Improving research support for environmental policy making: lessons from the literature and issues for debate

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Abstract

In order to deal effectively with looming environmental threats, we need to improve research support for policy makers. Our starting point was that, to date, considerations of research-policy interactions have been too narrow and that widening the focus raises critical questions which deserve more intense scrutiny. We brought together four literatures which are generally treated separately: research-policy interactions, their evaluation, considerations of research amount and quality, and theories of policy making. In research policy interactions we looked at differences in research and policy perspectives, types of engagement, checklists alerting researchers to policy complexities, boundary issues, and heterogeneity in research and policy making communities. As well as a range of evaluation issues, we also explored limitations of research in decreasing uncertainty, lack of uniform quality standards in research, and limitations in research capacity. We then considered four models of policy making, which, respectively, emphasise the technical-rational aspects, power and pressure groups, unpredictability and incrementalism. This broad approach opened up important ideas for debate around research equity, research limitations and researcher stance vis-à-vis policy.

Keywords
Research-policy interaction
Decision support
Evaluation
Research roles
Research limitations

1. Introduction

Concern is mounting nationally, regionally and globally over a range of environmental issues, so that governments are increasingly pressured to develop relevant policies. There is considerable interest in how researchers can best support policy makers in responding to these looming threats. As Rayner (2006) recently pointed out, there is increasing reliance on scientific and technical information in policy making, especially as the problems have become less tangible. Hence research has become more important as concern has moved from environmental issues like poisoned rivers, which those living nearby or visiting can clearly see as problems, to issues like climate change, which are harder for the public to distinguish from ordinary variations in the weather. Despite this researchers still commonly lament their lack of influence (e.g., Maxwell, 2000).

There is now a very large literature about research-policy interactions, but most of it occurs within limited frames of reference. We started this research project with the assumption that expanding the range of considerations would open up new ideas and issues for debate about research-policy interactions. While there are many ways in which we could have proceeded, we chose an expansive literature survey encompassing a) how research is used to support policy making, b) evaluating research-policy interactions, c) a range of considerations about the research enterprise, including capacity, quality, and scope, and d) theories of policy making. We acknowledge that while our considerations are broader than most, there are large important areas of publications that we did not cover, for example, the debates over scientific knowledge (Jasanoff, 1998).

Underlying this paper are three views, which are useful in providing insights into research-policy interactions, rather than being 'correct'. The first differentiates the research role of providing technical support to policy making into two components – the extent and quality of the technical support, in other words the amount of research information and its veracity, and the process of providing technical support. To this, we add a view of theories about policy making as lenses which highlight different aspects of a messy and complex process. Thus we suggest that theories of policy making as a technical-rational process illuminate one facet, while theories about power and pressure groups explain a different element. We argue that value comes from looking at these theories in juxtaposition, rather than in competition. Third, we highlight the importance of jurisdictional scale. In other words, we suggest that research-policy interactions will differ depending on whether the coverage of the governments involved is local, national, regional (across all or parts of a number of countries) or global.

The first section in this paper addresses the current literature on research-policy interactions. We provide a 'taste' of this literature, the issues it concerns itself with and important gaps. Two significant gaps that we deal with in some detail are lack of evaluation and lack of consideration of key aspects of the research enterprise. We then move to theories of policy making. We describe four theories and use those to reflect back on the research-policy interactions literature. Throughout, we use synopses of cases to illustrate major points. We conclude with an array of questions and issues that are raised by our particular considerations. We suggest that these provide the groundwork for ongoing debate, theorising and data collection and that they can help us think about research-policy interactions in fresh and practical ways.

In taking a broad approach, we have, of necessity, had to sacrifice depth and comprehensiveness. Indeed, because the literature now encompasses thousands of references, we have had to be selective rather than systematic and we have hunted for

the thought-provoking rather than the typical. The paper is based on evaluating our experiences in research-policy interactions against ideas generated by reading around 200 books and journal articles. We acknowledge that we will have missed key references and that the English-language literature we read, mostly from the USA, UK, Australia and Canada, is not representative of research-policy interactions globally.

The paper is a product of three intersecting programs of work. It was triggered by the Global Environmental Change and Food Systems program (GECAFS; http://www.gecafs.org/), which is particularly interested in the analysis of trade-offs between socioeconomic and environmental goals in relation to global environmental change and food security issues. The program is keen to provide effective research support to decision makers and its focus is on three regions, each of which covers all or part of several countries - the Indo-Gangetic Plain, the Caribbean and Southern Africa. GECAFS provides real-world, knotty, environmental problems to challenge our thinking.

