective university.

To administer the ExIn, committees and decision-making structures were established that are typical of the multilevel governance of German science and higher education. In accordance with the administrative agreement, the DFG and the WR appointed a "Joint Commission" consisting of an "Expert Commission" appointed by the DFG and a "Strategy Commission" appointed by the WR. An "Approval Committee" was established as the decision-making body (DFG & WR, 2015, p. 8), in which the members of the "Joint Commission" held the majority of votes, but which also included the ministers responsible for research in the states and at the federal level. The task of the Strategy Commission was to lead the review and evaluation of the "Institutional Strategies" (IS) at the university level and to prepare the

selection decisions. In contrast, the Expert Commission was responsible for reviewing and evaluating the two funding lines "Graduate Research School" (GRS) and "Excellence Cluster" (EC). In a two-stage process, applications in these two funding lines were first approved for submission by the Joint Commission based on a pre-selection process. In a second step, they were evaluated through a complex procedure, culminating in a funding recommendation. The DFG was thus integrated into a federal advisory and evaluation structure alongside the WR.

The empirical literature on national excellence initiatives – including the ExIn (for an overview: Yudkevich et al., 2023) – typically focuses on the university level, examining so-called "top" or "elite" universities (e.g., Buenstorf & Koenig, 2020; Mergele & Winkelmayer, 2021). In contrast, Heinze et al. (2025) analyze the selection decision for ExIn funding at the level of subject fields for the two funding lines GRS and EC, which together accounted for €3.3 billion (71%) of all ExIn funds. A first finding of their study is the extreme selectivity of the two funding lines: in the first ExIn phase (2006-2011), they covered only about 5 percent of all existing university subjects that were in principle eligible to apply. A second finding concerns the following funding phase (2012-2017), which was similarly selective – covering only about 6 percent of all university subjects eligible to apply – and in which funding decisions followed almost deterministically from decisions in the first phase. Most subjects not funded in the first ExIn phase did not receive funding in the second phase either, while those funded once could be reasonably certain of being funded again.

A third finding by Heinze et al. (2025) concerns the university level. ExIn reveals a stable stratification of the German university system on the dimension of organizational size. Universities with no ExIn funding represent, on average, the smallest entities. Universities with at least one funding line (GRS or EC) were bigger and had greater scientific visibility: their professoriate was 20 percent above, and their total grant funding was 30 percent above the average of all German public universities. In contrast, universities with all three lines of funding (GRS, EC, IS) were the largest entities: their professoriate was 40 percent and their total grant

funding 80 percent above the mean. Remarkably, this size-based order existed long before the ExIn started (1995-2005) and remained stable throughout the entire funding period (2006-2017).

Our conclusion regarding the third case study is that the ExIn raises questions about the legitimacy and costs of the selection process and the effectiveness of its stated objectives. Complex review and evaluation procedures are regularly justified on the grounds that qualitative features – indispensably requiring the judgement of renowned disciplinary experts – must form the basis for selection. However, given the high reproduction rate of funded and non-funded GRS and EC applications, the legitimacy of the procedure becomes questionable: Why conduct a costly and time-consuming second round selection procedure the results of which are largely redundant with the first round? Moreover, neither the WR nor the DFG documented the number of expert years invested in the preparation of grant applications, coordination among university staff, peer review, pre-selection, or final selection decisions, making estimates of application costs and administrative overhead speculative.

Furthermore, it seems questionable whether the ExIn ever possessed the potential to achieve the intended structural effects on the German university system, as claimed by the WR and the DFG (DFG, 2013; DFG & WR, 2015). Contrary to the policy narrative asserting that the ExIn was an effective means of scaling internationally competitive research capacities in German universities, one may reasonably ask: How could it be reasonably assumed that such a goal was achievable by funding only 5 to 6 percent of all eligible university subject fields? To reach global competitiveness, one could argue that significantly more subject fields would require substantial financial support.

7. DISCUSSION

An analysis of the selected WR recommendations and activities allows three conclusions to be drawn. *First*, an important function of the WR has been to design funding instruments enabling the deployment of federal funds in support of universities within the framework of joint funding

for science and research – despite the fact that higher education is a state responsibility. This applies both to the GKs and the ExIn (GRS, EC) discussed in the article. Accordingly, the WR functions as a coordinating body in surmounting constitutionally mandated funding constraints for higher education. *Second*, the WR is a conservative consensus-building body that, in addition to its numerous tasks in policy coordination and evaluation, repeatedly issues recommendations on structural issues concerning the German higher education and science system. As a rule, these recommendations do not aim at substantial institutional reforms but instead delineate the minimum consensus between the political executive (federal and state governments) and major science organizations within the federal system. In practice, such consensus generally means that little to nothing will change.

Third, this article has shown that the WR is not an independent political advisory body that formulates evidence-based recommendations. Kielmannsegg (1990, p. 211) aptly observed: "In the Science Council (...) those seeking advice sit at the table and participate in formulating the advice they are given. (...) Advice without risk, to put it succinctly." The organizational structure of the WR was never intended to provide independent scientific policy advice. We argue that the WR's committee and decision-making structures are fundamentally ill-suited for the tasks later assigned to it – in particular the evaluation of universities and non-university research institutions and the support of Germany's international scientific competitiveness – tasks for which independent and evidence-based expertise appear indispensable. As demonstrated in this article, all recommendations on higher education and science policy must pass through the narrow eye of political consensus-building. Along this path, reform proposals are either abandoned or substantially diluted. This is particularly evident in the case of "excellence funding," to which we now return.

To reiterate the first conclusion: The WR plays a central role in designing and coordinating funding instruments that channel federal funds to public universities. This is precisely how the WR's activities in the ExIn should be understood. Moreover, the WR's involvement in administering

the ExIn may also have facilitated acceptance of its funding decisions, especially because the distribution of ExIn funding among the states was predictably uneven. However, it is problematic that the WR has supported an illusion propagated by the political executives (federal level and states) and the major scientific organizations associated with ExIn. This illusion concerns the scale of investment necessary to elevate German universities and their subject fields to the frontiers of international competition in science.

Compared with the world's leading universities in the United States and the United Kingdom, even the largest German universities – such as LMU Munich, TU Munich, and Heidelberg – are rather small and therefore unable to maintain the disciplinary breadth and research capacities necessary to be internationally competitive across a broad spectrum of academic disciplines (Lepori et al., 2019). The small size of German universities is closely tied to the establishment and expansion of the publicly funded extra-university research sector. This sector was established in the early twentieth century through the founding of the Kaiser Wilhelm Society and today comprises several hundred institutes in four major research organizations (Max Planck Society, Fraunhofer Society, Leibniz Association, Helmholtz Association), jointly funded by the federal and state governments. A substantial share of the resources directed to this sector – currently around €12 billion per year – would arguably be required to raise universities to a significantly higher level of financial support. Ben-David (1971) historically linked the establishment of this research sector to internal structural deficiencies in German universities that hindered the development of new and emerging fields of research. Since then, science policy at both the federal and state levels has reinforced this institutional trajectory by directing funding for numerous innovative research areas to the extra-university public research sector rather than to universities.

Yet it is not in the interest of the functional elites of the state-funded, non-university research sector represented in the WR, nor of the ministerial bureaucracies at both the federal and State levels, to engage in discussions about substantial resource transfers to universities and – including the legal and constitutional changes such transfers would

require. Instead, the functional elites represented in the WR have chosen a far less costly and politically more feasible path: they have contributed to constructing and disseminating the illusion that Germany has already substantially improved the international performance of its universities through the implementation of the ExIn (since 2019: Excellence Strategy). However, this illusion prevents serious debate about the organizational and resource reforms required. The illusion created by the ExIn ultimately obstructs an evidence-based discussion about effective measures in higher education and science policy.

Such a discussion would be possible, however, if there were a politically independent council of experts for higher education and science policy. Such an expert council could help develop evidence-based proposals for the institutional renewal of the German university and science system and communicate innovative ideas directly to political decision-makers, including federal and State parliaments. The Expert Commission for Research and Innovation (EFI) has served as an advisory council on innovation and technology policy to the federal government for several years. It would therefore be a comparatively straightforward option to extend EFI's mandate to the broader domain of higher education, science, and innovation policy. Such an extension in EFI's mandate would allow the WR to refocus on its core task of policy coordination. In this scenario, policy statements and recommendations by the WR would no longer be necessary.

Main conclusions:

- We argue that there is an acute mismatch between the WR's important advisory role in institutional evaluation and German science policy, and its historically rooted, consensus-oriented structure and lack of political independence.
- We presuppose that Ben-David's (1960, 1971) comparative diagnosis of the German university system's fundamental structural weaknesses is even more pertinent today. From this perspective, the three WR cases discussed in this paper underscore a longstanding political failure to address these weaknesses effectively.

- WR instruments such as ExIn are likely to foster self-deception within German science policy circles about the level of investment required to enhance the international competitiveness of German research universities.

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QUALITY MANAGEMENT IN SCIENCE ADVICE. A PRACTICE REPORT.

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ABSTRACT

Effective science advice relies on quality that is actively produced throughout the advisory process. This practice report examines how the Austrian Council for Sciences, Technology, and Innovation (FORWIT) managed quality during its formative years. Using a narrative reconstruction of two advisory processes applying structured conversations and the CRELE heuristic (credibility, relevance, legitimacy), we demonstrate how quality is enacted through procedural choices, boundary-work, and compensatory strategies. The comparison highlights two patterns: first, quality assurance shifts into ex-post rationalization when consideration of either of the quality attributes is missing from early process design; second, procedural explicitness functions as a resource for both epistemic and political robustness. By making internal practices visible, this article contributes to institutional learning on how advisory bodies organize credible, relevant, and legitimate science advice.

Keywords: *Science Advice, Austrian Council for Sciences, Technology, and Innovation, Advisory Bodies, Advisory Process, Boundary Work.*

1. INTRODUCTION

In most industrialized countries, a multilayered landscape of the "knowledge space" (Braun, 2008) has evocated the establishment of national advisory councils for science and innovation. As comparative analysis shows (Cevallos & Merino Moreno, 2020), these boundary organizations are quite different from one another – hardly surprising, given how diverse national innovation systems have turned out. Yet collectively, one can argue, they form a distinct

group within the even broader (and, again, quite diverse) realm of scientific advisory boards and councils (Schwaag Serger et al., 2015).

In part, this notable distinction is due to the rather active, or coordinative, role those advisory councils often elicit, being expected to influence the very policy field(s) in which they operate. To some extent, however, the distinction is due to the nature of those policy fields themselves. As a baseline of our argument, we pose that, to be effective, advice in the field of science and innovation policy holds expertise on the specific institutional context in high demand. To convert such expertise into science advice effectively, a specific set of norms and procedures is required.

To explore whether effective science advice in the field of science and innovation policy is achieved (or not), this article examines two cases of advisory work in the Austrian science and innovation setting from the Austrian Council for Sciences, Technology, and Innovation (FORWIT). It needs to be emphasized that we, as the authors, do not solely have an academic interest in the topic: as employees of the council's secretariat, we are very much concerned with effectiveness (and, inevitably, effects) of the council's advisory work. Due to our position, this practice report might present partial results and draw biased conclusions. The benefits of the insights that outside observers might not easily attain outweigh these risks.

We take this practice report as an opportunity to reflect on the council's performance during its first two years of existence. FORWIT was established as an independent advisory council to the Austrian federal government in 2023 by a legal act of the Austrian parliament (FWIT-Rat-Gesetz, 2023),[1] following a recommendation by the OECD in its latest country report on Austria's innovation system to merge existing advisory structures into one (OECD, 2018).[2] FORWIT advises the federal government on the policy areas of research, science, innovation and

1 https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20012266

2 https://www.oecd.org/en/publications/oecd-reviews-of-innovation-policy-austria-2018_9789264309470-en.html

technology development to sustainably strengthen Austria's innovative power and increase the country's competitiveness. Consisting of twelve council members and an independent secretariat with several policy officers in support of the council, FORWIT is expected to cover the span of policy fields from science, research, innovation to technology development.

Right from its inception, FORWIT aimed to provide effective science advice, while at the same time coping with the fact that internal norms and procedures were not yet fully in place.[3] Besides "specific structural features of the Austrian institutional landscape" that impact the effectiveness of advisory bodies more generally (König & Stampfer 2026, 8), the policy fields of innovation and science that fall under the council's purview are somewhat integrated strategically yet separately governed by different ministries.

How, then, did the FORWIT fare in its initial attempts of providing advice? While it is difficult to assess the actual impact of science advice, we make use of the CRELE framework, which looks at quality as dimensions of effectiveness. By reconstructing attributions of effectiveness guided by the CRELE framework, we are able to find out whether the FORWIT achieved the necessary level of quality that, in its own perspective, it deems required for its advice to become effective.

However: even when it comes to quality more narrowly, much depends on specificities of each case. As there are neither universal guidelines how advisory processes should be conducted nor a general rationale to what end science advice is to be provided, much of what "quality" means initially is to be defined by FORWIT practices, its norms as well as procedures. To us, elaborating on this topic is not merely an academic exercise – as intriguing as it is – but also of importance for determining FORWIT's own progress three years into its existence.

3 Institutional memory was available insofar as the secretariat staff as well as three council members continued to serve from the two merged councils; however, FORWIT was set up with the promise to bring fresh approaches to science advice, in addition to the repertoire of the previous councils.

2. THE CRELE FRAMEWORK AS HEURISTIC FOR QUALITY IN SCIENCE ADVICE

The purpose of this article is to examine FORWIT's actual practices of managing quality in giving science advice, with this research question: **How does FORWIT understand the management, specifically the production and the assurance of quality when it comes to giving science advice?** To answer this question, we draw on the CRELE framework, which has increasingly become popular in literature on science advice (Heink et al., 2015). The power of this framework is that it draws upon three attributions – credibility, relevance, and legitimacy – that are all central to the endeavor, and hence can be understood as dimensions that, in sum, determine its quality.

The CRELE framework was developed as a heuristic approach to conceptualize the effectiveness of science advice. To do so, it views three interdependent qualities of any given advice: credibility, relevance (also sometimes called salience), and legitimacy. The framework's core assumption is that those qualities are not intrinsic properties of information, but attributions to science advice practices, made by actors in the science-policy interface. Effectiveness is conceptualized as depending on meeting threshold levels for each attribute across intended audiences; falling below any single threshold typically undermines effectiveness while these thresholds vary by context and over time. In this view, credibility concerns perceptions of scientific adequacy in both evidence and process; relevance concerns timeliness and the fit of scope and scale to decision contexts; legitimacy concerns whether processes are seen as fair, unbiased, and appropriately inclusive (Cash et al., 2002, 2003).

While the literature on CRELE comes from a question of effectiveness, it can be adapted for our interest in the *quality management* of science advice, as the two terms are often considered closely related to each other.[4] Given

4 On a sidenote, we have found it useful to understand "management" as two interlinked yet separate spheres of practices, namely the production as well as the assurance of quality. While this analytical distinction is not relevant for the remainder of this article, we still think it is important to mention it here.

the focus on the three said attributes, a conceptualization as a heuristic for quality seems rather obvious. Quality of science advice can accordingly be addressed as a question of attribution by the relevant actors. This directs the analytical interest towards the interplay of credibility, relevance, and legitimacy.

Because the attributes are tightly coupled, the CRELE framework foregrounds tradeoffs that arise in the practice of science advice. Empirical work identifies at least four practical tensions: speed–quality (rapid response vs rigorous assessment), clarity-complexity (simple messaging vs explicit uncertainty), push-pull (supplydriven vs demanddriven strategies), and personal time (interfacing vs other obligations). These tradeoffs are dynamic, often sensitive to the respective policy cycle (uncertainty is frequently more valuable in early stages; clarity later), and casespecific. Moreover, policy relevance should be distinguished from policy demand: advice can be relevant without being formally demanded, and supplyside activity can create demand over longer horizons – central to balancing the push–pull tradeoff (Sarkki et al., 2014).

From the perspective of the CRELE framework, quality in science advice emerges from boundary work ensuring that each attribute (credibility, relevance, legitimacy) is reflected given the specific context. Boundary organizations often do this work by coproduction of boundary objects (e.g., models, scenarios, or scoping requests) and dual accountability across science-policy interfaces (Cash et al., 2003). In many advisory mechanisms, a division of labor carries out said boundary work: independent advisors primarily carry epistemic credibility (and some legitimacy via independence), while professional secretariats actively construct relevance by shaping timing, scope and scale, as well as by formatting and sustaining selective permeability of the boundary (Allegra, 2024). E.g., coproduced requests can function as boundary objects that clarify topical and temporal limits while aligning advice to concrete decision needs (Allegra, 2024; Cash et al., 2003).

While CRELE has been criticized for abstraction and vagueness when applied evaluatively (Heink et al., 2015), its strength is heuristic: By looking at actors' attributions, the framework provides a structured lens

on advisory processes and their practices of producing and managing quality (Cash et al., 2003; Sarkki et al., 2014; Allegra, 2024).

3. A DESCRIPTION OF OUR TWO CASES

For our analysis, we have selected two cases of advisory work being formulated by the council. The two cases share some common ground. In both instances, the actual advice has been provided, meaning that the cases are already concluded at the time of this article, with a written document bearing FORWIT's logo published in the council's repository, manifesting the result. Also, each of the two cases deals with institutional reform, albeit at very different scales. That said, the two cases also differ in some important ways.

The first case concerns a broad set of science and innovation policy issues. Following its own constitution in late 2023, the freshly appointed council members decided that the upcoming parliamentary elections in the second half of 2024 would offer a good opportunity to draw up recommendations that the next government should take into consideration. A formal working group was set up and a policy officer was assigned to coordinate the task.[5] The working group was expected to finalize a draft of the recommendation in summer of 2024, and the final text of the recommendation was indeed adopted in early September. As a formal council recommendation, the text entails twelve fields of action that the council deemed necessary for the next government to tackle at the time (FORWIT, 2024). Those fields of action range from digitization and cyber threats to suggested reforms in educational policy and support for startups and a call to lobby for an integrated European financial market, to more specific comments on student commitment and research funding programs.

In the second case, FORWIT was reacting to an invitation by the Federal Ministry of Education, Science and Research (BMBWF) related to an evaluation report on a single medical faculty at an Austrian public university. A bit of institutional history is required here: Having been

5 See https://forwit.at/en/groups/requirements-for-the-government-programme-of-the-28th-legislative-period/

set up amidst intense discussion ten years earlier, the medical faculty's initial funding was set to be running out in 2028. The evaluation report, instigated by the university's management, was intended to examine to which extent the faculty has achieved its goals; implicitly, it was also an input for upcoming negotiations with the ministry regarding continuation of funding. The ministry asked FORWIT to contextualize the evaluation report, and to provide a different (more systemic) perspective on the issue. Upon discussion in the council plenum, response to the invitation was delegated to a group of two council members and the managing director of FORWIT, who authored an expert opinion that was submitted to the ministry and also published on the council's repository (Haubenberger et al., 2025). The expert opinion intended to assess the quality of the evaluation report itself, and to contextualize its findings into the greater Austrian landscape of medical research.

In several ways, the two cases represent different paths of science advice. While the first case was conceived by the council members themselves, the second was triggered by an initial request from the BMBWF. The first case was very broad, while the second case concerned a much more limited scope. In the first case, the recommendation was formally adopted as an official council statement, while the second case was delegated to an ad-hoc group of two council members and the managing director of the council's secretariat who wrote down, and submitted, their expert opinion. From a methodical point of view, the two cases represent opposing features.

4. REMARKS ON THE METHOD

To analyze how FORWIT approaches the issue of quality management in its advisory processes, we employed a narrative reconstruction of the two aforementioned selected advisory processes.[6] This allowed us to look at practices of our own organization through reflective, insider-based observation. The two cases were reconstructed through structured

6 On the term of "narrative reconstruction" see Roe (1994). Broadly, this approach relates to methodological considerations in the interpretive branch of policy analysis (Yanow, 2000; Fischer, 2007).

conversations between the two of us with a clear distribution of roles: the one of us who was involved in both advisory processes provided detailed recollections of decision-making processes, procedural steps, and internal considerations. The other took notes and posed questions; he also wrote a detailed protocol of each of these conversations, constituting the narrative reconstruction of each case. In the next step, we applied the CRELE framework as the interpretive lens to identify specific practices through which FORWIT enacts quality management.

Since only one of us was directly involved in both advisory processes (while the other was not involved at all), the asymmetry of different positional perspectives created an analytical vantage point, from which we gained both embedded insights and yet a distanced view.[7] Still, a few comments on limitations and constraints of this approach are warranted. First of all, it is important to note that the reconstruction is limited by the fact that it builds on the narrative account of only one involved practitioner. As the empirical basis of our analysis is a transcription of narrative reconstructions, our aim is neither to reproduce events with empirical finality nor to evaluate outcomes externally; it is restricted to understanding how practitioners of advisory work make sense of their own doing.

Consequently, our approach does not observe 'quality' directly. Instead, it reconstructs how both the council and the secretariat understand, interpret, and perform quality in concrete advisory situations. Despite this limitation, we can analyze how credibility, relevance, and legitimacy are attributed within internal processes, how tradeoffs are negotiated, and which compensatory mechanisms are mobilized when better-suited procedures are absent. The method provides access to the practical enactment of quality management at the council (both the expert advisors and the secretariat). Through this heuristic lens, we identified characteristic practices and the procedural ways in which the CRELE dimensions shape internal understandings of what constitutes quality in science advice.

7 As noted in the introduction, we believe that the benefits of a reflective approach from within the organization outweigh the inevitable risks of bias and partiality.

5. CASE STUDY 1: RECOMMENDATIONS FOR THE GOVERNMENT'S PROGRAM

In the case of recommendations for the government's program, the council's foresight and ambition to come up with recommendations related to science, technology and innovation policy for the next government was not (yet) met with the required tools, norms and procedures. It is noteworthy that drafting the text started almost immediately after the council was formally established. Measures and procedures to produce and assure quality were an afterthought at first – at least that's how the narrative reconstruction tells it.

Quality, in the reconstruction, is primarily mentioned through retrospective critique of the council's own procedure at the time. Tellingly, rather than depicting a single coherent production model, our narrative reconstruction repeatedly brings up the distinction between *"Plan B"* and *"Plan A"*. The distinction of the two plans is useful also for our analysis: *"Plan B"* is to be understood as identifying potential weaknesses and subsequently attempting to mitigate them. It is, in other words, the umbrella notion of compensatory measures that were actually adopted under constraints of timing and resources and while the process of drafting and revising the recommendations was already going on. *"Plan A"*, on the other hand, is a retrospective ideal of how quality management should have been constituted and organized from the very beginning of the case.

The operationalization of *"Plan B"* is told along two activities: the writing of an extended endnote apparatus and the conduct of expectation management. Writing an endnote apparatus was done by the secretariat by retrospectively fitting literature references to the existing text of the recommendations. The aim of the endnote apparatus is to compensate for a perceived *credibility* deficit by anchoring claims in evidence. In our reconstruction, this activity is viewed as ambivalent: it is credited as an active contribution of the secretariat, but it is also criticized as ex-post rationalization, retrofitting evidence to an already drafted narrative.

The other compensatory activity concerns what is called "expectation management" in the reconstruction. Since it reflects on the need

to anticipate how the council's recommendations will be judged by external audiences, this activity falls squarely under the attribute of *relevance*. This emphasis reveals a recurrent tradeoff: the council's recommendations are described as sensible from an expert standpoint but lacking salience for decision-makers. Relevance is not treated as intrinsic to content, but as contingent on how the output resonates with external conceptions of what matters. Expectation management, in this telling, requires differentiating between frontstage positioning and backstage coordination, with the secretariat taking the role of backstage signaling awareness of constraints and by promising improved performance in the future, thereby anticipating and pre-empting critical response.

The reconstruction highlights how positioning choices in the drafting of the recommendations can reconfigure this tradeoff. One example mentioned in the reconstruction concerns the emphasizing of a theme, namely setting an R&D intensity target for 2030, which is then interpreted as a deliberate attempt to align with perceived public expectations and to mark a recognizable stance. At the same time, this move is described as bearing the risk of drawing attention from other substantive elements, potentially generating new *relevance* conflicts and necessitating additional handling elsewhere. Observations like this draw connections between the dimensions of *credibility* and *relevance* to communicative strategy: the same text of recommendations can be evaluated differently depending on what audiences expect it to do.

The perceived ambivalence also points to a more general concern repeatedly emphasized in the narrative reconstruction under reference to the counterfactual ("*Plan A*"). It serves as an idealized alternative that entails notable measures that should have taken place if the advisory process had been set up properly from the beginning. Mentioned are elements such as systematically involving external experts early on, actively eliciting addressee needs to incorporate external conceptions of relevance and acknowledging (rather than disguising) uncertainties and evidentiary limits explicitly, thereby making the epistemic status of recommendations transparent.

The imaginary "*Plan A*" reveals the cumbersome process against which it is projected and therefore gives an important insight into how the credibility dimension of quality is imagined in an idealized form. It reflects a dissonance between self-understanding and external resonance. Identified deficits include limited contextual knowledge as well as a lack of observable policy effects. Also mentioned is that the list of recommendations was not thoroughly curated and vetted due to missing feedback loops with the ministries. The compensatory activities, which are set in motion to produce *relevance* after the fact are critically reflected: the attempt to influence the framing (notably by the preamble), announcements that seek to create attention, and intensified coordination that turn the text into a top-level responsibility.

Combinations of two dimensions appear in the reconstruction of this case only marginally through an unsuccessful attempt to involve external expertise. The narrative account suggests that such involvement would have strengthened both *credibility* and *legitimacy*, including by providing a broader basis for claims and by signaling procedural openness. Where this attempt fails, the endnote apparatus is mobilized as partial compensation, underscoring the centrality of secretariat work in maintaining the perceived quality (in the credibility dimension) of the output. The reconstruction also hints at an unrealized potential: the council could have acted more explicitly as a platform convening expertise also from outside, which in turn would have changed how *legitimacy* is attributed.

6. CASE STUDY 2: CONTEXTUALIZING AN EVALUATION REPORT

The reconstruction of the case on contextualizing an evaluation report provides a different picture. Here, attributions of *credibility* and *legitimacy* are often bundled together. The advisory process is reflected as being organized around the recurring formula of a "methodologically correct procedure". Through this formula, quality is negotiated as a matter of evaluative rules, standards, and their proper application. Accordingly,

the case concerns not only what is said about the object of the evaluation report (i.e., the medical faculty), but how the evaluation is done properly and how this can be rendered accountable.

The formula of "methodologically correct procedure" comprises two topical clusters in the narrative reconstruction. A first cluster concerns the "rules of the game". Here, it is stressed that templates and standards established by an independent Austrian platform for research and technology policy evaluation (fteval) must be applied and made visible. *Credibility* is pursued via adherence to procedural expectations and best practices, while *legitimacy* is pursued by demonstrating that the council's stance is grounded in a defensible method rather than discretionary judgement. This emphasis produces a second cluster: "robustness through methodological reflection". The council's own assessment is depicted as more robust when it explicitly distinguishes descriptive statements about the methodological procedure from substantive propositions, and when it communicates that distinction to audiences. The analytical implication is that quality assurance is enacted through disciplined structuring: separating method from content becomes a practical device to stabilize *credibility* and *legitimacy* simultaneously.

Yet the case also shows that such structuring is socially consequential. Concerns are expressed that a structured account of method can be interpreted as critique, even when the intent is procedural clarification. Consequently, the process incorporates defensive quality practices: avoiding pejorative language, smoothing formulations, and presenting the approach in a way that reduces exposure to contestation. In this sense, methodological explicitness and rhetorical caution operate as complementary boundary-work strategies.

Another cross-cutting motif is the "significance of the case". This theme appears repeatedly across the three dimensions of quality and functions as a justificatory hinge for why the council should engage in the case at all. In the *credibility* dimension, significance is not exhausted by methodological rigor; it is also articulated as a systemic perspective. In the reconstruction of the case, the argument is prominent that focusing only on the specific faculty would be short-sighted, and that decisions

cannot be discussed without situating the evaluation within the broader Austrian landscape of medical research and policy. This systemic framing simultaneously expands the scope and clarifies the mandate of science advice: it draws on system knowledge within the council and positions contextualization as a distinctive contribution.

At the same time, the systemic perspective requires explicit boundary-setting regarding what the council is – and is not – doing. This is reflected in the council's emphasis on not conducting an evaluation itself but assessing the evaluation and working with the text of the report. This distinction matters in the *credibility* dimension because it controls expectations about epistemic authority, and in the *legitimacy* dimension because it delineates an appropriate role vis-à-vis other evaluative actors. *Legitimacy* is additionally aimed at through roles and process design. On the one hand, there were concerns voiced about bias and the sensitivity of involvement by council members, and it stresses the separation between individual experts and the council itself. On the other hand, communication with the ministry, including iterative coordination, is presented as part of a careful process that helps to sustain procedural acceptability.

Moreover, *legitimacy* is supported by emphasizing exceptional circumstances: the case is framed as a situation in which the council can act in ways the ministry cannot, and in which purely routine treatment would be inadequate. These elements link *legitimacy* to both independence and appropriate responsiveness. *Relevance* is treated more often as an independent attribution and is anchored in a distinct formula: "being useful to the ministry". The ministry is perceived as asking how the council could help, and the council as providing interpretive assistance and arguments that can be translated into negotiating positions, while avoiding the appearance of advancing a political agenda. Usefulness thus functions as an explicit performance criterion, jointly recognized by the council and the ministry and considered achieved in this case by both.

