CHAPTER THIRTEEN

Working with government – innovative approaches to evidence-based policy-making

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13.1 Introduction

Governments internationally have long aspired to ground policy in rigorous evidence. Without evidence, policy-makers must rely on intuition, ideology, conventional wisdom or, at best, theory (Banks, 2009). Their evidence requirements span the physical, natural and social sciences. Policy issues in environment, natural resource management and biosecurity, in which risk and uncertainty are inherent, are prime examples. The UK government's White Paper on Modernising Government (1999) pledged to improve the use of evidence and research to better understand policy problems (Blair & Cunningham, 1999). Over the past three decades, the UK government has promoted evidence-based over ideologically driven policy (Banks, 2009). Likewise, the Australian government's 2012 Blueprint for Reform recommended strengthening relationships with academia to enhance strategic policy capabilities and drive innovation (Department of the Prime Minister and Cabinet, 2010). Such relationships help ensure that the government's significant investment in science, research and innovation is harnessed to engage with contemporary policy challenges (DIISRTE, 2012).

There has been much consideration of how scientists and government policy-makers interact and of the impediments to effective communication between science and policy. Organisational structures and social norms may impede the incorporation of science into policy development, as may the different timeframes over which science and policy are developed (Burgman, 2015a). Governments and researchers use different approaches to

https://doi.org/10.1017/9781108638210.013 Published online by Cambridge University Press

improve the delivery of policy-relevant science and to enhance the likelihood that science will contribute directly to policy decisions. The working model that is used depends on different factors, such as the degree of willingness to incorporate science into policy-making, the strength of existing relationships and available funding. This chapter first outlines the factors influencing science–policy relationships and then presents possible ways for scientists and policy-makers to work together. We introduce an innovative model of research collaboration that has had practical impacts on policy in Australia. In conclusion, we reflect on the implications of these innovations for interactions between science and government elsewhere.

13.2 The science–policy interface – how well does it work?

Government policy-makers and applied scientists frequently share the aspiration that science should contribute directly to policy decisions. Despite this, significant gaps can remain between the kinds of information that scientists provide and the kinds of inputs that government policy-makers find useful. The reasons for this can depend on culture, context and values, or on the relationships between individual scientists and policy-makers.

Different workplace cultures can impede the adoption of science in policy. Scientists are not always policy-literate and can fail to understand the complexity of the policy environment. This may include the wide range of inputs required, the interactions with other policies, the intensive scrutiny to which new policy proposals are exposed and the fact that policies are not made in isolation but are typically built on existing policy positions (Tyler, 2013; see also Chapter 2). The context in which policy-makers propose solutions to challenging problems is complex and characterised typically by competing, and at times conflicting, objectives among diverse stakeholders. The task of the policy-maker is to balance these objectives while being guided by political mandates and the public good. In these circumstances, policy-makers may appear to disregard scientific advice for reasons that scientists might support if they were privy to the full context of the decisions. For example, a solution that is suboptimal from a single scientific perspective may be the only tenable outcome in the short term and may contribute to a more ambitious policy objective in the longer term (Burgman, 2015a). Similarly, policy-makers often lack the skills to interpret science effectively and rigorously for their purpose, including understanding the quality, limitations and biases of evidence (Sutherland et al., 2013). These impediments are compounded when there is insufficient incentive for scientists and policy-makers to collaborate.

Policy-making is rarely an entirely objective process that leads to a single rational outcome. Decisions in complex situations involve both facts and values. Facts are not always certain and can be influenced by values, perceptions and emotions (Slovic, 1999; Burgman, 2015b). There is no single right way of assessing values (Gregory et al., 2012). Nor are scientists entirely objective and independent (Krinitzsky, 1993; O'Brien, 2000). Lack of objectivity can sometimes lead to situations in which scientific expertise is used deliberately and strategically to support a particular policy outcome. This can be especially strident where issues are emotionally or politically charged – the science of global climate change is a contemporary example (Burgman, 2015a). In most practical situations, the pool of scientific experts on which policy-makers can call is small and composed of people with differing values and partially overlapping experiences (French, 2012). In these circumstances, conventional science can help to clarify what might be lost or gained as a consequence of a policy decision, but can offer little to evaluate differences of opinion and the trade-offs that are often necessary to make a decision. Decision theory (French, 2012; Gregory et al., 2012) can provide a platform for structuring problems, engaging stakeholders, assessing alternatives and finding a solution that best achieves the aspirations of government.

