Literature review:

Science, Evidence and Public Policy

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1. Introduction

In this review of the peer-reviewed, academic literature we approach the topic of how science can support public policy decisions by bringing evidence into the decision-making policy. What is the (appropriate) role of science/evidence in public policy decisions? The question has two sides. One is the exploration of the reasons why science has an impact on public policy, and, if not, what can be done.

The other is a normative issue about the appropriate role: what about disinformation camouflaged as science? What about science that does not leave room to values and political judgement, is this still appropriate? Should scientists practice civil disobedience, how, and under what conditions? What is the so-called politics of expertise?

As will become clear throughout the discussion of the literature, the right emphasis is, in our opinion, on evidence-informed policy rather than evidence-based policy. With this expression we point to an important role of science in policy decisions, and at the same acknowledge that decisions in the public sphere should also be informed by values and judgement. This is entirely consistent with the mission of Science for Democracy. In other words, our literature review is colored by a political position we take about democracy, not just by the literature on science in public policy processes.

The current social scientific and political debate, indeed, revolves around terms like evidence-based policy, evidence-informed policy, and variations of these concepts. There is also a discussion as to whether we need to upgrade our beliefs and aspirations about what science and evidence can really 'do' for and in public policy, after having witnessed the limitations of simplistic approaches to evidence-based policy. In this line of reasoning, there is a strong argument for what has been called by the European Commission Enlightenment 2.0 - we follow up by talking about a 2.0 democratic agenda on the science-evidence-policy nexus.

With this literature review we will therefore bring order in this discussion. We will use links instead of the classic list of references to make access to the sources easier for the reader. We will argue that there is a relatively simplistic concept of evidence leading to correct policy decisions - labelled evidence-based policy, or the 1.0 agenda. With the accumulation of findings about knowledge and its utilization in public policy processes (the literature on knowledge utilization dated back to the 1970s) we can sketch the contours of a 2.0 version

of this agenda. We will argue that it is more appropriate to think of evidence-informed public policy, as opposed to evidence-based. This is also in line with our standards of legitimacy and accountability in the usage of expertise in democratic systems. In conclusion, the 2.0 agenda is evidence-informed public policy, based on robust evidence and balancing act concerning values.

2. Evidence Based policy: An Agenda with Limitations

To kick off, consider the following, admittedly blunt proposition: the old generation of evidence-based policy initiatives was about the notion of using science and evidence to fill in the information deficit of the decision-makers. But truth and power have a difficult relationship – to say the least.

Key to the evidence-based policy 1.0 agenda was the notion that evidence (from the natural sciences, risk assessment, economics, randomized control trials, and so on) would reduce uncertainty in policy choice. Although bounded rationality was already known since the 1950s, the first wave of evidence-based policy failed to take into consideration the way we think. Hence the cognitive and emotional biases of decision-makers were not part of the equation.

The causal arrow was supposed to work like this:

[1] SCIENCE & EVIDENCE -> REDUCTION OF UNCERTAINTY -> IMPROVED DECISIONS

Several empirical studies have documented the limitations (if not failure) of the model portrayed in [1]. The problem is that the policy process features ambiguity in addition to uncertainty. Ambiguity is defined as changing definitions of the policy problem, variation over time on the venues where the search for alternatives is carried out, and actors that come and go in the different venues. Hence ambiguity implies instability of the network of actors and instability of problem definitions in changing venues. Following Paul Cairney and others, ambiguity cannot be eliminated, it is a structural characteristic of the policy processes in democratic systems. Neither are policymakers usually looking for a simple yes/no solution to which a piece of evidence can readily provide an answer.

3. Science, Evidence and Policy Decisions

To be credible, the 2.0 agenda should put forward propositions that apply to a world where both uncertainty and ambiguity are present. It is also fundamental to have an agenda that acknowledges the importance of balancing values in making decisions. In systems that aspire to be democratic, decisions should be based both on evidence and on a public discourse and decision-making process that promoted balancing acts across different values present in society. In consequence, robust evidence in democracies is informing decisions in policy processes that are open, accountable, and balance the values present in the society.

To achieve that ambitious goal, we need to go back to how we model, conceptually, politicians, bureaucrats, and scientists. This step has to be empirically accurate.

Pragmatically, a sensible agenda should take into consideration the differences in preferences between politicians and bureaucrats – 'decisions' do not come out of a black box, but are the product of the nexus connecting public managers and their political 'principals'. A fundamental lesson drawn from the behavioural sciences https://journals.sagepub.com/doi/abs/10.1177/00732753660050010 1is that regulators, lawmakers, and bureaucrats, like all humans, have a brain that operates in different modes, is influenced by well-known biases, and is constrained by bounded rationality. The same sciences that have shown the range of biases and heuristics also point to possible ways to de-bias decision-making and regulatory processes.