7. COMPARATIVE ANALYSIS AND SUMMARY

This article explores how the FORWIT manages quality in its science advice processes. We chose two cases of advisory work, both quite different in scope, mandate, and activity, but both ultimately terminated with a written document bearing the FORWIT logo and posted on its repository. To unpack different aspects of quality management in each of the cases, we applied the CRELE framework to a narrative reconstruction of each case. Table 1 (see below) gives an overview of how the CRELE dimensions, and specific combinations thereof, could be identified in our narrative reconstruction of the two cases. The table lists a summary of selected quality management activities that our reconstruction identified. Some entries appear in more than one CRELE dimension, since the framework conceptually allows combinations of quality dimensions. The combinations that we deem the most important ones are listed in a separate row of the table.

	Case study 1	**Case study 2**
Credibility	Operationalization of "Plan B": • Writing an endnote apparatus • Involving external expertise	• Methodologically correct procedure • Significance of the case
Relevance	• Expectation management • Influencing the framing	• Being useful to the ministry
Legitimacy	• Involving external expertise (retrospectively)	• Methodologically correct procedure • Significance of the case
Important combinations	Credibility and Legitimacy: • Combined in the attempt to involve external expertise, even though unsuccessful	Credibility and Legitimacy: • Combined in the formulas of "methodologically correct procedure" and "robustness through methodological reflection" • Combined in the view of a systemic approach, expressed as "significance of the case"

Comments	• Perspective of "ex-post rationalization" guided engagement with all three dimensions • Quality management is revealed by formulating "ideal" procedures	• Credibility and legitimacy are in several ways combined; relevance remains standing alone • Distinguishing method and content is important theme in quality management, able to link the dimensions

Table 1: Identification of CRELE dimensions in the FORWIT's quality management activities in the two case studies
Source: Compiled by the authors

It is important to stress here again the inherent limitations of what follows, as the empirical basis for the analysis (the actual narrative reconstruction) is narrow and, due to our own involvement with the council, prone to being biased. However, when taken as an explorative attempt to reflectively reconstruct attempts of quality management at specific cases of science advice, the following statements can be made.

In the first case study, not all three dimensions of the framework could be addressed. This confirms the general, and rather critical, assessment of this case of science advice in the narrative construction: the council's ambition to point out fields of action that range wide and across different areas of policy making could not be matched with the tools and procedures that this would have required. In the second case study, a much more limited scope was met with a more appropriate set of such instruments; here, our reconstruction revealed that all three dimensions were addressed. The second advisory process, thus, can be described as a successful case of science advice insofar as the narrative reconstruction saw the quality management as satisfactory.

Another important insight from the second case is that "method" matters for quality management. The intriguing aspect here is that "method" is not only a (procedural) tool to be applied to the matter at hand – in our case determining the correct conduct of an evaluation along predefined standards and best practices. It is also of relevance in a more strategic sense, as it confirms the soundness of the result. This corresponds to an argument in the literature that science advice must ensure both epistemic and political robustness (see, e.g., Weingart & Lentsch,

2008) – an interplay we could observe in practice. Here, the pivotal role of secretariats becomes visible, contributing to the political robustness through division of labor, as Allegra (2024) puts it. Interestingly, while the first case study did not arrive at a similarly robust method, the analysis indicates that the retrospective ideal ("*Plan A*") would have provided a process-oriented alternative for quality assurance.

Is the CRELE framework suitable for assessing quality management of science advice? Critics point to the fact that, despite the seemingly intriguing complementarity of the three dimensions, the concept's strength as well as its weakness lies in the "polysemy" of its attributes (Heink et al., 2015, 686). We can testify in our exploratory analysis that it was difficult to operationalize the CRELE framework for our purposes. It required time in the interpretation sessions to arrive at a common understanding of the narrative reconstructions. That said, the framework worked well heuristically at least in three ways: first, exercises of reflection upon practices of quality management can be stimulated by, as well as structured with the framework. Second, it is a good way to make the process of two cases of science advice, even quite diverse ones, comparable, thereby allowing us to think about quality in the first place. Finally, dissecting cases along the three dimensions also brings new perspectives – always a valuable aspect when science advice is seen as a practice that depends on incremental learning.

For practicing science advice, a general learning from applying the CRELE framework is that all three dimensions, namely credibility, legitimacy, and relevance, should be considered already in the initial steps of coming up with science advice. Clearly, this was achieved in the second case, which seems to have contributed to the overall success of managing quality in drawing up the science advice. In contrast, and maybe due to the circumstances under which the first case of science advice was incepted, the three dimensions were not taken into account, leading to a rather laborious attempt of reverse-engineering, which additionally makes the advice more prone to critique at both content and process levels.

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ECOSYSTEMS

INSTITUTIONAL STRUCTURES AND SYSTEM DYNAMICS

SCIENCE FOR POLICY IN AUSTRIA – A SURVEY OF EXPERT COUNCILS AND THEIR AREAS OF RESPONSIBILITY

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ABSTRACT

This article examines the role of "science for policy" in Austria and provides a systematic mapping of institutionalised, science-based expert councils with a legal basis. It starts from the observation that, although evidence-based policymaking has become a guiding principle, the practical organisation of scientific policy advice remains fragmented. Rather than relying on large think tanks, the Austrian system is characterised by a plurality of advisory bodies, research institutions, and individual actors. Based on a systematic screening of federal ministry websites, 62 advisory bodies were identified and assessed in terms of their legal foundation and scientific orientation. The intersection of these criteria results in 12 permanent expert councils with a clear scientific basis.

The findings reveal a concentration of such councils in policy areas characterised by high complexity, such as economic, health, and integration policy. They also indicate that scientific advice is particularly in demand in contexts marked by uncertainty and information asymmetries. The article concludes by identifying key conditions for effective science for policy in Austria: institutional autonomy combined with a clearly defined mandate, trust-based interaction with policymakers, adequate resources, and targeted capacity-building for advisory roles. In doing so, the article combines an empirical mapping with conceptual reflections on strengthening evidence-informed policymaking.

Keywords: *Science for Policy, Expert Councils, Evidence-Based Policymaking, Science-Policy Interface, Institutional Autonomy*

1. INTRODUCTION

"Political decisions should be made based on evidence" (Austrian Parliament, 2023). This is the opening sentence of a report on evidence-based legislation by the Austrian Parliament and reflects the desire to improve the quality of political decisions through scientific research and analysis. In this regard, "evidence-based policy-making" has become a guiding principle of modern governance and is often associated with the expectation that political decision-making processes are more closely aligned with systematic evidence.[1]

Politics draw on scientific analyses and findings to benefit from the public's trust in science (see OeAW, 2025). When a scientific study has established empirical evidence, it could help legitimise political measures as well as increase public acceptance of them. Scientific expertise is often regarded as a particularly valid form of knowledge generation in political processes and is consulted as such. Consequently, it is also used as a colloquial "protective shield" against partisan criticism. Even if the relationship between science and policy is not always conflict-free and does not proceed smoothly for all parties involved, information and legitimation are the two essential functions of science in political advisory work.

In Austria, scientific policy advice is provided less through large, well-established think tanks known in the U.S. sense. Here scientific policy advice is provided through numerous advisory bodies (i.e., advisory boards, councils, commissions, expert groups, etc.), science-oriented institutions, and individuals with a concentration in specific policy fields (see Kevenhörster, 2021). This article attempts to provide an overview of the Austrian landscape of these scientific policy bodies. In particular, it focuses on those expert councils that are institutionalised, have a legal basis as well as a clear scientific base. It is preceded by conceptual considerations for classifying advisory structures, as well as a general overview of the advisory landscape in Austria.

1 It should be noted that the terms "evidence-based policy," "evidence-informed policy," and "science-based policy" are all in use, and each reflects a different degree of separation between science and policy. Since, "evidence-informed" implies a weak relationship and "science-based" conceptually excludes sources of knowledge that do not lie within the realm of science. The term "evidence-based" seems the most appropriate to the author.

2. CONCEPTUAL AND EMPIRICAL OVERVIEW

Consulting structures in a science and politics interface are diverse – Austria is no exception – and, therefore, a structured framework for analysis is necessary. Presented in Figure 1 is a drafted suggestion of the Austrian institutional organisational diversity. On the "supply side" for science-based policy advice are at least three areas that can be distinguished.

Firstly, counselling structures are an embedded activity at Austrian universities and non-university research institutions, including the Austrian Academy of Sciences (OeAW), the Austrian Institute of Economic Research (WIFO), and the Institute of Advanced Studies (IHS). In universities, science-for-policy activities are carried out by staff under a third mission output alongside their core missions of research and teaching. Additionally, in the non-university research institutions, policy advice is notably stated to be one of the central tasks.[2] Accordingly, this interaction between policymakers and institutional policy counselling takes place in three different ways:

(1) Individual members of institutions advise policymakers on an individual basis, either informally or in an official capacity as advisors. In this role, they speak out publicly, issue recommendations, and are explicitly consulted by policymakers. The degree of proximity to or distance from politics and the level of involvement in political decision-making processes can vary. Currently, generally accepted procedures or guidelines set by the employer are not in place; however, they would be desirable.

(2) Policy advisory work is not conducted on an individual basis, but rather within the framework of commissioned projects or studies. For example, policymakers issue a call for proposals, and members

2 The Austrian Academy of Sciences (OeAW) explicitly includes policy advice among its tasks; its patron is the current Federal President, and the chair of the senate—a body designed to strengthen the link between science and politics—is held by the current President of the National Council. The Austrian Institute of Economic Research (WIFO) is legally classified as an association, with the social partners serving as its governing members. WIFO serves as a key advisory body to the federal government, and its economic forecasts form the basis for the preparation of the federal budget. The Institute for Advanced Studies (IHS) is also legally classified as an association. Its members include ministries, the Oesterreichische Nationalbank (OeNB), and the City of Vienna. Its economic forecasts also serve as essential tools for political decision-making.

of universities or non-university research institutions respond to that call. The projects or studies are carried out, and interim and final reports are submitted to policymakers and discussed with them. In contrast to individual advisors, guidelines exist for this type of third-party externally funded research (e.g., AIT, IHS, JR, WIFO, 2022).

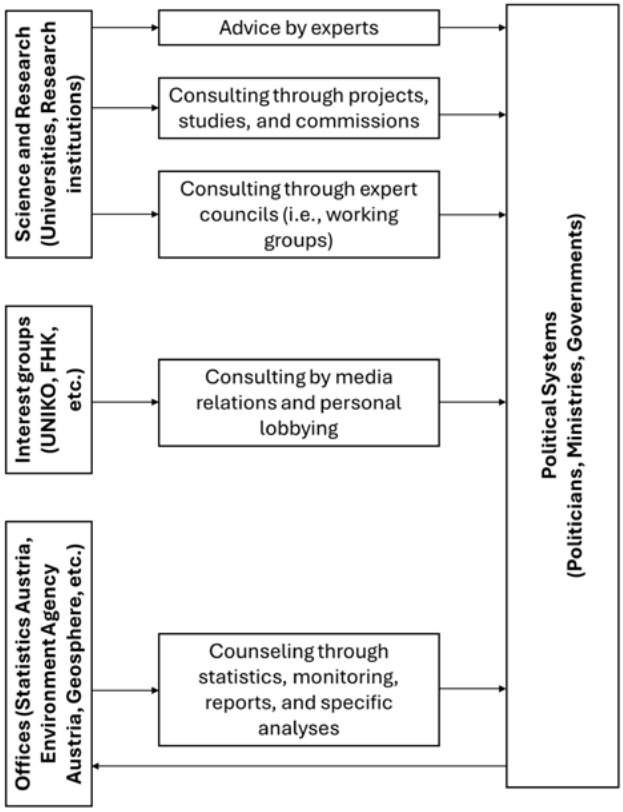

Figure 1: Providers and recipients of science-based advice

Source: Compiled by the author

(3) Finally, it is worth mentioning institutionalised advisory bodies (committees, commissions, councils, working groups) that are established either on a temporary or permanent basis and are composed primarily or exclusively of researchers. These advisory

> groups may have a legal basis or be established based on a political mandate. Interaction with the politically mandated side —that is, the government, individual ministers, or political parties — is not unidirectional; rather, there are feedback loops, dialogue, and sometimes joint public relations work. Many advisory groups establish their own rules of procedure and possess human resources.

The second area on the "supply side" for science-based policy advice is interest groups representing an institutional sphere of policy advice. Interaction with the political sphere here is less about consultation and more about presenting demands. The exchange, therefore, is mostly unidirectional: driven by press releases, lists of demands, and lobbying. In accordance, feedback from the political sphere is limited. The missions of interest groups are clear: higher education, research, and education policy should be shaped in their interest; "Science for Policy" (S4P) becomes an influence on "Policy for Science" (P4S). Examples of such interest group representations include the Universities Austria (UNIKO), as the voice of Austria's public universities, the Austrian University of Applied Sciences Conference (FHK) for all 21 Austrian universities of applied sciences, the Austrian Conference of Private Universities (ÖPUK), and the Rectors' Conference of Austrian University Colleges of Teacher Education (RÖPH).

Lastly, the third area for policy advice involves statistical offices, as well as specific agencies controlled by the public sector. These offices and agencies provide science-based answers for specific questions in the form of statistics, reports, and special surveys. Typical examples include agencies and offices dealing with the environment, climate and weather, geology and natural resources, and population trends. The degree of autonomy of the office itself is lower than that of universities and research institutions. Their areas of focus are predetermined, and their governing bodies are appointed by the public authorities. Nevertheless, they employ scientific methodologies, and the results are derived using scientific methods and are based on established professional standards. Examples for this area of science-based policy advice include the Environment Agency Austria (UBA-GmbH), a 100% state-owned entity and former department of the ministry; the Austrian Agency for Health

and Food Safety GmbH (AGES), state-owned and controlled by two ministries; GeoSphere Austria, a federal institute for geology, geophysics, climatology, and meteorology; and, Austrian National Public Health Institute (GÖG), which is legally separated from the ministry but whose board of trustees is chaired by the respective federal minister. Moreover, the direct political proximity of smaller and privately organised economic research institutes is even more pronounced. For example, the Momentum Institute is primarily funded by the Chamber of Labour, Agenda Austria by Austrian companies, and ECO-Austria through membership fees from the business sector as well as by civil society.

3. ANALYSIS OF EXPERT COUNCILS: RESEARCH QUESTION AND METHODOLOGY

The diversity of institutions and forms of interaction has become clear from the overview of providers of science-based advisory services in Figure 1. However, a more narrow focus is necessary. This article specifically focuses on expert councils, commissions, and working groups. Scientific advisory work by individuals is certainly important, but empirically difficult to track. The advisory work through studies or projects is also relevant, but extremely extensive and similarly difficult to survey. And the recommendations of statistical offices, federal agencies, or meteorological institutes have mandates that extend far beyond immediate policy advice and are thus not fitting the scope of this article.

In analysing these expert councils, the following questions take centre stage:

- Which expert councils (commissions, working groups) can be documented, and which of these are science-based and permanently established? Does "policy" tend toward ad hoc flexibility, or do they consider S4P as permanent?
- In which policy areas do these advisory groups operate, and what arguments explain this distribution pattern?

- What structural characteristics do these advisory groups exhibit in terms of their size, appointment process, and resource allocation?

To address these questions, the following steps were taken:

First, the websites of all federal ministries were screened, and the advisory groups listed there were entered into an SPSS-compatible file. In total, and after critical review, there were 62 relevant advisory groups selected. The critical review consisted of contacting the corresponding federal ministries to verify whether the advisory groups still existed and whether the information provided online was accurate.[3] It is possible that one or more advisory groups have not been identified, as they were not mentioned on the ministries' websites or they were overlooked even after personal inquiries to the ministries. Overall, this is considered unlikely to have been a frequent occurrence.

In the second step, the available documentation on the advisory groups (primarily their corresponding websites) was used to determine whether there was a legal basis for their establishment. This revealed that of the 62 publicly announced advisory groups, 43 advisory groups have a legal basis and 19 advisory groups are based on ministerial decisions. A legal basis did not always prove necessary. The "Expert Council for Integration", for example, is defined in § 17 of the Integration Act (IntG), while the "Development Policy Advisory Board" (Entwicklungspolitische Beirat) is defined in § 21 of the Development Cooperation Act (Entwicklungszusammenarbeitsgesetz (EZA-G)). On the contrary, the "Consulting Board for Inclusion and Special Education" (Consultingboard für Inklusion und Sonderpädagogik) was established solely as an initiative of the Ministry responsible for Education without a premeditated legal basis. In conclusion, in the analysis, 69% of the advisory groups have a legal basis and therefore are considered to have a longer-term perspective.

In the third step, the scientific basis was assessed in relation to the legal mandate and its members. This turned out to be a difficult decision when

3 One point to note: If one includes the additional advisory groups at the state and municipal levels (very often planning, design, and building committees), one very quickly arrives at several hundred advisory groups that operate at the intersection of science and politics to varying degrees.

the legal mandate lacked clarity. While many advisory groups include members from universities or research institutions, if they remain in the minority or science has no direct connection to the advisory group's mandate, the approach taken was to classify them as having no scientific basis, or only a weak one. For example, the Ministry responsible for Transport established an "Advisory Board for Historic Vehicles" (Beirat für historische Fahrzeuge) in accordance with the Motor Vehicle Act (Kraftfahrgesetz (KFG)), but its members include social partners, insurance companies, and automotive experts. There has been no apparent connection to science. By contrast, scientific expertise and practical relevant experience in the medical field are mandatory for the members of the "National Vaccination Board". Here, the scientific basis has clearly been established. Overall, around 19% of advisory groups are constituted to have a clear scientific basis, and a further 21% have a partial one.

This classification of advisory groups having a scientific basis inherently involves a certain degree of ambiguity. The Climate Assembly, for example, is designed in such a way that representatives of the population express and consolidate their interests and opinions. However, the scientists who support and guide the Climate Assembly possess an important role. Is the Climate Assembly science-based or not? Not in theory, but very much in practice, which is why it is also presented below.

Conversely, advisory groups may have a scientific focus, but they were established without a statutory mandate and are consequently temporary by nature. Particularly during the years of the COVID-19 pandemic, a number of advisory groups were established – often comprising individuals with high scientific standing – that are not permanent in nature. These temporary advisory groups, although science-based, have therefore not been included in the analysis.

Overall, the intersection of the criteria "duration based on a statutory mandate" and "clear scientific orientation through the mandate and membership structure" yields a total of 12 expert councils (see Tables 1-7), which will be listed and described further below by policy area.

4. ECONOMIC AND FISCAL POLICY

The Fiscal Advisory Council[4] is an independent advisory body that analyses budget implementation and, in particular, the development of public debt in the context of national and international capital markets. The chairmanship is held by a scientifically distinguished individual. The Fiscal Advisory Council emerged in 2013 from the former Government Debt Committee and is presented as the "independent body for monitoring compliance with budgetary rules," as required by the European Union (EU). The members of the Fiscal Advisory Council are not necessarily actively engaged in academic research, but they are nonetheless recognised experts in the field. As the Fiscal Advisory Council maintains a public presence, it can publicise its findings in the media, thereby also building political pressures.

Council	Task	Number of members	Duration of membership (in years)	Nomination by
Fiscal Advisory Council	Monitoring the public budget, in particular, financial debt; analyses, reports, and political advice.	15	6	Federal government, social partners
Austrian Productivity Board	Analysis of the competitiveness of the Austrian economy; analyses, reports, policy advice	5	6	Federal government, social partners (employers and employees)

Table 1: Institutionalised advisory groups (Science for Policy) in the field of economic and financial policy
Source: Compiled by the author

Additionally, the Austrian Productivity Board[5] is another advisory body in the field of economic and fiscal policy. The establishment of

4 www.fiskalrat.at/en/

5 www.produktivitaetsrat.at/en/

the Productivity Board followed the EU Council Recommendation 2016/C 349/01. It is an independent advisory body composed of five members who are not bound by instructions from the government and who come from the so-called fields of economics, productivity, and competitiveness. These members are appointed by the federal government and its social partners. The Oesterreichische Nationalbank (OeNB) and the Parliamentary Budget Office participate in the meetings in an advisory capacity only, as do other individuals with expertise and research experience. The central task of the Productivity Board is to analyse Austria's competitiveness against the backdrop of an ageing society, economic transformation, and in a global context. The Productivity Board advises policymakers directly and indirectly through intensive public outreach.

5. SOCIAL AND HEALTH POLICY

One advisory body to be highlighted in the field of social and health policy is the Commission on the Long-Term Financing of Pension Systems, also known as the "Pension Security Commission".[6] It is a body established by law (BGBl. I Nr. 29/2017)) with 20 members and a chairperson. Members are appointed by the social partners, the trade union, the Senior Citizens' Council (Seniorenrat) and the Youth Council (Jugendrat), as well as by selected ministries. In the Pension Security Commission consultation, independent members from the science community are in the clear minority. The Pension Security Commission task is to prepare expert opinions and reports on the medium- and long-term development of the statutory pension insurance system and to make proposals to ensure its financial sustainability. However, the Commission's political context ensures that its proposals are cautious and effective only in the long term. Furthermore, the body – and particularly its chair – is bound by confidentiality, which does not facilitate a political implementation of proposals.

6 www.sozialministerium.gv.at/Themen/Soziales/Sozialversicherung/Alterssicherungskommission

Council	Task	Number of members	Duration of membership (in years)	Nomination by
Pension Security Commission (Alterssicherungskommission)	Preparation of expert opinions and reports on the medium and long-term development of the statutory pension insurance system; to make proposals to ensure its financial viability	20	5	Ministries, trade unions, social partners, senior citizens' council (Seniorenrat), youth representatives (Jugendrat), science
Supreme Medical Council (Oberster Sanitätsrat)	Advising the respective Federal Minister of Health on all matters relating to the health care system	44	3	Ministry or Minister
Gen Technology Commission (Gentechnikkommission)	Advising the relevant ministries on fundamental issues relating to the application of genetic engineering and the enforcement of the Austrian Genetic Engineering Act (GTG)	25	5	Ministries, social partners, OeAW, universities and others
Bioethics Commission (Bioethikkommission)	Advising the Federal Chancellor on all social, scientific and legal issues from an ethical perspective that arise in connection with the development of science in the field of human medicine and biology	15	3	Federal Chancellery or Federal Chancellor
National Vaccination Board (Nationales Impfgremium)	Technical advice to the Minister responsible for health regarding vaccinations	Minimum 8 (currently 17)	3	Ministry or Minister

Table 2: Institutionalised advisory groups (Science for Policy) in the field of social and health policy
Source: Compiled by the author

In the field of health policy, the Supreme Medical Council[7] should also be mentioned. It too is established by law and serves as an important advisory body to the minister on matters relating to the health care system. This council issues recommendations and expert opinions that provide a technical basis for health policy decisions. The Supreme Medical Council currently comprises 44 members, and the chairmanship has been entrusted to the current rector of the Medical University of Vienna. The range of issues addressed by the Supreme Medical Council is very broad, as its role is to advise the respective Federal Minister of Health. The legislature has not limited the council's scope, which tends to be a disadvantage. The argument of this article is that if policymakers do not clearly state what they want, "Science for Policy" becomes a difficult undertaking, because the committee must identify the issues on its own without knowing whether there is an audience for the answers. In addition, the Supreme Medical Council is bound by confidentiality, restricting its option to approach the media on its own initiative.

Other important advisory bodies in the field of health include the National Vaccination Board[8] and the Genetic Engineering Commission (Gentechnikommission). The National Vaccination Board – internationally comparable to the Standing Committee on Vaccination (STIKO) in Germany – is an independent expert body that issues vaccination recommendations for policymakers. The Vaccination Board determines which vaccinations should be administered, at what age, and in which health policy-relevant situations. The National Vaccination Board is composed of experts with scientific knowledge and practical experience; it operates independently and played a key role in supporting health policy decision-making, particularly during the COVID-19 pandemic.

The Genetic Engineering Commission (Gentechnikommission (GTK)) advises the competent authorities on the enforcement of the Austrian Gentechnik-Gesetz (GTG) as well as on fundamental issues regarding the applications of genetic engineering (e.g., field trials or placing products on

7 www.sozialministerium.gv.at/Themen/Gesundheit/Oberster-Sanitaetsrat

8 www.sozialministerium.gv.at/Themen/Gesundheit/Impfen/Nationales-Impfgremium

the market). The Commission consists of representatives from ministries dealing with genetic engineering, social partners, and scientific experts (from the natural sciences, medicine, and ethics). The latter are publicly recruited by the Austrian Academy of Sciences (OeAW) and selected by the General Assembly of the OeAW. Genetic Engineering Commission (Gentechnikommission) is independent and issues recommendations that are submitted to the respective ministries and, in the form of a report, to the Austrian parliament as well.

The Bioethics Commission[9] is an advisory body based in the Austrian Federal Chancellery that advises the Federal Chancellor on all matters related to the further development of human medicine and human biology. Its composition is highly interdisciplinary. The legislation stipulates representation from the fields of medicine, molecular biology, genetics, law, social sciences, philosophy, theology, and psychology. Contextually, the commission is concerned with issues such as cryopreservation (freezing and storage of egg cells or embryos), compulsory vaccination and the handling of scarce resources in healthcare. Notably, there exist some personnel overlaps with other advisory bodies in the health sector, which have been observed and are legally allowed. The position of the commission includes ethical and sensitive questions, which are also considered by legislative policymakers.

6. MIGRATION AND INTEGRATION POLICY

An interesting advisory structure was established in early 2010 around migration and integration policy, partly as a response to social problems and the failure of policymakers to address them over many decades prior. The Federal Ministry of the Interior, which was responsible for this topic at the time, initiated the development of a National Action Plan for integration and established two advisory bodies. One of these bodies, the Advisory Committee on Integration[10], was and remains an institutionalised forum bringing together officials responsible for

9 www.bundeskanzleramt.gv.at/en/topics/bioethics-commission

10 www.bundeskanzleramt.gv.at/en/agenda/integration/advisory-committee-on-integration

integration at the federal and state levels, with the participation of social partners and several NGOs.

Council	Task	Number of members	Duration of membership (in years)	Nomination by
Expert Council for Integration	Evaluation, prioritisation, and development of integration policy measures	13	5	Federal Chancellery

Table 3: Institutionalised advisory groups (Science for Policy) in the field of migration and integration policy
Source: Compiled by the author

The other body, established by law, is the Expert Council for Integration. The Expert Council for Integration[11] comprises 12 experts, primarily from the academic community. This independent expert council evaluates the politically agreed-upon proposals of the National Action Plan for Integration, prioritises them, and makes recommendations for their concrete implementation. In addition, it independently addresses issues and develops policy measures for the areas relevant to integration policy: education, language, employment, housing, the rule of law, and values. The Expert Council is credited with helping to shape the debate on integration policy and providing impetus for the development of an integration monitoring system.

7. EDUCATION POLICY

In the field of education policy, there is a legally established advisory body known as the Quality Assurance Council for Teacher Education (QSR)[12] (Qualitätssicherungsrat für Pädagoginnen- und Pädagogenbildung). It was established to ensure that teacher education programmes are quality-

11 www.bundeskanzleramt.gv.at/en/agenda/integration/expert-council

12 www.qsr.or.at

oriented and demand-based. The legislature deemed this necessary because it wanted to ensure that the curricula developed autonomously by providers of teacher education programmes adhere to these specific goals and principles. Ultimately, universities and colleges of education train students in the field of teacher education for a single labour market; therefore, significant differences would not be beneficial. Accordingly, the QSR issues standardisation assessments during the review process of all teacher education curricula, which must be taken into account. In addition, the QSR monitors and analyses teacher education as a whole, compares national developments with international ones, and develops proposals for further development for the concerned ministry responsible for education.

Council	Task	Number of members	Duration of membership (in years)	Nomination by
Quality Assurance Council for Teacher Education (Qualitätssicherungsrat für Pädagoginnen- und Pädagogenbildung)	Observation and Analysis of the Development of Teacher Education in Austria	6	5	Ministry or Minister

Table 4: Institutionalised advisory groups (Science for Policy) in the field of education policy
Source: Compiled by the author

The six members of QSR are appointed for a term of five years. They act independently in the performance of their duties and are not bound by any further instructions. The QSR is supported in its work by an administrative office and reports annually to Austria's Parliament.

8. ENVIRONMENTAL AND CLIMATE POLICY

The former Federal Ministry for Climate Protection, Environment, Energy, Mobility, Innovation and Technology took a different approach to developing policy measures. These were not proposed by experts, but by a randomly selected panel of about 100 people. Statistics Austria

selected these individuals from the population of people aged 16 and older who had their primary residence in Austria for at least five years.[13] The members were guided, informed, and supported by a 15-member interdisciplinary team of scientists, which in turn turned out to play a very important role in setting the agenda for the assessment. Ultimately, 80 recommendations were put forward by the members of the Climate Assembly; these were prepared by the expert team but adopted by the Climate Council through a vote.

Council	Task	Number of members	Duration of membership (in years)	Nomination by
Climate Assembly	Discussion and development of proposals for the measures required to achieve climate neutrality by 2040	100+15 (Experts)	Project-specific	Ministry or Minister

Table 5: Institutionalised advisory groups (Science for Policy) in the field of environmental and climate policy

Source: Compiled by the author

Importantly, the Climate Assembly[14] does not fit into the "Science for Policy" framework, as science had to take a back seat when the idea of citizen participation was implemented. This is a deliberative participatory format whose design has been described as innovative, yet it is also the subject of critical debate regarding its representativeness and openness to different outcomes. Potential members had to actively fill out a questionnaire and commit to serving on the Climate Assembly. This resulted in a self-selection process for those who were

13 The process is considered complex and problematic. Statistics Austria contacted a total of 2,003 people selected at random from the population register in two rounds and asked if they would like to participate in the Climate Assembly. In addition, all participants were required to be vaccinated or have recovered from COVID-19 and to have undergone a PCR test, as pandemic control measures were in effect. Furthermore, a questionnaire on the topic of climate change had to be completed. Of the 2,003 people contacted, only 145 met all the requirements, and 128 ultimately agreed to participate in the Climate Assembly.