The rewards systems in governments and academia are also frequently incompatible. The determinants of academic advancement are commonly skewed towards publication records, although there is a growing emphasis on the importance of practical research impact. Indeed, all major international university ranking systems now include a measure of research impact. Unfettered academic publication can be impeded by the policy-making process, in which control over the flow of information may be necessary to manage policy change among diverse stakeholders (Burgman, 2015a). Conversely, most government institutions do not readily reward involvement of their staff in what may be considered speculative scientific research.

The timeframes over which science and policy are developed can also be a barrier for the effective use of science in policy-making. Policy-makers can be unaware of and unable to absorb scientific evidence or emerging scientific methods in the short time horizons that are often imposed on policy development. Conversely, the development of good science can be a lengthy process that lags behind the response times required by new policy challenges. In other circumstances, where relevant science already exists, scientists can underestimate the time that it takes to implement policy change, including the time taken to evaluate the social, economic and political implications of potential change.

Limited access to data and research outputs may impede policy-makers' use of scientific evidence. This can be a simple communication issue, because it is not straightforward to write and disseminate research findings in a way that can be readily interpreted and applied by the policy community. More problematically, policy-makers may look to scientists to provide certainty. Scientists may be motivated not to disclose the full weight of uncertainty in their assumptions and results, or may be unaware of it, or not know how to communicate it to policy-makers (Sutherland et al., 2013). This low accessibility creates an imperative for policy-makers to understand the limitations and the context of the scientists themselves, and to cross-examine their evidence.

Useful and 'usable' science most often arises when researchers and policy-makers work closely together to iterate through problem formulation and solutions (Dilling & Lemos, 2011; Burgman 2015a; Chapter 10). In many cases, science contributes to public policy effectively because researchers and government policy-makers have developed personal relationships (Gibbons et al., 2008). In these instances, the 'literacy' barrier on both sides is reduced. However, roles and responsibilities can change frequently, especially in government, and can undermine the time taken to establish effective personal relationships (Burgman, 2015a). It is rare that informed personal relationships will consistently overcome all of the substantial barriers to the effective use of scientific evidence in policy-making.

13.3 Ways of working with government

Issues related to context, values, culture, timeframes, communication and relationships can thwart the effective use of science in policy. Participants attempt to bridge the gap between science and policy, using a range of ways of working together (Table 13.1). Here, we discuss models for science–policy interactions along a spectrum of time investment and complexity. This is not a complete list, and concepts and strategies for improving the effectiveness of partnerships evolve over time. Corroborating the dynamic nature of these elements, a recent survey indicated that Canadian scientists' and policy-makers' ideal way of working in the future would involve collaborative study design and analysis, indicating a shift of focus from knowledge dissemination to knowledge generation (Choi et al., 2016).

13.3.1 Policy briefs

At one end of the spectrum, strategies include one-off events or communication products. For example, policy briefs are succinct documents that address a single policy issue of high interest to policy-makers. The analysis of a priority policy problem is context-specific, incorporates solutions and implementation considerations and is usually completed within days (Lavis et al., 2009a). Policy briefs are an acknowledged method for disseminating knowledge to policy-makers and are often used in the health and social sciences sectors (Lavis et al., 2009b; Rajic et al., 2013; Balian et al., 2016). The Food and Agriculture Organization of the United Nations adopted policy briefs to disseminate information about agricultural development issues to the general public. However, the impact of policy briefs depends on the reader. Experts are less likely to change their opinion after reading a brief than non-experts (Masset et al., 2013).

