European Commission

Assessing national institutional capacity for evidence-informed policymaking: the role of a science-for-policy system

Expert report series: Developing an evaluation framework for science-for-policy ecosystems

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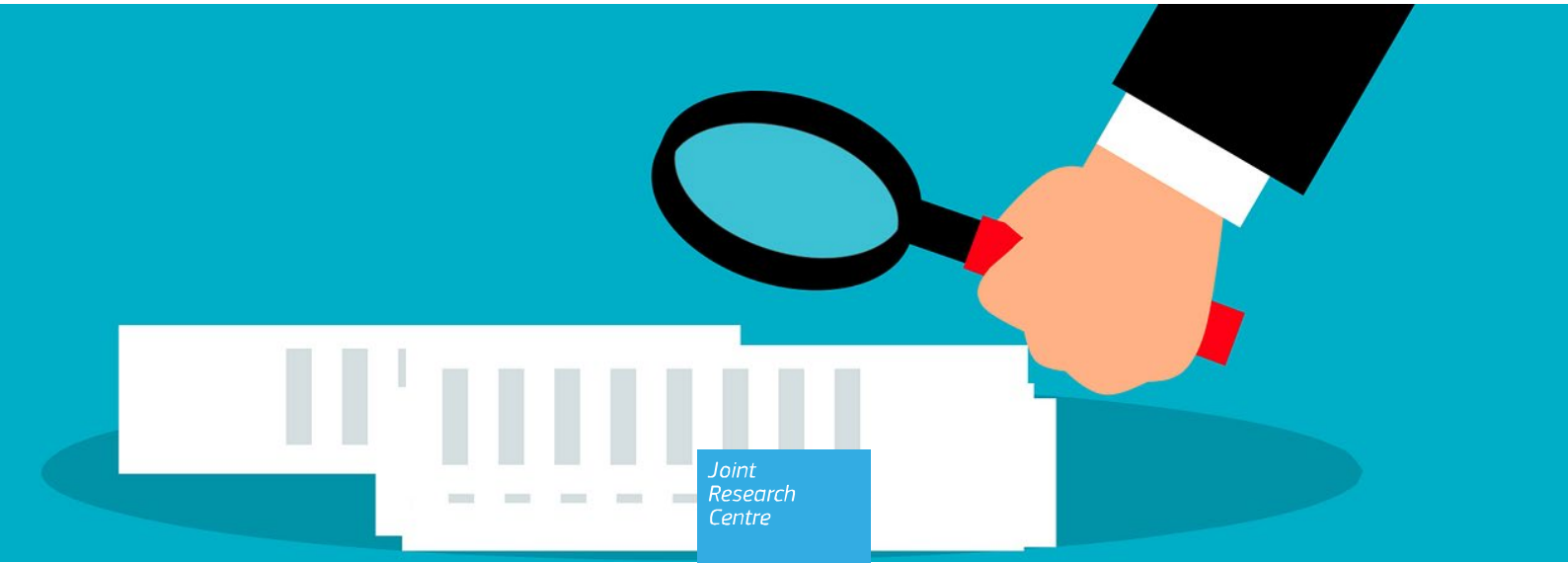

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Foreword

In line with its role as the European Commission's science and knowledge service in support of EU policymaking, the Joint Research Centre (JRC) has launched several activities that aim at strengthening and connecting science for policy ecosystems within EU Member States. As policy issues become increasingly complex and interconnected and politics ever more polarised, robust institutions that ensure that scientific knowledge is mobilised, synthesised, translated for, and integrated into the policymaking process become increasingly relevant.

In this work, the JRC benefits from the input provided by professionals working about and/or at the science-policy interface across Europe, from public servants in ministries, government agencies, Parliaments, and government research funding bodies to staff of public and private research institutes, universities, national academies, learned societies, research councils, think tanks, committees, scientific networks, and publishing houses. Through surveys, commissioned studies, and participatory workshops, the JRC seeks to stimulate a vibrant debate about structures, networks, processes, and practices underpinning evidence-informed policymaking across Europe.

To inform and structure the debates about capacity building in support of robust, interconnected science for policy ecosystems, one strand of this work focuses on developing, together with an interdisciplinary group of experts and practitioners, an evaluation framework for the institutional capacity of such ecosystems. Through a combination of commissioned studies, participatory events, and pilot studies, the JRC aims to provide a playbook that support policymakers and other stakeholders at the science-policy interface in designing an evaluation process for the institutional ecosystem that connects scientific research with policymaking processes.

You are about to read one of the studies that we commissioned to develop this playbook. We welcome any feedback that you can share via JRC-E4P-ECOSYSTEM@ec.europa.eu.

We also warmly invites you to join our 1,600+ member strong “Science for Policy Ecosystems” community (https://knowledge4policy.ec.europa.eu/evidence-informed-policy-making/topic/science-policy-ecosystems_en).

Kristian Krieger & Lorenzo Melchor

June 2022

Acknowledgements

As an academic studying evidence production and use, and as a participant in the UK government science advisory system, my insights in this report are based on my experience, my research with colleagues (e.g. with Annette Boaz (Oliver and Boaz, 2019; Oliver *et al.*, 2022), and discussions with the other report authors (Ingeborg Niestroy and Roger Strand) and JRC policy analysts (Kristian Krieger and Lorenzo Melchor). All mistakes and omissions remain my own responsibility. The remarks made below should be read as provocations for debate and discussion rather than proposals for action.

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Editors

Kristian Krieger, PhD and **Lorenzo Melchor, PhD** both work as policy analysts at the Knowledge for Policy: Concepts and Methods Unit of the European Commission's Joint Research Centre (JRC). They are responsible for the analysis and capacity building of the institutional foundations of evidence-informed policymaking. They jointly lead and manage the JRC projects on "Strengthening and connecting ecosystems of science for policy across Europe" and "Developing an evaluation framework for science-for-policy ecosystems", under which framework this current discussion paper has been developed.

Summary of report and indicators

This report sets out a conceptual map for potential elements of a science-for-policy advisory ecosystem. The aim of this map is not to propose an ideal system, but rather to highlight how elements need to connect with each other at multiple levels; to allow us to ask how all involved in evidence production, mobilisation and use can act to support more effective system functioning. This paper assumes that the goal of a science-for-policy system is the delivery of relevant, robust evidence to people with the capacity to absorb and fully understand it, in order that it might inform their decision-making. The proposed indicators therefore help identify opportunities for support, intervention, and more strategic use of resources to improve supply and demand of evidence.