GECAFS staff enlisted an Integration and Implementation Sciences approach to help develop strategies for improving research-policy connections. This is the second large program of work. Integration and Implementation Sciences is an emerging discipline which provides concepts and methods to a) foster integration across disciplines and practice to enhance the knowledge brought to bear on complex problems and b) strengthen the application of that knowledge in policy, practice or technological innovation (Bammer, 2005). It is the latter which is specifically relevant here.

One of the tasks of Integration and Implementation Sciences is to consolidate relevant knowledge from different academic areas about how research can most effectively interact with policy. Thus, it is not only environmental scientists who worry about how to influence policy. Researchers in public health, security, biotechnology, sociology and many other areas have the same concerns. Integration and Implementation Sciences is seeking to develop a unified knowledge base that is broadly applicable. This project therefore tapped into a third program of research, which is a multi-disciplinary work group (the authors of this paper) exploring the research-policy interface. Each of us is involved in research that seeks to influence policy – in Australia, globally or both – and we have combined forces to enhance our understanding of how to become more effective in that process. We are actively trading ideas between our experiences as researchers investigating GECAFS (GB, PD), substance abuse (AR, GB, DM), health-promoting working conditions (LS), mental health and wellbeing (HB), and global public health institutions (LvK). Some of us (AR, HB, DM) have had previous careers as policy makers. This paper therefore also presents the journal's environmental sciences readership with outsider perspectives, some of which will resonate with how environmental scientists tend view research-policy interactions and some of which may stimulate new thinking.

2. A Taste of the Literature on Research-Policy Interactions

We note that there is a large literature exhorting researchers to conduct investigations that are more relevant to policy concerns (Edwards, 2004; Gregrich, 2003; Secker, 1993), along with many papers urging researchers to pay more conscious attention to the presentation of research results, writing short reports tailored to policy makers, abridging results without oversimplification, and taking care that they reach policy makers through special mailings or face-to-face presentations (Brownson et al., 2006; Edwards, 2004; Heyman, 2000; Saunders, 2006). However, we begin our considerations with literature which views researchers and policy makers as "two communities", seeing

the primary task of engagement as bridging those communities. We consider attempts to raise awareness of the different perspectives of policy makers and researchers, different kinds of engagement between these two groups, questions and checklists which aim to alert researchers to key issues relevant to influencing policy, and ways of spanning the boundaries. We also look at the value of highlighting rather than glossing over the heterogeneity within each community.

2.1. Different perspectives

One element of the two communities approach is to raise awareness of the different perspectives of policy makers and researchers, which can make working together difficult. Gregrich (2003) emphasises:

(i) different research and policy priorities, so that research does not address the most pressing questions for policy-makers;
(ii) inability on each side to effectively manage uncertainties, plus lack of understanding of the limitations inherent in research and policy approaches;
(iii) inability to communicate vital information to the 'other side';
(iv) different time cycles, so that, for example, release of research findings rarely takes into consideration the policy-makers' decision-making timelines, such as budget and legislative cycles;
(v) lack of researcher appreciation of policy funding constraints; and
(vi) no current differentiation of researchers from self-interested parties seeking to influence public policy.

Heyman (2000) has taken a different approach, highlighting:

(i) researcher emphasis on making one change at a time, and holding other variables constant, versus policy maker emphasis on multiple changes and horse-trading between options;
(ii) researcher emphasis on randomized controlled trials as a gold standard versus the political difficulties of running trials on social policies. Voters expect policies to be based on the best evidence rather than experimentation, which may succeed or fail;
(iii) researcher emphasis on central tendency (such as effects of interventions on mean scores) versus policy maker emphasis on the full diversity of the effects of policy;
(iv) researcher dismissal of 'outliers' versus policy maker attraction to unusual stories that can encapsulate symbolic power and/or capture the media;
(v) researcher emphasis on targeting for maximum benefit versus policy maker emphasis on general applicability; and
(vi) researcher emphasis on long-term effectiveness versus policy maker favouring of short-term results that fit within budgetary, electoral or other politically significant cycles.

Case 1 illustrates some of these mismatches using three examples from global climate change in the USA and shows how they can stymie effective progress on this issue.