14 www.klimarat.org/english/

particularly interested in the topic. Thus, the questionnaire conflicted with principles of random selection. This may be one reason why the 80 recommendations were adopted almost unanimously. Moreover, the framing had been predetermined, as climate protection measures were the focus, and not the socio-political consequences.

9. SECURITY POLICY

Unlike the Climate Council, the Science Commission at the Federal Ministry of Defence (BMLV) does not deal with political decisions, but rather with autonomously defined topics relevant to security policy. The advisory group was established in 1992 as a commission[15] pursuant to Section 8 of the Federal Ministries Act (BMG). The commission's term of office is five years and consists of sixteen core members with executive functions. Additionally, six sub-advisory boards and their members are invited to contribute their expertise in military history, military medicine, the social sciences, security policy, defence technology, the natural sciences, and economics. One of its central tasks is to advise the relevant minister on issues pertaining to the ministry's portfolio based on scientific research findings. Thus, the Science Commission serves as a link between the ministry and scientific institutions.

Council	Task	Number of members	Duration of membership (in years)	Nomination by
Science Commission of the Ministry of Defence (BMLV) (Wissenschafts-kommission beim BMLV)	Scientifically sound advice to the department on broadly defined security policy issues	16 (Executives)	5	Ministry or Minister

Table 6: Institutionalised advisory groups (Science for Policy) in the field of security policy
Source: Compiled by the author

15 www.bmlv.gv.at/wissen-forschung/wisskomm

In 2024, the Federal Crisis Security Act (B-KSG) came into force in Austria. The act established a new framework for the government-wide coordination of national security and crisis management in order to better address challenges such as natural disasters, infrastructure failures, or pandemics. Accordingly, an Office of Crisis Management was established within the Federal Chancellery, headed by a National Security Advisor. It remains unclear whether science will play a role in the prediction and management of crises in the spirit of S4P, or whether a new and permanent advisory structure will emerge as a result.

10. RESEARCH, TECHNOLOGY, AND INNOVATION POLICY

Following a political reform, various advisory groups in the area of "Policy for Science" were dissolved and replaced by an overarching advisory body, the Austrian Council for Sciences, Technology and Innovation (FORWIT)[16]. It is a legally established committee that submits proposals to the federal government for the further development of research, science, innovation, and technology development. FORWIT comprises twelve members whose qualifications are precisely defined by law and who are appointed by the ministries with research responsibilities. Additionally, the Federal Chancellery appoints the chair, which underscores the importance of this committee.

Council	Task	Number of members	Duration of membership (in years)	Nomination by
Austrian Council for Sciences, Technology and Innovation	Advising the Federal Government on research, science, innovation, and technological development	12	4	Federal ministries with research responsibilities, Federal Chancellery

Table 7: Institutionalised advisory group (Policy for Science) in the field of research, technology, and innovation policy
Source: Compiled by the author

16 www.forwit.at/en/

The FORWIT committee itself operates independently of any directives, has its own administrative office, and acts autonomously. FORWIT is organised as a legal entity under public law with full legal capacity and is funded by the federal government and submitted statements that can influence political decision-making processes.

In the field of "Science for Policy," other institutions also make public statements and recommendations, as has already been noted (see Figure 1), but these are not advisory committees in the strict sense, rather interest groups such as previously listed UNIKO or the FHK. The degree of consistency and political effectiveness of these public recommendations also depends on coordination within the sector.

11. SCIENCE FOR POLICY – IS IT EFFECTIVE?

The above compilation of advisory institutions and committees has documented the diversity and complexity of those bodies. However, it also suggests that scientific advice is in demand, particularly in policy areas characterised by high complexity and significant information asymmetries. Economic policy is a good example of this, as economic policy is complex, and the achievable goals are contradictory. Those who pursue an expenditure-oriented policy may accelerate inflation, those who invest too little risk a potential economic downturn. In such situations, there is often a demand for scientific expertise, particularly in the form of economic analyses, as has also been the case in the health sector. In questions regarding the approval of vaccines, the control of epidemics, or the use of genetic engineering, policymakers justifiably rely on scientifically advisory bodies.

Is "Science for Policy" successfully implemented in Austria? This question cannot be answered easily and continues to be a subject of further analysis (see OECD, 2020). Not only have the criteria for successful advisory work yet to be uniformly developed (see König, 2024). But also, based on the author's own observations and experience — as a scientist, head of an advisory group, and minister in charge — several recurring dimensions can be identified.

1. **Autonomy**. A high degree of autonomy is considered conducive to an active and, indeed, successful consulting work. Those who dictate everything and leave no leeway for advisory bodies will only receive the answers that were ordered. On the one hand, scientific expertise can only flourish if it is not overly restricted thematically. On the other hand, too much autonomy is detrimental because, at the end of the advisory process, the interests of policymakers may be missed. If policymakers only specify broad subject areas (health, education, and economy), the committee may lose its way. Conclusion? The greatest possible autonomy within a clearly defined subject area is necessary.

2. **Trust**. Trust-based relationships are considered a key prerequisite for the effectiveness of consultation processes. Firstly, a resilient relationship of trust is based, on the one hand, on careful handling of the media. If politicians learn from the media which policy measures their advisors recommend (or oppose), it seriously jeopardises trust. On the other hand, a resilient relationship of trust is based on careful interaction with one another. It requires political engagement on the part of the academic community. It is important to consider what is reasonable and what is not for a politician to be advised in a specific situation. This also includes concrete expertise regarding what is politically feasible and what is not. An advisory body must accept this limitation on its scope of thought if it wishes to be heard (see König 2024, p. 7). Those who do not accept this should not take on the specific task.

   Secondly, politics should accept science, not misuse it for political purposes, and not shy away from strong personalities as chairs of advisory bodies. Independent and professionally qualified leadership can enhance the visibility and impact of advisory bodies. Politicians should also accept the findings of science and not alter, omit, or otherwise manipulate them to suit their own purposes. Reports should always be published, as anything else jeopardises trust within an advisory body, as well as public trust in the advisory process.

3. **Resources**. The availability of human and organisational resources is considered an essential prerequisite for ongoing consulting activities. Members of advisory bodies usually have full-time jobs that are amply demanding. Therefore, it is important to facilitate advisory work as much as possible. This can be done by providing a secretariat to aid in literature research, schedule meetings, and ensure that resources are available to address knowledge gaps. Active advisory bodies have a secretariat, meeting spaces, and staff that provide academic support.
4. **Training**. Strategic institutional support and capacity-building for evidence-based policy advice are becoming increasingly important for institutions at the intersection of science, research, and policy (advice). Members of these institutions should be trained for the task of policy advising; they should practice dealing with the media, and they should also learn to cope with attacks from social media or political opponents. Meanwhile, institutions should make their members aware that the line between scientific advice and political enforcement must not be crossed. Particularly, the Vienna Theses on Policy Advice, developed by the German National Academy of Sciences Leopoldina and the OeAW, have clearly established this (see OeAW, Leopoldina, 2023).

Science for policy can contribute to evidence-based policy-making. When Science for Policy is done well, both politics and science benefit equally. Politics gain in quality, and science learn what drives political action. The "epistemisation of the political" can therefore entail potential risks, particularly with regard to possible tensions with democratic negotiation processes. But under suitable conditions, scientific evidence can serve as a resource for improving political decisions, and this originally critical formula can thus also be a normative demand (see Bogner, 2021).

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Biography

Heinz Faßmann was a professor at the TU München and University of Vienna, Vice-Rector at the University of Vienna, the Chair of the Expert Council for Integration at the Austrian Ministry for Europe, Integration and Foreign Affairs, a founding member of the Expert Council of German Foundations for Integration and Migration in Berlin and member of the Commission on Migration of the Austrian Ministry of the Interior. He has been serving as Austrian Federal Minister of Education, Science and Research between January 2020 to December 2021 and served in the same capacity from December 2017 to June 2019. He is a permanent member and President of the Austrian Academy of Sciences, the European Academy of Sciences and Arts and the Academia Europaea and his achievements have been recognized with a number of awards.

THE SERVANT OF TWO MASTERS SCIENTIFIC POLICY ADVICE: THE ESTABLISHMENT OF A NATIONAL SCIENTIFIC ADVISORY NETWORK IN SWITZERLAND – A FIELD REPORT

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ABSTRACT

This article examines the establishment of the National Science Advice Network (NSAN) in Switzerland as a response to the challenges revealed during the crisis management of the COVID-19 pandemic.[1] The approach of institutionalising scientific expertise in a network managed by Switzerland's six central education, research and innovation (ERI) actors aims to overcome the fragmentation and insufficiently formalised integration of scientific expertise into crisis management, which was identified after the pandemic. Switzerland's political system – marked by direct democracy, federalism, and concordance – creates structural conditions that complicate the systematic use of scientific knowledge in policymaking. Unlike countries with more centralised advisory structures, Switzerland relies on a decentralised and often informal system of consultation, which increases coordination costs and lack of transparency. While evidence-based instruments such as policy evaluation and regulatory impact assessments have been steadily developed within public administration alongside a growing and increasingly professional consulting market since the late 1990s, the incorporation of scientific expertise remains often informal, based on personal and organisational networks and influenced by political interests.

1 I would like to thank Dr Joël Graf, scientific advisor at the Secretariat of the SSC, who provided critical feedback on this article and thereby helped to make the argument clearer and more coherent.

At the heart of the considerations outlined here is the question of how scientific knowledge can be more formalised and institutionalised so that it can be made available to decision-makers in an appropriate, comprehensible, accepted and rapid manner in the event of an acute crisis (science for policy). To do that, the political and administrative framework conditions and the specific knowledge required in acute crises must be considered. This article is intended as a "field report", as the solutions are currently only just being institutionalised as part of a pilot project and the author is involved in the field in question as part of the Swiss Science Council SSC. Methodologically, the report draws on conceptual considerations regarding expert knowledge, on the results of an in-depth analysis by the SSC carried out immediately after the COVID-19 pandemic and on participant observations as an established method of qualitative social research (Flick, 2018) of the institutionalisation process by the head of the secretariat of the SSC.

Keywords: *Scientific Policy Advice, Institutionalisation, COVID-19 Pandemic, Expertise, Evidence-Based Policy.*

1. INTRODUCTION

The Swiss Science Council SSC is an extraparliamentary commission and advisory body to the Federal Council of Switzerland in the field of policy for science. After overcoming the acute phase of the COVID-19 pandemic and still under the impression of an initially poorly coordinated approach to incorporating scientific expertise into crisis management, the SSC has conducted an in-depth examination of the instruments and organisational forms that can be used to systematically harness and apply existing scientific expertise in the political decision-making process in a targeted manner. Based on an expert report it commissioned, the SSC has formulated recommendations for the Federal Council and the various actors in Switzerland's education, research and innovation system. An essential insight was that the incorporation of scientific expertise was insufficiently formalised and that mutual understanding and trust between government and scientific actors should be improved through appropriate institutional frameworks while taking into account

the organisational and political framework conditions of Switzerland (Schweizerischer Wissenschaftsrat, 2022).

This article first examines the political system and the structural framework conditions for incorporating scientific knowledge into the political decision-making process. It draws a conceptional distinction between different types of scientific knowledge – evidence and expertise – and considers the fact that acute crises call for a specific type of knowledge. Against this conceptual backdrop, the article analyses existing policy advice instruments and the measures taken by the Federal Council in response to various reports and evaluations of crisis management during the Covid-19 pandemic, including a report by the SSC. The article then discusses the solution in form of a national network of scientific expertise, which exhibits characteristics typical of neo-corporatist ad-hoc-ism in Switzerland. Due to its loose institutionalisation, the chosen approach gives rise to specific challenges which are discussed at the end of this article. On the one hand, this approach is challenging, as the network may be either overused or underused, and its rather weak institutionalisation increases the risk that one of the existing institutions with sufficient resources and strategic vision will eventually take over the network's tasks. On the other hand, the network's character enables situation-appropriate and dynamic solutions for the provision of scientific expertise in a complex crisis without establishing a costly administrative structure.

2. THE SWISS POLITICAL SYSTEM AS A DETERMINING FACTOR FOR THE USE OF SCIENTIFIC EXPERTISE

The Swiss political system is characterised by direct democracy, concordance and federalism. Accordingly, deliberative elements play an important role in the decision-making process, considering the needs of multilevel government[2] and the influence of various interest

2 "Multilevel governance involves intergovernmental relations within general-purpose jurisdictions, characterized by non-intersecting memberships. The number of jurisdictions is limited to a few levels, such as the national, subnational, and local levels. Additionally, there is a system-wide architecture in place. This type of governance is essentially akin to federalism, understood as a power-sharing arrangement between central and subnational governments. In this context, governance focuses on authority relations. The non-intersecting memberships mean that memberships are usually territorial, such as nation-states, with the boundaries of

groups (political, economic, regional; Armingeon & Sager, 2022). This is achieved through formal consultation procedures, in which draft legislation with significant political, financial, economic, environmental, social or cultural implications is examined for its factual accuracy, feasibility and acceptability. To this end, draft legislation is submitted to the cantons, the parties represented in the Federal Assembly (i.e. Swiss Parliament), the umbrella organisations of the municipalities, cities and mountain regions, the umbrella organisations of the business community and other interested parties in individual cases.[3] In addition to these deliberative elements, the concordance of a multi-party government, in which all seven Federal Councillors are formally equal (in contrast to a presidential system), has a decisive influence on the decision-making process and the structural implication of scientific policy advice. The principle of decentralisation and departmentalisation, i.e. the fact that each of the seven Federal Councillors heads a department and bears political responsibility for it,[4] generally means that cross-cutting and interdisciplinary issues are difficult to implement. Finally, the federal system of government with its principle of subsidiarity results in a relatively lean federal administration, with Switzerland ranking in the bottom third of all OECD countries in international comparisons (OECD, 2025).

These institutional and structural conditions mean that expertise of the scientific community plays a comparatively minor role in the political decision-making process in Switzerland – it is in fact only one of many voices and does not enjoy a particularly prominent position compared with the influence of civil society and economic considerations. The existing institutional arrangement for scientific expertise is on the national level much less formalised in the Swiss political-administrative system than it is in a more centralized system with a strong Prime Minister

these jurisdictions typically being stable and durable (Hooghe and Marks 2003, 236–37)." (Trein, 2025, p. 7)

3 Federal Act on the Consultation Procedure (Consultation Act, VlG), https://www.fedlex.admin.ch/eli/cc/2005/542/de

4 Art. 27 para. 1 RVOG: "The head of the department manages the department and bears political responsibility for it."

like the United Kingdom of Finland, in which scientists can advise the Prime Minister directly or in similar federal systems like Germany and the Netherlands with other institutional approaches.[5]

3. TYPOLOGY OF SCIENTIFIC KNOWLEDGE: EVIDENCE VS. EXPERTISE

As mentioned at the outset, political and administrative actors require different knowledge in acute crises than in normal situations. In her analysis of scientific knowledge transfer in the political decision-making process, Ledermann (2014) distinguishes two distinct types of scientific knowledge, which, in practice have a variety of hybrid manifestations: evidence and expertise. Expertise encompasses "knowledge that is person-bound, meaning that individuals provide policymakers with their professional expertise acquired through their long-term and in-depth involvement with a topic" (Ledermann quoted from Hadorn et al., 2022, p. 362). Evidence, in contrast, is defined as "independently observable and verifiable." In other words, evidence is defined by its adherence to established standards of scientific methods and procedures. For instance, the results of scientific research are regarded as intersubjectively comprehensible, reliable, and valid (Ledermann, 2014, p. 456).

Hadorn et al. (2022) referring to Veit et al. (2017) develop an analytical model that makes it possible to examine the relationship between different types of scientific knowledge and the requirements of scientific situation assessment in crisis management. Accordingly, three general elements in the logic of scientific knowledge can be distinguished: salience, credibility and representativeness. Salience denotes "the relevance and timeliness of advisory knowledge for policymakers, [...] credibility refers to whether the production of knowledge follows established epistemological standards, i.e. whether it is scientifically robust [, and] representativeness denotes

5 It should not be overlooked that this form of institutionalisation did not protect the UK from considerable systemic disruption in the case of the COVID-19 pandemic, as evidenced by the creation of the Independent SAGE (Marres & Valderrama Barragán, 2025).

whether knowledge is produced in an unbiased way by considering all relevant interests" (Veit et al., 2017, 87).

Type of scientific knowledge	*Logic of scientific knowledge*		
	Salience	Credibility	Representativeness
Expertise	High	Low	Low–high
Evidence	Low	High	High
Demand in times of crisis	High	Low–moderate	Low–moderate

Table 1: Contrasting logics of scientific knowledge for different types of scientific knowledge and in times of crisis (in Hadorn et al., 2022, p. 367)

Table 1 illustrates the potential tension between scientific policy advice and crisis situations. Due to the complexity and dynamics of the subject matter, as well as political decision-making constraints and time pressure, expertise becomes increasingly important in crises. Unlike evidence, expertise has the advantage of being able to offer knowledge that is timely and specific to the situation. Accordingly, the aspect of salience outweighs all other aspects of scientific knowledge. If expert committees are close to the decision-making process, they can respond flexibly to the demands of policymakers. At the same time, credibility can suffer because the production of knowledge cannot follow the established, generally accepted scientific procedures. The aspect of representativeness is closely linked with the selection of disciplines and individuals that provide policy advice. Therefore, and as experience in dealing with the Covid-19 pandemic has shown, particular attention should be paid to representativeness, because it can be ensured by transparent and formalised selection processes and is not attributable to the specific aspects of any crisis. Another aspect concerns the individual challenge for every scientific actor involved in crisis management to be able to personally justify its approach to switching between different types of scientific knowledge and to communicate transparently about the limitations involved.

4. EXISTING INSTRUMENTS OF POLICY ADVICE IN SWITZERLAND

Switzerland has a large, highly developed and differentiated education, research and innovation system (ERI-system) with international outreach and appeal. Accordingly, it also has a differentiated set of instruments for scientific policy advice at the federal level (Balthasar et al., 2022; Hirschi et al., 2022). In the following, these instruments are discussed in more detail, considering the contrasting types of scientific knowledge – evidence and expertise – just established.

4.1. EVIDENCE-BASED POLICY MAKING

4.1.1. EVALUATION SYSTEM

In Switzerland there is a well-developed and institutionalised policy evaluation system which is aimed for policymaking based on evidence. With the revised Federal Constitution of 2000, Article 170 came into force, which explicitly states that the Federal Assembly (i.e. Federal Parliament) must ensure "that the effectiveness of federal measures is reviewed" (BV, 2000; translated by the author). The legal effect is not limited to the Federal Assembly – it directly influences the inclusion of scientific evidence at the level of the Federal Council and the Federal Administration. In 2004, the Federal Council called for an even stronger focus on the effectiveness of federal measures. It demanded the formalisation of quality assurance and improved coordination within the Federal Administration. The latter was achieved by creating a *network for evaluation* within the Federal Administration and by setting binding standards for policy evaluation with the Swiss Evaluation Society (SEVAL), which was founded in 1996. In addition, an instrument for ex-ante evaluation was created in 2000 which, in contrast to the ex-post evaluation described above, provides for regulatory impact assessments (RIA) for federal projects (Sager & Rissi, 2011). According to the Federal Council's guidelines from 2024, the RIA is "an instrument for analysing and presenting the economic impact of federal projects. This also includes the impact on environment and society. The impacts must be analysed and presented in economic terms

(in particular costs, benefits and distributional effects)" (RFA-Richtlinien, 2019; translated by the author). The RIA is aimed at contributing to sound, evidence-based decision-making and thus to good legislation. This professionalisation of evaluation practice in Switzerland has been accompanied by the development of a network of evaluation expertise with numerous public and private enterprises specialising in this field. This is because the federal administration's demand for policy advice is mainly met by "short-term mandates with external contractors" (Himmelsbach, 2019, p. 465; quoted in Hadorn et al., 2022). The network for evaluation (SEVAL) mentioned above is closely linked to the federal government's departmental research.

4.1.2. DEPARTMENTAL RESEARCH: RESEARCH WITHIN THE FEDERAL ADMINISTRATION

Departmental research ("Ressortforschung") is a frequently underestimated and not sufficiently recognised instrument of evidence-based policy advice, as it is strongly integrated into the federal administration.[6] Based on Article 16 of the Federal Act on the Promotion of Research and Innovation (2014), federal offices may launch their own research projects "if the results are necessary for the fulfilment of their tasks." To this end, they may operate their own research institutes (Art. 16 para. 2 lit. a), contribute to research programmes at universities (Art. 16 para. 2 lit. b and c) or award individual research contracts (in the sense of contract research) (Art. 15 para. 2 lit. d; Himmelsbach, 2019; Sager & Stadelmann-Steffen, 2008). As permanent institutions, research institutes are particularly important for policy advice, as they can establish and maintain networks between science and administration. They may be part of the administration (such as the Spiez Laboratory, the Institute for NBC Protection; Agroscope, the Federal Institute for Agricultural Research; or MeteoSwiss, the Federal Office of Meteorology and Climatology) or be integrated into the ETH Domain (such as the Swiss Federal Institute for Forest, Snow and

6 In 2023, the federal government spent around 355 million Swiss francs on departmental research (https://www.ressortforschung.admin.ch/rsf/de/home/dokumentation/zahlen-und-fakten.html; accessed on 20 November 2025).

Landscape Research or the Swiss Seismological Service; Balthasar et al., 2022). There are also research institutions of national importance (Art. 15 of the Federal Act on the Promotion of Research and Innovation RIPA) that advise the authorities on specific risks (one example is the Swiss Tropical and Public Health Institute). As Hirschi et al. (2022, p. 6) rightly point out, these instruments are suitable for policy advice on certain risks, but they are limited in scope and cannot be applied to all threats or crises.

4.2. EXPERTISE INTEGRATION IN POLITICAL DECISION-MAKING

Compared to the evidence-based policy advice, the formalised incorporation of expertise is comparatively weak in Switzerland. Although there is expertise involved in the legislative process through political advisory bodies that advise the authorities and policymakers – for example, in hearings in parliamentary committees, which play an important role in the preliminary discussion of matters before Parliament. However, these forms of involvement are largely informal and barely institutionalised. The selection of experts often depends on the personal networks of parliamentarians and parliamentary secretariat staff, which is not unusual in a neo-corporatist militia system such as Switzerland (Vatter, 2024). Therefore, from the perspective of political decision-makers, the line between lobbying and scientific expertise threatens to become blurred.

4.2.1. EXTRA-PARLIAMENTARY COMMISSIONS

Furthermore, the federal administration may draw on external expertise if specialised knowledge is required which is not available within the federal administration (Art. 57 lit. b GAOA, 1997). These so-called Extra-parliamentary commissions (EPC) advise the Federal Council and Administration on an ongoing basis in the performance of their duties. EPCs are volunteer bodies (Milizgremien) in which members make their knowledge available free of charge.[7] A distinction can be made between administrative commissions, which have a purely advisory role, and official commis-

7 There are currently 80 administrative commissions and 21 public commissions (as of July 2025).

sions, which have decision-making powers. The degree of organisational development of the administrative commissions varies greatly: some have no secretariat specifically assigned to them and meet only irregularly, while others are supported in their work by a well-developed secretariat and can draw on additional expertise through advisory mandates. These volunteer organisations should prevent the administrative apparatus from growing and costly mandates from being awarded to experts. The members of the administrative commissions perform their duties as a service to the state. In their work, these bodies can rely on evidence, for example by awarding external mandates to experts for specific issues or carrying out this task themselves with the support of their secretariats, and on expertise available within the commissions. It can generally be said of the EPCs that they "primarily draw on the experience of their members when preparing reports. External analysis or in-depth investigation by commission members are rare." However, the importance of extra-parliamentary commissions "has gradually decreased over time, both numerically and in terms of their inclusion in policy formulation" (Hadorn et al., 2022, p. 364, referring to Himmelsbach, 2019). This development is also the result of the fact that the necessity of EPCs is regularly questioned by Parliament against the backdrop of general criticism of bureaucracy in recent decades. The critical political assessment has found particular resonance in Switzerland's strongly republican-liberal understanding of the state (Beetschen & Rebmann, 2016).[8]

8 Just very recently a motion was only rejected by a narrow majority, which demanded that a quarter of all EPCs be dissolved (Motion 25.3018, 2025) The main argument in each case is that the overall use of external expertise has continued to increase despite the existence of the EPCs and that, instead of advising the Federal Council and the Federal Administration, the EPCs have a tendency to lobby members of parliament and thus exert direct influence on the political decision-making process. In addition to the EPCs, which are legally grounded in the Government and Administrative Organization Act (GAOA), Switzerland's scientific advisory system may also encompass expert committees. These committees can be appointed ad hoc by the federal government, for instance, to facilitate the development of legislative reforms. The Federal Council rejected such a blanket dissolution of the EPCs and advocated a case-by-case assessment. As part of this assessment, the Federal Council proposed to Parliament that the SSC, amongst others, should be dissolved, arguing that the changed framework conditions for advisory services now require rapid ad hoc expertise and that a permanent body such as the EPCs no longer meets these requirements. At the time of writing, the public consultation is currently underway. The Federal Assembly will decide on the future of the SSC in spring 2027. In the public consultation, the SSC strongly opposed against this decision: Statement by the Swiss Science Council (SSC) on its planned dissolution": https://files.wissenschaftsrat.ch/swr_2026_stellungnahme-auflosung-swr_version-d.pdf | SWR (website accessed on 29 March 2026).

4.2.2. HIGHER EDUCATION INSTITUTIONS, ACADEMIES AND FUNDING AGENCIES

Higher education institutions, including the two Federal Institutes of Technology (ETH), contribute to scientific policy advice in a variety of ways, either through representation in the aforementioned committees or directly through research mandates and expert opinions (Hirschi et al. 2022, p. 49). Just in 2025 ETH Zurich has opened the Albert Einstein School of Public Policy as an interdisciplinary centre that combines public policy, science and technology to address "the greatest societal challenges of our time". Its mission is based on teaching and further training, research and policy dialogue. With this step, ETH Zurich pooled its resources and institutionalised the science-policy interface. Additionally, there are long-established institutions with similar but slightly different profiles at the Universities of St. Gallen (Research Centre Public Management and Governance), Bern (Competence Centre for Public Management), Lausanne (Institut de hautes études en administration publique, IDHEAP) and Geneva (Geneva Science-Policy Interface), as well as doctoral programmes at the Universities of Zurich and Basel (Doctoral Programme in Science and Policy) that are more strongly focused on science communication. In addition to these advisory services at universities, it is part of the core mission of universities of applied sciences to contribute their expertise to regional economic and political-administrative ecosystems. Finally, it is the statutory mission of the Swiss Academies of Arts and Sciences to provide scientific expertise to policymakers (science for policy). The Swiss National Science Foundation (SNSF), the Swiss funding agency for science, is also involved at the interface between politics and science, for example with the National Research Programmes (NRP), the National Centres of Competence in Research (NCCR) or the Agora funding programme, which offers consulting services and further training in the field of science communication.

5. THE EXPERIENCE OF THE COVID-19 PANDEMIC AS LITMUS TEST FOR THE USE OF EXPERTISE TYPE OF SCIENTIFIC KNOWLEDGE

The coronavirus crisis was a turning point in global science advice (Pearson, 2024). Within a short period of time, and in all countries with the appropriate academic and private-sector infrastructure, there was an urgent demand from political decision-makers for scientific interpretation and expertise on the epidemiological situation. Globalised mass media coverage made it possible to identify different approaches to solving the problem in real time and to compare their effectiveness. Concurrently, following an introductory period of astonishment and of rallying around the flag, a vocal political opposition emerged against the interpretive authority of the expertise provided chiefly by epidemiologists. In Switzerland, the absence of formalised procedures for providing scientific advice during political crises promptly became evident. Not only was scientific advice relatively poorly institutionalised, much worse, crisis management had to be developed in practice, even though the Federal Council had issued new directives on crisis management in the federal administration just two years before the outbreak of the pandemic (Weisungen über das Krisenmanagement in der Bundesverwaltung, 2019). Ultimately, Switzerland has not been accustomed to crises. The nation's political system is oriented towards stability and the predictability of outcomes. In periods of crisis, the government tends to respond in a reactive, opportunistic, and improvisational manner. In this regard, Switzerland is characterised by a pronounced manifestation of pragmatic neo-corporatist ad-hoc-ism. Furthermore, input legitimacy is of paramount importance, ensuring that even in times of crisis, the conventional legitimation processes and democratic participation procedures are upheld.

5.1. RECOMMENDATIONS OF THE SWISS SCIENCE COUNCIL (SSC)

As early as in the end of 2021, that is, whilst the international public health emergency declared by the WHO was still in force, the SSC

commissioned experts from different Swiss universities to conduct a study on scientific policy advice in Switzerland. The researchers took a comparative approach to reconstruct the different forms of policy advice, their strengths and weaknesses, and the institutional framework used in three crises that differed in nature and severity. These were the financial crisis of 2008-2009, the nuclear accident in Fukushima in 2011 and the COVID-19 pandemic of 2020-2022. What all these crises have in common, is that the administration was able to draw on existing expertise, as this is already embedded in the federal administration's risk assessment structures. This risk-based and backward-looking form of institutionalised knowledge in crises highlights however a general fact, namely that "[states] are perfectly prepared for the last crisis, but not necessarily for the next one" (Hirschi et al., 2022, p. 46). The crises examined can be distinguished in terms of their temporal, spatial and social dimensions.[9] The varying characteristics of these dimensions mean that "there can be no uniform science-for-policy mechanism" (ibid.), there is no "cure for all ills" but rather a plurality of mechanisms that exist in parallel and follow a "fit-for-purpose approach" (Mavrot et al., 2024). This insight into the complexity of institutionalised approaches prompted the SSC to address the recommendations summarised below to the Federal Council and the ERI institutions.