If the system were working well towards this goal, we would see:

— a research community resourced, able, and willing to do research to help government address challenges;
— a government able to access relevant evidence to help inform their decision-making;
— funders and intermediaries supporting excellent policy-relevant research and effective knowledge exchange; and
— policies being made and implemented which generate positive social change.

Indicators of systems readiness to do this might include:

Type of actor	Possible indicators
Funders	— Engage regularly and effectively with the research communities and with relevant policy teams to support policy-relevant research through shared problem-framing — Offer appropriate training and capacity building to research organisations and teams, who include support staff — Dedicated research funding for research into evidence production and use — Balance between responsive and policy challenge-led research funding
Research organisations	— Support diverse and skilled research workforce by offering appropriate degree and other training and capacity-building support — Reward and recognise policy-relevant research and engagement activities to policy
Researchers	— Appropriately skilled and diverse workforce — Produce interesting and novel research, or relevant syntheses — Routinely engage with evidence users as a legitimate part of their work
Intermediaries	— Have skilled workforce able to synthesise and mobilise evidence in range of ways, network, and support and advocate for evidence use — Recognised and resourced specialist units or organisations dedicated to knowledge exchange — Support shared problem-framing and deliberation between policymakers and stakeholders
Policymakers	— Clearly stated knowledge needs — Capabilities within government to assess and absorb evidence of different kinds — Transparent mechanisms to solicit and engage with evidence and experts — Internal reflection and scrutiny of advisory systems
Parliament, media and other scrutiny bodies	— Existence of, and mandate for independent, evidence-capable body(ies) to scrutinise science-for-policy system and its elements, and hold to account — Science and evidence capabilities for general scrutiny of evidence use in policy-making at national, regional and local levels

Key Words: evidence system; capabilities; indicators; knowledge exchange; evidence use

1 Introduction: context to this report

The European Commission's Joint Research Centre (JRC) is engaged in capacity-building efforts to support evidence use in policy. This report forms part of their work into developing toolkits to help member states consider appropriate ways to invest in effective science systems. However, the goal of this report is not to offer a clear pathway towards an 'effective' science system, but rather to help encourage debates about what 'effective' systems look like, what the constituent elements might be, and what the tensions and trade-offs are when making different choices to invest in science systems.

There are many ways to approach the question of how evidence can, does or should interact with policymaking of different kinds. There are intellectual contributions to be made to this debate from most, if not all academic disciplines, with each providing its own framing, tools, concepts, and terminology. For example, in engineering and technology studies, the translation of knowledge into concrete changes in the world is known as 'knowledge' or technology transfer', 'commercialisation', 'innovation', or 'impact'. In health sciences, this process is known as 'knowledge mobilisation' or 'translation', with changes to practices, services, or patient outcomes as endpoints. This matters, because the ways in which different disciplines and sectors imagine the relationship between evidence production and use creates a normative framing with value judgements about what constitutes 'good' evidence, 'good' evidence use, and even the fundamental purpose of such a relationship.

It is not the purpose of this paper to set out all the potential normative framings, nor to explain the critical perspectives on them which derive from work in – for example – science and technology studies (giving rise to concepts such as "responsible innovation", history of science, public policy studies, sociology of knowledge, or philosophy. Rather, I describe a set of participants ("actors") involved in knowledge production and use, and some of the connections between them. If we imagine that these actors are linked through a common purpose – to deliver useful evidence for policy decision-making – we can begin to ask questions about how these connections might be necessary to achieve this goal, and what this might look like.

The idealised elements of a science-for-policy system therefore below are there to enable discussion about shared and conflicting goals, ways to measure and support activities undertaken by these organisations, and to think critically about what it means to be part of or to lead a system. There is a lack of empirical evidence about how these kinds of systems work in practice, with most research on the area focused either on research assessment or on knowledge mobilisation activities. One positive outcome from the JRC's programme of work would be an increased awareness about the lack of empirical research, and the relative uselessness of the all-too-common punditry which this topic attracts.

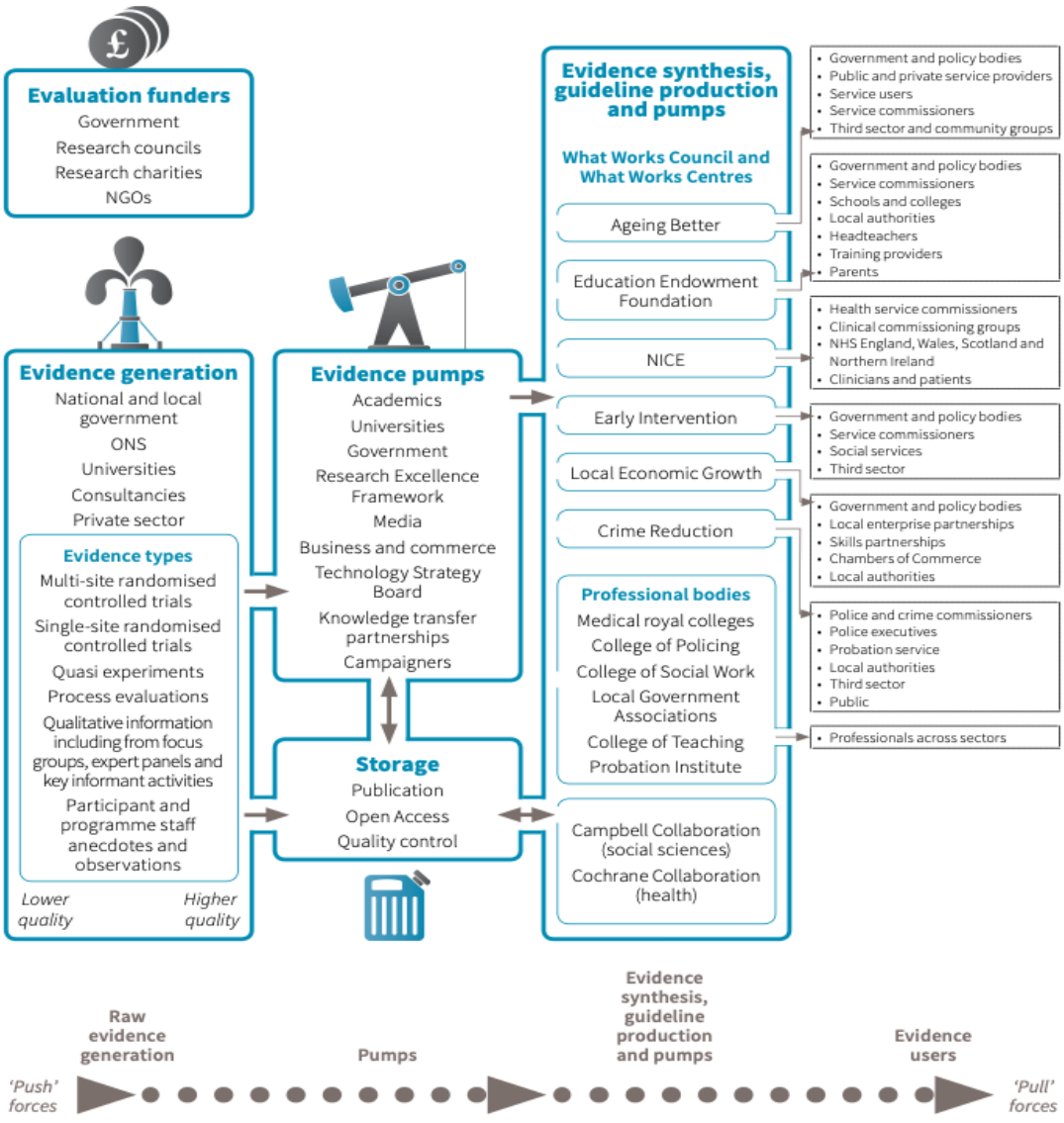
2 What is a science system?