> **CASE 1. Mismatches between researcher and policy maker perspectives**
> First, in an analysis of climate change policy in the United States from 1957 to 1974, Hart and Victor (1993) argued that research facilitated, more than led, policy positions. Policy entrepreneurs from outside the world of research were the engines of influence, while scientists' narrow construction of the problems associated with climate change limited the impact of their research.

Second, and more recently, Pielke (2000a; 2000b) laid out the political and administrative complexity that surrounded the emergence of the US Global Change Program, a major research initiative that aimed to develop predictive understanding of climate change. Yet this predictive capability fell short of the needs of policy-makers, who were focused on developing action programs and policies. Although the research was scientifically successful, the mismatch with the needs of policy makers meant that the research fed strategic political manoeuvring, rather than serving as a foundation for clear consensus and agreed courses of action. The linear notion of "science feeding into policy", upon which the research program was founded, constrained the science and prevented researchers from adopting a more iterative, responsive stance.

Third, the issue of impending sea level rise illustrates how connectedness between researchers and policy-makers, along with advocacy, established and kept this topic on the public agenda in the United States. As Moser (2005) reported, researchers engaged closely with state level planners as a mechanism for promoting the issue, and gaining political recognition. Yet this constant effort and ongoing engagement paid variable dividends, with some states acting on the scientists' views, and others not. The researchers were able to drive a policy agenda, but were occasionally over-ridden by events beyond their control, such as political reactions to natural disasters that in some cases supported policy change and closed it down in others.

Gibson (2003b) provides a complementary analysis to that of Gregrich and Heyman, exploring a matrix between the "irrefutability" of the evidence and the "immutability" of policy (Figure 1).

		Irrefutability of the evidence	
		High	Low
Immutability of the policy	High	Confrontation	Change very unlikely
	Low	Change likely	No pressure for change

Figure 1. Change depends on the combination of policy immutability and evidence irrefutability (adapted from Gibson, 2003b)

Changed, or new, policy is most likely when the evidence for change is strong and the political forces maintaining the existing policy are weak. Changed policy is least likely when the evidence is weak and the political forces maintaining the existing policy are strong. When the evidence for change is strong, but the political forces maintaining the existing policy are also strong, the stage is set for confrontation. Nathan and colleagues (2005) make the same point when they say: *"Where strong interests and powerful groups oppose policy direction, the evidence base for government action … needs to be substantial"*.

Gibson (2003a) goes on to explore the considerations that policy makers will be influenced by in such circumstances and posits five indicators of their responsiveness to research:

(i) Responsibility – the extent to which the policy-making organisation is unequivocally responsible for the policy problem, either in terms of legislative

requirements or precedent established by prior action. The more responsible they are the more likely they are to act.
(ii) Capacity – the extent to which the policy-making organisation has the capacity and power to effect change in the problem.
(iii) Performance – the extent to which it is possible to measure the policy-making organisation's performance in relation to the policy problem.
(iv) 'Theatre of justification' – the extent to which performance information and other data relevant to the problem are available for public scrutiny and debate.
(v) Vulnerability to the consequences of error – the extent to which there is a cost (political or economic) for policy failure. Research responsiveness will increase as these costs increase.

One way to overcome these differences in perspectives is for closer engagement between policy makers and researchers and we turn to this literature now.

2.2. Engagement between researchers and policy makers

Jones and Seelig (2004) provide a typology which differentiates between 'engineering', 'engagement' and 'enlightenment' models of research-policy interaction, which puts ideas about engagement in a broader context. The *engineering model* assumes a rational process where the role of science is to provide conclusive evidence. Researchers are the technical experts who generate a solution to the problem identified and defined by policy, without questioning or involvement in policy goals, or in the way knowledge is received or implemented. An *engagement model* is more complex and ambitious. Rather than just being an evidence provider, the researcher is committed to bringing the knowledge, skills and values of their research to influence policy. The researcher takes a more hands-on approach, seeking and building collaborative relationships with relevant policy makers, so that their input and evidence can influence policy directly. The third model, the *enlightenment model*, is essentially one of no engagement, where researchers are neither service providers nor collaborators, but are focused on their particular scientific enterprise. The policy influence of their work is not managed; the research may eventually influence policy through diffusion, but intellectual independence and excellence is the priority.