In short, the literature today is fully aware of what happens in the world of bounded rationality – social scientists and governments have also learned about de-biasing. The 2.0 agenda should also model the incentives and preferences of scientists and decision-makers, meaning that both scientists and decision-makers are endogenous to the explanation. Conceptually, the literature is sensitive to the importance of mechanisms operating in specific political and administrative contexts. The mechanisms are the WHY of the explanation, they tell us why certain things happen or do not happen in evidence-based policy processes.

These mechanisms are not the same everywhere every time. Indeed, they operate in specific contexts where governance revolves around relations between elected politicians and public organisations (such as government departments and regulatory agencies). Note that the problem is less one of information deficit and more one of information surplus, or how to direct attention in a world where (dis)information has low cost and is available in all media.

To wrap up, the three important points concerning the democratic use of science and evidence in public decisions are: (1) there is ambiguity as well as uncertainty in the public policy processes (2) these processes feature various types of linkages between evidence and decisions, in different settings, with a realistic model of how the brain of decision-makers works and its biases; and (3) there is a high ratio of noise to signal, or surplus of information that makes it problematic to distinguish (dis)information from high quality scientific and evidence-rich inputs to democratic decisions.

The arrows of this new causal relationship are represented in [2]:

[2] SCIENCE AND EVIDENCE -> DECISION-MAKING PROCESS = Function of (UNCERTAINTY + AMBIGUITY) -> MECHANISMS IN CONTEXT-> REAL-WORLD POLITICIANS AND BUREAUCRATS MAKE DECISIONS CONSIDERING BOTH EVIDENCE AND VALUES/SOCIAL NORMS

Further, the literature shows that systems like 'science' 'society' 'law-making' follow their internal logic, whilst the arrows suggests smooth or at least logical sequences. Following Boswell and Smith, we can think of four models of research-and-policy interactions: (a)

research, science and evidence are used to make public decisions (b) political power and social norms shape knowledge (c) co-production of socially-relevant knowledge in the spheres of research and governance; and (d) research and policy are autonomous worlds with their own rules - they are different worlds or "orders of comprehension", to follow Dunsire. All approaches deserve attention, particularly at a moment when governments design policies and funding mechanisms for universities based on 'impact of research'. These policies should not presuppose simplistic understandings of concepts like 'impact' and 'utilisation of knowledge by policy-makers'. The Research Excellence Framework (REF) in the UK has originated a debate, well documented with evidence from the 2014 REF, on how to capture impact and use these notions of impact to allocate research funding to universities. The risks of simplistic understandings are to misallocate funding and to give the wrong incentives to researchers.

MODELING ACTORS –

Consider the arrows in [2]. We have different actors, namely scientists, politicians, and bureaucrats. We should then model these actors. What do they want, what are their preferences? Decades of research in public management and political science have informed us of the different preferences of politicians/political parties (which seek re-elections and manipulate policies accordingly) and bureaucrats. They pursue different goals: consensus and votes for politicians; task expansion, reputation and standard operating procedures for the public managers. But it is not just a question of preferences. There are also social norms and emotions. Whether we look at how organizations learn, the logic of negotiating truth in science and public policy, or at field experiments the message is that emotions carry explanatory leverage in political language, and consequently also when it comes to the delivery of evidence-based policy. Thus we should accommodate reason with both the logic of incentives and the logic of emotions – at a higher conceptual level, choice and appropriateness, in a context of bounded rationality, heuristics and biases. Finally, no matter what the logic of interests and emotions tells us, there is the hard ceiling (for evidence to make an impact into policy) of organisational capacity.

OF SCIENCE AND SCIENTISTS –

And yet, we have not said a word about the other actor, the scientist. The literature on science and technology studies provide their lessons. Although we assume that evidence-based policy 1.0 is typical of naïve policy-makers, the same naïve belief may exist in the mind of the scientists when they discount the complexity (as well as the values) of public decision-making. If we say that all scientists have to do is to speak the truth to power we cover only a fraction of the 2.0 picture. As research on policy learning has demonstrated, the speaking-the-truth-to-power posture brings failure given certain characteristics of the policy process. It can work when the policy process approaches the conditions of epistemic learning: but it delivers much less as soon as we enter bargaining, authority, or a level-playing field between lay and professional knowledge.