Table 13.1 *Examples of working strategies between scientists and policy-makers to improve the effective use of science in policy, including a brief description and relevant references*

Working strategy	Description	References
Policy briefs	A short but comprehensive analysis and discussion of a high-priority issue including solution statements and implementation considerations	Balian et al. (2016) Lavis et al. (2009a) Masset et al. (2013) Rajic et al. (2013)
Science–policy forums	A networking event allowing policy dialogue. Researchers and policy-makers present research findings and policy requirements in an interactive knowledge-sharing setting	Lavis et al. (2009b) Boydell et al. (2017) Gregory et al. (2008)
Training courses, exchange programmes and job-shadowing	Theoretical or practical learning settings that aim to convey to scientists and policy-makers a better understanding of the content and the circumstances in which science and policy operate	DIISRTE (2012) Gibbons et al. (2008) Young et al. (2014)
Knowledge brokers	Intermediaries who facilitate interactions between scientists and end users but remain impartial to the decision-making process	Rajic et al. (2013) Ward et al. (2009) Meagher and Lyall (2013)
Informal working groups	Ad-hoc arrangements where scientists and policy-makers collaboratively address a policy problem	Burgman (2015a) Gibbons et al. (2008) Nichols et al. (2015)
National funding schemes	Funding schemes that explicitly support research with strong links to the objectives of other organisations such as government, industry and business	Australian Research Council (2018) Cooperative Research Centres (2018)
Shared governance model (coproduction)	Government-funded research centres where the development of research priorities and achievement of outcomes is shared between policy-makers and scientists	Van Kerkhoff and Lebel (2015) Burgman (2015a)

13.3.2 Science–policy forums

A science–policy forum, or policy dialogue, brings stakeholders and scientists together. In contrast to policy briefs, policy dialogues may concentrate on actions in response to research evidence. The main aim of this tool is to facilitate discussion (Lavis et al., 2009b). Policy dialogues can be time-intensive to plan and organise but provide an opportunity to hear about experiences from a diversity of stakeholders. They may establish and cultivate ongoing personal relationships between decision-makers and researchers (Boydell et al., 2017). Deliberate engagement techniques, such as policy dialogues, can generate confidence among participants that their inputs will guide policy development (Gregory et al., 2008).

13.3.3 Training courses, exchange programmes and job-shadowing

Training courses for researchers and policy-makers may support translation skills, communication and networking skills or understanding of subject matter or of government processes, so individuals can communicate more effectively with their counterparts (Young et al., 2014). Exchange programmes such as secondments are a useful way for scientists to learn how to translate their knowledge to generate benefits in the specific decision-making contexts in which policy-makers work. They can also catalyse new relationships (Gibbons et al., 2008). The National Environmental Research Program in Australia 2010–2015 aimed, in part, to enhance mutual understanding by offering short-term secondments for researchers into policy settings (DIISRTE, 2012). Job-shadowing, in which individuals accompany high-level policy-makers in their daily professional interactions, is also valuable for improving understanding of the realities of decision-making (Young et al., 2014).

13.3.4 Knowledge brokers

One outcome of theoretical or practical learning may be the emergence of so-called knowledge brokers, individuals or groups that facilitate interactions and knowledge transfer between researchers and end users (Rajic et al., 2013) by understanding and serving the needs of both. However, the effectiveness of such arrangements is not often evaluated (Ward et al., 2009; Meagher & Lyall, 2013).

13.3.5 Informal working groups

When scientists and policy-makers have established relationships, they may create ad-hoc working groups to address public policy issues (Burgman, 2015a). If participants define problems and outputs well, and consider incentives for both parties, then working groups offer shared responsibility for objectives and the prospect of effective outcomes for policy needs (Gibbons

https://doi.org/10.1017/9781108638210.013 Published online by Cambridge University Press

et al., 2008). Working groups have the potential to grow into longer term arrangements. For example, in the USA, the ad-hoc formation of a working group of waterfowl managers and biologists from federal and state agencies led to the development of a now long-running programme based on adaptive resource management principles (Nichols et al., 2015).