Other approaches to engagement start with the recognition that the research-policy nexus is not an *"input-output relationship (research in and policy out)"* but is complex and iterative (Edwards, 2004). This has led to a growing literature promoting greater involvement of policy makers early in the research process to enhance the relevance of the research (Walter et al., 2005). Key aspects are jointly defining the problem and providing ways for policy makers to interact with the results, for example by providing models which allow policy makers to try out the consequences of different policy options through various future scenarios (Henrichs, 2006). There is also a literature advocating close working partnerships for the whole research process (Brownson et al., 2006).

A related literature concerns adaptive management. While it often focused on the interaction between researchers and various stakeholders such as farmers, adaptive management has also been proposed as a way to link science and policy. As Cash and Moser (2000: 117) point out *"The central notion of this perspective is that for environmental risks characterized by long time horizons, high levels of uncertainty and stochasticity, effective policy should be based on adaptive, iterative, and flexible experimentation"*. Adaptive management emphasises high levels of communication and information flow, the creation of integrated information and decision systems and a

process that builds trust through participation, learning and iteration (Cash and Moser, 2000).

2.3. Questions and checklists

Another helpful facet of the research-policy interactions literature are sets of questions and checklists that aim to help researchers, in particular, better appreciate the complexities of interacting with policy makers, as well as strategies which may be effective. We present two sterling examples here.

First, is a set of questions developed by Jones and Seelig (2004), which builds on their typology presented above. We have modified the questions to use the GECAFS program as an example:

1. What does it mean to link research and policy in considerations of global environmental change and food systems?
2. In which countries is this prominent on the policy agenda? Why or why not? In which regional and global bodies is it prominent on the policy agenda? Why or why not?
3. Nationally and internationally, what are the main drivers of the idea of research-informed policy in global environmental change and food systems in the early 21st century? What have they been over recent decades?
4. Why is policy interested in this topic now and how strong is this interest? Do policy makers in the various jurisdictions have similar or different interests in this issue?
5. Which model(s) [engineering, engagement or enlightenment] best describes the current research-policy relationship and expectations for this relationship?
6. Is there consensus between researchers and policy makers on this?
7. What other relationships are possible and desirable?
8. Are there any risks to manage?
9. Which model(s) would be optimal? Is there a preferred model? Why or why not?

Second, Court and Young (2006: 88) have developed a matrix of questions for researchers. One axis covers "what you need to know", "what you need to do" and "how to do it". The other axis covers "political context", "evidence", "links" and "external influences". There is a set of questions in each box of the matrix. For example, in "what you need to do" in terms of "political context", the listed questions are:

- *"get to know the policy makers, their agendas and their constraints,*
- *identify potential supporters and opponents,*
- *keep an eye on the horizon and prepare for opportunities in regular policy processes,*
- *look out for – and react to – unexpected policy windows"*.

2.4. Boundary spanners and boundary organisations

There is also a literature that posits that engagement can be advanced if it becomes a specific task for some individuals and organisations, leading to growing interest in spanning the boundaries between research and policy. This is also one response to the question of who is responsible for feeding research into the policy mix and how. In the case of individuals, various terms have been used, including boundary spanner (Williams, 2002), knowledge broker and research retailer (Lomas, 1993). Boundary spanners tend to work with a high degree of autonomy, are negotiators and brokers comfortable with complex ambiguous situations and perform "*the role of policy*

entrepreneur to connect problems to solutions, and mobilize resources and effort in the search for successful outcomes" (Williams, 2002: 121).

In terms of boundary organisations, Rayner (2006) has argued for new institutional forms to bring science and policy together. These should also include representation of broader public viewpoints. In particular he advocates *"flexible, reflexive, and accountable institutions of representative democracy that can track the emergence of issues, and are imbued with regulatory authority to respond proportionately as new information develops"* (Rayner, 2006: 6). He goes on to say *"if we recognize that science cannot compel public policy, the need to develop effective institutional arrangements for it to appropriately inform public policy is greater than ever"* (Rayner, 2006: 6).

Consideration of boundaries also refocuses attention from the strict demarcation of roles between research and policy towards blurred boundaries and contingent circumstances the permeate research-policy interactions (Guston, 2001). This line of enquiry could profitably lead into considerations of co-production of science and policy (Jasanoff, 1996; Lövbrand, 2007; St Clair, 2006), but we do not follow it here.