More fundamentally, speaking the truth to power does not tell us anything about the preferences of scientists. They care about truth and science, of course. But they also care about their reputation and funds for their institutes and projects. This is not necessarily a bad

thing, of course. Actually in some circumstances being dependent on funding from policy makers can have a good effect. One can argue that researchers who need to compete for funding from policy makers and bureaucracies have a better understanding of the policy process and the needs of their clients – they have to, in order to get funding.

Some scientists pursue their preferences by talking up science. There are some cases when scientists oversell. They do so because they want more prestige and want to perforate the veil of communication with public opinion and decision-makers. The phenomenon may not entail anything wrong: a climate scientist with information about seasonal forecasts sees the importance of this information and is puzzled why it is not used to a larger extent. A policy maker may not quite understand how to use this information.

Thus, the scientist keeps pushing with the evidence on the table. Is this really overselling? There is also an issue about communication. Communicating the bounds of knowledge in the language of probability is correct. It mitigates the tendency to oversell. This is the territory of probability, sensitivity analysis and the language of incredible certitude. Scientists should adopt the language of humble science, prudence, and openness to conjectures and confutations. And yet: how exactly will being humble and speaking the language of probability contribute towards success in conveying the climate change challenge that we face? How can this approach meet the logic of communication in a world of fast, quickly-paced (dis)information in social media?

The literature seems to settle on the following proposition: Science can help policymakers make sense of their own ambiguity but scientists have to accept their own uncertainty. Further, where does communication take place? There are venues other than social media, such as deliberative and participatory settings. Although there is a lot of talk about the loss of trust in experts, deliberative and participatory policy experiments suggest that ordinary citizens may benefit from the dialogue with scientists given the correct scope conditions. The conditions for public engagement as means to increase or restore public trust in science and experts are: to avoid self-selection (that is, only the already knowledgeable and educated citizens participate), to calibrate engagement so that citizens can effectively develop their knowledge during citizens-experts panels, and to avoid domination. Crucial is the coupling between deliberative and institutional fora. Engagement deteriorates in quality and participation over time, unless the results of the engagement feed into the decision-making process. Co-production of research with stakeholders is a collaborative model often presented as a template. But some argue that co production has hidden costs, which are unequally borne by participants.

Finally, we often think of science as something public, done in universities and public institutions, publicly funded labs for example. But today a lot of science is commercial. The scientific enterprise is carried out in private settings by company labs – for example in the sector of Artificial Intelligence. In a post-industrial economy, the private sources of research and development is inevitable and not problematic in itself. What is problematic is the accountability issue, for example the failure of pharma companies to report negative findings. Failure to publish negative results is not unique to the private sector, but it is a problem given financial implications for coverage.

4. Uncertainty and Usages

The effects of uncertainty on science and public decisions are asymmetrical. Uncertainty is precious in science, it is the trigger of the scientific enquiry, it is always there in processes of scientific discovery and scientific enquiry. In a sense for a scientist more uncertainty in a given domain is a good thing, it means that there is a lot of promising research that can be done. For policy-makers, instead, uncertainty is, so to speak, 'bad'. Policy-makers do not want to follow arguments cast in the logic of uncertainty. When this asymmetry is coupled with ambiguity, the scene is set for multiple usages of science in public decisions. Science can be used INSTRUMENTALLY to improve on policies, or POLITICALLY to improve on popularity, elections, visibility, campaigns, and so on. Governments adopt reforms that have higher expected political payoffs rather than those with higher instrumental value. However, if one wants to reform and use science instrumentally, one has to be aware of the political feasibility of the reform.

Consequently, not always do instrumental and political considerations clash, they can also be complementary.

Science can also be deployed in yet another mode, symbolically, to add a veneer of 'scientific' justification on decisions taken on non-scientific grounds. This is a kind of back-of-the-envelope, justificatory science. For this reason, the evaluation of evidence used in public decision-making processes should be as pluralistic as possible. A sort of society-wide review of the scientific basis of public decisions (coming from different institutes and think tanks) and citizens mobilised to defend and extend their right to science are important.

On wide, whole-of-societyl, pluralistic review, regulators and governments should assist with funds institutes and think tanks to carry out their own autonomous review of the evidence used by regulatory agencies and lawmakers, at least in cases of major controversial regulations. This idea was originally discussed in the USA by Resources for the Future, but it could be applied to the European Union. The examples of Sense about Science and Science for Democracy show how advocacy for the campaign for the right to science may work in Europe and at the level of the United Nations.