There have been many attempts to map, visualise and or conceptualise 'science systems' (see, e.g. Shepherd, 2014; Dowling, 2015; Nurse, 2015; Alliance for Useful Evidence, 2016; Rudan and Sridhar, 2016; Government Office for Science, 2019; UKRI, 2019; Hanney et al., 2020; Hopkins et al., 2021). They are often created by researchers, and thus refer mostly to research funding and activity (e.g Katz, 1996).

The system metaphor is both helpful and unhelpful. Unhelpful, because it can offer an over-simplified picture of the set of actors, processes and interactions by which evidence is produced, mobilised and used. Used well, systems tools are an attempt to reflect dynamic processes, such as non-linear change, transformation, and learning and adaptation feedback loops (see, e.g. Krieger, 2016). But in the case of science systems, dynamic processes are not widely considered in the context of evidence production and use.

The system metaphor suggests that these diverse actors share a common goal, which is to deliver the best (research) evidence for policy. In reality, of course, people do research and knowledge exchange for lots of different reasons and individuals and organisations involved have multiple goals and purposes, and ways of working; For example, universities do education as well as research, of which not all is policy-relevant.

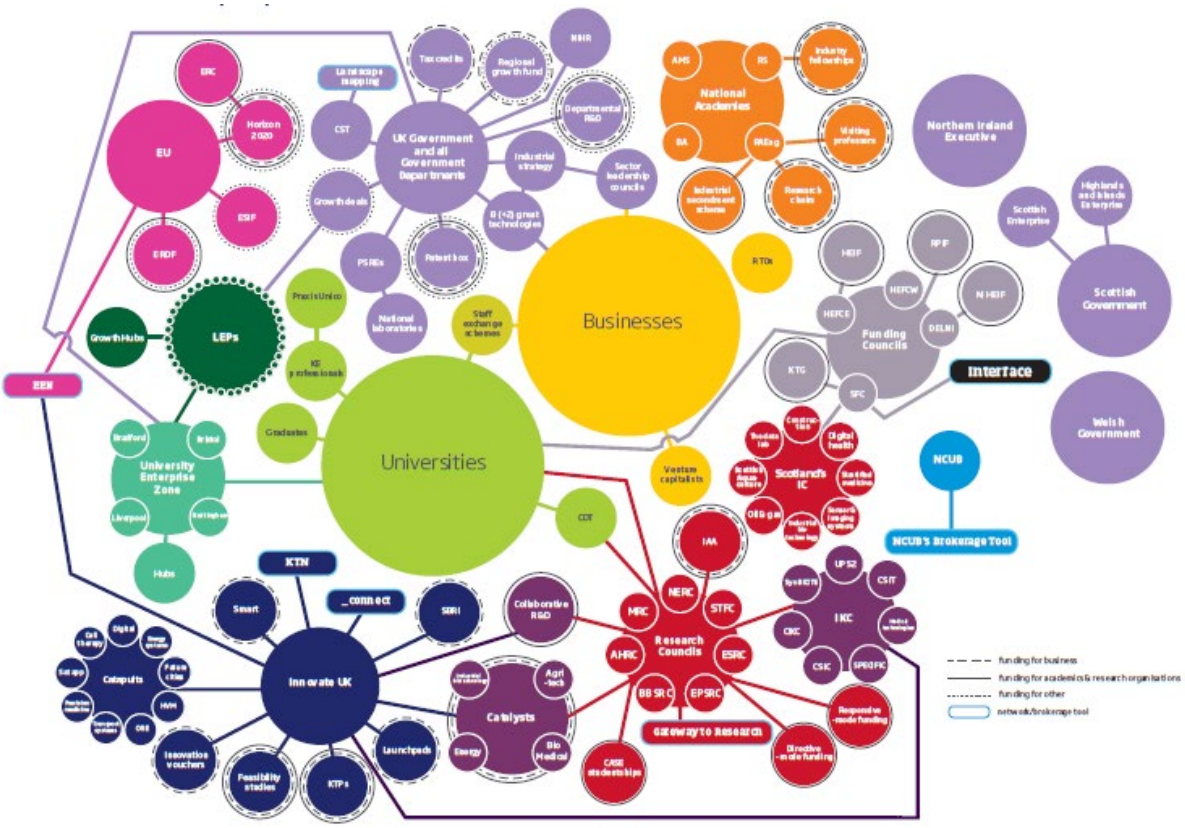
Figure 1. Example of science system visualisation from Shepherd (2014)



The system metaphor can also give the impression that interventions could be implemented in a relatively simplistic way to achieve this goal (see e.g. Figure 1); whereas in reality, everything we know about complex systems tells us that they generate outcomes in the absence of central control, and that intervention often adds

to a chaotic set of activities with unpredictable outcomes generated almost at random (Greenhalgh and Papoutsi, 2018). Some visualisations of the science system hint at this chaos, without indicating any potential organising principles (see, e.g. Figure 2).