- First, the human aspect and trust in the field of scientific expertise must not be underestimated. Trust between scientists, administrative collaborators and policymakers is essential. Therefore, the exchange

9 In terms of time dimension, Hirschi et al. (2022, 46) distinguish between the pre-crisis, acute, and post-crisis phases of the process; in the spatial dimension between spatially concentrated and spatially distributed crises; and in the social dimension between the degree of social impact, the consensus or dissent on norms, and the goal of crisis management, which is to bring about behavioural continuity or behavioural correction. Unsurprisingly, the social dimension is the most complex, as it has a cumulative potential, "i.e. the possible spread from one social subsystem to another". Thus, "supply crises can escalate into economic crises, natural disasters into health crises, and pandemics into political crises" (ibid.). The conclusion is that expertise in complex crises must be organised in a multidisciplinary and dynamic manner. In terms of the spatial dimension, Fukushima stands out as a crisis with far-reaching effects but no Swiss epicentre, in contrast to the other two crisis, which directly affected Switzerland – although the Covid-19 pandemic presented its own unique complexities due to its federal, multi-level nature. In terms of the social dimension, the financial crisis and the pandemic present the sharpest contrast: maximum secrecy and enforced continuity of behaviour on the one hand, maximum public visibility and urgently needed behavioural change on the other. Here too, Fukushima occupies a middle ground – indirect impact, but highly charged with normative significance due to the nuclear energy debate in Switzerland.

between government (i.e. administration and executive power) and sciences should be established to strengthen mutual understanding and trust.

- Secondly, at universities, ETHs and research institutions of national importance, capacities for scientific policy advice should be developed and maintained. This should be part of their "third mission". Examples include the specialised higher education institutes such as the Competence Centre for Public Management at the University of Bern, the IDHEAP at the University of Lausanne and the Albert Einstein School of Public Policy, as mentioned above. However, this aspect should be emphasised more strongly in all higher education institutions, including universities of applied sciences. Academic incentive and reputation structures should be adjusted accordingly, so that outstanding scientific policy advice is taken into consideration when awarding teaching and research positions and funding (SNSF, Innosuisse, cantonal and private funding agencies).
- Thirdly, federal departmental research ("Ressortforschung des Bundes", see 5.1.2) should build bridges between government and science to identify risks, knowledge gaps and the need for additional expertise in specific areas. Since departmental research pursues a strongly impact-oriented, transdisciplinary approach, it is an inherent and natural fit for this type of research to incorporate scientific expertise in order to solve specific problems of a political and social nature. This orientation should be further concretised in the future, and exchanges with external research groups should be intensified. Extra-parliamentary commissions can also make an important contribution here, but only if their role in crisis preparation and management is clarified, the volunteer committees are supported by a professional administrative office, and their importance is not further diminished.
- Fourthly, the procedure for setting up an ad hoc task force should be formalised and the rules for cooperation, ethical conduct and communication should be set out in a binding agreement.

- Finally, the EPCs as typical organisations of expertise, such as the Federal Commission for Pandemic Preparedness (FCPP) and the Federal Vaccination Commission (FVC), did not play a role in the early stages of the pandemic. As for the FCPP, the Federal Office of Public Health (FOPH), which was in charge of managing the crisis, considered that its services were not required. Furthermore, the FCPP was not specifically intended to provide its expertise in the event of acute crises. Thus, the FOPH limited itself at the beginning of the pandemic to occasional contact with experts in Swiss research institutions and refrained from activating the FCPP (Hirschi et al., 2022, p. 58ff.). In addition, the majority of FCPP members were medical practitioners, who were heavily involved in their practical work during the acute phase of the pandemic and therefore did not have the resources to additionally advise the government on the management of the crisis. The composition of the FCPP together with the obstructive attitude of the FOPH – which led to a certain lack of understanding among policymakers and the public – were among the reasons why representatives of basic research concluded that there was insufficient scientific expertise in the federal government's crisis management. In the SSC's view, the EPCs continue to be an important source of scientific and civil society expertise; this may also apply in the event of a crisis, but only if targeted reforms are implemented. The SSC therefore recommends in its report that the role of the EPCs in the event of a crisis be explicitly set out in the relevant mandate. To date, this task has not been explicitly laid down in the EPCs' legal framework. Consequently, the FCPP lacks an optimal composition and has only limited capacity.

5.2. MEASURES TAKEN BY THE FEDERAL COUNCIL: AD-HOCISM, WEAK INSTITUTIONALISATION AND NETWORK

After the acute crisis had been overcome, the federal government's (and cantonal) crisis management organisation enjoyed considerable attention in the political arena. Numerous political initiatives called on the Federal Council to critically review the situation and take

measures to improve federal crisis management.[10] The Federal Council's report (Bundesrat, 2023) provided the starting point for revising the principles of the federal government's crisis management organisation in its Ordinance on Crisis Management in the Federal Administration (Verordnung über die Krisenorganisation der Bundesverwaltung, KOBV, 2025). The most important conclusion from the perspective of scientific policy advice is the Federal Council's recognition that, in future, science should also be systematically involved in the federal government's crisis management. In this matter the Federal Council has taken up some of the recommendations by the SSC. Considering the scientific advisory body the revised Ordinance states that "clear roles and responsibilities should ensure coherent and holistic crisis management". Standards are therefore required to delineate the methodology for identifying, notifying, and engaging such actors. With this approach, the Federal Council is addressing the challenge described above of ensuring representativeness when drawing on expert advice in the event of a crisis (see chapter 4). Article 16 of the KOBV now stipulates that the Federal Council may establish such a body "if necessary", and that this appointment shall be made by means of an order. The order must regulate the following points: the members, the organisation, the affiliation with the crisis organisation of the Federal Administration, the services and remuneration, communication with the public, and confidentiality and information protection. The Federal Chancellery is designated as the contact point for scientific advice in crises and takes the "preparatory measures for the involvement of the scientific community" (ibid.). Under this regulation, the Federal Council or the department in charge of the crisis management has the decisive role in setting up an advisory body.

It is worth noting at this point that in the case of the COVID-19 pandemic, the Federal Council formally involved the external expertise of epidemiologists in crisis management only after much hesitation and

10 21.3205 FDP-Liberal Group "Role of the Federal Civil Protection Task Force in the context of the COVID-19 pandemic" of 17 March 2021, 21.3449 Security Policy Committee of the Council of States "Strategic crisis management" of 25 March 2021 and 22.3343 Green Liberal Party "Finally ensuring the institutional crisis resilience of the Federal Council" of 18 March 2022. Similarly, numerous motions were also submitted at cantonal level, which led to further external evaluations (e.g. Schwenkel et al., 2024).

considerable pressure. In other words, there can be significant differences in interpretation between the scientific community and the political actors when it comes to the need for additional scientific expertise from outside the administration in a crisis. The legal basis establishes that the authority of interpretation remains with policymakers, a position that is fundamentally understandable from a democratic point of view and the separation of powers. However, this mechanism can also result in the instrumentalisation of science by policymakers, which poses a risk of scientific expertise's autonomy being questioned.

The KOBV provides for a basic organisation for crisis management (Basisorganisation Krisenmanagement, BOK) in preparation for crises (and in dealing with them), with a division of labour between the Federal Office for Civil Protection (FOCP), responsible for risk management at federal level, and the Federal Chancellery (FC). When preparing for a crisis, Article 12 and the designated role of the Chancellery is of particular interest. It is tasked with "assessing developments that could lead to a crisis within the framework of crisis anticipation, involving the departments, cantons and third parties" (KOBV, 2025). In other words, in future there should be better links between early crisis detection and the federal government's analysis of the situation and environment, taking into account scientific assessment and the federal government's risk management – as potential risks can lead to acute crises. With the KOBV, the Federal Council now intends to institutionalise scientific expertise more firmly within the framework of situation and environment analysis and risk management, and thus outside of acute crises. The formalised involvement of the scientific actors is to be conducted via the National Science Advice Network, which will subsequently be discussed in the following chapter.

5.3. THE NATIONAL SCIENCE ADVICE NETWORK (NSAN) – BETWEEN INSTITUTIONALISM AND "AD-HOC-ISM"

The Federal Chancellery did not intend to designate the Extra-parliamentary commissions as existing advisory body for use in a crisis and to clarify their role in such a scenario. Instead, it decided to establish an informal network, the operation of which is the responsibility of

the BFI stakeholders. However, based on the experiences during the COVID-19 pandemic, it was clear that the reform of crisis management must also aim to formalise scientific advice in acute crisis situations, to define processes and to clarify public communication.[11] This resulted in a Cooperation Agreement (Zusammenarbeitsvereinbarung, 2023) and a Code of Practice, both of which were signed by the parties involved on 8 December 2023.[12] The Code of Practice (2023) regulates the responsibilities between the Federal Council, the Federal Administration, the ERI actors and the ad hoc advisory groups. It defines the principles of science-based policy advice, the role of experts in advising and their accountability, and in particular communication in normal times and during acute crises. After all, it was primarily the poorly coordinated communication between political authorities and representatives of the scientific community that gave rise to criticism during the coronavirus pandemic. In times of crises and in their role as advisors to the Federal Council, experts within the Network "should avoid public political commentary" (ibid.). They should maintain their scientific integrity, act as "honest brokers" (Pielke, 2014), disclose conflicts of interests, and provide balanced assessments.

The NSAN, designed as a pilot project running until 2027, is made up of clusters of scientific experts on crisis-related topics, each led by three to four coordinators, with a chair and a deputy. Their secretariat is provided by one of the six ERI actors. The clusters are defined on a risk basis by the Conference of Secretaries General of the Departments (CSG, "Generalsekretärenkonferenz"), the highest coordinating body of the federal administration. According to the Government and Administration Organisation Act (GAOA, Art. 53), the CSG contributes to "forward-looking, effective and coherent administrative activity." To date, clusters

11 See also the Federal Council report of 23 November 2022 in response to postulate 20.3280 Michel (www.parlament.ch > 20.3280 > Report in response to the parliamentary motion "Harnessing scientific potential in times of crisis") and the background report "Options for scientific policy advice in relation to crises" (https://www.newsd.admin.ch/newsd/message/attachments/74010.pdf, translation by the author)

12 The Federal Chancellery, as the Federal Council's administrative office, is responsible for coordinating the process. The agreement was signed by the State Secretariat for Education, Research and Innovation and the presidencies of swissuniversities, the ETH Board, the SNSF, the Swiss Academies of Arts and Sciences, the Swiss Science Council and Innosuisse.

have been organised for "cybersecurity", "disinformation", "international challenges" and "public health". Clusters for "natural hazards" and "economic crises" are to be set up in 2026. An evaluation at the end of the pilot phase will provide information on the appropriateness of the network. The aim of the NSAN is to build trust and institutionalise exchange between science, administration and politics in normal circumstances, so that in the event of a crisis, scientific expertise can be better and timelier incorporated into political decision-making.

6. CHALLENGES FOR SCIENTIFIC POLICY ADVICE

As discussed before, the NSAN is designed as a neo-corporatist network. It considers hereby the institutional framework of Switzerland's political and administrative preferences. At the same time, it has retained its ad hoc character and thus considers a "fit-for-purpose approach". However, this form of organisation also means that its degree of institutionalisation and resource allocation remains somewhat unclear: its form is a compromise between institutionalism known from EPCs and other standing expert panels – which have a legal base and dedicated resources – and more ad hoc arrangements. It appears that the Federal Council favours the latter form of expertise, having only just approved fundamental reforms to the EPCs, under which around a quarter are to be abolished. This contributes to the steady decline in the importance of neo-corporatism in the Swiss political system, a trend that was already observable ten years ago (Beetschen & Rebmann, 2015). The lack of resources without a dedicated budget and the lack of an explicit legal base on the one hand and the fluid form of organisation on the other may raise fundamental problems for this type of organisation.

Firstly, the lack of formally defined tasks can hinder operational efficiency, as it is challenging to establish a basis of trust for close cooperation without purpose-specific personal exchanges within the network and with policymakers. Secondly, and in reference to the "tragedy of the commons" (Hardin, 1968), free goods such as scientific policy advice in this form are either undervalued and/or overused. Thirdly, there is a growing risk that due to the lack of resources the network is perceived

as biased and therefore vulnerable to political questioning. An argument commonly used during the COVID-19 pandemic was that scientists would hardly provide policy advice at their own expense and without compensation unless they were pursuing a personal agenda, even if only with the intention of securing follow-up contracts. Finally, there are challenges regarding the political legitimacy of the thematic clusters selected. Currently, thematic clusters for potential crises are being defined by the Conference of Secretaries General, an administrative body with no political legitimacy. This raises the question whether it would not be more appropriate for the Federal Council (and Parliament) to define and approve these clusters.

These challenges for the transparency, legitimacy and operability of scientific policy advice must be further clarified in the future, including in relation to ad hoc committees of a scientific nature which offer "politicised policy advice" (Weingart, 2006) in the decision-making process and whose representatives are recruited directly by the government involved. Such a politicisation has the potential to compromise the credibility of the involved experts and, by extension, the credibility of academia as an institution. This was the case, for example, in one of Switzerland's largest reform projects of the last years to fundamentally review tasks and subsidies of the federal state (Gaillard et al., 2024), in which a mixed group of representatives from academia and politics was commissioned by the Finance Minister to develop recommendations for structurally relieving the federal budget. The analysis, which was carried out under considerable time pressure, identified potential savings of between four and five billion Swiss francs. As with evaluations in general, the crux of the matter often lies in the formulation of the initial situation, the framework conditions and the objectives of research and consulting assignments. This framing influences the collection of empirical data and evidence and ultimately the result of the scientific assessment of a political problem.[13]

13 The mandate was as follows: "The expert group is tasked with proposing expenditure measures to the Federal Council that could reduce the budget by at least CHF 3 billion from 2027 and by at least CHF 4 billion from 2030. It is prioritising the measures in case the need for adjustments turns out to be less than currently expected." The basic assumption here was, as the finance minister said, that Switzerland had a spending problem, not a revenue problem (Schäfer & Neuhaus, 2023).

The risk of political control of expertise continues to increase with the growing polarisation of the political discourse because of the increasing success of populist movements globally and the modus operandi of social media ("self-reinforcing feedback systems"; Sunstein, 2018) and disinformation. There are finally two distinct positions that shape public discourse, each presenting its own challenge for scientific knowledge in general. Hirschi, referring to Jasanoff, characterises these positions as the "elitist" and "relativist" models (Hirschi, 2021): The elitist model attributes to experts "a privileged influence on decision-makers based on their superior expertise, which extends to the right to have their recommendations implemented in a binding manner" (Hirschi, 2021, p. 164). The relativist model refutes the notion of their influence "precisely because of the limitations and provisional nature of their expertise and reduces their recommendations to one relevant opinion among many" (ibid.). Whereas policymakers used to employ the two models mentioned above in an instrumental and situational manner, they are now ideologically charged and repurposed in a trench war between opposites, "which one camp wages in the name of science and the other in the name of the people" (ibid., translation by the author).

7. CONCLUSION

This article is intended as a field report against the backdrop of an analysis of scientific policy advice in Switzerland. The catalyst for this in-depth analysis was the experience gained during the COVID-19 pandemic. The management of this highly complex crisis posed a significant challenge to Switzerland's crisis management – scientific expertise had to be incorporated into crisis management quickly and had to be adapted on an ongoing basis. The Swiss political system assigns a rather subordinate role to scientific policy advice, even though the formal institutionalisation of evidence is well advanced. As discussed, evidence-based policy is required by the constitution and aims to provide good governance.

However, as has been shown, the management of an acute crisis requires a specific form of scientific knowledge, which has been referred to as

expertise. It is characterised by person-bound knowledge. Compared to other countries, however, the use of scientific *expertise* is poorly developed and often opaque. Traditionally, expertise type of knowledge has found expression in the Swiss political system in the form of EPCs, to which the Federal Council appoints experts ad personam for a term of four years. EPCs tend to take a long-term, evidence-based often systemic view of their subject area and are therefore not designed for the management of acute crises or the support of crisis management. Furthermore, there are currently political efforts to weaken the EPCs with the argument that they are not fit-for-purpose anymore. Thus, rather than clarifying the role of EPCs in crisis management, the Federal Council opted for incorporating scientific expertise through a newly established network, formed by the ERI actors and with support of the Federal Chancellery. The network continues to have a certain ad hoc character, therefore considers the unpredictability of crisis and the scientific knowledge required to overcome them. Yet, although a degree of formalisation has been achieved through a Cooperation Agreement and a Code of Practice, its institutionalisation remains relatively weak. For this reason, and due to its lack of dedicated resources, the role of this network remains to be determined, both in acute crises and, especially, in so-called normal times. It is precisely in times like these that the low degree of institutionalisation and lack of a clear legal basis becomes particularly apparent.

Finally, on the one hand, the structural challenge lies in the fact that it remains the Federal Council's decision, at the request of the department in charge, to determine when a given situation should be defined as crisis. According to the Crisis Ordinance, a situation must be defined as a crisis "if it can no longer be managed within the usual structures." For political and reputational reasons, and to avoid the "blame-game" (Hinterleitner 2026, 16ff), government is very cautious and reluctant to admit that the established structures are no longer sufficient to handle a political problem requiring action – and thus define a situation as a crisis. This reservation was recently demonstrated in a striking example during the negotiations between the US government and Switzerland in the wake of the unilateral imposition of tariffs by the US, when the

Federal Council chose not to involve to the existing cluster "International Challenges", fearing that labelling the situation as a crisis might jeopardise the negotiations. On the other hand, the role of "honest broker" must be accepted and practised by the scientific actors themselves. When they are tasked with contributing domain-specific knowledge to the government, they must acknowledge the inherent constraints of the validity and scope of their advice. They have to act under conditions of high complexity and a significant degree of interdependence in "poly-crises" (Tooze, 2021), incomplete information and considerable time pressure, where empirical evidence may not be available yet and the need for their expertise therefore all the more important.

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Biography

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KNOWLEDGE FOR PLACE-BASED POLICYMAKING: TOWARDS INTERACTIVE SCIENCE-FOR-POLICY ECOSYSTEMS

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ABSTRACT

This paper explores how science-for-policy ecosystems can integrate advisory, reflexive and evaluative functions to support place-based, evidence-informed policymaking in the face of contested and transformative challenges. The roles of science, technology and innovation (STI) policies in economic development processes are being reshaped in a new global context characterised by grand environmental and social challenges alongside rising geopolitical tensions, fast-changing technologies and high uncertainty. Amidst these changes we see shifting demands from policymakers for the translation of theoretical and empirical knowledge in more agile cycles of real-time policy experimentation. Drawing on in-depth comparative analysis of cases characterised by two distinct institutional settings and levels of maturity, the paper identifies key structural, operational and practical characteristics that enable more dynamic, co-produced and politically aware knowledge use in STI policy. The findings suggest that strengthening science-for-policy ecosystems requires moving further beyond linear models of evidence use toward more dynamic, co-created approaches that embed evaluation and learning within policy processes. This involves fostering institutional capacities for experimentation, supporting intermediaries who can navigate between knowledge and action, and creating spaces for deliberation and reflexivity. Importantly, the study highlights the need to recognise and manage the political dimensions of knowledge use, particularly in areas where policy goals are contested or evolving.

Keywords: *Place-Based Policymaking, Evidence-Based Policymaking, Science-for-Policy Ecosystems, Knowledge Co-Production, Policy Evaluation.*

1. INTRODUCTION

Shifting global economic and political landscapes are reshaping the roles of science, technology and innovation (STI) policies in economic development processes. Specifically, the imperative to foster place-based resilience in the face of technological, economic and environmental disruptions have placed STI policy at the centre of competing demands. These include demands to promote strategic autonomy and technological sovereignty to ensure economic resilience and national security, and demands to enable green and just societal transitions. The tensions across these demands are further exacerbated by the increasing speed of change and growing politicization and contestation of STI policy objectives and instruments, particularly around mission-oriented and transformative approaches. In this context, the role and structuring of knowledge for policy interfaces is evolving, calling for actors to integrate various functions and pursue more participatory and action-oriented approaches. Specifically, the integration of advisory and evaluative functions within science-for-policy ecosystems at a range of different territorial scales becomes both critical and increasingly challenging.

The specific STI policy issues can be framed in broader debates around the evolution of the roles of universities, which are increasingly seen not only as producers and curators of learning, knowledge and thinking, but also as proactive catalysts and co-creators of sustainable development and transformation in their territories (Aranguren et al., 2016; Benneworth & Fitjar, 2019; Canto-Farachala et al., 2024; Pugh et al., 2022; Schwaag Serger et al., 2021; Trencher et al., 2014; Trippl et al., 2023). Yet while there is a strong trajectory of research that explores how universities and their academics engage with firms and/or as entrepreneurial agents (Bozeman, 2000; Meerman & Davey, 2025; Miller et al., 2018), there is less research on how academic knowledge in the STI field engages with policymakers.

The existence of an important knowledge gap as regards the key interface between academic knowledge and policy is highlighted in the context of the evolution of discourse around STI policy over the last decade towards transformative, third generation, or mission-oriented policies (Mazzucato, 2018; Schot & Steinmueller, 2018; Weber & Rohracher, 2012). While arguments for the need for more transformative STI policies that can respond in real time to key societal challenges such as sustainability, ageing populations and economic resilience are conceptually compelling, designing and implementing policy in this way in practice is challenging, requiring experimentation, organisational innovation and multi-actor governance (Uyarra et al., 2017).

This paper explores how STI knowledge can be more effectively mobilised to support place-based and evidence-informed policymaking in an era of complex, contested and transformative challenges, contributing to ongoing debates about how to design and sustain science-for-policy ecosystems that are both robust and adaptable. Concretely, it addresses two related research questions. Firstly, as policy seeks to become more transformative, how are the modes of operation changing in the relationship between knowledge and policy? Secondly, what implications do these changes have on advisory, reflexive and evaluative practices and the interactions between them in science-for-policy ecosystems? These research questions are explored by synthesizing lessons from two cases with different levels of maturity and set in different, experimental institutional contexts.

The paper is structured as follows. In the next section we provide some background on the parallel evolution of STI policy itself, on the one hand, and the role played by policy-relevant research within place-based innovation systems, on the other hand. We then set out our methodology, which is based on understanding emerging practice in the day-to-day practice of the knowledge-for-policy interface. After an in-depth comparative analysis of two cases characterised by distinct institutional settings and levels of maturity, we discuss the key findings with respect to each of the research questions. The final section concludes with reflections on limitations, implications and ideas for further research.

2. PLACE-BASED INNOVATION SYSTEMS, STI POLICY AND THE ROLE OF POLICY RESEARCH

The main contribution of this paper is to explore the contemporary knowledge-for-STI-policy landscape and dynamics on the ground. By doing so we aim to offer practical implications for policymakers and researchers, responding to the growing demand for more integrated, reflexive and politically attuned approaches to supporting place-based policy with academic knowledge. To contextualise our case analysis, we first provide some background on how thinking on place-based innovation and STI policy have evolved over recent years, and the implications for policy-relevant research.

A key place-based framing for contemporary STI policy is the national and regional innovation system concept that emerged during the 1990s (Cooke et al., 1998; Lundvall, 1992; Freeman, 1995; Nelson, 1993). Nelson built his conception of a national innovation system from the evolutionary theory of technical change (Nelson & Winter, 1982), whereby diversity is introduced into organisations within a system by technical change and selection mechanisms support the emergence of new technologies and organisational forms. Lundvall, on the other hand, conceived innovation as a learning process and stressed the relevance of user-producer interactions and institutions, leading to a broader definition of a national innovation system that includes all the economic and institutional actors that affect learning within the production system (Mytelka & Smith, 2002). Cooke et al. (1998) and others adapted the scale of analysis, conceiving the regional innovation system concept that has become a mainstay of regional innovation policy.

Universities and other research organisations are considered integral components of innovation systems, where their role has evolved from a technology transfer function (Bozeman, 2000; Falani & Torkomian, 2024) to a richer entrepreneurial role (Bercovitz & Feldman, 2006; Cerver Romero et al., 2021; Clark, 1998; Guerrero & Urbano, 2012; Feldman, 2001). As innovation systems thinking takes a more transformative direction, this role continues to evolve, placing increasing emphasis on

addressing complex societal challenges alongside the more established economic objectives of innovation (Schot & Steinmueller, 2018; Lundvall, 2024). In this context universities' mission of external engagement and collaboration is becoming more complex, for example embracing sustainability transitions (Cai & Ahmad, 2023; Trippl et al., 2023) or the transformative agendas associated with smart specialisation strategies (Canto-Farachala et al., 2022). This implies universities becoming engaged in more sophisticated forms of multi-actor engagement that are often conceived in terms of applied knowledge co-creation processes under labels such as "civic universities" (Goddard et al., 2016), "transformative academic institutions" (Canto-Farachala et al., 2024) or "fourth generation universities" (Lukovics & Zuti, 2017).

Beyond the strictly place-based context, such changes in the roles of universities and other research institutions have evolved in line with changing STI policy thinking, especially over the last decade. In the wake of the adoption by the UN of Agenda 2030 and the Sustainable Development Goals in 2015, STI policy embraced more directional and normative transitions with a broader socioeconomic focus, adding to its more traditional economic focus on the commercialisation of research, competitiveness and growth. In particular, greater priority has been given to environmental and social sustainability, a change that can be discerned both in theory (Schot & Steinmueller, 2018; Haddad et al., 2022) and in practice (Schwaag Serger & Palmberg, 2022; Avdeitchikova & Schwaag Serger, 2024). Mission-oriented innovation policy emerged as one specific manifestation of attempts to target societal and environmental challenges (Mazzucato, 2017; European Commission, 2017; OECD, 2021; Larrue, 2022). This evolution has profound implications for the knowledge base for, and the design and implementation of, STI policymaking, which we return to below.

A second significant shift saw STI policy evolve from working with complicated problems to struggling with complex problems, partially because of the pivot towards more directional and normative policy. Complex problems (sometimes also called 'wicked problems') tend to be difficult to identify or pinpoint precisely, are often contested, generally

require a systems approach, and are rarely fully solved (Rittel & Webber, 1973). They also tend to be characterised by significant uncertainty, urgency and interconnectedness, and addressing them often requires stakeholder engagement (Head, 2022). To put this in the context of STI policy, while promoting innovation for growth can be characterised as 'complicated' in that it requires various policy instruments that target a range of different actors, challenges such as inclusion, cohesion, climate change and biodiversity are 'complex' in the sense of also having many of the characteristics identified above. As STI policy seeks to, or is expected to, tackle societal challenges, the combination of complexity and urgency highlights the need for different policy approaches. The required approaches tend to push beyond the traditional scope, reach or remit of policymakers in the innovation policy domain, as challenges intersect with other policy domains. Their effectiveness may also require new policy instruments or innovations to existing policy instruments, implying a gradual evolution in the STI policy toolbox.

The two shifts in STI policy outlined above lead inevitably to a third change: the need for different types of knowledge upon which to base policies that are more directional, normative and complex. The normative turn in STI policy, manifested especially of challenge-oriented societal goals and a holistic sustainability agenda, has important implications for the types of knowledge that can support policy design and implementation, including how it is created and used. More specifically, the complexity, urgency, uncertainty and contestation of challenges call for opening policy processes to new sources and types of evidence, including more reflexive approaches to policy learning that embrace a greater variety of perspectives.

The difficulties for policymakers in tackling complex, wicked or intractable problems are not new. Several authors have discussed issues such as policy contestation, the need for multiple and different sources of knowledge, and the importance of interactive policy processes (Nelson, 1974; Lindblom, 1959,1979; Wildavsky, 1973; Rittel & Webber, 1973; Head, 2022). As STI policy enters the realm of such problems, it becomes clear that the traditional STI policy toolbox – which is filled with

a combination of, usually stand-alone, supply-side, demand-side and systemic instruments oriented towards correcting distinct market failures - is not well equipped to address the complexities of transformation. Moreover, in many cases nor does it have the reach or mandate to do so. Different instruments, competencies, policy-mixes and governance structures are needed. The question then becomes whether the current providers and sources of knowledge (universities, research institutes, think tanks) and the ways of accessing, disseminating and utilizing them (academic research and papers, publications, consultation, evaluation) are appropriate for a new, normative, transformative and fundamentally place-based innovation policy. Specifically, it opens debates around a more proactive approach for policy-related research that fulfils roles such as knowledge brokering (Bergenholtz, 2011; MacKillop et al., 2023) or boundary spanning (Williams, 2012) within territorial innovation systems. Such roles imply engagement with a wide range of regional stakeholders with a specific role for policy engagement, in what might be labelled science-for-policy ecosystems.

In such ecosystems researchers are called on to complement traditional functions of knowledge production and dissemination with "systemic intermediation functions": articulation (of demand and strategic options), alignment (of actor networks and complex actions over time), and support of learning processes (van Lente et al., 2003). In networks and systems (compared to more traditional one-to-one interactions), learning processes move beyond knowledge and technology transfer and capacity building to include translation and synthesis of knowledge, and action-oriented system-level learning (learning by doing, using/applying, reflecting and sensemaking, all in interaction) (van Lente et al., 2003; van Mierlo et al., 2010; Beers & van Mierlo 2017; Hilger et al., 2021).