13.3.6 National funding schemes

National funding schemes can aim to bring scientists and policy-makers closer together by creating policy-relevant incentives for research institutions. The Australian Research Council (ARC) linkage funding scheme, for example, encourages the development of partnerships between science and government, business, industry and community organisations. ARC has also created Centres of Excellence, consisting of long-term collaborations between eligible higher education organisations and partner businesses and agencies. They focus on priority research that is identified by the Australian Government, and operate within clearly articulated governance structures (ARC, 2018). The Australian Cooperative Research Centres Association programme was established in 1990 to bring large groups of researchers in the public and private sectors together with end users (CRCA, 2018). The role of the end users is to help plan the direction of the research and monitor its progress (Burgman, 2015a; CRCA, 2018).

In the UK, from the early 1900s, the Haldane Principle guided government investment in research based on the philosophy that decisions about research priorities should be made by researchers. In 1972, this was replaced by the Customer Contractor Principle, which introduced a market-orientated approach to government support for research (Kogan et al., 2006; Daniels et al., 2014). The 2014 UK Research Excellence Framework (HEFCE, 2018) guided national research investment in universities and used impact to assess the benefits of research beyond academia (Greenhalgh & Fahy, 2015). Similarly, in the USA, the Office of Productivity, Technology & Innovation was created in the Department of Commerce in 1981 to advocate Research and Development Limited Partnerships at universities to accelerate the transfer and private appropriation (through patents) of federally funded technology. The US National Science Foundation now considers the benefits for society of scientist's discoveries when allocating funding (Wiley, 2014; N. Voulvoulis & M. Burgman, unpublished data).

13.3.7 Shared governance

Long-term arrangements, such as Centres of Excellence and Research and Development Limited Partnerships, focus on joint research priorities. However, research centres operating under a model of shared governance go a step further. In the shared governance model, scientists and policy-makers

https://doi.org/10.1017/9781108638210.013 Published online by Cambridge University Press

co-develop and co-manage research priorities, business cases and project plans, and the delivery of research outcomes. Shared governance, also referred to as 'co-production', between scientists and policy-makers is possible when partners 'have sufficient trust, willingness and institutional room to manoeuvre to share information and decision-making power' (Van Kerkhoff & Lebel, 2015). This model encourages the formation of research–policy partnerships built on strong personal relationships (Gibbons et al., 2008) and has the potential to overcome many of the issues limiting the effective use of science in policy. The Centre of Excellence for Biosecurity Risk Analysis (CEBRA) is one example (Burgman, 2015a).

13.4 The Centre of Excellence for Biosecurity Risk Analysis – a collaborative approach to bring science to policy

In the biosecurity domain, CEBRA and its predecessor, the Australian Centre of Excellence for Risk Analysis (ACERA), are examples of governance arrangements that encourage close science–government interaction. ACERA was established in 2006 to develop state-of-the-art methods (tools, guidelines, procedures) to enhance risk analysis in the Australian Government. It was a collaborative agreement between the Australian Government Department of Agriculture and Water Resources and the University of Melbourne. In 2014 the partnership expanded to include New Zealand's Ministry for Primary Industries and sharpened its focus on biosecurity risk, continuing under the new name of CEBRA. The two governments provide the majority of the financial resources to operate the centre and have signed a research agreement with the university provider.

CEBRA's governance arrangements and operational practices include a number of features that have evolved to avoid or overcome some of the most pervasive impediments to effective communication between scientists and policy-makers. They aim to maximise the likelihood that CEBRA's research outputs will generate pragmatic policy outcomes. A key characteristic of the governance model is shared responsibility for the development of research themes, priorities and the delivery of outcomes.