Figure 2. Example of map of the science-industry-policy system in the UK (Dowling, 2015)



On the other hand, the idea of a system helps us to focus on knowledge production and use in terms of connections (processes, activities) between actors. And, even if not all actors would agree that they share the same purpose - that is, to improve how evidence is made and used for decision-making - conceptualising the actors, activities and processes involved as components within a research system is a useful exercise (see Fig 3 for a simplified, but relational model of the UK science advisory system). We can define **the science-for-policy system** as:

> *The set of actors and connections through which scientific knowledge is acquired, synthesised, translated, presented for use, and applied in the policymaking process*

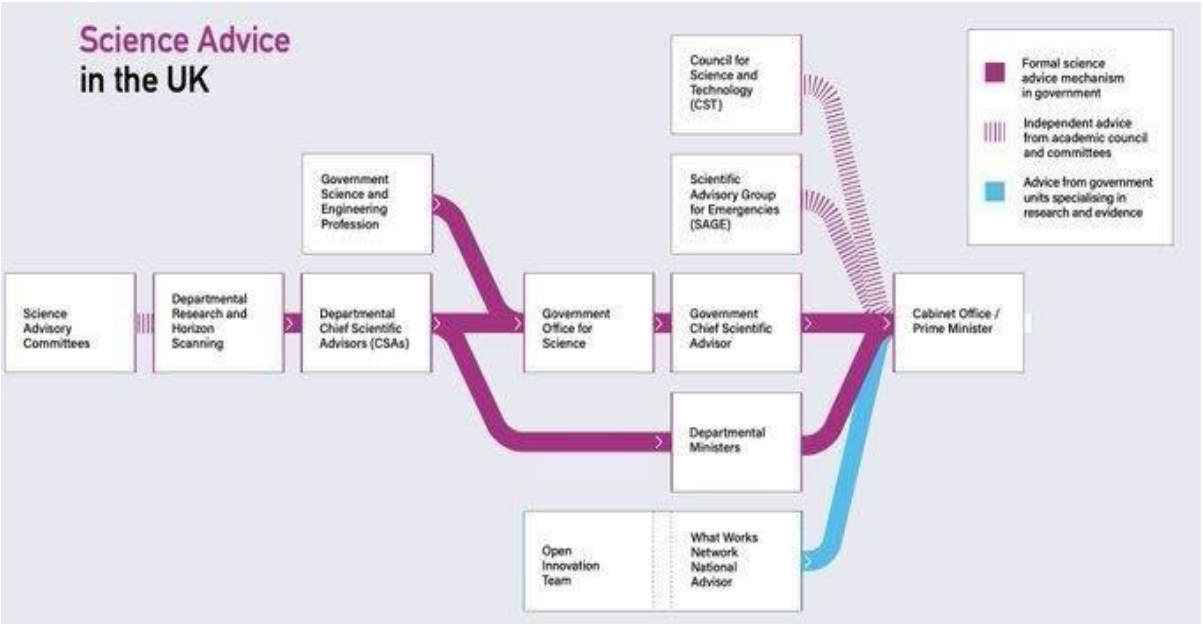
Using this definition, we can begin to think about which types of organisations and groups might be members of this system, and to map out their interconnections and activities.

Even if we cannot yet think clearly about the interconnections and processes, this systems perspective still enables identification of the key organisations and activities, allows us to ask questions about how these actors fit and work together, what the desired goals might be at component- and system-level and how to measure these goals – and even what supports and changes might be required to optimise delivery of these outcomes. Many people are of course already asking questions about these components, processes, outcomes and interventions. For example, those working in research evaluation are concerned with how the process of peer review improves the quality of research, and whether this can be assessed by citation metrics (outcome measurement). Similarly, many interventions are being undertaken and evaluated, such as promoting increased

academic engagement with policy through training and secondments (intervention) to increase evidence uptake in policy (outcome).

In many of these investigations and - more usually - commentaries, the overall goal of these activities or organisations is implicit, but rarely stated clearly. For example, a goal of the system might be improved research quality or increased 'evidence use' (e.g Lavis *et al.*, 2003; Gluckman, 2014). Even if not stated clearly, commentators are operating with an implicit understanding of a research system, even if not clearly conceptualised. Increasingly, systems approaches are being explicitly taken by both policy and research organisations (Government Office for Science, 2019; Hanney *et al.*, 2020; The Global Commission on Evidence, 2022).

Figure 3. A visualisation of the UK science system (Hopkins *et al.*, 2021)



3 Guiding principles from the literature on evidence-informed policymaking

The academic literature on evidence-informed policymaking, on the other hand, has a clear, albeit very broad goal – that of increasing and/or improving research evidence use in policy. This extensive interdisciplinary literature on evidence and policy suggests key principles for effective science-for-policy system, including::

3.1 Transparency

Clear and transparent processes to generate and assess evidence engender confidence in the findings (Parkhurst, 2017; Mair *et al*., 2019; The Global Commission on Evidence, 2022). When research is reproducible and a clear line can be traced between research question, methods, results and conclusions, it is easier for others to assess the validity of claims made. The same principle applies to the mobilisation and use of evidence. Transparent systems to select, prioritise, and interpret research, and to offer recommendations for action enable observers to understand where policies and practices come from. Transparency around science advice in particular leads to greater trust in governments (Cvitanovic *et al.*, 2021). Being able to see how decision-makers approach problems, and assemble evidence to move towards a decision builds confidence in democratic processes.

3.2 Quality and rigour

Much of the literature on evidence use in policy is concerned with appropriateness, quality, rigour, and robustness of evidence (Parkhurst and Abeysinghe, 2016). Often, this is taken to mean evidence generated using specific methods (such as randomised controlled trials, or systematic reviews). There is also widespread concern about the quality of research reporting, enabling reproducibility (Nosek and Errington, 2017). However, a more nuanced debate also seeks to understand the extent to which a body of knowledge is truly representative of the range of perspectives and interests relevant, making it more democratically legitimate; and through transparent processes and deliberative mechanisms, providing scrutiny opportunities for robust challenge and contestation.

3.3 Credibility and legitimacy

For evidence and experts to be taken seriously, they must be both credible and legitimate. Legitimacy is conferred by perceived fairness, processes and balancing of values, beliefs and interests; what political scientists refer to as input/output/throughput legitimacy (Cash et al., 2003; Parkhurst, 2017). The concept of credibility gains salience whenever a provider of knowledge seeks to influence another, and has been a topic of scholarship in fields as diverse as communications studies (including science and risk communication), information science, marketing and management science that have variously treated credibility as a property of the source, the media and/or the information, acknowledging that these are closely linked (Rieh and Danielson, 2007). Jasanoff explains that societies confer credibility on experts/expertise according to what we consider to be characteristics of high-quality public knowledge. She explains that "In a litigious society such as that in the USA, expectations of openness, transparency, and the right to look behind formal claims are deeply engrained in a multiplicity of institutional practices. … Another society, with different traditions for producing and testing public knowledge, might dress up its expertise in other guises" (p.394, Jasanoff, 2003). In other words, values, as much as epistemological criteria tell us who ought to be considered an expert.