Given both the different nature of the relationship between academics and policymakers (as opposed to between academics and businesspeople) and the different disciplinary mixes required for policy engagement (primarily social sciences), we need to understand more about the institutional settings that facilitate effective science-for-policy

engagement relationships. Moreover, these relationships must be forged in the context of an STI policy landscape that is itself rapidly changing in response to the demands of complex societal challenges such as ecological transition and demographic change.

3. METHODOLOGY

To better understand the evolving demands and the changing modes of operation in the knowledge-for-STI-policy relationship, this research has followed a qualitative approach based on an in-depth comparative analysis of two cases that are characterised by distinct institutional settings and levels of maturity. The research was conducted in two phases, described below.

Selection of cases and exploratory questions

The research was initiated as a peer learning exercise within the context of a two-year experimental initiative (GReaTr) in Sweden.[1] The organisations and initiatives that participated[2] were selected to represent a range of perspectives and experiences from regional, national and supra-national levels, as well as a range of institutional settings. The two exploratory cases included in this research (GReaTr and Orkestra) were selected based on the following criteria:

- They represent different geographies, policy contexts and experience in supporting the implementation of transformative innovation policies (Mazzucato, 2018; Schot & Steinmueller, 2018; Weber & Rohracher, 2012) directed at addressing complex societal challenges.

1 GReaTr was a two-year experimental project (Oct '22 – May '24) that gathered policymakers, academics and policy experts from several countries, the EU Commission and the OECD to co-create and co-curate knowledge that could be of use and relevance in 'governing resilience and transformation (GReaTr)'. The initiative was funded by Vinnova, the Swedish Government Agency for Innovation with significant in-kind contributions from senior researchers and experienced practitioners (policymakers and other policy experts).

2 Austrian Institute of Technology (AIT), Fraunhofer Institute for Innovation Systems Research (ISI), Governing Resilience and Transformation (GReaTr) initiative, Mission-Oriented Innovation Policy Observatory (MIPO) at Utrecht University and Orkestra – the Basque Institute of Competitiveness, as well as the Joint Research Center of the European Commission in Seville, and the OECD Directorate for Science, Technology and Innovation.

- They represent knowledge actors with different levels of institutional maturity and practical experience in actively working to support effective place-based TIP (transformative innovation policy) knowledge-for-policy processes.

Initial data was presented from each academic institution, responding to five common questions:

1. What changes in the policy context have you observed in recent years? (new policy aims and/or programmes, governance/organisational structures, budget changes, etc.)
2. How/how often do you/your research group interact with policy practitioners? (informal vs. formal, types of practices/processes)
3. What types of knowledge products result from the interaction?
4. (How) do you determine value/relevance/ impact?
5. What are the biggest challenges in your context with regard to working with/on knowledge-for-policy?

Initial identification of key similarities and differences were discussed at the workshop, and it was agreed to pursue a written cross-case analysis.

Elaboration of case studies and comparative analysis

Initial case descriptions were elaborated over the course of three months. A common template and example case description was provided by researchers leading the GReaTr initiative. Then, each peer representative took responsibility for providing a written draft of their case study using a combination of primary (synthesis of interviews and experiences over recent years provided by participating researchers) and secondary data (e.g. from institutions' websites and strategy documents).

These initial case descriptions were further developed as written (5-6 page) briefs, from which a comparative analysis was conducted and refined. Building on the cases and previous work within the innovation policy practitioner and research communities (Eu-SPRI SAB, 2024), we used an interpretive and inductive approach (Alvesson & Sköldberg,

2000) to identify from the cases the core structural, operational and practice-oriented characteristics that underscore effective knowledge for policy processes and that could be applied in different settings:

- Structural characteristics include territorial and cultural setting, governance arrangements, and institutional mandates;
- Operational characteristics include transdisciplinary knowledge and skill base, as well as capacities, tools and methods for co-design, evaluation, and learning;
- Practice-oriented characteristics include different forms of interaction for trust-building, reflexivity, and iterative engagement in real-time empirics over time.

These three characteristics were used as the framework for comparative analysis. Case descriptions were manually coded according to these characteristics and restructured to enable a more transparent comparative analysis of the cases. The common key questions (for setting up case studies) and the common analytical framework provided an important basis for balancing the dual role of case contributor and analyst and delivering a neutral comparison of cases. In addition, authors sought perspectives from colleagues (internally) and used the broader peer group to validate the analysis, An overview of highlights from the case descriptions and key findings from the comparative analysis are provided in the next sections.

4. SUMMARY OF CASES

The two cases represent different sizes and types of transformative academic institutions, located within different regional and national innovation ecosystems and policy contexts in Sweden and Spain (see overview in Table 1). A short synopsis of key policy trends and relating structural, operational and practice-oriented characteristics is presented for each case below. An overview follows in Table 1.

Governing Resilience and Transformation (GReaTr) initiative

In Sweden, the rise of transformative innovation policy (TIP) is apparent with the launching of several new innovation programmes (including Impact Innovation and other mission-oriented innovation programmes e.g. Food system, Viable Cities, etc.) or instruments for system transition (like system demonstrators for climate neutral cities). These new policy instruments give rise to new knowledge and capacity demands. In parallel, the changing geopolitical context (including Sweden's membership in NATO) and focus on green "new industrialisation" has led to relatively greater focus on other policy objectives (e.g. security, defense, tech/AI, energy, resilience) and how innovation policy can contribute to achieving these.

Driven by an acknowledged need for more agile and timely knowledge inputs to inform and support reflection for policy development, GReaTr was formed as an experimental project initiative with the aim of serving as a forum for interactive knowledge generation and curation to inform and support policy development in Sweden. The initiative (hosted at Lund University, Department of Economic History) mobilised resources in the form of time from senior researchers and experienced practitioners (consultants and policymakers), together with co-financing from Vinnova, the Swedish innovation agency, as a core base. The small (3-person) core engaged other researchers, experts and policymakers from Austria, Finland, the UK and elsewhere in Sweden (in total 30) in agile "learning spaces" on two thematics: the medium-term effects of recovery and stimulus measures on innovation, transformation and resilience; and the evaluation and design of transformative innovation policy. These two thematics were chosen based on expressed demand for knowledge development in combination with researchers' interest and experience in these thematic areas. While other themes were considered, these two thematics were prioritized as a starting point for developing and testing different scopes and modes of interactive knowledge generation. The first theme (on the medium-term effects of recovery and stimulus measures) had a narrower scope and more targeted ambition for collaborative analysis between policy and researchers across three

countries – feeding into national and international policy debate in real time. The second theme (on the evaluation and design TIP) had a broader scope and more exploratory ambitions to coalesce perspectives of researchers, policy design and analysis to better understand new needs for evaluation of TIP. This learning space – and the researchers and policy practitioners engaging in it – continues to evolve with various interactive and accompanying research projects (in Sweden and internationally).

GReaTr attempted to address policymakers' changing demands for knowledge and capacity by testing new, more agile, forms of interaction with policymakers and expert practitioners (including facilitated learning processes and co-production of various knowledge products). Each topic's interactive knowledge development process was developed through ongoing dialogue and flexible decisions on appropriate next steps or questions to explore. Common to both themes was the blend of perspectives from theory and practice, the agile approach to interactive learning processes, and the active work to compare (or co-learn) with similar cases internationally and plug into relevant international and supra-national networks.

The main product that GReaTr generated was a transdisciplinary and cross-sectoral platform that mobilised researchers and policy experts in interactive knowledge exchanges and co-development spaces (structured around the two thematics mentioned above but also exploring the topic of interactive knowledge development itself). In addition to producing various written knowledge products, the experimental initiative contributed to initiating a new national platform for system innovation research in interaction (SIRI)[3]. The SIRI platform and parallel calls for interactive research projects continue to serve as instruments to push forward a more demand-led and interactive (cross-sectoral, cross-disciplinary and in real-time) approach to addressing key questions and challenges faced in the design, implementation and evaluation of TIP. While this is a positive step in the right direction, the path dependent nature of "normal modes of operation" (both in research

3 For more detail on SIRI, see: https://www.siri-transformation.se.

and policymaking) pose challenges to further developing and scaling the interactive approach to address other thematics.

Orkestra – Basque Institute of Competitiveness

The Basque Country is an autonomous community or region in the north of Spain, whose innovation policy context has similarly experienced a sharpening of the environmental sustainability agenda in all areas of policy, with clear implications for the economic and social dimensions of regional development. In addition, there has been a sharp increase in concern with attracting and rooting talented people within the region and with addressing skills gaps, an issue that has implications for policies in multiple areas. A consequence of these shifts has been important changes in how policy is designed, implemented and evaluated. There is increased interaction between policy domains, greater recognition of the need for multi-level policy coordination, and a widening of the realm of 'policymakers' to extend across the quadruple helix.

Orkestra was established in 2006 within Deusto Foundation (the foundation for knowledge transfer of the University of Deusto) with an explicit mission to undertake action-oriented research to foster the competitiveness of the Basque Country and improve the well-being of its citizens. Orkestra's funding is largely independent of the university, coming from a mix of direct funding from regional stakeholders and competitive research funding. Given the rooting of its research agendas in the problems and challenges being faced by regional stakeholders in the pursuit of sustainable regional competitiveness and wellbeing outcomes, Orkestra's work is very sensitive to changes in the Basque (and international) policy context, which impact both 'what' is researched and 'how' it is researched.

Orkestra has around 40 full-time researchers and research-related staff working within four transformative research labs.[4] Rather than formal structures, these labs are conceived as fluid spaces for the co-creation

4 In the areas of (i) public policy; (ii) smart business; (iii) wellbeing; and (iv) energy and environment. For more detail, see: https://www.orkestra.deusto.es/en/research/research-labs-territorial-competitiveness.

of knowledge and action among Orkestra researchers and the regional stakeholders with which they are working. Indeed, they are dynamic spaces that change continually, in terms of the challenges being worked on, the researchers and stakeholders involved, the methodologies being employed, and the specific projects in which concrete research questions are grounded.

Across the four research labs, Orkestra typically develops 30-40 projects a year, each of which is associated with one or more regional stakeholders or external stakeholders. A significant proportion of Orkestra's projects pursue different forms of action-oriented research, based on regular or continuous interaction with policy practitioners. Indeed, Orkestra actively develops a research agenda focused on the methods of action research alongside the thematic research agendas within the four research labs, a key result of which is the action research for territorial development (ARTD) framework that provides a methodological anchor for many projects (Karlsen & Larrea, 2014; Larea, 2019; Larrea, 2020). This framework emphasises collective knowing that is generated through cycles of reflection and action in which researchers engage with policymakers around a shared problem or challenge, such as exploring regional futures (Izulain et al, 2024). In addition to traditional academic publications, knowledge products from these research projects include frameworks, observatories or platforms, practitioner-oriented reports, as well as action research processes and events.

	Policy context (trends in economic development and innovation policy)	**Structural characteristics** (mandate/institutional setting, funding, types of policy stakeholders with whom engage)	**Operational characteristics** (staffing, research focus areas/skills, infrastructure)	**Practice-oriented characteristics** (modes of interaction, forms of knowledge creation)
Governing Resilience and Transformation (GReaTr) initiative	The Swedish innovation agency's launch of mission-oriented policy initiatives (addressing societal challenges); created a demand for new knowledge and capacity (e.g. system mapping and analysis, new approaches to monitoring, evaluation and learning, etc.); Greater focus on aligning R&I investments across levels of governance Increasing focus on security, defense, tech/AI, energy, resilience	Experimental initiative (10/21-3/24); organised within dept. of Economic History, LU Aim of providing more agile and timely knowledge inputs to inform policy developments Co-financed from Vinnova (national innovation agency) and in-kind financing from LU senior researchers and external policy practitioners and experts	Core team of 3 researchers; mobilised engagement of other researchers, students and practitioners in Sweden and internationally (total 30 engaged researchers and policymakers) Focused on two thematics (Transformative impact of EU recovery and resilience packages, TIP evaluation)	Tested new, more agile, forms of interaction (facilitated learning processes, short-term affiliations to a theme, co-production of knowledge) between researchers, policymakers and practitioners Knowledge products included written briefs and articles, but also syntheses/overviews from learning processes and international benchmarking exercises Key outcome was initiation of a cross-disciplinary and cross-sectoral platform for interactive knowledge exchange and co-development spaces (evolved into SIRI)

Orkestra – the Basque Institute of Competitiveness	Growing emphasis on environmental sustainability (with implications for economic and social dimensions of regional development) Focus on attracting and retaining talent and tackling skills shortages (to maintain competitiveness) Greater interaction/ convergence between policy domains and multi-level coordination in policy design and implementation, as well as a widening realm of 'policymakers' (all sectors of the quadruple helix) New demands for/ research emphasis on governance analysis and new governance mechanisms	An independent institute (est. 2006) as an initiative of the University of Deusto, through the Deusto Foundation Explicit mission to foster the competitiveness of the Basque Country through action-oriented research that improves the well-being of its citizens Funding largely independent of the university, coming from a mix of direct funding from regional stakeholders (government institutions at different levels and firms) and competitive research funding Annual budget around €3m	43 people (of which 60% PhDs and PhD students) Transformative research focused on competitiveness and regional development, with regularly updated research agendas driven by changes in (and interactions with) the Basque (and international) policy context Research organised in four transformative research labs, acting as fluid spaces for co-creation of knowledge and action, in which specific projects are identified and developed	Response to (policy) challenges addressed by action-oriented research projects with different levels and types of engagement with regional actors (leveraging own "action research for territorial development" framework) 30-40 projects/ year across the four research labs (each project associated with one or more regional or other external actors) Knowledge products include frameworks, observatories or platforms, reports, action research processes, events and academic publications

Table 1: Overview of peer institutions
Source: authors

5. KEY FINDINGS

Changing roles and modes of operation

The two cases reflect similar policy trends towards addressing complex societal challenges in their respective territorial settings. These include an increasing focus on security, resilience and strategic autonomy (especially in the Swedish case) and enhanced efforts to address environmental, social and related human resources agendas (especially in the Basque case). In both cases these agendas are developing under rising demands for strategic coordination of research and innovation investments across policy domains and levels of governance. Their experience is consistent with growing interest in cities and regions to formulate and mobilise action on place-based transformative agendas anchored in local challenges (Schwaag Serger et al., 2023).

The increasingly complex set of challenges that policymakers are facing are generating new demands on knowledge, encompassing both the types of knowledge sought (spanning a broad range of disciplines and application settings) and the dynamic modes in which it is developed and put into practice. The two cases illustrate these new demands, which are more concretely expressed in terms of demands for advice and agile/reflexive approaches to policy learning (leveraging real-time empirics), as well as demands for more interactive forms of monitoring and learning (e.g. accompanying or action research) that can be applied as an integrated part of policy implementation.

Related to these changing demands and the evolution of more interactive relationships between knowledge and policy, the cases highlight changing modes of operation in terms of structural characteristics, operational characteristics and practice-oriented characteristics. Findings and insights from the comparative review of the two cases are presented for each set of characteristics below.

Structural characteristics

'Structural characteristics' are not easy to change, and they condition academic institutions' possibilities for 'doing' knowledge-for-policy. They include: (i) the territorial and cultural setting, (ii) the institutional mandate, and (iii) the funding arrangements.

The two cases present quite different structural characteristics. Orkestra is an independent regional institute with a mandate for action-oriented research to benefit the territory, while GReaTr was an informally-organised network of researchers (from multiple academic institutions) with a mandate to test new (agile) knowledge inputs to inform policy developments. The different institutional contexts were reflected in different approaches to funding and governing. For example, Orkestra defines its research agenda to align with the needs of their key stakeholders, is more actively engaged in expert advisory functions, and has the challenge of continually adapting to changes in regional stakeholders (and their needs). GReaTr, on the other hand, had a more traditionally stable organisational framework rooted within the host university (and other universities involved in the network), but tended to be more distanced from the dynamics and practical questions of policymaking. In both cases, the engagement with policy stakeholders was conditioned by history, and specifically by the trust relationships (between individuals and institutions) that had been built over time.

The comparative analysis highlights the benefit of stable funding for generating a structure that can support: sustained efforts to build trust and understanding of the context and its particular challenges; engagement on an ongoing/continuous basis (and the ability to more easily be part of real time empirics); and the possibility to take on new roles, such as systemic intermediaries, process conveners/facilitators, and action-oriented researchers. Whereas Orkestra's organisational and financial structures are based on more active engagement with stakeholders and alignment with their needs, GReaTr's university-base may present challenges with regards "organisational distance". However, this can be alleviated with alternative operational practices (see next characteristic).

Operational characteristics

Innovation policy and economic development research are a social science, yet span multiple disciplines within technical, economic and other academic fields. Thus 'operational characteristics' refer primarily to the staff and range of skills that organisations have at their disposal to engage in knowledge-for-policy. However, it also encompasses enabling infrastructure (e.g. databases and advanced data analysis tools), resourcing practices (e.g. mobility programmes, research affiliations, etc.) and methods for co-design, evaluation and learning.

Both cases are rooted in a core expertise in innovation research (spanning technical, economic, social, policy, historical and geographic perspectives), yet highlighted an increasing need for literacy in a mix and broader range of knowledge fields (now spanning e.g. systems design, behavioural sciences and big data analysis). The two institutions also highlighted an increasing demand for translational and action-oriented research and process leadership capacities to enable (and actively facilitate) the co-development of knowledge.

The two cases provided examples of several emerging instruments and changing modes of operation, including hiring (or training) individuals with new skill sets and methodologies (including action research and foresight methods, big data analysis and visualisation/communication of data). Another changing mode is the adoption of new, more agile, operational practices to enable interaction, such as formation of "transformation labs" (or similar) and dynamic affiliation (of researchers and others) to "thematic spaces" or processes for co-design, exploration and co-development of knowledge. At Orkestra, the introduction of new practices to train PhD students in action research has not only built organizational capacity but also influenced the 'normal' mode of interaction with policymakers – deepening relationships and integrating an interactive approach to addressing transformative challenges in real-time. The introduction of 'affiliation' to agile knowledge spaces in GreaTr created an initial impetus for coalescing efforts (across disciplines, different universities and research institutions, and policy practitioners from different organisations) on the

topic of evaluation of TIP. This informal community continues to evolve – contributing not only to the knowledge base on the evaluation of TIP but also to an evolution in practice (with increasing attention to accompanying research and learning-oriented evaluation).

Practice-oriented characteristics

'Practice-oriented characteristics' are the day-to-day practices and mechanisms that characterise how academic institutions do knowledge-for-policy, including different modes of interaction with stakeholders (for trust-building, reflexivity, and iterative engagement in real-time empirics over time), as well as different types of knowledge products and methods of communication.

Despite the significant differences in institutional contexts and capacities, both cases highlighted an evolution of practice. In addition to more traditional forms of engagement, newer modalities of interaction that leverage real-life empirics, such as action/accompanying research and co-designed/co-created research, are becoming more prevalent. This is seen, among many other examples, in governance innovations that are helping to adapt policies to local competitiveness challenges (Arrona et al., 2020) and in a research-led process that has supported the emergence of a new private-public institution (a cluster management organisation in the field of financial services) oriented to tackling emerging challenges related to rooting local industry and financing industrial transition (Gil de San Vicente & Wilson, 2025).

In a similar way, we see an evolution in the types of knowledge products that are being generated. While both organisations continue to produce academic articles and analytical reports, there is clear evidence of increasing demand for more accessible and practice-oriented written products, as well as frameworks, observatories and data-driven platforms that enable benchmarking, analysis and trend tracking over time. There is also a rising demand for other types of knowledge products and processes that foster a common understanding of strategic aims (e.g. development of system maps or theories of change), shared approaches

to doing (e.g. guides and training material), and support to reflexivity (e.g. accompanying research and facilitated sensemaking).

Enabling conditions, challenges and implications for science-for-policy ecosystems

Together, the dimensions above help to illuminate the conditions under which science-for-policy ecosystems can integrate advisory, reflexive and evaluative functions in ways that are context-sensitive, politically aware, and oriented toward agile knowledge development. They also highlight a number of challenges that may hinder the ability to foster effective science-for-policy ecosystems that balance between advisory, reflexive and evaluative practices and embed real-time policy learning. Key enabling conditions and challenges are presented in Table 2 below.

	Enabling Conditions	Challenges
Structural	Neutral spaces for co-development of knowledge Dynamic research agendas (oriented towards relevant questions/challenges in the context) Stable funding for sustained efforts (for the interactive infrastructure)	Stable organisational frameworks may lack outward (policy-focused) orientation Institutions with 'self-centred' mandates and research agendas Funding generally oriented to short-term projects
Operational	Combination of disciplines and perspectives (theory and practice) Agile forms of affiliation/engagement in "transformation labs" or "thematic spaces" Capacities and tools/methods for facilitating interactive knowledge development processes	Inflexible organisational (human resource and management) structures – for both knowledge and policy organisations Lack of incentives (career development and merit structures) for taking on facilitation and process leadership roles
Practice-oriented	Regular/ongoing (formal and informal) interactions between knowledge and policy actors; mutual engagement to address shared questions Possibility to take on intermediary roles (convening and facilitating/coordinating learning processes) in ongoing (real-life) empirics	Clarity of (shared?) responsibilities in relation to actions based on co-developed results Managing the combination of practice-oriented and academically relevant knowledge products and processes

Table 2: Science-for-policy ecosystems: enabling conditions and challenges
Source: authors

The enabling conditions highlighted in the table above mirror many of the characteristics of "transformative academic institutions" (Canto-Farachala et al., 2024) or "fourth generation universities" (Lukovics & Zuti, 2017), for example connecting with diverse stakeholders in local ecosystems, developing research agendas that respond to external needs (outside-in), and actively guiding challenge-based learning processes that deliver impact in real time. Indeed, there is a call for academic organisations to move beyond traditional teaching, research and commercial valorisation and engage as an integrated part of local ecosystems, facilitating the co-creation of solutions to address complex questions as they emerge. In effect, these characteristics are associated with leveraging academic knowledge in processes of action-oriented facilitation of reflexive learning. Yet as more transformative academic institutions undertake changes to their structures, roles and modes of operation to meet the evolving demands of (transformative innovation) policy, there are implications not only for how their researchers interact with policymakers, but also for the "functional rigging" of science-for-policy ecosystems.

For **policymakers**, the changing modes of operation desired from academic institutions necessitate changes in their operations as well. Specifically, there are two primary changes required, referring to: (i) the ways in which policymakers themselves engage with researchers (i.e. not just reactively receiving knowledge but also being an active participant in knowledge co-creation); and (ii) the support that policymakers provide for facilitating different engagement spaces (i.e enabling "agile/dynamic knowledge spaces" through institutional support and adjusted aims and criteria in research funding calls[5]).

For **researchers** and research groups in transformative academic institutions, as structural, operational and practice-oriented conditions evolve, there is a need to work continuously to deepen, broaden and innovate in how interactions with policymakers take place. This requires building a culture of stronger awareness and understanding of

5 A recent example of such a change is Vinnova's 2024 call for Research in interaction for transition to sustainable societies and institutional support to SIRI.

the knowledge needs of policy, and openness to more action-oriented approaches to evaluation exercises and policy learning processes.

Overall, the findings suggest that strengthening **science-for-policy ecosystems** requires moving beyond linear models of evidence use toward more dynamic, co-productive approaches that more fundamentally embed evaluation and learning within policy processes. This involves fostering institutional capacities for experimentation, supporting intermediaries who can navigate between knowledge and action, and creating spaces for deliberation and reflexivity. Importantly, the analysis highlights the need to recognise and manage the political dimensions of knowledge use, particularly in areas where policy goals are contested or evolving.

6. CONCLUSION

This paper has examined how knowledge-for-STI-policy can be mobilised more effectively to support place-based, evidence-informed policymaking under conditions of complexity, urgency and contestation. Through a comparative analysis of two contrasting, yet complementary, initiatives – GReaTr in Sweden and Orkestra in the Basque Country – we have explored how structural, operational and practiceoriented characteristics jointly shape the evolving functioning of scienceforpolicy ecosystems.

A key conclusion is that advisory, reflexive and evaluative functions are evolving and becoming more interactive and integrated in transformative policy agendas. To address demands for more context sensitive, politically aware and agile advisory support in this context, academic knowledge creation in the STI policy sphere itself needs to be more co-productive, iterative and embedded in realtime policy processes, affecting how interactions are structured and implemented.

- The cases show that durable engagement infrastructures (neutral spaces, stable funding, flexible mandates) are important **structural** ingredients that enable researchers and policymakers to navigate contested goals, bridge domains and maintain momentum.

- **Operationally**, transdisciplinary skill mixes and process leadership capacities –spanning action research, facilitation, data analytics, foresight and communication – are increasingly pivotal.
- **Practically**, modality shifts are evident: from static reports towards living frameworks, observatories, platforms, and accompanying research that support sensemaking, benchmarking and adaptive course correction.

Together, these changes position transformative academic institutions as systemic intermediaries that convene actors, align actions over time and foster *collective learning* that is rooted in (and contributes to) an *academic knowledge base*.

Implications follow for multiple communities. Policymakers should invest and participate in agile knowledge spaces, adjust funding and commissioning criteria to tolerate experimentation in the knowledge-for-STI-policy relationship, and value process stewardship alongside outputs. Researchers should deepen boundary-spanning competencies, strengthen translational practices, and mainstream action-oriented evaluation designs that capture learning-by-doing. For the policy evaluation community, more specifically, there is a need to complement summative assessments with developmental, theory-of-change-based approaches, to measure not only outcomes but also capacities, trust, alignment and adaptability, and to make learning loops explicit within governance arrangements. At the same time, political dimensions – goal contestation, timing, and potential capture – must be recognised and managed transparently.

The study has clear limitations as it draws on two cases with distinct territorial contexts and relies on an interpretive, inductive approach. However, this exploratory analysis has highlighted a set of key features underpinning science-for-policy ecosystems that provides a solid basis for future research extending in a variety of possible directions: multicountry, longitudinal comparisons; testing and adapting action-research frameworks across governance settings; developing robust indicators for co-production quality and ecosystem health; or exploring

incentive structures that reward facilitation and reflexive practice in universities and agencies. Ultimately, strengthening science-for-policy ecosystems requires reimagining universities and allied institutes as civic, fourth generation, transformative organisations, and treating evaluation as a shared, reflexive and continuous practice embedded within policy implementation. Building the enabling infrastructure—stable yet flexible mandates, skilled intermediaries, and open learning spaces—will be decisive for developing the policy needed to advance green, just and resilient place-based transitions.

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SCIENCE, TECHNOLOGY AND INNOVATION POLICYMAKING, ADVICE AND EVALUATION CAPABILITIES IN POST-APARTHEID SOUTH AFRICA: AN ASSESSMENT

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ABSTRACT

This paper examines the configuration of South Africa's science, technology and innovation (STI) policymaking, advisory and evaluation capabilities in the post-apartheid era, responding to calls for deeper analysis of evidence-in-use. The research question probed is: How have institutional histories and sector-specific developments shaped the country's ability to generate, mobilise and apply evidence in support of policy learning? The analysis is structured around four case studies – institutionalisation of STI measurement, policy advice and evaluation; the HIV/AIDS crisis; the Square Kilometre Array (SKA); and the Pebble Bed Modular Reactor (PBMR) – each refracting strengths, weaknesses, opportunities and risks within the national system of innovation. The cases reveal a system characterised by both resilience and fragmentation: strong indicator and evaluation infrastructures coexist with uneven advisory autonomy, variable political commitment to evidence, and inconsistent cross-domain learning. The paper argues that strengthening South Africa's STI policymaking, advisory and evaluation capability nexus requires more autonomous advisory bodies, milestone-based review and evaluation ("decision gates") for major projects, and institutional mechanisms that enable knowledge brokerage across sectors. These findings offer lessons for countries seeking to balance expertise, politics and public accountability in STI governance.

Keywords: *Evidence-in-Use, Assessment, Science, Technology, and Innovation, Policymaking, Advice, Evaluation, South Africa, National System of Innovation.*

1. INTRODUCTION

Evaluation scholars have called for deeper analysis of *evidence-in-use* in Africa's public policy contexts (Goldman & Pabari, 2021). Such calls recognise the complex, context-specific, interactive, and iterative nature of evidence-informed policy making. They also challenge earlier linear models (science-push, or science-pull for example), recognising change processes occurring at individual, interpersonal, organisational and system levels, and in the context of several constraints, such as resources, ideological, data-related, and use-informed constraints (Cloete, 2009, 2017). In the South African context, the evidence ecosystem has been found to be characterised by growing institutionalisation of evidence use (Stewart et al., 2019). However, scholars have also warned of the dangers of performative scientism (e.g. Muller, 2021) and emphasised the critical role of knowledge-brokers in bridging the gap with policy (Strydom et al., 2010). Deeper contextual analyses, for example by sector or policy domain, are key to provide indications of strengths, weaknesses, opportunities and risks in the broader enterprise of evidence-in-use to inform policy learning.

In part as a response to Goldman and Pabari's injunction, this contribution focuses on the nexus of South Africa's science, technology and innovation (STI) policymaking, advice and evaluation capabilities. The mandate for STI falls under the same ministerial umbrella in South Africa, as do the human and institutional capabilities for STI policymaking, advice and evaluation. Policymaking, advice and evaluation capabilities, however, reflect distinct competencies and communities of practice, and the first analytical step of this paper is to historicise their evolution. Critically, where these capabilities do or do not converge at different "moments" of policy decision-making in and beyond the remit of the ministry – that is, in which key personalities or organisations mobilise resources and pursue strategic visions – unique insights may be gleaned about the resilience of these evidence-in-use capabilities and, equally so, their points of fracture or contestation. In a second analytical step, this paper draws on four case studies of such moments of policy decision-making that can be instructive to inform the future(s) of STI policymaking, advice and evaluation.