5. Can evidence-informed policy be a success?

Whether we call the object of our search evidence-based or evidence-inspired policy, we must be clear on the goal we have in mind. There are fundamental dimensions of success:

(a) In INFLUENCING policy makers. This means shaping the framing of a policy, for example a decision can be framed in terms of individual freedom or in terms of necessity for the state to impose regulations on citizens. Beliefs and moral emotions are key to this process of influence.
(b) On the SUBSTANCE of policy. The policy-makers may 'successfully learn' the wrong lesson by considering the weaker scientific argument because it is close to their ideology, and not learn the correct lesson. Clearly, this is not a successful evidence-based policy in terms of substance, although the decision-makers, in this case, have been definitively 'influenced' by science.

(c) Success on preventing wrong choices, and more generally success as REACTIVE mode
(d) Success as PROACTIVE mode, in leading towards the right choice

Although there is no hard evidence, the literature seems to point more frequently to success in reactive mode – that is, cumulative evidence assists when failure of existing decisions or non-decisions is wide-spread. The challenge is to generate success in proactive mode and in science-based issues.

Finally, there is the problem of documenting success. Arguably, there is a publication bias towards documenting more failure than success. Of course, studying the inefficiencies and limitations of the use of science in public decisions is instructive. Scientists embrace critical and sceptical thinking of what the government does. For public managers the incentive to document success is instead visible: they need to collate and show success to be promoted in their career, to show how they spend their budget, to report on how well their country is doing within international organisations. The two worlds operate with different biases, and we cannot simply average out the two biases - of social scientists and policy makers.

For sure, social scientists should correct their bias – possibly encouraged by the choices made by editorial committees of the main outlets for policy research, such as policy research journals.

6. How can we use evidence and science in policy?

We often focus on the supply of evidence and how it should be considered by decision makers as well as the public. But what about the demand side? In terms of design, it is useful to think of ways in which advocacy organizations such as Science for Democracy can put pressure on politicians and regulators, make it costly to ignore evidence, and make them more likely to demand science. Procedural regulatory instruments make public administration accountable to science (broadly conceived) by design.

Examples are the obligation to consult experts, to carry out and publish risk assessment, to provide estimates and sensitivity analyses on the impact on the environment of legislative and regulatory policy proposals, to use or not use a given discount rate and value-for-life estimates in policy formulation, to rely on objective counterfactual analysis in the evaluation of policy programs. These instrumentations for ‘accountability by design’ are examined in the Protego project for the EU-27 and the UK.

Further, deliberative exercises that increase public awareness and interest in science would not be ignored by politicians. Transparency reviews put pressure on decision-making. Official statistics should be framed and addressed as public goods, and protected as such.

Considerable efforts have been made in increasing the public understanding of science. One important goal in these efforts is to raise awareness of science among politicians and bureaucrats. However, these actors do not necessarily have truth and knowledge as their priority.

For this reason a new generation of efforts should be directed in raising the scientists' awareness of the fundamental variables at play in the policy process and modes of learning in public policy. In short, after having tried to explain science to politicians and regulators, the social scientists should also empower natural scientists by explaining to them how policy processes vary depending on key variables.

This can be achieved by condensing our knowledge of policy processes into formats and presentations with high potential for dissemination. This is exactly what P Cube aims for. It also requires a new commitment of social scientists to judge the quality of their research in terms of how many audiences it can reach and how accountable it is in democratic processes, beyond the community of other social scientists. This vision has been called translational policy sciences, but has many roots, such as evidence use, research uptake, knowledge mobilisation and meta- science. Whatever the background may be, scientists need to be cautious about how, when and whether to engage, and to ensure they are using evidence-informed techniques to do so.

In conclusion, there is no simple, direct transformation mechanism that turns evidence into public policy. And rightly so. Elected officers have to balance value too. Emotions and Reason interact in public policy processes. Citizens are right to demand that bureaucracies, regulators and politicians make decisions informed by, rather than based on, robust evidence and science - and that this robust evidence is combined with a balancing act where different values matter. All this in a process that is transparent, where it is clear to all where science and evidence are coming for, and with what analytical tools they have been processed to inform (not 'to determine') public decisions.

This humble but realistic agenda does not diminish the role of science and evidence. Quite the opposite. It avoids an escalation of expectations about evidence-as-base for policies, and gives science its appropriate, accountable role in democratic systems. It pushes us to make sure that tools translate science in ways that are comprehensible to all - an effort is made in our P Cube games. But it does not water-down the contribution of science and evidence. It makes it more pragmatic, more accountable and more justifiable. If there is something we should be afraid of today, arguably this is not technocracy or the triumph of science over values. Rather, it is the presence of evidence-free decisions and 'scientific dis-information'.

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