In terms of science systems, commentators debate what constitutes quality of evidence and expertise; the importance of diversity of perspective, of participant and of knowledge; and what constitutes authority, and how this can be exercised. Credibility also speaks to the democratic or formal official mandate which public scientists may have to represent and articulate evidence for decision-makers (Parkhurst, 2017). Transparency of process and of inputs allows challenge and scrutiny, which generates credibility and trust in the system.

3.4 Trust

An important facilitator of evidence use according to the literature is trust; in the experts, in the processes which generated evidence, and in the relationships which connect evidence producers to decision-makers. Trust can be achieved through appropriate ways of working within the science infrastructure, and by capacity and capabilities around effective and ethical engagement. Trust is a quality of relationships between individuals, and can be damaged by turnover, perceived or genuine bad-faith engagement, poor experiences and conflicting agendas (Cairney and Oliver, 2018; Oliver and Cairney, 2019).

4 The goal of a science-for-policy system

From the perspective of this body of scholarship, then, the goal of evidence-informed policymaking is the delivery of relevant, robust evidence to people with the capacity to absorb and fully understand it in order that it might inform their decision-making.

- **Delivery**: recognising there are multiple routes by which knowledge of different kinds reach decision-makers
- **Relevance**: How decision-makers frame problems dictates what they consider to be relevant evidence to bring in and consider. By making this as inclusive a process as possible, problems would be able to be framed with a broad understanding of context, actors, perspectives as possible
- **Robustness**: Historically, and still often, researchers interpret this to be essentially a methodological judgment about whether the correct design/methods have been selected and used as well as possible to address a problem. This is a very narrow conception about what robust might mean; for example, interdisciplinary, addressing different facets of a problem, transparently assembled and synthesised etc. Socially, politically robust.
- **Absorptive capacity**: We can call the ability and resource available to enable decision-makers to seek, assemble, and fully comprehend the strengths, weaknesses, and key implications from evidence absorptive capacity. This operates at individual and organisational levels. The science system ideally creates and sustains this capacity
- **Inform**: Where evidence informs decision-making, this can be either instrumentally (enables technocratic decision-making, in the sense that clear evaluated choices between policy options are offered by scientists) or via a more democratic, discursive process by which the strengths and weaknesses of different knowledges are offered and discussed (sometimes thought of as conceptual or ideational evidence use). Processes which lie closer to the second of these are likely associated with stronger and more credible science systems.

Although the science-for-policy system itself may not have a clear strategic goal, we can ask which organisations and groups within the science system might be involved in delivering the goal of evidence-informed policy-making. We can also start to imagine what these different actors might do in aid of this goal – intentionally or otherwise – and so how this might be better supported and measured.

5 Elements of the science-for-policy system: what they do, and how we can tell

This section describes elements (i.e. organisations and groups) within a science-for-policy system. For each, I describe the roles and activities which would be ongoing if they were optimally supporting evidence-informed policy-making. I also reflect on the (paucity of) empirical evidence about these potential contributions to the science-policy system. This is a set of provocations to begin exploring activities which could be measured and supported; and ultimately help us imagine how to intervene effectively to support the science system.

5.1 Funders

Funders provide resources to support research activity. They can incentivise researchers through offering policy-relevant funding, e.g. through challenge-led calls. They also offer training and development of capacity and capability in research, support engagement activities. If working systemically to support a science-for-policy system, they would respond to policy priorities and knowledge needs. They could support career progression and cultures of professionalisation in evidence production, for researchers as well as knowledge brokers and other intermediaries. By engaging long term with policymakers, they can seek to both shape long-term policy agendas, and respond to policy needs. They can also support research into policy evaluation, to test the long-term impact of evidence use, and evaluate use of research evidence in producing, designing, implementing and evaluating policy.

— There is little empirical research on the role and contribution of funders to science-policy ecosystems, and recent work suggests that their role within the system is less well-conceptualised than that of others (Tseng, 2022). Funders are potentially transformative within the system, as they have the power to allocate resources, incentivise shared-problem framing, and build skills and capacity. Most research on funder activity, however, focuses on research assessment processes (Clarke *et al*., 2016; Tamblyn et al., 2018), resource allocation methods (Barnett *et al*., 2015; Fang and Casadevall, 2016), or funding patterns (e.g. (Robson, Malik and Yentis, 2014). Enquiry into their activities and how they might support evidence-use is not always welcomed as a research topic in its own right, with many funders adopting a 'impact add-on' or otherwise non-strategic approach to research impact funding, which has led to a chaotic and messy academic-policy engagement space (Oliver *et al*., 2022). There is some evidence that funders globally are beginning to recognise their contribution at a systems level, and to investigate ways to collaborate and embed more effective working practices (Kamenetzky and Hinrichs-Krapels, 2020). Most funding for knowledge mobilisation takes the form of (i) research academic progression via different fellowships, (ii) engagement with industry with fellowships and placements, and more rarely and recently, (iii) engagement public administration and NGOs for policy issues.

Table 1. Funders: possible indicators

Type of actor	Activities – what might they need to do?	Possible indicators – how would we know these are being undertaken?
Funders	— To foster a culture of professionalisation in evidence production and mobilisation, supporting and promoting skills and careers to engage effectively and ethically — To engage with, respond to, and shape governmental knowledge needs and researcher-led priorities — To support and use research into effective knowledge systems	— To engage regularly and effectively with the research communities and with relevant policy teams to support policy-relevant research through shared problem-framing — To offer appropriate training and capacity building to research organisations and teams, who include support staff — Dedicated research funding for research into evidence production and use — To balance between responsive and policy challenge-led research funding organisations and teams, who include support staff — Dedicated research and knowledge exchange funding for research into impact and processes of evidence use in policy — To balance between independent, responsive research funding and policy relevant/challenge

5.2 Research organisations

Research organisations may support and reward this kind or research activity, which is designed to generate policy-relevant research. Although much research is conducted within university settings, research activities of course take place in other bodies, such as public or government-owned laboratories and research institutes, within government and local government, and (in particular evidence synthesis) in clearing-houses. These organisations could all promote and support skills for engaging effectively with policymakers, and base their recruitment, training and education strategies around long-term policy agendas to ensure that appropriately-skilled and talented researchers are being produced for the workforce. They could support career progression and cultures of professionalisation in evidence production, for researchers as well as knowledge brokers and other intermediaries. Within research organisations, universities and others, there are questions about the allocation of resources towards specialised services to support research engagement with policy – for example towards skilled staff to train and support researchers who want to participate in the science advisory system. At present, the staff who perform these services are often not given clear career progression support or recognised for the breadth of activities which they undertake and enable.