2. HISTORICISING SOUTH AFRICA'S STI POLICYMAKING, ADVICE AND EVALUATION CAPABILITIES

The South African National System of Innovation

A conceptual starting point is the innovation systems perspective, which South Africa has formally adopted as both analytic concept and development tool (Freeman, 1987; Kuhlmann & Arnold, 2001; Lundvall, 2002, 2007; DST, 2019). In this perspective, innovation is more than the net result of the R&D-performing firm. It is rather a function of a broader set of organisations, interactions, conditions and, critically, institutions. In recent decades, several scholars have developed important analyses of aspects of South Africa's national system of innovation (NSI) (e.g. Kahn, 2006; Scerri, 2009; Lorentzen, 2009; Walwyn & Cloete, 2016). In this paper, we start from a recent model of NSI contained in Akoojee, Kahn and Letseka (2021) (Figure 1), which moves beyond the box and stick model of innovation systems and offers a sextuple helix. This model emphasizes the complex, open, self-organising nature of innovation activities (centre of Figure 1). The model also eschews straight lines, proposing curved linkages that speak to the multiple connections that well-functioning innovation systems are predicated upon.

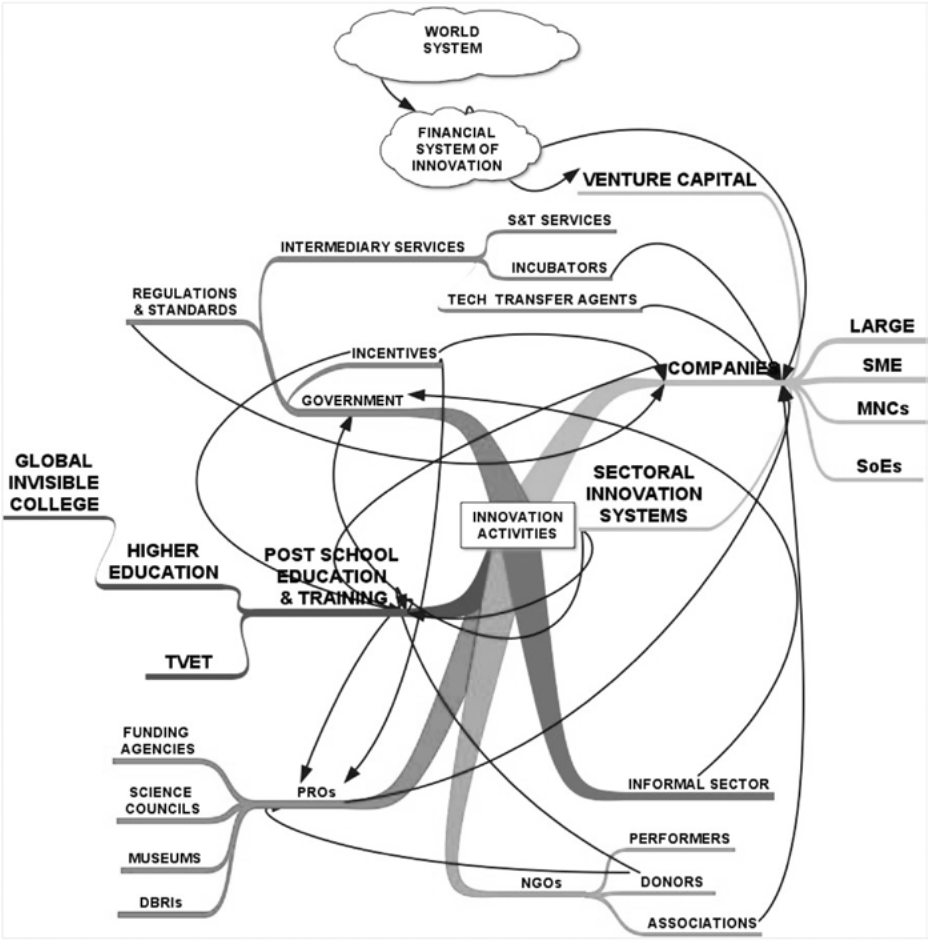

Figure 1: "Spaghetti" model of the SA innovation system

Notably, the left-hand side of the model includes the public sector, including Technical Vocational Education and Training (TVET) and Department Based Research Institutes (DBRIs); the right is the set of market facing actors; the bottom-right includes the third sector and the informal sector; while the top reflects the state and its regulatory

institutions. Should all linkages be shown, the graphic would resemble a plate of cooked spaghetti. The development of the spaghetti model is informed by complexity science; its present use value lies in the way that it may highlight system failures, such as disarticulation, that characterises innovation systems of emerging economies.

Policymaking capabilities

Explicit science and technology (S&T) policy formulation dates from the First World War period during which the Union of South Africa played a major role as a logistics and *matériel* production hub. Based on this experience, the Department of Mines and Industry under Minister JP Malan promoted the equivalent of mission-oriented research and development (R&D) and industrial policy in the 1920s, deepening and expanding state control of the commanding heights of the economy. The Second World War saw further industrial diversification, and the growth of a military-industrial complex that in 1945 birthed the Council for Scientific and Industrial Research (CSIR). From the 1960s the country slid into low-intensity civil war, with the CSIR playing the roles of research performer, organisational incubator, weapons laboratory, and seat for S&T policy advice to government alongside the office of the Chief Science Advisor and the Scientific Advisory Council (CSIR, 1964, 1970). Academia enjoyed the state's support to function much like Polanyi's (1962) Republic of Science.

By the 1980s, the Republic of Science was being compelled to reckon with fast-swelling anti-apartheid resistance. It was also facing strategic choices about its orientation towards neo-liberalism (Garrett & Clark, 1992; Lutjeharms & Thomson, 1983). Indeed, neo-liberalism informed the granting of "framework autonomy" – a form of conditional independence for research institutions to govern their own research agendas, internal policies, and operational structures, while remaining accountable to national authorities and developmental goals – to the Science Councils[1] as part of the agenda of corporatisation (CSIR, 1986). By the time of the

1 Science Councils refers to several research-performing, mostly state-funded entities established at different points in the twentieth century, such as the CSIR, the Human Sciences Research Council, the Medical Research Council, Agricultural Research Council, Council for Geoscience, and the like.

democratic transition, corporatisation saw the privatisation applied to telecommunications, air transport, steel, forestry, and chemicals.

Post-1994 redress and modernisation came through a range of sectoral policies including the White Paper on Science and Technology (DACST, 1996), the subsequent National R&D Strategy (DST, 2002), and the establishment of a dedicated Department of Science and Technology (DST). The White Paper advocated for the adoption of the innovation system approach alongside the establishment of new institutions – the National Research Foundation (NRF), Academy of Science of South Africa (ASSAf), and National Advisory Council for Innovation (NACI). A notable achievement of the period was the National Research and Technology Foresight study (DACST, 1999).

Curiously, the subsequent R&D Strategy and Ten-Year Innovation Plan (TYIP) (DST, 2008) promoted the linear model of change in contradiction to that of a self-organising national system of innovation. In addition, the heuristic device of the "innovation chasm" was advocated to explain the lack of – or difficulties associated with – commercialisation of R&D. These assertions exerted a powerful influence on the evolution of STI policy and organisational strategies, notably that of the DST, CSIR and the new Technology Innovation Agency (TIA). A key recommendation of the R&D Strategy was to abolish the coordinating mechanism of the parliamentary grant to the Science Councils, known as the "Science Vote". This took place alongside re-arrangement of their reporting lines, with CSIR moving to the DST. By contrast, the apartheid-era publication subsidy, researcher rating system, the Technology and Human Resources for Industry Programme (THRIP), and the Support Programme for Industrial Innovation (SPII) were maintained. Also, DST introduced five new supply side incentives, namely the South African Research Chairs Initiative (SARChI), Centres of Excellence, Centres of Competence, the National Intellectual Property Management Office (NIPMO) with support for technology transfer offices, and the enhanced R&D Tax Incentive. The TYIP was given substance through the development of sectoral roadmaps.

Evaluation and assessment capabilities

Following the Organisation for Economic Co-operation and Development (OECD) review of South Africa's innovation policy (OECD, 2007), three Ministerial reviews were initiated and published (DST, 2012, 2017; HESTIIL Ministerial Committee, 2020). As noted in the independent review of the National R&D Strategy and TYIP (NACI, 2020a), notwithstanding successes in radio astronomy (Case Study B below) their various recommendations led to new institutional modalities, but resulted in little systemic change. The White Paper on STI (DST, 2019) and the STI Decadal Plan 2022-2032 (DSI, 2023) continue to advocate basic research with efforts toward innovation-driven socio-economic impact. These two instruments give substance to the recommendations of the Ministerial Review (DST, 2012) in advocating government-industry cooperation, and a re-capacitation of an autonomous NACI.

Other assessments include Kaplan (2010), who argued that skills constraints would limit the attainment of the TYIP; while Cooper (2011) drew attention to the related problem of sub-optimal personality-driven research groups. The NRF commissioned an external evaluation of its five grant programmes, finding that:

> "The chance of socioeconomic impact ... is enhanced when eight interconnected factors work in synergy ... grouped into two sets of factors that reflect (i) leadership in science and innovation ... and (ii) the character and quality of the context for science and innovation ... by a policy environment cognisant of economic, environmental and sociocultural trends, and by the interface between the producers and users of the capacities and knowledge the NRF grants and scholarships helped to develop." (NRF 2015, p. 3)

While an evaluation function is institutionalised in the Presidency, and while bodies such as NACI, CeSTII and SciSTIP perform such evaluation routinely, it is debatable as to whether STI evaluation is institutionalised in as complete or coherent a manner as it should be (see Case Study A below).

Kahn (2019, 2013) described the pre-1994 social contract as one in which the South African science system marched on two legs[2] – that is, through the Republic of Science (one leg) and state-driven technology missions (the other leg). Kahn avers that the social contract *continues* to walk on two legs – the Republic of Science as the one and flagship science projects as the other. This bifurcation, accompanied by the dominance of supply-side measures, and weak university-industry links would limit policy socio-economic impact.

Advice capabilities

On the one hand, in terms of institutionalised advice on STI policy, NACI was established in 1997 to advise the Minister and, thereby, Cabinet. Prior to its establishment, the Mandela administration created the Ministerial Council on Science and Technology. Its deliberations and achievements are not in the public domain, and it was quietly abandoned in 1999 when the Mbeki administration took office. In contrast to its sister organisation, the Council on Higher Education, NACI plays a subordinate role to its parent, the DSTI, functioning as a sub-division.[3] Even though its advisory notes are unclassified, these are not in the public domain, and its visibility is constrained (DST, 2012, p. 75). The ASSAf, established in 2001, plays a limited advisory function through its consensus reports, but its impact on STI policy has not been evaluated. There is no office of Chief Scientific Advisor; in effect this role is played by the Science Council presidents who may initiate or respond to the need for specialist advice.

On the other hand, South Africa's highly diversified biomedical science system (Glanzel, 2000) acts as both a formal and informal source of discipline-specific scientific advice. Disciplinary excellence, as measured by category-normalised citation index scores is high across most of the Essential Science Indicator categories, implying the capability to provide state-of-the-art advice on request or by volition. This represents

2 The reference here is to the Altendorff et al. (1974) report China: Science Walks on Two Legs.

3 Currently, the Department of Science, Technology and Innovation. Previously, the Department of Science and Technology (2002 to 2019) and the Department of Arts, Culture, Science and Technology (1994 to 2002).

the Republic of Science at its best, as attested to by its response to understanding the aetiology of HIV (Kahn, 2016) (Case Study B).

The timeline of STI policy, advice and evaluation outputs is summarised as Table 1 that illustrates the involvement of stakeholders in policy formulation.

Year	Document	Type	Process
1996	White Paper on Science and Technology	Policy	Stakeholder-based through the Department
1997	National Advisory Council on Innovation (Act 55 of 1997)	Legislation	Internal to Department; Parliament
1999	National Research and Technology Foresight	Foresight	Generated by 12 panels appointed by Department
2001	Academy of Science of South Africa (Act 67 of 2001)	Legislation	Internal to Department; Parliament
2002	R&D Strategy	Strategy	Internal to Department
2008	Ten Year Innovation Plan (TYIP)	Plan	Internal to Department
2011	Science Amendment Act	Legislation	Internal to Department; Parliament
2012	Ministerial Review Committee	Review	Committee; selected interviews; international consultants
2017	A Review of the South African Science, Technology and Innovation Institutional Landscape	Review	Committee; selected interviews
2019	White Paper on Science, Technology and Innovation	Policy	Internal to Department; public consultation
2020	A Review of South Africa's Higher Education, Science, Technology and Innovation Institutional Landscape	Review	Committee; selected interviews
2020	South Africa Foresight Exercise for Science, Technology and Innovation 2030	Foresight	International and local consultants

2021	Review of the R&D Strategy and TYIP	Review/ Evaluation	National consultants to NACI
2023	Decadal Plan	Plan	Internal to Department

Table 1: Summary timeline of key policy, strategy and evaluation instruments (1996 – 2023)

3. CASE STUDIES INFORMING STI POLICYMAKING, ADVICE AND EVALUATION CAPABILITIES

This section provides high-level insights into South Africa's STI policymaking, advice and evaluation capabilities, which are drawn from empirical examples. Four cases are storied to reflect a SWOT analysis: strengths, weaknesses, opportunities, and threats (replaced with risks) (Puyt et al., 2023). The utility of a SWOT lens in analysing the case studies, is to be able to present a synthetic assessment of important policymaking, advice and evaluation events. The significance of choosing these specific cases requires a qualification: each case study represents a significant development in South Africa's post-apartheid STI trajectory from which insights into how STI policymaking, advice and evaluation capabilities cohered or fractured, including, and critically, in which the role of evidence is implicated. The systemic importance of each case study cannot be over-stated and their illustrative value for different capability dimensions mentioned above (policymaking, advice, evaluation) is clear.

By way of structure, Case Study A is oriented to strengths, B to weaknesses, and so on. Methodologically, the availability of a diversity of case study data in the public domain – that is, non-embargoed public reports, articles, and scholarly literature – that could be used for document analytical purposes (Bowen, 2009), formed an important part of the selection rationale.

3.1. BUILDING STRENGTH: INSTITUTIONALISATION OF STI MEASUREMENT, POLICY ADVICE AND EVALUATION

Purpose and contextualisation of the case

This case study aims to highlight the inherent strengths of three South African organisational entities active in the production and use of evidence to inform STI policy decision-making. While their organisational stories exhibit overlaps, each has a distinctive mandate and function, which point toward a state of institutionalisation of STI measurement, policy advice and evaluation.

The meaning of "institutionalisation"

For the institutionalisation STI measurement, policy advice and evaluation to be durable and effective, several interrelated characteristics must be established. First, formal, legally or policy-recognised institutional bodies should be designated to carry out measurement, provide policy advice, and undertake independent evaluation; such recognition anchors mandates and accountability within the state framework (OECD, 2015). Second, measurement activities must be routinised rather than episodic, requiring stable funding lines, dedicated staff and organisational infrastructure so that data collection, indicator development and reporting occur as sustained functions (OECD, 2015; UNESCO, 2015). Third, empirical evidence produced by these measurement systems must be integrated into decision-making processes: scientific evaluation should inform policy formulation, priority-setting and allocation decisions, with formal mechanisms linking evidence producers and recognised decision-making bodies (Nutley, Walter & Davies 2007). Fourth, evaluation and advice functions should be institutionalised so they persist beyond the tenure of individual office-holders; organisational continuity, clear procedures and statutory safeguards for independence help ensure that bodies continue to operate when senior officials or ministers change (OECD, 2018). Finally, investment decisions by funding agencies and partners – for example to establish national entities for STI indicators and policy analysis – should reflect and reinforce these institutional features, aligning resources, mandates and governance to create an enduring ecosystem

of measurement, advice and evaluation (UNESCO, 2015). How has South Africa fared considering these broad criteria?

Institutionalising STI measurement

In the three decades since its democratic transition in 1994, South Africa invested in the institutionalisation of STI measurement and indicator production to inform its national STI policy development, implementation, and monitoring and evaluation (DACST, 1996; DST, 2019; Kruss & Ralphs, 2021). If the 1996 White Paper on Science and Technology, in effect, marked the starting point of post-apartheid STI institutionalisation, it explicitly positioned STI measurement and indicators as essential for rebuilding the NSI after apartheid. It did this by linking evidence to democratic accountability and developmental policy goals, and framing measurement as a strategic public investment necessary to move from fragmented science governance to a coordinated, evidence-based STI policy regime. This investment ensured the production of national R&D and innovation indicators according to OECD guidelines.

R&D surveys had been conducted by the CSIR since 1968 (Blankley & Kahn, 2005). This function was transferred to the Foundation for Research Development (FRD) in 1990. FRD conducted R&D Surveys 1991/92 and 1995/96, after which the series terminated for various reasons (the survey was given lower priority during the transition to a democratic government, the National Research and Technology Audit took the place of the R&D Survey, and the surveys being moved between different bodies resulting in a loss of expertise and weakened institutional memory among respondents). The DST then decided to resuscitate the series and commissioned Human Sciences Research Council (HSRC) to perform the survey for 2001/02, that laid the basis for the 2003 establishment of the Centre for Science, Technology and Innovation Indicators (CeSTII). CeSTII grew the competencies needed to conduct various STI surveys (Kruss & Ralphs, 2021).

CeSTII's strengths lie in conducting national R&D and innovation surveys, producing analysis informing policymaking, and development of new measurement frameworks, including informal sector innovation

(Mustapha et al., 2022). CeSTII has shared its expertise across the Southern African Development Community (SADC), and more broadly across the African continent through its support to the African STI Indicators Initiative (ASTII), a flagship programme of the African Union. CeSTII works with the UNESCO Institute for Statistics and the OECD committee of National Experts on STI Indicators.

Institutionalising policy advice

NACI is mandated to provide advice on a range of issues related to STI to government, through the Minister of Science and Technology. NACI plays a strategic role by commissioning and coordinating STI indicators reports and policy-related research. It operates through collaboration with local and international experts, organisations and institutions (NACI, 2020b) and aims to foster engagement across sectors to improve transparency, accountability, and effectiveness, and in order to synthesize evidence on investments, research outputs, human resources, and digital competitiveness in innovation (see Table 1). Another main goal is to monitor progress against national innovation plans (Cele, 2020).

Institutionalising evaluation

The Stellenbosch University Centre of Excellence in Scientometrics and Science, Technology and Innovation Policy (SciSTIP), established in 2014 as part of the DSI-NRF Centres of Excellence Programme and jointly held with the Institute for Economic Research on Innovation at Tshwane University, developed from the earlier work of the Centre for Interdisciplinary Studies (CENIS) that morphed into the Centre for Research on Evaluation, Science and Technology (CREST). The Centre of Excellence has two mandates: scientometrics – to monitor and measure the performance of the South African STI system – and STI policy – to conduct research and analysis that contributes to national policy debates on STI (CREST, 2026). Its research focuses on R&D performing institutions and their funding; science and innovation for socio-economic development; the expansion and transformation of human resources; and science-society interactions.

SciSTIP provides evaluation of the STI ecosystem in part through the NSI Monitoring and Evaluation Framework. The 2019 White Paper noted certain weaknesses in strategic monitoring and evaluation (M&E) of STI, including poorly institutionalised policy learning mechanisms; fragmented and non-coherent evaluation practices; weak data, indicators, and analytical foundations; and limited system-wide and multi-stakeholder integration. To address these weaknesses, NACI partnered with SciSTIP to produce the NSI Monitoring and Evaluation Framework (NACI, 2020b).

Key lesson: Long-term investment in capabilities matters

The above mentioned should not be taken to imply that these three entities entirely and fully address system needs (Cele, 2020). Collectively, they strengthen evidence-in-use for policy learning but are subject to limitations. CeSTII produces robust empirical indicators, yet despite extensive longitudinal datasets and indicator systems, its outputs are still not fully embedded in policy processes at all levels of government decision-making. NACI acts to synthesize strategic policy evidence with institutional coordination, yet its advisory role is still constrained by fragmented evidence inputs from multiple institutions and limited authority to coordinate across departments and agencies. SciSTIP indeed helped in the design of an STI M&E framework and has performed work on several major evaluations, but the full transition from framework design to operational system implementation is incomplete, particularly in terms of a fully institutionalised, national STI M&E architecture.

That the goals of each of these bodies is not fully realised is not an indication of failure. South Africa has made crucial foundational investments in STI policy capabilities, and these are cumulatively valuable even if the system is not fully integrated. Capabilities have been successfully built but not cohesively coupled into a high-functioning system, as effective STI policy learning systems emerge only after sustained investment in underlying analytical and institutional capabilities. Once these separate entities have matured, deeper integration, feedback loops, and policy learning can be institutionalised.

An important step toward tighter integration of empirical STI indicators with high-level policy advice is the relocation of CeSTII into NACI announced to Parliament in 2026. Embedding CeSTII's robust longitudinal datasets and indicator systems within NACI's advisory and coordination remit, the move aims to improve evidence flow into strategic decision-making, reduce fragmentation of inputs, and strengthen institutional linkages across departments. This can help assimilate CeSTII outputs into policy cycles, enable more coherent synthesis of quantitative evidence with sectoral strategy, and create clearer feedback loops for monitoring and learning.

3.2. COUNTERING WEAKNESS: CONFRONTING THE POLICYMAKING AND ADVICE CRISIS DURING THE HIV/AIDS EPIDEMIC

Purpose and contextualisation of the case

This case study examines crisis response in the hands of the Republic of Science that mitigated State weakness in dealing with the HIV/AIDS epidemic. The case study describes how NSI actors confronted the HIV/AIDS crisis and why political failure – rather than technological or scientific limitations – allowed the epidemic to spiral catastrophically. It examines the country's contradictory record: a global pioneer in medical research (think, the first successful heart transplant performed by Christiaan Barnard), yet the site of one of the most destructive AIDS epidemics. The central purpose of the case study is to explain how state denialism emerged and persisted, why it constituted a "political market failure," and how a coalition of civil society actors, scientists, courts and business – a quadruple helix – mitigated the failures.

Analytic frameworks to interpret the case

To interpret the crisis, two analytic frameworks are drawn on. First, Dependency Theory (Frank, 1967; Wallerstein, 1974) that helps to explain the ideological terrain on which AIDS denialism took root. South Africa's political leaders, especially President Thabo Mbeki, increasingly viewed Western biomedical science with suspicion, interpreting it through a postcolonial lens that emphasised exploitation, pathologisation of

Africans, and multi-national pharmaceutical company profiteering. The epidemic's spread was also amplified by structural features long rooted in the country's colonial and apartheid political economy – most notably the migrant miner labour system that fragmented families and intensified infection pathways, this being amplified by long-distance trucking across international borders.

Second, the NSI approach avers that innovation capacity depends not only on firms and research institutes but on interactions across the whole system. As argued above earlier, the innovation system continues to "walk on two legs". Post-1994 policy sought to democratise and expand the NSI, but R&D funding stagnated, Big Science projects dominated priorities, and HIV research remained marginal in official strategy. The once-powerful civil society movement that mobilised against apartheid became weakened during the transition, as donors redirected funding to the new democratic state and many activists entered government. Deficiencies in service delivery soon re-activated activism, and the courts became the arena where citizens asserted "second-order constitutional rights" such as access to housing, water and healthcare. This set the stage for the rise of a new form of social entrepreneurship. The key actor on HIV mitigation was the Treatment Action Campaign (TAC), founded in 1998 (Heywood, 2009).

Despite stagnating investment, the Republic of Science – the academic and research community enjoying significant autonomy – continued to produce world-class research, especially on infectious disease. It was this institutional robustness, as noted earlier, that later allowed scientists to work effectively with civil society against denialist policy.

The emergence of a policy vacuum

HIV cases had first appeared in the mid-1980s, to which the apartheid government offered limited response. By the mid-1990s it was clear that the virus had spread among sexually active adults (Sharp & Hahn, 2011). While life expectancy had been improving for decades, the 1990s marked an abrupt reversal: by 2005 it had fallen to levels last seen in the mid-20th century. Although tuberculosis appeared as the leading

cause of death in official statistics, the exclusion of "AIDS" as a notifiable category obscured the true impact of HIV. Mortality doubled within a decade, hitting poor black South Africans hardest. This decline occurred despite impressive economic growth that reached 5%, rising incomes for millions, and an increasingly capable democratic state. Yet health policy and interventions stagnated.

Despite a national strategy of awareness promotion, the Mandela administration emitted inconsistent signals, including a remedy sold as Virodene based on an industrial solvent. Under Mbeki's leadership, scepticism hardened into new orthodoxy. Convinced that HIV was not the main cause of AIDS, Mbeki convened an advisory panel of mainstream scientists and denialists. He increasingly viewed Western biomedical discourse as racist and conspiratorial, asserting that poverty – rather than a virus – was driver of AIDS. His health ministers supported this; provincial health departments and the Medicines Control Council became conflict zones; and the official response offered incoherent messages about nutrition, lifestyle, traditional medicine and abstinence. Research institutions studied the aetiology of the disease, but in silence. The Medical Research Council and other scientific bodies expanded research on HIV and opportunistic tuberculosis, but government neither championed nor funded these thrusts aggressively. Private companies, recognising the economic threat, began offering antiretrovirals (ARVs) to their employees, but unemployed citizens remained without access to ARVs.

Role of the Quadruple Helix in addressing system failure

It was in this policy vacuum that the TAC emerged as the country's most influential social movement since the anti-apartheid era. Its strategy combined activism, scientific evidence, litigation and international alliance-building. TAC: exposed failures in mother-to-child transmission prevention; challenged drug patents by importing generic medicines; joined the state as *amicus curiae* against pharmaceutical companies defending monopolies; sued the government itself to compel it to provide ARVs to pregnant women, and mobilised mass protests, hunger strikes and media campaigns.

South Africa's independent judiciary repeatedly found in TAC's favour, compelling the State to provide life-saving treatment. After a series of public embarrassments – including the international outcry when the health minister promoted garlic and beetroot as treatments – for AIDS, the political tide turned. For a variety of reasons President Mbeki was removed from office, and the subsequent administration expanded ARV access rapidly. By the mid-2010s, South Africa operated the world's largest ARV programme, with more than 2.4 million ARV beneficiaries and the near-elimination of mother-to-child transmission.

This transformation was possible because the emergence a Quadruple Helix of civil society (TAC), universities and researchers, public research organisations and regulators, business and the pharmaceutical sector had come into being: The quadruple helix emerged organically in response to crisis and political failure (Kahn, 2016).

Key lesson: Value of coalitions of and for evidence-informed policymaking

The case study shows that South Africa's innovation system was resilient enough to withstand political interference: its scientific institutions, legal system, and activist traditions collaborated to restore evidence-based policy. The TAC's achievements exemplify how social entrepreneurship, backed by evidence and legal recourse, can overcome even ideologically entrenched political resistance. Yet future work is needed to examine TAC's knowledge networks, the sustainability of donor-funded research, and how South Africa can maintain its innovation capacity as external funding declines as a consequence of US isolationism. In effect, evidence-based political mobilisation was successful in bringing about a change to policy. A single interest coalition emerged to pressurise a government that was then at its peak of political power. Nothing of similar magnitude has since emerged. From a political economy standpoint, a diffuse set of interests coalesced independent of structural form or change.

3.3. PURSUING OPPORTUNITY: SOUTH AFRICAN ASTRONOMY'S MUSKETEERS AND THE SKA PROJECT

Purpose and contextualisation of the case

South African STI policymaking, advice and evaluation capabilities converged meaningfully in the decision to compete as a site for the Square Kilometre Array (SKA) and, not least, in the commencement of its construction. Not without its governance complexities (Binneman & Davis, 2021; Chinigò, 2025; Walker & Chinigò, 2018), this case study highlights the pursuit of opportunity by "personalities" working at the nexus of international, longstanding fields of scientific exploration and policy, with the backing of South Africa's national infrastructure development ambitions.

Emergence of astronomy in South Africa

The emergence of astronomy in South Africa, as a scientific field within an active community of scholarly practice, has a history spanning more than two centuries (Dubow, 2019). Coinciding with the 1820 arrival of British settlers to what is now the Eastern Cape, the Royal Observatory in Cape Town was established as an extension of the Royal Observatory at Greenwich in England, serving for some time as "the Cape's premier scientific institution" (Dubow, 2019, p. 664). Owing to favourable geographical positioning in the Southern Hemisphere, over the next two hundred years astronomy in South Africa became institutionalised through interactions between metropolitan scientists, colonial administrators and South Africa's nascent scientific institutions, such as its universities and, from the mid-1940s onward, its CSIR (Dubow, 2019; Twidle, 2019). Additional observatories in Johannesburg, Durban, and Sutherland, and the formation of the South African Astronomical Observatory (SAAO) and the Hartebeeshoek Radio Astronomical Observatory (HartRAO) were some outcomes of this sustained attention. Additionally, the field of theoretical cosmology, which had as its local pioneer in the person of George Ellis (2004 Templeton Prize winner) at the University of Cape Town from the 1970s onward, represented another outcome, and indeed

served as a "notable example" (Dubow, 2019, 683) of South African astronomy's resilience.[4]

It is important to situate the emergence of *the idea* for an SKA as a consequence of international scientific and political developments. For example, writing in a preface to their comprehensive history of the SKA project from 1990 to 2012, Schilizzi et al. (2024, xi) recount:

> "The concept of a collecting area of one million square metres, one hundred times more sensitive than the most powerful telescope in the world, did not come out of the blue; it built on decades of radio telescope development after the Second World War. Not surprisingly, the idea proved attractive for a much wider community and the science case expanded, as did the requirements for innovative supporting technology to make it affordable and to service the other observing frequencies and modes of operation involved."