In CEBRA, policy-makers identify research themes, ideas and priorities on an annual basis, under the guidance of a steering committee that comprises senior executives of both the Australian and New Zealand governments, and considering other biosecurity research efforts in which the governments participate. CEBRA researchers and their government counterparts then collaborate to develop the prioritised research ideas into detailed project descriptions and budgets, including implementation plans. The final set of projects to be undertaken depends on the priority list and the available budget. Both the Australian and New Zealand governments have prioritised some multi-year projects that contribute to important strategic objectives. The balance between applied and more speculative research is achieved by earmarking 20% of the budget for 'blue-sky' research, focusing on topics that are relevant to CEBRA's mission but that may not solve the most immediately pressing policy questions.

Shared responsibility between researchers and policy-makers extends to meeting milestones and generating deliverables. On each project, a research leader from CEBRA is teamed with a project manager from government who provides research and administrative support. In addition, a senior government executive sponsors each project and champions its delivery through government, including, where necessary, facilitating acquisition of relevant data and allocating staff time and other resources. CEBRA is responsible for finding experts to deliver the research projects, either from its own staff or in collaboration with researchers from other institutions. A science advisory committee provides assurance of the scientific integrity of project proposals and the scientific quality of research outputs, overseeing peer review and encouraging publication of results. It comprises independent and appropriately experienced scientists, who assess scientific integrity and quality using a process comparable to the peer-review process of international journals. The centre's strategic direction and governance arrangements are overseen by an independent advisory board, comprising university, government and independent members, under an independent chair.

CEBRA's experience has been that the close working relationships fostered between researchers and policy-makers under this model benefit the delivery of pragmatic research outcomes and increase the likelihood that research findings will be implemented. Somewhat unexpectedly, the policy demands of government led to the development of research agendas in entirely new areas. For example, CEBRA's early investment in research on expert judgement led to a suite of experiments, tests and empirical results that have wide applications outside biosecurity (Burgman, 2015b), including in geopolitical forecasting for security and intelligence (Wintle et al., 2012), and conservation biology (Martin et al., 2012). Increasing levels of trust over time have enhanced researchers' understanding of the context in which biosecurity decisions are made and the constraints inherent in the policy-making process. This includes the timeframes for providing usable science outputs. Conversely, policy-makers teamed with researchers have the opportunity to participate in science to achieve policy-relevant outcomes, better understanding the limitations and uncertainties of the scientific results. This has proven effective even where policy-makers have minimal previous scientific experience.

A further advantage of the model is that scientists maintain their independence and are perceived to be independent by other stakeholders in industry and the wider community (Burgman, 2015a). The agreement between government and the university stipulates that the Centre's work should be in the public domain. This is important for government, because biosecurity decisions can be highly contestable, including at the international level. Part of this independence is that scientists are free to publish their work or comment with the usual academic freedom. Policy-makers may or may not decide to endorse the products of the research and can dissociate themselves from advice or commentaries that they consider to be inaccurate, inappropriate or in conflict with public policy (Burgman, 2015a). Under this model, university researchers are able to undertake work that is directly relevant to public policy, where it can have immediate and significant impact, while maintaining their traditional academic freedoms.

Creating policy impact has been a key objective of CEBRA since its establishment and a number of projects have achieved this. For example, CEBRA designed a monitoring system for aircans (containers for aeroplane baggage) that significantly reduced the burden of intervention for the then Australian Quarantine and Inspection Service in the wake of the 2001 foot-and-mouth disease outbreak in the United Kingdom. CEBRA developed a monitoring regime for aircans based on applied statistics and the operational experience of stakeholders, but also considered the constraints of different regional offices. Under the current system (Robinson et al., 2011), the Australian Government inspects a maximum of 15,000 aircans a year, out of the almost 400,000 that arrive, while assuring the government that the pathway continues to present a very low risk.

In the area of biosecurity intelligence, CEBRA and its government collaborators found a way to monitor publicly available information on the global spread of pests and diseases systematically and cost-effectively. The department now uses innovative software, the International Biosecurity Intelligence System (IBIS), to search open-source information for emerging pest and disease threats, providing early warning. It generates daily reports that effectively monitor the disease status of Australia's trading partners. Government staff convert the information IBIS generates into usable intelligence that informs risk identification, assessment and prioritisation (see Chapter 3 for more details of this process).