— Universities in particular have sought to colonise the academic-policy engagement space through the creation of Policy Labs, Tech Transfer Units, Knowledge Transfer Units or similar (Oliver et al., 2022). These often seek primarily to promote the work of their own academics along the lines of any marketing or PR organisation, although in the UK the University Policy Engagement Network (UPEN) attempts to collaborate reducing competition are ongoing (Stevenson, 2019). Evaluations of training offered by universities to promote appropriate skills is rare, although anecdotally tend to reward and create a homogenous set of academic participants in policy debates (Oliver and Cairney, 2019). More broadly, the failure of universities to promote or reward those seeking to build careers as academics or knowledge mobilisers more broadly is well-documented (Chang et al., 2005; Ward, 2017; Kislov et al., 2018). More generally, the evaluation and assessment of research organisations – which is almost exclusively aimed at universities – focuses on the activities of researchers, counting publications, citations and so on. There are indicators in the Research Excellence Framework and the Knowledge Exchange Framework which include academic-policy engagement and other forms of impact, but few real incentives aiming to galvanise engagement with policy. Actor-centric indicators of this kind fail to capture more systemic conditions and activities (which could include adapted career pathways, competence frameworks, university rankings on the basis of engagement).

Table 2. Research organisations: possible indicators

Type of actor	Activities – what might they need to do?	Possible indicators – how would we know these are being undertaken?
Research organisations	— To support a diverse workforce equipped with skills and expertise relevant to policy challenges through relevant training, and capacity building opportunities — To reward and enable research engagement with policy and practice organisations	— To support diverse and skilled research workforce by offering appropriate degree and other training and capacity-building support — To reward and recognise policy-relevant research and engagement activities to policy — To support a diverse workforce with capabilities in knowledge exchange with policy

5.3 Researchers

Researchers whether in universities or in other organisations might engage in policy-relevant research. They may be incentivised to do useful research or choose to do so for ethical and moral reasons. They may engage with partners to enable this research to be framed in a useful way. The research workforce itself would be diverse and inclusive, highly skilled and resourced and incentivised to investigate issues of importance to policy.

— The evidence suggests that university researchers at present are not skilled at, rewarded for, and do not feel incentivised to undertake engagement with policy and practice (Upton, Vallance and Goddard, 2014). Where this kind of activity is undertaken, it is often because researchers feel it is morally or ethically correct, rather than a legitimate use of work time; rarely is it counted in work plans or job descriptions. Finding ways to help researchers build skills in is a priority for healthy science-policy systems (Bayley *et al.*, 2018). It should be noted that many feel (as funders and peer review colleges often express) that engagement is a threat to academic identities and independence (Boaz *et al.*, 2021). The challenge is to help participants in the science-for-policy system articulate the tensions between independence, robustness, relevance, and importance of different evidence types and activities, while seeking to understand how to navigate between different choices about how to engage, for what purpose, and with whom (Cairney and Oliver, 2018). As stated above, few researchers are assessed – or therefore incentivised - on their ability to successfully engage with policy at any level.

Table 3. Researchers: possible indicators

Type of actor	Activities – what might they need to do?	Possible indicators – how would we know these are being undertaken?
Researchers	— To produce interesting and novel research evidence relevant to policy challenges — To seek to support effective knowledge systems	— Appropriately skilled and diverse workforce — To produce interesting and novel research, or relevant syntheses — To routinely engage with evidence users as a legitimate part of their work

5.4 Intermediaries

Intermediaries support the mobilisation of this research, through synthesis, through training, through networking and convening, and through being trusted and credible sources of advice and evidence for policymakers. They may include synthesis clearing-houses, such as the What Works Network in the UK (Bristow, Carter and Martin, 2015; Gough, Maidment and Sharples, 2018) which brings together a set of organisations which (mostly) synthesise evidence on different policy sectors (Health, local economics, etc), and often focus on a particular set of evidence types such as systematic reviews. There are also learned societies, national academies, parliamentary bodies and public agencies (Nentwich, 2019). Those intermediaries which interact more with policymakers are less synthesis-oriented and often house individuals who have backgrounds across policy, research and hybrid organisations. They tend to understand the research system better than other types of organisations, and hold deep expertise in convening and long-term policy engagement (Parker *et al.*, 2014), although currently most large intermediaries are focused on using fellowships and secondments to promote their members' work.

— Globally and at national levels, intermediary organizations are often supported through research or government funding. The role as advisers of these organisations is quite prominent in many countries (UK included). Some are also equipped with specialised policy staff who often hold deep expertise in convening and engaging effectively with both researchers and policymakers, often due to hybrid careers which span policy and research organisations. Yet it can be challenging to build long-term careers in this space, and there is little empirical evidence about where these intermediaries are best placed to act or how.

Table 4. Intermediaries: possible indicators

Type of actor	Activities – what might they need to do?	Possible indicators – how would we know these are being undertaken?
Intermediaries	— To support effective functioning of the system through providing convening and network opportunities — To synthesise and mobilise evidence in range of ways	— To have skilled workforce able to synthesise and mobilise evidence in range of ways, network, and support and advocate for evidence use — To have recognised and resourced specialist units or organisations dedicated to knowledge exchange — To support shared problem-framing and deliberation between policymakers and

5.5 Policymakers

In an efficient science-for-policy system, policymakers would have clear and transparent mechanisms to seek diverse, appropriate and relevant research evidence. They would be able to actively and efficiently engage a range of perspectives in developing, implementing and evaluating policies, and provide opportunities for deliberation over policy goals and shared problem-framing with a range of stakeholders.

— Much has been written about the ability of policymakers to respond to evidence, and the various challenges which hinder this process (Oliver, Lorenc and Innvær, 2014; Cairney, 2016; Parkhurst, 2017). Most interventions to address this problem assume that more evidence will improve decision-making (an un-evidenced assertion), and seek to increase dissemination or build relationships between researchers and decision-makers ((The CIPHER Investigators, 2014; Crowley, Scott and Fishbein, 2018). Investigations into science advisory systems tend towards the anecdotal or suffer from lack of day-to-day empirical insights into the machinery of government (Wilsdon, J and Doubleday, 2013). By contrast, strategic reports into policy processes which seek to engage with science and evidence within government offer clear recommendations about how to build capacity within government, but lack empirical insights about the rest of the system (Government Office for Science, 2019).