However, in the preface to the same project history, Womersley also writes of the tension between this scientific ambition (foresight), policy, investment and the "element of luck" that characterised the decision by the UK's government to support the SKA (Schilizzi et al., 2024, p. vii). In that context, political timing was critical and, indeed, the UK – a major player, in that it now hosts the SKA headquarters at Jodrell Bank – was the last country to ratify the convention for the SKA to be "recognised as an intergovernmental organisation" (Nordling, 2020). For South Africa, the element of luck would come into play both in its strategic geo-location and in the persistence and alacrity with which its scientists and policymakers pursued the opportunity it presented.

Advocating for the South Africa SKA site co-hosting

In the early South African involvement in the SKA, several key personalities emerged, who have since shaped the direction of astronomy in post-apartheid South Africa in profound ways. One of these was Rob Adam, a nuclear theoretical physicist who would become DACST's second director general. Promotion of astronomy was a key feature of the 1996

4 Indeed, one of the authors of this paper was a student of Ellis in the UCT Applied Mathematics department.

White Paper developed under the leadership of the first director general, Roger Jardine. On the side of public administrators, Jardine and Adam are widely regarded as having played key roles, alongside the FRD's vice-president, Khotso Mokhele, and leading astronomers, Bernie Fanaroff, George Nicholson and Justin Jonas (Schilizzi et al., 2024). It was largely in the personalities of these prime movers or "musketeers" (Schilizzi et al., 2024, p. 88), who, combining policy and advice, and working project by project, built and sustained the business case for the South African science mega-project in its early years.

The South African Large Telescope (SALT) project was authorised in 1998, when the South African government committed USD $10-million in funding for it; it was completed and opened in 2005, starting full scientific operations in 2011 (Campbell, 2025). After ground was broken in 2000 for the SALT, several moves were made by the "musketeers" – to whom others would later be added, such as science administrator Adrian Tiplady and science diplomat Daan du Toit – to convince the South African government to get behind a bid to host the SKA site. "This proposal was taken up by the DST in November 2002," write Schilizzi et al. (2024, p. 86), "and as, Adam describes, the *case was made outside science*." (emphasis added) They continue:

> "The appeal was the prospect of a world-class scientific and engineering project on the African continent, the big data challenge, and the potential to use the SKA project to attract and retain young people in science and technology in Africa."

Fanaroff was selected as the project manager and a South African SKA Steering Committee was formed with Adam as its chair (Schilizzi et al., 2024). The law followed suit, through the Astronomy Geographic Advantage Act of 2007 that created an electromagnetic quiet zone across 120 000 square kilometres of Karoo desert (SARAO, 2026).

The SKA builds on the expertise in dish receiver design and construction embodied in the KAT-7 array and its successor MeerKAT with 64 dishes (McMullin et al., 2020). Both complexes use a low noise detector that was designed and built by a company based in Stellenbosch Technopark (Kahn

2021). After the successful construction and launch of the MeerKAT, work on the first phase (SKA1) commenced for the period 2021 until 2030. In SKA1, there are two components: SKA-Low, located in Western Australia, will be made up of "131,072 log-periodic dipole antennas distributed across 512 aperture array stations of 256 antennas each"; and SKA-Mid, consisting of "133 15-m SKA dishes and 64 13.5-m MeerKAT dishes" in the Northern Cape of South Africa (SKAO, 2026). A second phase of the SKA project (SKA2), yet to be fully specified, envisions "increasing both the number of receptors (stations/dishes) and baseline lengths for each telescope (extending to other African countries in the case of SKA-Mid), and perhaps the addition of other telescopes (survey dish array, mid-frequency aperture array)" (SKAO, 2026). Expected to be completed in the 2030s, the SKA would then be the world's largest radio telescope.

Evaluation capabilities for steering signals

The positioning of evaluation capabilities within the context of the case requires some further context. The SKA project is designated, in South African governance parlance, as Strategic Integrated Project 16 (SIP 16) – one of two "Knowledge SIPs" – under the Presidential Infrastructure Coordination Commission (PICC, 2012). This means that, at the highest level, its progress is tied to national infrastructure targets, requiring a specialised overarching evaluation framework that links the Big Science of the SKA project: to national economic developmental goals. At the level of project implementation, then, several evaluations or assessments have been undertaken to address different aspects of the SKA, notably its strategic environmental impact assessment comprising several domain specific sub-assessment reports (CSIR, 2016); routine performance and accountability audits; and scholarly and policy-oriented analyses assessing the socio-economic impact of the SKA on local communities in the Northern Cape (Adams, Tiplady & Sgard, 2023), on capabilities and skills (Gastrow, Kruss & Petersen, 2016) and on the role of the SKA within the broader public imagination (Twidle, 2019; Gastrow, 2016). Expenditure on R&D within space science has also been a question added to the South African R&D Survey from 2016/17 onward (Case Study A).

Key lesson: Going far, together

The case of the SKA refracts an image of state-backed, flagship science in South Africa as internationally networked, ambitious and forward-looking. For South Africa's part, this case study highlights the opportunities that arise when policymaking, advice and evaluation capabilities come together. It particularly highlights the role of personalities in advancing South Africa's science agenda. However, it also highlights the importance of alignment to national planning as a route to ensure comprehensive evaluation and assessment as well as broader political support.

3.4. FACING RISKS: THE RISE, DEMISE, AND POTENTIAL REBIRTH OF THE PEBBLE BED MODULAR REACTOR

Purpose and contextualisation of the case

This case illustrates how weaknesses in South Africa's STI policymaking, advisory and evaluation capabilities, particularly the lack of any institutionalised evaluation architecture, allowed the PBMR project to advance despite accumulated evidence of technical, financial and governance risks.

Background and evolution of the PBMR programme

On 17 November 2025, South Africa's Nuclear Energy Corporation (NECSA) announced the re-commissioning of the Pebble Bed Modular Reactor (PBMR), a project mothballed in 2010 after consuming more than R8 billion (approximately USD 1.1 billion) in public funds, primarily from the Department of Public Enterprises (Biyela, 2025; Research Professional News, 2010a, 2010b; Thomas, 2011).[5] This decision, driven by soaring energy demand and potential fuel commercial opportunities, reopens critical questions about the governance of large-scale technology projects. The original PBMR venture, this case study suggests, exposes how governance failures such translate directly into risks for STI policymaking, offering stark lessons on democratic accountability, transparency, and resistance to regulatory capture.

5 Calculated using an average exchange rate for 2010 of 0.137 USD per ZAR.

The PBMR project, initiated in 1999, aimed to develop "small-scale, high-temperature reactors in an effort to provide cheap electricity" (Research Professional News, 2010a). It represented "the most determined recent attempt" to commercialise a High Temperature Gas-cooled Reactor (HTGR) design, a pursuit with a 50-year global history of failed attempts across Germany, the USA, the UK, and France (Thomas, 2011, p. 2431). Despite this, the PBMR became South Africa's largest R&D project. However, Thomas (2011, p. 2431) notes that, by 2010, the programme was "running decades late and the costs were many times over the original budget".

The project was terminated in February 2010. Then Public Enterprises Minister Barbara Hogan announced the cessation of state funding, stating: "The problem with the project is that it has not been able to get a long-term investor and a customer" (Fig, 2010, p. 1). The government revealed that a staggering further R30 billion (approximately USD 4.11 billion)[6] was needed to achieve commercial status (Thomas, 2011), and it only had R1 billion (approximately USD 135 million) remaining funds (Research Professional News, 2010a). Consequently, over 75% of its 800-strong workforce was dismissed (Fig, 2010). The withdrawal of Exelon in 2002 – whose CEO called the project "three years behind schedule and... too speculative" (Fig, 2010, p. 16) – dealt a critical commercial blow in that it eliminated the partner needed to navigate US safety approval, thereby undermining the PBMR's export ambitions (see also Thomas, 2011). At the same time, PBMR CEO Dave Nicholls publicly expressed confidence in Exelon's continued involvement (Fig, 2010, p. 16), highlighting starkly contradictory assessments between investors and project leadership.

Policymaking capability failures

Despite this well-documented international poor track record of HTGRs, particularly the failure of Germany's THTR-300, proponents instead championed the AVR (Arbeitsgemeinschaft Versuchsreaktor) prototype as a success story. However, a 2008 safety re-evaluation of the AVR revealed

6 Same exchange rate used as in note 5.

dangerously high fuel temperatures that massively contaminated the reactor vessel, raising generic safety questions for all pebble-bed designs (Moormann, 2008, cited in Thomas, 2011). The US Nuclear Regulatory Commission had identified the fuel temperature issue as early as 2001, yet the South African National Nuclear Regulator (NNR) granted approval in principle in 2003 with no mention of it (Thomas, 2011). Furthermore, the PBMR's key innovation – a helium-driven gas turbine – was an unproven technology. Development struggles led to the replacement of contractor Alstom with Mitsubishi Heavy Industries, and the gas turbine was ultimately abandoned in a 2009 redesign in favour of a conventional steam cycle, undermining a core claimed economic advantage (Thomas, 2011).

Advisory capability failures

Despite early assurances that nuclear policy would be handled transparently – Finance Minister Trevor Manuel famously remarked that such decisions would not be left to "experts in dark, smoke-filled rooms" (Fig, 2010, p. 8) – the PBMR quickly became characterised by closed, centralised decision-making. In practice, authority over the programme was tightly concentrated within the Department of Minerals and Energy and the Department of Public Enterprises, with little room for broader participation. As Fig (2010, p. 9) observes, decisions about the direction of the nuclear industry were largely confined to these two departments, leaving stakeholders and the public firmly on the margins. He further notes that what ultimately emerged as government policy had been shaped without meaningful debate in formal policy spaces or within ANC structures themselves (Fig, 2010, p. 9).

The policy process was dominated by executive branch capture, vulnerable to industry lobbying. Fig (2010, p. 2) argues this pattern "raises broad questions about the relationship between mega-projects and development, about public policy making, about the special pleading of small lobby groups and about shaping democratic governance in a young democracy". Specifically, "the executive branch of government has come to dominate national policy making... Cabinet has become susceptible to the special pleading and some of the false claims of the industry"

(Fig. 2010, p. 9). The organised nuclear lobby, including the PBMR company itself as a founder member of the Nuclear Industry Association of South Africa (NIASA), effectively promoted its interests at the expense of rigorous independent evaluation (Fig, 2010).

Evaluation capability and evaluation architecture failures

The PBMR's trajectory illustrates a fundamental absence of an institutionalised evaluation architecture. Unlike the STI evaluation entities described earlier in Case Study A (e.g., NACI, CeSTII, SciSTIP), the nuclear governance domain lacked equivalent institutionalised evaluation architecture, leaving no dedicated body with the mandate to impose systematic evaluative requirements across the project lifecycle.

This weakness appeared in several ways. First, there were no mandated milestone reviews or decision-gates requiring the PBMR to demonstrate technical feasibility or risk reduction before advancing. As a result, the project continued despite long-standing warnings – most notably those arising from the AVR re-evaluation, which identified dangerously high fuel temperatures and generic design risks (Moormann, 2008, cited in Thomas, 2011). Second, the governance system lacked standardised evaluative methods. There was no requirement for comparative international benchmarking, independent technical audits, or structured scenario-based assessments. This allowed project advocates to override or ignore extensive international evidence on HTGR failures. Third, institutional mandates were fragmented, with no entity empowered to integrate evidence, enforce review cycles, or halt the project pending evaluation. Regulatory oversight was not tied to formal evaluative procedures, leaving accountability for risk appraisal diffuse and inconsistent.

Collectively, these gaps reveal that the PBMR advanced without the mandated processes, evaluative methods, milestone checkpoints, or the necessary decision-gates needed.

Transparency and accountability failures

Thomas (2011, p. 2438) observes a critical failure of accountability: "It is unclear why the South African government should have had such total faith in a project that... was, so blatantly, going badly wrong." Eskom and foreign investors (Exelon, BNFL/Westinghouse) stopped contributing after 2004, leaving the government as the sole funder, yet it lacked representation on the PBMR Ltd. board (Thomas, 2011). This opacity directly contradicted constitutional norms. Fig (2010, p. 18) observes the lack of openness "flies in the face of the culture of transparency established by the South African Constitution and the Promotion of Access to Information Act". The industry maintained a "global reputation for secrecy, opacity and impunity," which Fig (2010, p. 26) argued did "not bode well for... a young democracy like South Africa".

The 2025 recommissioning: renewed promise or reproduced risks?

The PBMR's demise resulted in significant opportunity costs, workforce displacement and a loss of public trust. Thomas (2011, p. 2439) argues that investment in energy efficiency, renewables or gas could have produced a "cheaper, more reliable and 'greener'" energy system for South Africa. Yet, the 2025 recommissioning takes place amid global energy shifts driven by AI-related data centre demand. PPPs are promoted to share risks and expertise (Croucamp, 2025), situating the PBMR within a hybridity model (Reissner, 2017; Sadri, Aristidou & Ravasi, 2024). Yet unresolved safety issues, historical cost overruns, market uncertainty, nuclear waste challenges and South Africa's greylisting by the Financial Action Task Force (FATF) raise questions about governance readiness (Gungor & Sari, 2022; Croucamp, 2025). Thomas (2011) argues that any renewed attempt requires clear evidence that earlier technical and governance failures have been fully addressed.

In contrast to the institutionalised measurement and evaluation structures in Case Study A, the PBMR case shows that the energy/nuclear domain operated outside these established mechanisms, illustrating significant fragmentation in national evaluation capability. The analysis

underscores the absolute necessity of several reforms to ensure robust governance. These include establishing an independent advisory capacity insulated from undue influence, implementing transparent and rigorous milestone-based evaluations with clear decision gates along dimensions of technical complexity barriers and economic return on investment, whilst guaranteeing meaningful stakeholder participation throughout the policy process.

Key lesson: Avoiding capability path dependency

Although the PBMR sits formally within the nuclear energy policy domain, the technical nature of HTGR development and its status as South Africa's largest publicly funded R&D project place it squarely within the STI system. However, unlike entities in the STI evaluation ecosystem, nuclear governance lacked an institutionalised evaluation architecture.

The PBMR was not halted due to effective STI oversight but because it collapsed under cumulative failures in policymaking, advisory and evaluation systems. The 2025 recommissioning represents a critical test: whether South Africa can build the institutionalised governance and evaluation architecture needed to avoid repeating past mistakes. Without such reforms, the PBMR risks becoming an even more costly replication of its earlier demise.

4. CONCLUSION: BUILDING SOUTH AFRICA'S STI POLICYMAKING, ADVICE AND EVALUATION CAPABILITIES FOR THE FUTURE

Using a series of case studies as a lens, this paper has traced how South Africa's a distinctive, if uneven, ensemble of STI policymaking, advisory and evaluation capabilities has emerged in the post-apartheid period. Historically, the system has oscillated between a Republic of Science grounded in academic autonomy and a mission-oriented, State-driven technology project. Post-1994 reforms expanded the institutional repertoire – new councils, agencies, policies and foresight exercises – but

did not fully resolve this dualism. The four case studies show that the key question is no longer whether evidence exists, but how it is mobilised, contested and institutionalised in practice.

Returning to the question posed earlier, the strengths of the system lie above all in the institutionalisation of measurement and evaluation. The emergence of NACI, CeSTII and SciSTIP has created a durable backbone for producing STI indicators, synthesising evidence and experimenting with monitoring and evaluation frameworks. These institutions illustrate how "evidence-in-use" can be stabilised through routines, standards and long-term investments in capability, even within a resource-constrained setting.

The HIV/AIDS case exposes the converse: the catastrophic consequences when political leadership actively resists evidence and when advisory and evaluative capacities lack the autonomy or positional power to correct course. Yet it also demonstrates systemic resilience. The bottom-up formation of a quadruple helix of activism, science, business and courts shows how alternative pathways for evidence use can emerge when formal advisory structures fail, and how constitutional mechanisms can be mobilised in defence of scientific reason.

The SKA case illustrates the opportunities that arise when policy vision, scientific excellence and institutional entrepreneurship converge around a mega-science project. Here, a small group of "musketeers" leveraged South Africa's astronomical tradition, crafted a compelling international scientific development agenda, and secured legislative and fiscal commitments. This success underscores the importance of personalities and networks, but also of strategic foresight and credible evaluation of benefits and risks over long time horizons.

By contrast, the PBMR case exemplifies systemic risk: technological over-optimism, regulatory weakness, opaque decision-making and failure to learn from international evidence. Its possible rebirth under new public–private configurations raises difficult questions about whether the underlying governance pathologies have been addressed, or merely repackaged. The case warns that mega-projects can hollow out evaluation, crowd out alternatives and erode public trust when accountability is weak.

Taken together, these cases suggest that South Africa's STI policymaking, advisory and evaluation capabilities are best understood as a dynamic, contested assemblage rather than a coherent design. Capabilities are uneven across domains; they depend on institutional histories, leadership, and wider political economy conditions. Advisory councils and expert bodies matter, but they are embedded in broader constellations that include social movements, courts, international partners and private actors.

Looking ahead, building a more robust nexus of policymaking, advice and evaluation will require: strengthening the autonomy and transparency of advisory bodies; institutionalising milestone-based evaluation for large projects; enhancing cross-domain learning between health, energy and astronomy and indeed on a broader scale beyond the cases described in this paper; and protecting spaces where dissenting evidence can be voiced without political sanction. For African and other transitional contexts, South Africa's experience shows both the possibilities and perils of striving to locate science policy "between expertise and relevance" – where evidence is neither technocratically insulated nor wholly subordinated to short-term politics, but negotiated through institutions capable of learning from both success and failure.

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THE EVOLUTION OF SCIENTIFIC ADVICE IN EU INSTITUTIONS

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ABSTRACT

Scientific advice to policymaking plays a central role in modern techno-scientific societies, informing and legitimizing policymaking. Yet the appropriate role of scientific advice and how to best institutionalize it remain problematic, with a fundamental tension existing between appeal to scientific authority and the neutrality of science, and the need for policy relevance and democratic accountability. These concerns are particularly prominent in the context of European Union (EU) policymaking, where technical decisions form the core of its mandate and scientific expertise and advice play a central role. This paper traces the historical development of scientific advice in EU policymaking from the late 1990s to the most recent developments, zooming in on the functioning of the European Commission's Scientific Advice Mechanism (SAM) and the recent developments in the EU science for policy ecosystem. The paper explores the tensions between independence and policy relevance, and discusses the limitations of sectoral advisory bodies and the fragmented nature of the EU's scientific advisory landscape, identifying a need for strategic cross-cutting advisory bodies and adequate resources.

Keywords: *Scientific Advice, Science Advice, European Union, European Commission, Science for Policy*

1. INTRODUCTION

Science plays an important role in informing policymaking on a wide range of issues, ranging from healthcare to climate change to the regulation of new technologies. In recent years, there has been growing recognition of the importance of scientific advice to policymaking by both policymakers and scholars. Although science plays an increasingly important role in all areas of policy (OECD, 2015), the provision of effective scientific advice remains challenging (Gluckman, 2014). Scientists can play multiple and sometimes controversial roles in policymaking (Pielke, 2007), spanning from "honest brokers" to advocates, and the issues they are called to deal with often pertain to what has been referred to as *"post-normal science"*: where *"facts are uncertain, values in dispute, stakes high and decisions urgent"* (Funtowicz & Ravetz, 1993). The appropriate role of scientific advice in democratic societies, and how to best institutionalize it remains problematic, with a fundamental tension existing between its appeal to scientific authority and the neutrality of science on the one hand, and the need for policy relevance and democratic accountability on the other (Pamuk, 2021).

These concerns are particularly prominent in the context of European Union (EU) policymaking, where scientific expertise and advice play a central role. The EU is a particularly interesting locus for the study of scientific advice, as it comprises a diverse polity that nevertheless strives to reconcile plural values in common decisions over techno-scientific issues, to achieve epistemic and normative consensus despite underlying differences of both epistemologies and values. This paper traces the historical development and evolution of scientific advice in EU institutions from the late 1990s to the most recent developments until the end of 2025, zooming in on the functioning of the recently established European Commission's Scientific Advice Mechanism (SAM).

This paper is based on the author's doctoral thesis on the division of labour within scientific advisory bodies in the EU (Allegra, 2024). Building on the empirical and analytical foundations of the dissertation, this article focuses specifically on the historical development of scientific advisory arrangements in the EU, highlighting how the SAM represents a novel

instance of institutional experimentation in this landscape and a shift from sectoral to cross-cutting advisory bodies. The article further expands on the dissertation by presenting the latest developments of 2024-2025, and explores the further shift from individual advisory mechanisms to a more holistic conception of science for policy ecosystems, and its significance for understanding the role and institutionalization of scientific advice in EU policy.

2. SCIENTIFIC ADVICE IN TECHNOSCIENTIFIC SOCIETIES

In a broad sense, scientific advice can be understood as the "practices involving individuals, organisations and structures that mobilise natural and social scientific and engineering knowledge into public decision-making".[1] More specifically scientific advice normally refers to the institutionalised processes through which scientific knowledge is synthesised and presented to support governmental or intergovernmental decision-making (Gluckman, 2014; Jasanoff, 1990; Pielke, 2007), operating through institutional channels—formal appointments, procedures, and accountability mechanisms—where advice is commissioned, vetted, and often recorded in official outputs. Scientific advisory organizations take multiple institutional forms, the most common are individual scientists personally advising politicians and senior policymakers, either informally upon request or in formal roles such as Chief Scientific Adviser (Doubleday & Wilsdon, 2012; Gluckman, 2014); advisory councils or committees; in- house research agencies, centres and offices; and scientific academies (Lentsch & Weingart, 2011). The issues on which scientific advice is sought by policymakers vary broadly, from technical and regulatory issues such as food safety and environmental standards, to long-term strategic issues such as energy transitions and climate change, to emergency response in situations like pandemics or hydrogeological disasters (OECD, 2015).

1 https://www.sciencecampaign.org.uk/membership/guest-blog/capacities-for-dealing-with-complex-and-uncertain-evidence/ (retrieved on 31/03/2026).

A key defining feature of scientific advisory organizations is that they span the boundary between the domain of science and the domain of policy, providing a space where both scientific and political considerations can be taken into account in the production of policy-relevant scientific advice. Regardless of their specific institutional setup, scientific advisory organizations are often described and conceptualized as "boundary organizations" (Gustafsson & Lidskog, 2018), i.e. organizations providing a site, and sometimes the incentives, for actors from the scientific and policy domains to work together and collaborate (dual agency or dual participation) to co-produce scientific and social order (Jasanoff, 2005), and create and use boundary objects (Star & Griesemer, 1989). Boundary organizations stabilize the boundary between science and policy by internalizing its negotiation "at the lowest level and the greatest nuance within the confines of the organization" (Guston, 2001). While demarcation between the scientific and policy domains is an important part of the work of boundary organization, its stability and effectiveness come not from isolating itself from external political authority, but rather from its coordination between, and responsiveness and accountability towards, both domains. Boundary organizations thus engage in both coordination and demarcation at the same time, and have to manage the tensions between the two activities. Scientific advice is thus both an epistemic and a political activity (Jasanoff, 1990), and its effectiveness rests on carefully constructing and managing the boundary between science and policymaking (Cash et al., 2002; Bijker, Bal, & Hendriks, 2009; Owens, 2015). To be effective, scientific advice needs to combine scientific credibility, policy relevance, and political legitimacy (CRELE) (Cash et al., 2003).

3. THE CENTRAL ROLE OF SCIENTIFIC ADVICE IN EU POLICYMAKING

Scientific advice plays a particularly central role in the policymaking processes of the EU. Due to the supranational nature of the EU and its history of integration, EU policymaking tends to cover a large number of technical areas relying heavily on expert advice, such as setting common

standards (Kaiser & Schot, 2014) and regulations for the integration of the common market (Alemanno, 2008). Some scholars even describe the EU as a "regulatory state" (Majone, 1997) which exercises its power mainly through regulations, rather than through providing its citizens with services as in the traditional contemporary model of welfare state. Advice from scientific and technical experts therefore plays a central role in EU policymaking (Alemanno, 2014), making it an especially interesting site for research on scientific advice. As recognized by former Chief Scientific Adviser to the EU President, Anne Glover, "EU policies are much more technical than national policies; this is because the bulk of them are about standardisation and harmonisation, which at the end of the day boils down to scientific-technical matters. Science is therefore crucial at the EU level" (Glover, in Wilsdon & Doubleday, 2015).

The EU institutions themselves recognize the centrality of scientific evidence and expertise in EU decision- and policy- making. For example, the 2002 *Communication on the Collection and use of expertise* sets out the Commission's guidelines and principles for improving the knowledge base for better policies, aiming to "encapsulate and promote good practices related to the collection and use of expertise at all stages of Commission policy-making".[2] More recently, in the 2021 *Communication on the "better regulation" agenda*, the overarching framework for good policymaking at the EU level, scientific evidence is explicitly recognized as a "cornerstone" of good policymaking, "vital to establishing an accurate description of the problem, a real understanding of causality and therefore intervention logic; and to evaluate impact".[3]

Despite its appeal to universal notions of science, scientific advice is deeply contextual, and the structures and practices through which knowledge is produced, validated, and used to inform decisions tend to be shaped by

2 European Commission Communication on "the collection and use of expertise by the Commission: principles and guidelines - Improving the knowledge base for better policies" (2002) - https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52002DC0713#:~:text=This%20Communication%20seeks%20to%20encapsulate,stages%20of%20Commission%20policy%2Dmaking.%20It (retrieved on 31/03/2026).

3 European Commission Communication on "Better Regulation: Joining forces to make better laws" (2021) - https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52021DC0219 (retrieved on 31/03/2026).

the political and institutional cultures from which the scientific advisory system emerges. These public reasoning styles are referred as civic epistemologies, "the institutionalized practices through which members of a given society test and deploy knowledge claims used as a basis for making collective choices" (Jasanoff, 2005, p. 255). Such practices include the ways to produce, express, validate and challenge public knowledge claims; the availability and functioning of accountability mechanisms; the accepted standards of objectivity; and the criteria concerning what counts as expertise and it is publicly performed.

As a unique multi-level governance structure without a well-defined common polity or political sphere, the EU does not necessarily have a single cohesive culture of how scientific knowledge and evidence is used in policymaking, and its many diverse national civic epistemologies still play a prominent role. The EU is characterised by both a broad political and cultural diversity among its constituent parts, and the need for common policy decisions to be taken. This tension is well captured in its motto "United in Diversity".[4] While "objective" (and therefore shared) factual knowledge is often appealed to in the attempt to reconcile these diverging and sometimes conflicting values and reach common decisions, the challenges emerging from this diversity are well-recognised. The 2001 *White paper on European governance*[5] recognizes the principle of plurality as one of the key tenets of expert advice in EU policymaking, while the 2002 *Communication on the Collection and use of expertise* acknowledges that "Acting at the European level introduces additional challenges. European approaches must accommodate the diversity of national situations. Questions of comparison, harmonization, validation, and interoperability are often key elements in the policy process".[6]

4 https://europa.eu/european-union/about-eu/symbols/motto_en (retrieved 31/03/2026).

5 European governance - A white paper (2001) - https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52001DC0428 (retrieved 31/03/2026).

6 European Commission Communication on "the collection and use of expertise by the Commission: principles and guidelines - Improving the knowledge base for better policies" (2002) - https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52002DC0713#:~:text=This%20Communication%20seeks%20to%20encapsulate,stages%20of%20Commission%20policy%2Dmaking.%20It (retrieved on 31/03/2026).

Despite these challenges and complexities, however, as recognized by Joly (2016) some unique characteristics of a distinct civic epistemology emerging in the context of EU-level policymaking can be identified, namely a primacy of "laboratory science" over "regulatory science" (Jasanoff, 1990) in risk assessment, and an inclusive and pluralistic approach to expert assessment. This civic epistemology puts a strong emphasis on the independence of scientific advisors from policymaking, and is the product of a historical evolution outlined below.

4. THE CO-EVOLUTION OF FOOD SAFETY AND SCIENTIFIC ADVICE IN THE EU

The institutional arrangements that underpin scientific advisory mechanisms are historical products, which continuously evolve to adapt to a dynamic scientific and political landscape. The EU institutional ecosystem of scientific advice, and the conception of the science-policy relationship and the civic epistemology on which it is based, have been evolving since the establishment of the EU. In particular, the evolution of food safety policy has played a major role in shaping the broader normative and institutional development in the use of scientific knowledge and expertise in EU institutions.

Historically, the creation of a common market for food and agricultural products has been a key component of the process of EU integration and required among other things the harmonisation of food safety standards to enable the free flow of products within the Union. For this reason, EU food policy is considered a key constituent area of EU policy, and its development and evolution are considered to offer an interesting window on EU regulation and EU policymaking more generally (Alemanno 2008, p. 24). The food and chemical safety crises in the late 1980s and 1990s are commonly recognized as representing a watershed separating two distinct periods in the evolution of risk management in the EU, and eventually led to a broader shift in the institutionalisation of expert advice and its relationship with the public in the EU (Millstone & Van Zwanenberg, 2002; Stilgoe et al., 2006).