2.5. Adding complexity to the 'two communities'

While the two communities framing is very helpful in alerting each 'side' to the interests and perspectives of the other, it glosses over the heterogeneity within each group. Stone and colleagues (2001) tease out differences among researchers, identifying contract researchers, who work in a range of academic and quasi-academic settings, such as universities and public sector think-tanks; in-house researchers who are employed within a policy-making institution; political advisors who have a scholarly or scientific background; civil society researchers who work in private think-tanks or non-government organisations, as part of a strategy of conducting research into areas that are not covered by publicly funded research, and, finally, disinterested researchers, who are pure scientists, pursuing knowledge for its own sake. Each of these is likely to have a different orientation to policy making.

Similarly, if we look at a national level, government policy makers can be divided into elected, appointed and career officials. In a democracy like Australia, for example, elected officials can be further differentiated between politicians in power, in major opposition parties and in minor parties (which may be significant if they hold the balance of power). Countries such as the USA have a greater range of elected officials including sheriffs and key legal posts. In Australia, appointed officials include political advisers and heads of government departments. In the USA appointed officials are in even more influential roles, for example, the whole team surrounding the President is appointed. Career officials are public servants whose position continues regardless of which government is in power. Some are deeply knowledgeable about their areas of responsibility, whereas others have more generic and less contextualised policy-making skills. As this brief discussion illustrates, the mix of types of policy makers differs between countries with democratic systems of government. When countries which have non-democratic systems of government are taken into account, the policy making landscape becomes even more heterogeneous. In many industrially developing countries international donors also have to be factored in as key players.

Different levels of government provide another layer of diversity, in terms of numbers, types and power of policy makers. This diversity becomes particularly significant for regional and global issues. It is also worth noting that policy makers are *"elusive as a category"* (Crewe and Young, 2002: 5). As these authors point out, apart

from those in the most senior positions, government officials tend to deny they are policy makers. While we use policy makers here to refer primarily to government officials (including civil servants), the term is also used much more loosely in the literature to encompass, for example, civil society, the judiciary and the media (Court and Young, 2003).

The topics discussed to this point give a flavour of the sorts of issues covered in the research-policy interactions literature and we have also highlighted one limitation, which is the lack of detailed consideration given to research and policy making heterogeneity. We now move on to discuss two other sets of limitations in more depth. First we explore the general lack of and difficulties in evaluation of research-policy interactions. Second, we explore a number of aspects of research, which we suggest need closer attention.

3. Evaluating research-policy interactions

In our reading we found little evidence of evaluation of the effectiveness of research support for policy making. This means that overall there is inadequate learning about what works best, why, and in what situations. We are not alone in these concerns. A wide-ranging and in-depth review of literature and case studies conducted for a UK government agency reported: *"The case studies revealed no examples of rigorous evaluation of the organisations' practices to maximise research impact. For the most part … sources base their conclusions upon self-reporting by and observation of participants in the research-policy relationship"* (Nutley et al., 2003).

What do we mean by evaluation? A recent United Nations definition emphasises *"expected and achieved accomplishments, examining the results chain, processes, contextual factors and causality, in order to understand achievements or the lack thereof"* (United Nations Evaluation Group, 2005). Both process and outcomes are important. To markedly improve our understanding of research-policy interactions, it is important to evaluate a range of issues, including (a) the amount and quality of the research evidence provided, (b) the processes involved in developing and implementing research support, (c) the utilisation of research support by people engaged in decision-making activity and (d) the outcomes of the research support in terms of policy activity and its impacts on stakeholders.

In principle, evaluation can take different forms at the various stages of a research-policy interaction to meet different purposes. Formative evaluation occurs early in the process to assess if the benefits of providing research support for policy are likely to justify the expenditures of time, money and expertise required (European Commission, 2001). Such evaluation contributes to the development and fine-tuning of the interaction, clarifying and joining up goals, resources, activities, products and hoped-for outcomes. Formative evaluation is context-specific and usually provides little information that can be generalised. Summative evaluation, on the other hand, is conducted after the research-policy interaction has been operating for some time or has concluded. It provides information on what has been achieved and how. It should demonstrate how the outputs and outcomes are causally related to the activities undertaken. Summative evaluation provides information that may be used to make decisions about future research-policy interactions. For example, is the research quality good enough and should on-going interactions be continued, continue in a different form, or be terminated?