A third CEBRA research programme has led to a shift in thinking about biosecurity inspection rules and their implementation. A suite of subprojects developed and applied economic experiments and drew on principles from behavioural economics and micro-economic theory to better understand how importers react to incentives within a new compliance-based inspection scheme for a range of plant–product import pathways (Robinson et al., 2012; Rossiter et al., 2015; Rossiter & Hester, 2017; Leibbrandt et al., 2018). The government uses this scheme to reward consistently compliant importers by imposing reduced inspections. While this work is ongoing it has had some significant practical impacts on compliance-based inspection schemes.

13.5 Lessons learnt

There are many ways in which governments work with scientists to maximise the opportunity to apply sound evidence in the policy-making process. Since its establishment in 2006, CEBRA and its predecessor ACERA have developed a model based on shared responsibility for the development of a research agenda, priorities and the delivery of outcomes. This close relationship between research objectives and policy needs has contributed to the strong uptake of research outcomes. The relationship between policy-makers and scientists has evolved since 2006 to one of mutual respect for the complementary roles and skills that each brings. This has been key to the success of the organisation.

CEBRA's shared governance arrangement respects the conventional academic reward system. It encourages peer-reviewed publication of articles. Staff present papers at international conferences and CEBRA hosts scientists from other institutions for working groups, workshops, research projects and sabbaticals. This supports traditional pathways to advancement through the university system. Less traditionally, but just as importantly, the collaborative nature of working on public policy issues with government staff can contribute to overall job satisfaction, especially when applied research outcomes positively influence biosecurity policy or operations.

Some CEBRA projects started as one-year projects and expanded into multi-year projects. CEBRA's longer-term funding model allows more in-depth scientific discourse on research questions related to specific policy needs. Continuation of work leads to greater development of expertise and is more likely to result in satisfactory practical outcomes for biosecurity policy. If a research project team has a productive partnership with their policy counterparts, then long-term (multi-year) projects benefit.

While the shared governance model delivers many positive outcomes for scientists and policy-makers, some challenges persist. Working in close proximity to the machinery of government, researchers may be subject to novel administrative obligations. For example, there can be a requirement for frequent verbal or written progress reports. Further, the collaborative development of a detailed business case can be time-consuming because it is an iterative process involving a number of contributors, and proposals for new projects require formal approval by senior government officials. Government internal quality assurance and contract management processes in general might have an impact on researchers' workloads and project timeframes, although these are generally no more onerous than writing and managing conventional grants.

A close relationship between project sponsor and research provider may also lead to pressure on researchers to expand the scope of a project when new insights emerge during its progress. In contrast, researchers working under a shared governance arrangement may not put enough effort into achieving project milestones because of the long-term nature of the research centre contract. It is an issue that can be resolved, however, through a responsive, structured and transparent process of change management where all involved parties are informed of and agree to changes in project deliverables or timeframes.

One challenge for research scientists in the shared governance model is shared by all other modes of interaction. That is, the researchers have to at least partially subordinate their interests to those of their research partner. It is not enough to have an idea or a skill and to look for opportunities to apply it. Rather, the researchers have to listen carefully and understand the context of their colleague's operational environment. Only then can they draw on the suite of skills and experience they have acquired to solve problems. They also have to be patient and persistent in searching for ways of presenting the solutions they discover in an accessible and useable form. Not all researchers are capable of such adjustments.

In conclusion, biosecurity in an Australian context has provided an example in which government regulation has been enhanced by the application of good science. The CEBRA model of collaborative governance arrangements underpinning pragmatic policy outcomes could be applied to other areas of government policy-making in which scientific considerations are important. Potential examples include public health, natural resource management and environmental issues, including conservation policy.

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https://doi.org/10.1017/9781108638210.013 Published online by Cambridge University Press

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