In particular, in the late 1990s and early 2000s, a shift away from the technocratic model of science-policy relationship took place in Europe, largely in response to these crises (Millstone, 2007). In the old advisory setup, the functions of risk assessment and risk management were normally in the hands of the same institutions, and scientific uncertainties were downplayed and often concealed from the public. Millstone and Van Zwanenberg (2002) identify several structural and procedural features characterising food safety policymaking and advisory systems until the 1990s. These included the conflation of consumer protection and industrial and trade promotion; a lack of openness and accountability; advice being provided by small group of scientists with industry ties; policy decisions presented as being based on "sound science" (Jasanoff, 2011) alone, concealing almost all of the conflicting policy objectives, implicit framings, uncertainties, and residual risks; policymakers hiding behind scientific experts; and more generally a conflation of risk assessment and risk management. These arrangements meant that food policy decisions "could be, and were, taken to advance commercial and political ends as distinct from the ostensible policy goal [of food safety]". These factors severely undermined the democratic legitimacy of such systems (Millstone & Van Zwanenberg, 2002).

A number of food safety crises in the late 1980s and 1990s, most notably the 1996 Bovine spongiform encephalopathy (BSE, also known as the Mad Cow disease) outbreak in the UK, provoked serious loss of public confidence in food safety and the policy institutions governing it, undermining the legitimacy and trustworthiness of the old system and leading to the establishment of the current food safety policy regime (Millstone & Van Zwanenberg, 2002). This has led to a "range of structural and procedural reforms to the ways in which public policies are decided, legitimated and communicated" (Millstone & Van Zwanenberg, 2002). As a key element of these reforms, the provision of scientific advice on food safety (risk assessment) was separated from the process of making policy decisions about it (risk management).

5. THE EUROPEAN FOOD SAFETY AUTHORITY (EFSA) AND THE PARADIGM OF INDEPENDENCE

The 2000 *White paper on food safety* published by the European Commission (Commission of the European Communities, 2000) following a further crisis over dioxin in animal feed proposed establishing a separate entity to provide independent scientific advice, a European Food Authority, to act as a separate risk assessment body to advice the European Commission, with the latter retaining the function of risk manager. After lengthy political negotiation, this led to the adoption of the 2002 *General Food Law Regulation* and the establishment in 2004 of the European Food Safety Authority (EFSA), thus enshrining a separation between the advisory function of risk assessment and the policy function of risk management in the institutional architecture of the EU (Alemanno, 2008). This institutional shift was also followed by a change in the rhetoric used to legitimize food safety policy (Millstone & Van Zwanenberg, 2002): the emphasis was on "independency" of the agencies and of the experts involved in the process, without however clarifying what previous dependencies they were now free from. This could be interpreted as independence from commercial and industrial interest, but also as independence from political pressures from politicians and government officials.

This post-2000 model of scientific advice in EU policymaking is exemplified by the European Food Safety Authority (EFSA). As argued by Joly (2016) the authority of the scientific advice produced by EFSA rests on the centrality given in the risk assessment process to a committee of "laboratory scientists" drawn mostly from the academic sector, who are assisted by the EFSA staff in the evidence collection and analysis. This is markedly different from other contexts such as for example the US FDA. While EFSA committee members had "another day job" and were assisted in the evidence collection and analysis by the EFSA staff, FDA work was done in-house by fully dedicated regulatory science experts, with external peer review of the outputs. The authority of EFSA's experts, and thus of the advice produced by the agency, is therefore based on drawing a rigid boundary between the scientific and regulatory/policy domains, relying on the experts scientific credentials and their research

expertise in a laboratory setting, which is then brought to relevance onto the regulatory domain, rather than on the in-depth expertise on the topic at stake or regulatory science more broadly. This choice was made when the EFSA was being designed because "it was thought that by involving the 'best scientists' (rather than experts in regulatory science), the confidence of the European public would be regained" (Joly 2016, p. 302).

These shifts in the institutionalization of scientific advice in the context of food safety policy influenced the broader conception of the relationship between science and policy in the EU, and motivated the development of the 2001 *White paper on European governance* and the 2002 *Guidelines on the collection and use of expertise*, referred as the "manifesto" of the EU's regulatory epistemology (Morvillo, 2020). These documents further enshrine the paradigm of independence and reinforce a narrative of separation between science and policy, by noticing for example that "It is often unclear who is actually deciding - experts or those with political authority. At the same time, a better informed public increasingly questions the content and independence of the expert advice that is given".[7]

Beyond EFSA, the EU has established several other specialized agencies that provide scientific advice in their respective domains, forming a decentralized network of expertise. The European Environment Agency (EEA), established in 1990 and operational from 1994, represents an earlier model of EU scientific advisory capacity, providing independent information on the environment to support policy development and implementation across Member States (Waterton & Wynne, in Lentsch and Weingart, 2011). Unlike regulatory agencies such as EFSA, the EEA's mandate explicitly excludes regulatory functions, positioning it primarily as an information and assessment body that synthesizes environmental data and produces regular reports on the state of Europe's environment.[8]

7 European governance - A white paper (2001) - https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52001DC0428 (retrieved 31/03/2026).

8 Regulation (EC) No 401/2009 of the European Parliament and of the Council on the European Environment Agency and the European Environment Information and Observation Network (2009). See also Waterton and Wynne (2011) on the EEA's deliberately "non-regulatory" positioning.

The European Medicines Agency (EMA), established in 1995, provides scientific advice on the quality, safety, and efficacy of medicines, combining regulatory decision-making with scientific assessment in ways that parallel EFSA's structure. The European Chemicals Agency (ECHA), created in 2007 to implement the REACH regulation, similarly merges scientific evaluation with regulatory oversight of chemical substances.[9] More recently, the European Centre for Disease Prevention and Control (ECDC), established in 2005, emerged as a crucial source of scientific advice during the COVID-19 pandemic, though its coordination role revealed gaps in the EU's capacity for rapid cross-sectoral scientific advice during emergencies (Jordana & Triviño-Salazar, 2020). These agencies share EFSA's emphasis on independence from political and economic interests, but their narrow sectoral mandates mean they cannot address cross-cutting, strategic scientific questions highlighting the fragmented nature of the EU's scientific advisory landscape.

6. THE FIRST EU CHIEF SCIENTIFIC ADVISOR AND THE EMERGENCE OF STRATEGIC SCIENTIFIC ADVICE

In parallel to the regulatory scientific advice provided by EFSA and other EU agencies, a more strategic scientific advisory function has been developing in the context of EU policymaking in recent years. In 2009 the then President of the European Commission, José Manuel Barroso, announced his intention, during his second term to review "the way European institutions access and use scientific advice" and "to set up a Chief Scientific Adviser who has the power to deliver proactive, scientific advice throughout all stages of policy development and delivery".[10] In 2010, he established the post of Chief Scientific Advisor (CSA) to the President of the Commission, appointing the Scottish microbiologist Professor Anne Glover to the role.

9 Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

10 Speech by José Manuel Durão Barroso President of the European Commission "Passion and responsibility: Strengthening Europe in a Time of Change" European Parliament Plenary Strasbourg, 15 September 2009 - https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_09_391 (retrieved on 31/03/2026).

The post was directly attached to the President's office, with a broad mandate which included provision of direct advice to the President; provision of scientific analysis and opinion on policy development and guidance on the interpretation of scientific uncertainties; involvement in strategic emergency planning; building relationship with advisory bodies and the EU and Member States level; scientific foresight; and acting as a public champion and ambassador of the value of science.[11] However, the post was not adequately resourced and institutionalized within the machinery of government of the Commission, leaving the incumbent with limited means to fulfil the mandate and leading to frictions with departments such as the Joint Research Center (JRC) and the Directorate-General for Research and Innovation whose mandate it overlapped (Glover, in Wilsdon & Doubleday, 2015).

While specialized agencies like EFSA provide regulatory scientific advice in specific domains, the European Commission has long relied on its in-house science service, the Joint Research Centre (JRC), as a key source of scientific and technical expertise. Established in 1957 as part of the European Atomic Energy Community (Euratom) to conduct nuclear research, the JRC has evolved into a multi-site research organization employing thousands of scientists across multiple institutes covering diverse fields from energy and transport to health and consumer protection.[12] Unlike external advisory bodies, the JRC operates as a Directorate-General within the Commission structure, providing direct scientific and technical support to EU policymaking through research, monitoring, and evidence synthesis. Its institutional position as an internal service gives it privileged access to policymakers but has also raised questions about its independence and the extent to which it can provide advice that challenges Commission positions (Wilsdon & Doubleday, 2015). The establishment of additional strategic advisory mechanisms such

11 Press release, 5 December 2011, Appointment of Chief Scientific Advisor - https://ec.europa.eu/commission/presscorner/detail/en/IP_11_1497 (retrieved on 31/03/2026).

12 European Commission, "The Joint Research Centre: 60 Years of Science for Policy," Publications Office of the European Union, 2017.

as the Chief Scientific Advisor and later the SAM thus created potential overlaps and tensions with the JRC's existing mandate, requiring careful delineation of roles between in-house scientific capacity and external independent advice (Alemanno, 2014; Glover, in Wilsdon & Doubleday, 2015). This tension reflects broader questions about whether scientific advice is more effective when provided by external independent experts or by embedded institutional expertise with deeper knowledge of policy processes and constraints.

Moreover, the incumbent got embroiled in a number of public controversies with Members of the European Parliament and NGOs regarding pesticides, endocrine disruptors, and Genetically Modified Organism (GMOs), leading to the Commission publicly distancing itself from her views and testing the limits of the independence of the role from the Commission itself (Wilsdon & Doubleday, 2015). The advisory model centred on an individual CSA, inspired by the UK and US, also lead to controversies regarding the appropriateness for the EU of what was perceived as a typically "Anglo-Saxon" model of scientific advice. In particular, several NGOs publicly criticized the model and called for its scrapping on the grounds that it was untransparent and concentrated too much power into a single unaccountable individual.[13]

At the end of Barroso's presidency in 2014, the incoming Junker Commission decided not to renew the CSA post. However, under pressure from the scientific community it created instead a new Scientific Advice Mechanism (SAM). In this process, the European Commission sought to explore "how to better institutionalise future independent scientific advice to the Commission, based on the experience made in all Member States" (Juncker, 2015). Established in 2015, the SAM's function is to provide strategic and cross-cutting scientific advice to the political leadership of the European Commission distinguishes it from other advisory bodies operating at the EU level. While the advice provided by specialized bodies like EFSA is clearly targeted at informing a specific

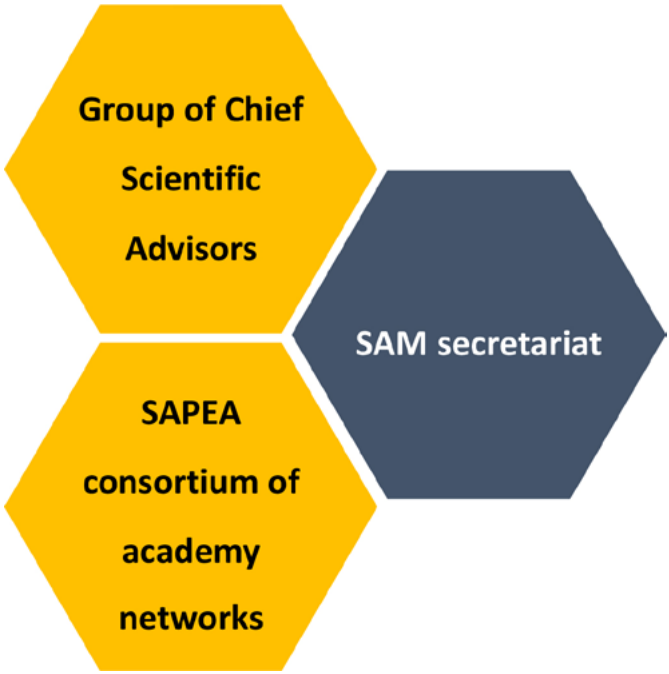
13 Letter from European NGOs to the President on the European Commission on "The position of Chief Scientific Advisor to the President of the European Commission", 22 July 2014 - https://corporateeurope.org/sites/default/files/attachments/ngo_letter_on_chief_scientific_adviser_-_final.pdf (retrieved on 31/03/2026).

piece of regulation or policymaking, SAM's advice is often more open-ended and systemic, cutting across several policy areas.

7. THE SCIENTIFIC ADVICE MECHANISM (SAM)

The SAM presented a novel and peculiar institutional architecture with a tripartite structure: a Group of seven Chief Scientific Advisors (GCSA), a consortium bringing together academies of sciences from across Europe (SAPEA), and a professional secretariat hosted by the Commission.

The structure of the European Commission's Scientific Advice Mechanism (SAM)



Source: Own elaboration

The central element of the SAM, and the main element of continuity with other EU scientific advisory bodies, is the Group of Chief Scientific Advisors (GCSA). Its main task is to "provide the Commission with independent scientific advice on specific policy issues where such advice is critical to the development of EU policies or legislation and does not duplicate advice being provided by existing bodies".[14] The Group is composed of "up to seven, but no less than five members, with an outstanding level of expertise and collectively covering a wide range of scientific fields and expertise". Members are "independent experts, appointed in their personal capacity and who act independently and in the public interest"[15] for a period of 3 to 5 years, and their mandate is not linked to working on a specific topic. They remain employed by their university and only work 20-40 days a year for the Commission. Given the breadth of policy domains on which the SAM might be called to provide advice, subject matter expertise in a specific domain is less important than general scientific standing, as reflected in their selection criteria. The GCSA and the SAM as a whole are supported by a professional secretariat composed of a small number (5-8) of European Commission officials, often referred to as "the SAM unit" or simply "the Unit".

The second leg of the SAM is composed by the consortium of European Academies of Sciences, SAPEA (Science Advice for Policy by European Academies). The consortium brings together a pan-European academy (Academia Europaea), and four networks of European scientific academies, representing the natural, medical, engineering, and social & human sciences respectively (in some countries one academy covers several of all disciplinary areas, while in others there is one academy for each area). The main function of SAPEA is to provide, at the request of the European Commission, "targeted scientific evidence in a timely and transparent manner to inform the production of science advice by the Group of Chief Scientific Advisors while ensuring the highest scientific

14 Commission decision on the setting up of the High Level Group of Scientific Advisors (2015, amended in 2023) - Commission decision on the setting up of the High Level Group of Scientific Advisors (europa.eu) (accessed on 31/03/2026).

15 Ibid.

quality, developed by complete and independent evidence analysis and synthesis." To fulfil this function, "SAPEA assembles interdisciplinary Working Groups of scientific experts" to "produce Evidence Review Reports or other scientific inputs for the Chief Scientific Advisors".[16] SAPEA thus provides the main link between the SAM and the scientific and research community across Europe.

The transition from a single CSA to a committee model represented a better alignment with the Commission exiting practices and structures. The so-called "high-level expert groups" are a common feature of the Commission use of external expertise[17], and existing administrative frameworks and practices could be easily adapted to enable the creation of the GCSA. The Committee structure of the GCSA is an important feature of the SAM and contributes to its legitimacy in the eyes of the EU policy community. Such structural feature better reflects the "collective" style of decision-making in the EU and its pluralistic civic epistemology and mitigates against the risk of individual advisors holding idiosyncratic views or close ties to political or economic interest, thus addressing some of the criticism and controversies off the previous CSA post. From a legal and administrative perspective, the SAM is firmly centred on the GCSA, with the secretariat and the SAPEA consortium of academies representing ancillary support structure.

The SAM has its legal basis in the "Commission decision on the setting up of the High Level Group of Scientific Advisors"[18] (henceforth referred to as "Commission decision"), and the process through which it produces its advice is described in the "Rules of Procedure of the Group of Chief Scientific Advisors" and its annex "From questions to answers - How the European Commission's Scientific Advice Mechanism produces scientific

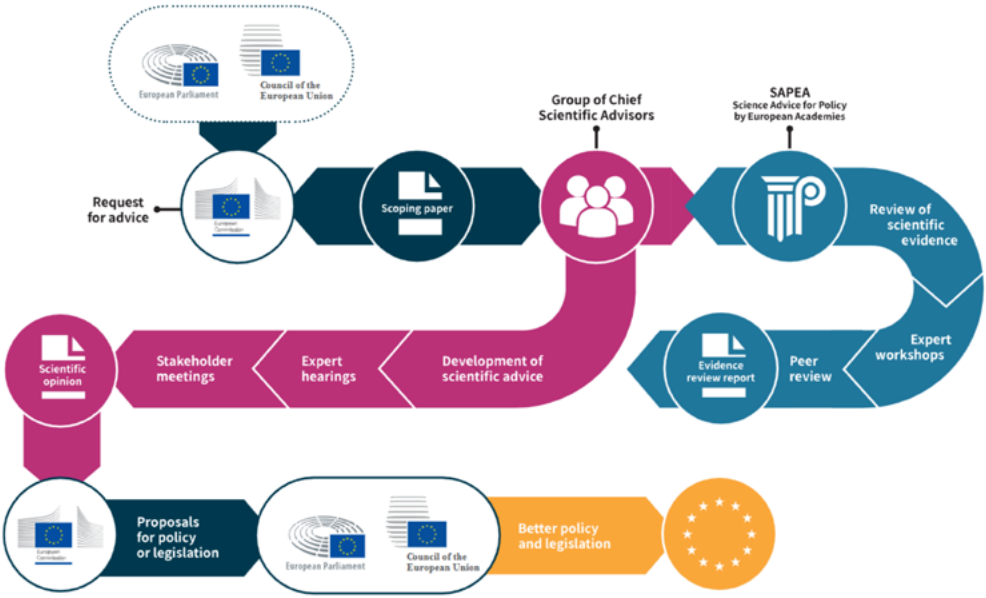
16 SAPEA grant agreement, quoted in the SAPEA Guidelines on advising policymakers and society (2023) - https://scientificadvice.eu/reports/quality-assurance-guidelines-and-procedures-on-science-advice-for-policy-and-society/ (retrieved on 31/03/2026).

17 See the Register of Commission Expert Groups and Other Similar Entities - https://ec.europa.eu/transparency/expert-groups-register/screen/expert-groups-explained?lang=en (accessed on 31/03/2026).

18 Commission decision on the setting up of the High Level Group of Scientific Advisors (2015, amended in 2023) - Commission decision on the setting up of the High Level Group of Scientific Advisors (europa.eu) (accessed on 31/03/2026)

advice to support policy making", collectively referred to as the SAM guidelines.[19] These guidelines describe five steps in the production of the SAM's scientific advice: 1) identification of a subject for scientific advice; 2) defining the question (in the form of a "co-defined scoping paper"); 3) gathering evidence; 4) drafting the GCSA advice; and 5) adopting and communicating the advice. The SAM guidelines are complemented by SAPEA's own "Guidelines on advising policymakers and society" and its "Procedures for quality assurance of scientific advice".[20] The process is also illustrated in an infographic flowchart published on the SAM website and reproduced below:

How the SAM works



Source: SAM website[21]

19 European Commission (2020) - https://research-and-innovation.ec.europa.eu/system/files/2020-10/rules_of_procedure_group_of_chief_scientific_advisors_sep2020.pdf (accessed on 13/11/2023).

20 SAPEA Guidelines on advising policymakers and society (2023) - https://scientificadvice.eu/reports/quality-assurance-guidelines-and-procedures-on-science-advice-for-policy-and-society/ (retrieved on 31/03/2026).

21 https://scientificadvice.eu/ (31/03/2026).

In most cases, scientific advice provided to the European Commission by the SAM takes the form of two complementary documents: a longer *Evidence Review Report (ERR)* produced by SAPEA, which presents a synthesis of the state of knowledge on the topic and provides the main scientific underpinning of the advice, and a shorter *Scientific Opinion* produced by the GCSA, which provides policy recommendations. While the process is presented in a linear order, with the production of the ERR preceding logically and chronologically that of the Scientific Opinion, in practice it is largely iterative with many steps taking place in parallel.

Independence remains a key feature of the SAM's self-identity and of its legitimizing narrative. In the context of the SAM, the concept of independence is operationalized as a combination of autonomy of its various parts from each other, independence from private (mostly economic) interests, and from political pressures. Independence is engrained both in the structure of the SAM and in its processes. However, the setup and functioning of the SAM also recognizes that a degree of coordination with policy demand plays an important role in ensuring its relevance, and that trade-offs exist between these two dimensions. This requires careful management by the secretariat, which has to reach across into the policy domain to orchestrate with the policy demand side while at the same time buffering the Advisors to protect their independence.

This shift from an absolute focus on independence to a limited recognition of the importance of coordination across the science-policy boundary can be explained by several factors. First, the newer and more strategic scientific advice mechanism require a different legitimizing narrative than narrower and more technical advisory bodies like agencies. Second, the internal architecture of the SAM introduces a more structured division of labour within the mechanism, which allows to present orderly separation between policy-relevant scientific knowledge (embodied by SAPEA and its Evidence Reviews Reports) and science-informed policy advice (embodied by the Group of Chief Scientific Advisors and its Scientific Opinions), while at the same time allowing for coordination across the science-policy boundary through the work of the secretariat.

8. THE COVID-19 CRISIS AND THE SHIFT FROM MECHANISM TO ECOSYSTEMS

To this day, the provision of scientific advice to EU institutions remains a crucial and contested issue. On the one hand, science is presented as necessary to ensure good policy outcomes, especially in the face of the perceived rise in the politicization of facts and of fake news and misinformation (Group of Chief Scientific Advisors to the European Commission, 2019). Reliance on experts and scientific advice is presented as a necessary bulwark against populism. On the other hand, scholars and civil society groups have denounced how the processes and logic of scientific advice and use of science in regulatory processes have been captured by narrow interest groups (for example Saltelli et al. 2021), thus making them fertile grounds for lobbying in the name of "sound science".

Despite the efforts put into the institutionalization of EU scientific advice since the 2000s and the recent establishment of the SAM, the provision of scientific advice to EU policy remains fragmented at an institutional level, and its authority often challenged. The explosion of the COVID-19 pandemic in 2020 and the ensuing scramble by governments worldwide to contain and combat it threw scientific advice in the spotlight, and put to test many of the assumptions and frameworks developed to understand the science-policy interface. According to many scholars and commentators (The Lancet, 2020), COVID-19 was probably the biggest test of science advice in decades, with its global nature allowing for large-scale international comparison. The rapid deployment and evolution of scientific advice mechanisms, and the intense public attention and scrutiny they received in many countries, revealed many of the unspoken assumptions underpinning the functioning of the science-policy interface in most countries. The legitimacy of decisions taken on the basis of expert advice has been challenged in many countries, and the inner workings of scientific knowledge productions have been dissected publicly, with scientific uncertainties debated in the media and accusations made of both science being politicized and politics hiding behind the science. The crisis has thrown in sharp relief the many unresolved issues at the interface between science and policymaking,

and the inadequacy in most countries of the scientific advice institutions working at this interface. Countries with existing and well-developed scientific advisory mechanisms, such as the UK with its SAGE (Scientific Advisory Group for Emergencies), found them being stress-tested to a degree never seen before. Others such as Italy, where such mechanisms were not clearly institutionalized before, had to quickly create and scale up them.[22] Anecdotal evidence even suggests the hypothesis that pre-existing scientific advisory structures might have constrained and limited the flexibility needed to respond to the pandemic.[23]

The 2021 Commission Communication on "*Drawing the early lessons from the COVID-19 pandemic*" recognised that "the early months of the crisis exposed the uneven level of research and advice in different Member States, as well as the different approaches taken to providing and using that advice. This meant that evidence was patchy, sometimes contradictory and often confusing as a result of different messaging in different Member States". The Communication calls for more coordination at the EU level on scientific advice and points to a "need to bridge the gap between science and policymaking".[24] This fragmentation goes beyond the specific context of COVID and pandemic response and is a more general feature of scientific advisory structures.[25]

Recognizing this led to the realization that establishing scientific advisory mechanism at the EU level needs to go hand in hand with strengthening broader science for policy capabilities and competences at all levels of governance. This broader approach was first conceptualized in an analysis produced by the European Commission in 2022, which identifies science for policy ecosystems as the "complex of organisational

22 Allegra et al, Italy case study, in Jasanoff et al, Comparative Covid Response: Crisis, Knowledge, Politics, 2021 https://compcore.cornell.edu/wp-content/uploads/2021/03/Comparative-Covid-Response_Crisis-Knowledge-Politics_Interim-Report.pdf.

23 European Science Advisor Forum (ESAF) https://esaforum.eu/wp-content/uploads/2020/07/Highlights-Virtual-ESAF-Meeting-24-june-2020.pdf. (retrieved on 31/03/2026)

24 European Commission, Communication on "Drawing the early lessons from the COVID-19 pandemic, 15 June 2021 (31/03/2026).

25 European Commission, Staff Working Document Supporting and connecting policymaking in the Member States with scientific research, 25 October 2022 (retrieved on 31/03/2026).

structures and entities, processes, and networks that interact to support the mobilisation, acquisition, synthesis, translation, presentation for use, and application of scientific knowledge in policymaking processes".[26] This was further recognized in the Council Conclusions adopted under Spanish Presidency in December 2023,[27] giving political momentum to several initiatives across the EU at all levels. These include for example the inclusion of strengthening science for policy as a key action of the 2025-2027 European Research Area (ERA) Policy Agenda,[28] the EU main strategy for research and innovation policy; and the launch of several capacity building activities in Member States to strengthen national public administration`s use of scientific evidence and expertise and further institutionalized scientific advice at national and subnational level.[29] This marks a shift from an atomistic conception of scientific advice focused on individual advisory structures, to a broader "ecosystem" approach taking into account the institutional, political and cultural context in which these operate.

At the same time, the intrinsically political nature of scientific advice is increasingly recognized explicitly by EU institutions. The 2022 Commission paper on *Supporting and connecting policymaking in the Member States with scientific research* acknowledges that "in this era of complex policy challenges, it is key that policymaking makes best use of scientific knowledge. This is not only a much-needed response to the complexity of climate change, global pandemics, artificial intelligence etc. It also recognises the complex political environment in which policymaking takes place now. A better use of science can help boost public trust in governments and their competence. It can help explain better the policy choices to the public, fight disinformation

26 European Commission, Staff Working Document Supporting and connecting policymaking in the Member States with scientific research, 25 October 2022 (retrieved on 31/03/2026).

27 Council of the European Union, Strengthening the role and impact of research and innovation in the policy-making process in the Union, 8 December 2023 (retrieved on 31/03/2026).

28 https://european-research-area.ec.europa.eu/era-actions-2025-2027#AdvancingtheEuropeanSciencefor PolicyS4Pecosystem (retrieved on 31/03/2026).

29 https://knowledge4policy.ec.europa.eu/news/tsi-capacity-building-eipm-project-reports_en (last consultation 22/11/2025) (retrieved on 31/03/2026).

and improve support and implementation of adopted policies".[30] This message is further reinforced in the 2025 *Commission Communication on the European Democracy Shield*, which emphasizes the link between scientific and defending democracy by highlighting that "Evidence-informed policymaking ensures that institutions, debates and decision-making are rooted in factual, transparent and accountable processes and impartial data based on freedom of scientific research, fostering trust and legitimacy in governance."[31]

9. CONCLUSIONS

These developments illustrate some important considerations for the development of scientific advice across the EU. Advisory mechanisms operate as part of a broader ecosystem. Sectoral advisory bodies with specific remits, however effective and well-designed, have intrinsic limitations and need to be complemented by others with a more cross-cutting strategic remit, and these various actors need to work in a more integrated manner to overcome the system's fragmentation. Adequate resourcing, both at the level of individual advisory bodies and of the ecosystem as a whole, including its underpinning research base, is crucial to ensuring their effectiveness. Recognising the political nature of scientific advice implies actively thinking about how to balance the intrinsic tension between independence and policy relevance in the design of advisory structures. As the institutional experiment of the SAM illustrates, a clear division of labour between external advisors and a well-resourced professional secretariat with strong access to policymaking processes can partially mitigate this tension, dynamically balancing the tension and trade-offs between these two dimensions. More broadly, strong ecosystems. Further development in scientific advice in the EU need to take these lessons into account.

30 European Commission, Staff Working Document Supporting and connecting policymaking in the Member States with scientific research, 25 October 2022 (retrieved on 31/03/2026).

31 European Commission, Communication on the European Democracy Shield, 12 November 2025 (retrieved on 31/03/2026).

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BMFWF – Federal Ministry of Women, Science and Research; **BMIMI** – Federal Ministry of Innovation, Mobility and Infrastructure; **BMWET** – Federal Ministry of Economy, Energy and Tourism; **ACR** – Austrian Cooperative Research; **FORWIT** – Austrian Council for Sciences, Technology, and Innovation; **Austrian Institute For SME Research**; **AIT** – Austrian Institute of Technology; **AQ Austria** – Agency for Quality Assurance and Accreditation Austria; **AWS** – Austria Wirtschaftsservice Gesellschaft mbH; **CDG** – Christian Doppler Research Association; **convelop** cooperative knowledge design GmbH; **HCW** – University of Applied Sciences Campus Vienna, **FFG** – Austrian Research Promotion Agency; **FWF** – Austrian Science Fund; **Gesellschaft für Forschungsförderung** Niederösterreich; **IHS** – Institute for Advanced Studies; **IWI** – Industriewissenschaftliches Institut; **Joanneum Research** Forschungsgesellschaft mbH; **Klima- und Energiefonds**; **Ludwig Boltzmann Gesellschaft**; **Technopolis Group** | Austria; **OeAD** – Agency for Education and Internationalisation; **ÖAW** – Austrian Academy of Sciences; **Vienna Business Agency**. For the City of Vienna; **WIFO** – Austrian Institute of Economic Research; **WWTF** – Vienna Science and Technology Fund; **WPZ** Research GmbH; **ZSI** – Centre for Social Innovation

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