Table 5. Policymakers: possible indicators

Type of actor	Activities – what might they need to do?	Possible indicators – how would we know these are being undertaken?
Policymakers	— To have internal capacity and capability to engage with shared problem framing, identify and seek out a range of diverse evidence types, and able to assess and comprehend evidence findings and implications — To state clearly their knowledge needs, and have clear and transparent evidence-informed mechanisms to seek diverse and appropriate evidence	— Existence of clearly-stated knowledge needs — Range of capabilities within government to assess and absorb evidence of different kinds — Transparent mechanisms to solicit and engage with evidence and experts — Internal reflection and scrutiny of advisory systems

5.6 Scrutiny actors

Scrutiny of science advisory processes and structures of science advice by **parliament** or equivalent would provide a good check on whether appropriately diverse, representative, and policymakers, advisors and scientists are all accountable to the public for their activities within the science-for-policy system.

— Studies of science systems across the world tend to assert that few legislatures have good access to evidence, but on closer scrutiny it can be seen that this refers to a relatively narrow set of evidence types (such as health technology assessments) (Monaghan and Ward, 2022). Similarly, although there are some studies of whether or not funded research matches the priorities of different groups (McLean *et al.*, 2018; Luce and Simeone, 2019; Jo, 2020), there are few empirical insight to draw at a systemic level. Yet again, there is almost no empirical evidence about the different mechanisms which governments use to bring in knowledges of different kinds, nor about how these processes and outcomes might be appropriately scrutinised. This leaves science advisors, and science systems in general open to opinionated punditry, which unfortunately stands in for good quality empirical and critical analysis which could guide future investment into science-for-policy systems.

Table 6. Scrutiny by parliament, media or others: possible indicators

Type of actor	**Activities – what might they need to do?**	**Possible indicators – how would we know these are being undertaken?**
Parliament, media or others	— To provide effective scrutiny of effective systems functioning, include gaps between knowledge needs and produced research evidence, workforce diversity, and assessment systems — To enable government to identify what it does not yet know it needs to know	— Existence of, and mandate for independent, evidence-capable body(ies) to scrutinise science-for-policy system and its elements, and hold to account — Science and evidence capabilities for general scrutiny of evidence use in policy-making at national, regional and local levels

Overall, therefore, there may be ways to examine the roles, responsibilities, and pressures on different elements of, and actors in the science-for policy system.

6 Measuring the science-for-policy system: what can be measured, and what does it tell us?

Although the elements and relationships set out above are simplified, this nevertheless allows us to think about who is doing what, to what effect, and to what purpose. There is, as noted above, almost no attempt to map activity of, or outputs from non-research actors in the science-for-policy system. Instead, we have measurement predominantly of research activity (often in terms of publications and citations, which is taken as a proxy for productivity or creativity), or impact (often measured effectively anecdotally). There is a long debate about the utility or otherwise of these metrics (see, e.g. Wilsdon, 2017). The academic consensus about these appears to be that we measure what can be measured, rather than what is useful to know. Publications are said to be a poor proxy for bodies of knowledge (Woelert, 2013), and citations affected by social biases like sexism, racism and desire for power and recognition (Oancea, 2019). The assessment of research has become, it is argued, a form of performance management within universities (Zait, Spalanzani and Rusu, 2010) which is highly costly (Petrova and Barclay, 2019) and often resented by researchers (Nolan 2008, Torrance, Shewan 2006, Tomlinson 2000). Constraining measurement in this way also creates perverse incentives around producing publications rather than socially useful knowledge, and disincentivise useful behaviours. Metrics can guide behaviours, rather than indicate activity. Part of this debate is essentially a response to greater scrutiny and management of researchers within universities and other research organisations – traditionally, in the UK at least, a sector with a very light-touch management culture. But much of the critique, while possibly accurate in terms of effects and perverse incentives, fails to acknowledge that the metrics available are simply not measuring what is useful to know. Thus, what might we wish to measure? (Table 7).

Table 7. Summary of possible indicators of a science-for-policy system

Type of actor	Possible indicators
Funders	— Engage regularly and effectively with the research communities and with relevant policy teams to support policy-relevant research through shared problem-framing — Offer appropriate training and capacity building to research organisations and teams, who include support staff — Dedicated research funding for research into evidence production and use — Balance between responsive and policy challenge-led research funding
Research organisations	— Support diverse and skilled research workforce by offering appropriate degree and other training and capacity-building support — Reward and recognise policy-relevant research and engagement activities to policy
Researchers	— Appropriately skilled and diverse workforce — Produce interesting and novel research, or relevant syntheses — Routinely engage with evidence users as a legitimate part of their work
Intermediaries	— Have skilled workforce able to synthesise and mobilise evidence in range of ways, network, and support and advocate for evidence use — Recognised and resourced specialist units or organisations dedicated to knowledge exchange — Support shared problem-framing and deliberation between policymakers and stakeholders
Policymakers	— Clearly stated knowledge needs — Capabilities within government to assess and absorb evidence of different kinds — Transparent mechanisms to solicit and engage with evidence and experts — Internal reflection and scrutiny of advisory systems
Parliament, media and other scrutiny bodies	— Existence of, and mandate for independent, evidence-capable body(ies) to scrutinise science-for-policy system and its elements, and hold to account — Science and evidence capabilities for general scrutiny of evidence use in policy-making at national, regional and local levels

As discussed briefly above, these indicators can tell us much about the functioning of groups of actors, and all may be necessary to support the healthy functioning of a science-for-policy system. Yet, as adequately documented elsewhere, indicators can also drive perverse incentives (such as an over-focus on evidence production, or on activities rather than effectiveness and efficiency). Thus, as well as requiring element-functions indicators, we can also consider how we would assess the system as a whole. For example, could we examine concordance between identified policy knowledge need, and produced research / skilled individuals / data and evidence? Would evidence of long-term knowledge and research agendas meeting these needs suffice? How could these be assessed? As mentioned in the introduction, systems-thinking applied to this field is in its infancy, so these are merely suggestions to sketch out the level at which connectivity and learning might begin to be expressed in a science-for-policy system.