In practice, however, evaluating the effectiveness of research-policy links is not a simple or straightforward task. For example, if such evaluation involves researchers or

research organisations which are actively seeking to make such links, the assessment has to serve multiple goals, including demonstrating success, process accountability, return on investment, building or maintaining credibility, as well as fostering strategic planning and efforts to improve. In our second case study we describe the approaches of three organisations that have recently attempted to evaluate the influence of their research on policy, respectively using formal impact assessment, a descriptive exploratory survey and qualitative case studies – and illustrate some of the challenges involved.

CASE 2. Challenges in evaluating the influence of research on policy

1. *Formal impact assessment*: The International Food Policy Research Institute used Impact Assessment as the foundation for their approach to evaluation. Their approach categorised the products from their economic policy research and related activities as outputs, outcomes or influences, policy responses and welfare impacts. They included retrospective narratives that reflected on case studies, rather than an overarching quantitative approach. The choice of such cases posed a conflict between wanting to present success stories for credibility and investors, and wanting to learn from failures and improve overall performance (Anderson et al., 2005).
2. *Exploratory survey*: The World Conservation Union chose to take a descriptive, exploratory approach which cut across their Secretariat and commissions, including 31 programs. The initial part of the two-phase review was shaped around four topics: the nature of the policy work; factors and drivers shaping the policy work; approaches and mechanisms for guiding policy; and intended outcomes. The evaluation noted that existing mechanisms, such as contractual obligations to report to donors and stakeholders for accountability and the on-going planning system, were not suited to the task of evaluating the policy influence and impact of Conservation Union's work (Ofir, 2005).
3. *Qualitative case studies*: The International Development Research Centre took a qualitative case study approach, supplemented by a number of literature and program reviews. The cases were purposively sampled from 'successes' to focus attention on how influence happened. The cases were followed by regional workshops and a cross-case analysis. The evaluation noted that such a context-rich approach increased the difficulty of identifying the causes of change, as many factors other than research come into consideration (Carden, 2004)

These cases show that evaluation is difficult. To effectively use evaluation for accountability, as well as learning and improving future performance, we need better understanding of the complexities of research-policy interactions, so that any evaluation can take these into account in an appropriate manner.

4. Limitations of the research enterprise

Consideration of research-policy interactions tend to focus on the process of providing research support, rather than the quality of the research, research capacity or other salient issues on the research side of the equation. In this section we start to tease out some of the key research issues. We begin with the limitations of what research can

offer, particularly in terms of decreasing uncertainty. We then deal with the lack of uniform quality standards, and finish by considering limitations in research capacity.

4.1. Research may increase rather than decrease uncertainty

Rayner (2006) reminds us that the promise that science can point to clear-cut policy options is often illusory. As he points out: *"policy makers are consistently led to believe that, given time and money, scientific inquiry will reduce relevant uncertainty about environmental risk. Their scientific advisors hold out the promise that more fine-grained information will clarify the nature and extent of the problem and enable policy makers to craft efficient and effective responses."* He goes on to say that this disregards two factors, namely that increased scientific knowledge often raises new questions leading to new uncertainties, and that more knowledge may lead to more conflicting views In both cases the evidence base for policy becomes less rather than more secure (Rayner, 2006: 5).

4.2. Lack of uniform quality standards

As more research is undertaken and as the problems addressed become more complex, requiring an array of research knowledge, it becomes harder to compile, let alone critically review what is known. There is an encouraging trend in some environmental research, in medicine and in some other areas, of meta-screening of research knowledge, to provide decision makers with the best possible summation of what we know. An outstanding example in the environmental area comes from the Intergovernmental Panel on Climate Change (IPCC) which has a strenuous vetting process. In addition, a streamlined systematic review process has been successfully introduced for judging medical research through the Cochrane Collaboration (www.cochrane.org) and for social, behavioural and education research through the Campbell Collaboration (www.campbellcollaboration.org). However such processes are very expensive and are not uniformly applied to all areas of research.