7 A system within a system

Coming back to the key principles and goals, the potential map of elements (and recognising the paucity of empirical work in this area) allows us to ask questions about how these attributes of processes, individuals and relationships might enable evidence users and producers to share and discuss problems. If trust and credibility are key factors which functional systems require, how can this be fostered when actors have such different pressures and incentives working on them? What might the tensions be between transparency of activity, and independence of advice? How can opportunities to shape shared problem-framing enable policy-relevant evidence to be generated and used most effectively? These tensions cannot be easily resolved but should be borne in mind when considering what a 'good' system looks like, for whom, and how it can be measured.

For example, a system which operated solely for the benefit of government would have narrow problem spaces, funnel resources towards those, and have a strong evidence 'pull' mechanism. On the other hand, having no say over what research to do may lead to a demotivated and de-skilled research workforce. The argument is made that research-led, curiosity driven research is essential for the generation of robust evidence, presumably on the basis that only when truly interested can researchers perform well (Belcher, Suryadarma and Halimanjaya, 2017). However, in the absence of empirical evidence about the most effective research management methods, it is difficult to say what the "best" balance is between challenge- and curiosity-led funding. The same applies to the other challenges across the system – tensions need to be discussed in the light of empirical evidence about options.

The job for those constructing and supporting science-for-policy systems, would be easier if there were greater reflection and enquiry into different models of evidence production and use. This type of research, (otherwise known as research on research, science of science, meta-research, evidence useand so on) is rarely considered a priority by research funders, and less so by peer review colleges. Where research investments are made, activity is almost exclusively focused on research assessment or practices (such as reproducibility) which is a minor aspect of the overall problem (Oliver and Boaz, 2019). Too much meta-science tries to solve the micro-problems. The impact of this is the lack of empirical evidence on which to ground this report.

As a result, this conceptual map of the science-for-policy system is an idealised set of relationships and processes which in reality is much more complex. The science-for-policy system is embedded in much more complex systems, in which every stakeholder or partner have different often competing agendas. This wider system includes all producers of knowledge, who may or may not be incentivised to produce policy-relevant knowledge; it also includes funders, intermediaries like evidence synthesisers, and decision-makers whether actively seeking research evidence or not. Conceptualising this set of actors as a system implies a shared goal and purpose, whereas the activities of people and organisations in the system are usually not related to delivering science for policy. This gives the misleading impression that relatively simple interventions can improve the system, whereas we know that interventions in this space tend to add to a chaotic mass of activity rather that to shared outcomes of the wider evidence-policy-practice system (Oliver et al 2022).

Variation across member states is likely to be significant. Not all will have independent public funders or research; highly centralised research management and assessment; different governance systems which influence policymaking cultures and practices, and variation in service delivery models (Hanney *et al.*, 2020). Highlighting these differences across contexts and settings would be an important empirical contribution. It is not the purpose of this paper to suggest that the creation of a centralised system is possible, or even desirable. It would only be possible under certain circumstances, if accepted as legitimate and credible by other actors within the wider evidence system. The key implications of the principles and elements described above are:

- Existence of actors, roles or initiatives is not sufficient to assume good 'systems functioning'
- An assessment of the degree to which their functions and activities contribute to the science system would be necessary
- We would need to understand how the science system is supported by the wider system, in terms of incentives, drivers and norms.
- Interventions to improve the science system would need to take account of competing initiatives and other systemic factors.

Ultimately, it may not be possible to have a discrete 'excellent' science for policy system without a robust and productive wider science system; yet, we know little about how this wider system operates, nor how to support it well.

8 Questions to debate

8.1 Leadership and coordination

To what extent is leadership and coordination of the science-for-policy system desirable or possible, within the wider systems of governance, policy and knowledge?

The power to set questions, identify contributors, generate findings, and accept or ignore implications lies with the leaders of the science-for-policy system. Effective leadership might create opportunities for shared problem framing, but also seek to improve the system through transparency, incentivised connectedness and support for credible actors. Leadership and coordination might be visible through the creation of networks to help align interests and priorities, creating similar cultures of decision-making and institutional practices.

Leadership of science systems is often diffuse and, potentially, not even connected with each other. This is the case in the UK, where funders, decision-makers and researchers are incentivised and motivated in different directions. The existence of a centralised Government Science Advice system creates visible leadership and opportunities to coordinate with public funders of research, but the downstream activities at research organisation and researcher level remain driven by institutional or individual gain. This is often argued to be a positive attribute, widening diversity and plurality, as well as robustness of research outputs. Thus - should activities be streamlined and overseen (and by whom) or is a more organic, thousand-flowers-in-bloom approach more appropriate?

8.2 Governance level

At what level should activities operate? What is the role of international, national, regional and local capacity in supporting effective science-for-policy systems?

Debates about scaling up of knowledge generation often focus on the local role of universities as generators of economic growth (although few studies of local science advice exist), but there are greater questions to be asked around economies of scale and appropriate levels for different elements and activities. One way to assess the strength of national systems might be to examine their links with international research and policy networks which would enable them to access a more diverse set of knowledges than exist locally. For example, what is the balance between EU- and member state-led public funding of research? Does the UK need capabilities in technical testing if they have access to European expertise and institutions? What can be scaled up and what needs to remain local?

8.3 Comparability

How comparable are science systems? Does the above level of conceptual abstraction work and can we create indicators meaningful to very diverse systems?

Do all science systems need the same elements, and to what extent should these be shaped by differing policy and governance systems? Does “healthy” system mean different things in different contexts (does evidence (production) need to look different in a centralised versus fragmented political system to be seen as legitimate and/or even considered by policymakers?) What are the implications of federal vs central state systems, or parliamentary versus semi-presidential versus presidential systems?

8.4 Goals

What is the goal of a science-for-policy system?

Do we agree that the goal is to generate evidence for policy where and when it is needed? What are the tensions around independence of research and policy/practice need (quality, retaining workforce, robustness)? What is evidence for, and is impact a useful way to think about the purpose of this system? Where do opportunities lie to ascertain and deliver this goal (perhaps through shared problem framing?) This, admittedly highly functionalist framing omits the broader context of political decision-making, which occurs in very different ways (democratic, autocratic, technocratic) in different contexts. All flavours of government draw on evidence and knowledge in different ways; the question for science advisory systems and those who wish to support them is to what extent the science system can and should be used in support of these broader political aims.

8.5 Strengthening

How can this system be strengthened?

Intervening to improve the system tends to add to a chaotic mass of activity rather than create streamlined strategic order, or even desired / desirable outcomes. We cannot just look for what is in place (e.g. an intermediary at the Parliament; a funding scheme appreciating impact case studies; etc). Rather, we need to get an understanding of the extent/quality to/with which structures/actors in place engage with science for policy. In other words, what is the theory of change to which we are working, and for what purpose?

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