This leads us to a more general discussion of criteria for judging research. In Australia, the National Health and Medical Research Council evaluates four dimensions: level (study design); quality (bias); relevance (applicability to policy); and strength (precision, reproducibility and attributability) (National Health and Medical Research Council, 2000). Jacobs and colleagues (2005) put forward most of the same factors, as well as some additional ones. They suggest that usefulness may be judged by assessing whether researchers are asking and answering "the right" questions, whether decision-makers are able to understand the data and analyses, whether the findings are considered accurate, trustworthy, and relevant to the decision that has to be made, whether the information was timely, and whether the findings were sensitive to relevant constraints. Cash and colleagues (2003) reiterate some of these issues and give additional emphasis to legitimacy, in other words inclusive, respectful and fair treatment of diverse stakeholder values and perspectives.

A key point here is that not all research deserves to be influential in policy terms, but this seems to be rarely considered when researchers are encouraged to engage with policy makers. For example, research which takes a narrowly-focused simplistic view of a complex problem may best be ignored. Similarly research which is self-serving self-promotion may also be best disregarded. We argue that the onus is on the research, rather than the policy, community to effectively screen research and that the IPCC,

Cochrane and Campbell collaborations, as well as the more general criteria for judging research provide guidance on how this can be done.

4.3. Limitations in research capacity

There are not only limitations in what research can achieve in terms of producing certainty, there are also inherent limitations in research capacity. There can never be enough researchers to study all the important problems existing at any one time (Lindblom, 1990). Even if every adult became a researcher, this would still not be enough.

In the previous section we alluded to the fact that not all research deserves to influence policy. Lindblom takes this further highlighting a range of research behaviours and institutional structures that limit the value of the research that is conducted. These include researcher difficulties in remaining open to new ideas that challenge key beliefs, hasty work because of competition, insulation through institutionalised subfields, allowing available research methods to dictate the work rather than the requirements of the problem, and bypassing troublesome topics in favour of easier ones.

Furthermore, research capacity is not evenly distributed on a global scale. As Anderson and Bammer (2005) have shown it is greatly skewed in favour of high income countries. For example, they report that UNESCO Research and Development data (1996-2002) show that there was a median of 2,618 researchers per million inhabitants in upper income economy countries compared with 47 in low income economy countries. While these figure starkly illustrate the disparity, the exact numbers must be treated with caution, as UNESCO only provide data for 91 of the world's 241 countries and for many of the 91 countries data are missing.

Limitations in capacity raise questions about what research should be given priority and this is relevant in both high and low income countries. In addition, for countries with low research capacity, what in-country research is most critical and what research findings from other countries can they effectively use?

The issue of research priorities also highlights a more practical query, namely what sorts of research do policy makers find valuable and is this available to them? There is a general view that policy makers look for summaries, reviews and "transdisciplinary" analyses which include economic modelling, meta-analysis, and an understanding of human behaviour (Davies, 2004). However, this does not seem to be an area that has attracted much empirical research and there may be benefit in further investigation of what policy makers need to work effectively and how easy it is to access.

We now move on to examining four models of policy making and their implications for research-policy interactions.

5. What can we learn from different models of policy making?

Policy making defies easy categorization or description. We begin by looking at four models of policy making, which are a selection of the models available (e.g., see Sabatier, 1999). We start with the technical rational model which is most geared to research input. We then explore two models which highlight some of the political aspects of policy making: power and pressure groups, and unpredictability. Finally we describe Lindblom's incrementalist model, which describes a very common element of policy making, namely piecemeal change rather than radical overhaul. As we

highlighted in the introduction, we see these models as illuminating different facets of policy making, rather than as competing explanations.

5.1. Technical-rational facets of policy making

Thinking about policy making as a technical-rational process can help explain the important issues of problem identification and problem solving using expert research input. The emphasis is on systematic consideration of issues and responses through a value maximising process (Bulmer, 1986; Fenna, 2004). Some suggest this involves six-steps (Bulmer, 1986):

1. identify problem;
2. identify causes;
3. develop options;
4. analyse options;
5. select intervention;
6. implement and evaluate.

Others prefer to think of a policy cycle, with additional elements (Figure 2). After the issue or problem is pinpointed, policy options for dealing with it are identified along with the types of policy interventions (ie instruments) that could be used; such interventions include laws and regulations, taxation, education, and services. This is generally followed by consultation which may be with other government ministries affected by the problem, various interest groups, or the general public. There is also coordination with other ministries, especially those governing expenditure, which leads to a decision being made. If favourable, the decision will lead to implementation of the policy intervention chosen and eventually evaluation of how effective this change has been. Problems identified by the evaluation lead to a continuation of the cycle.

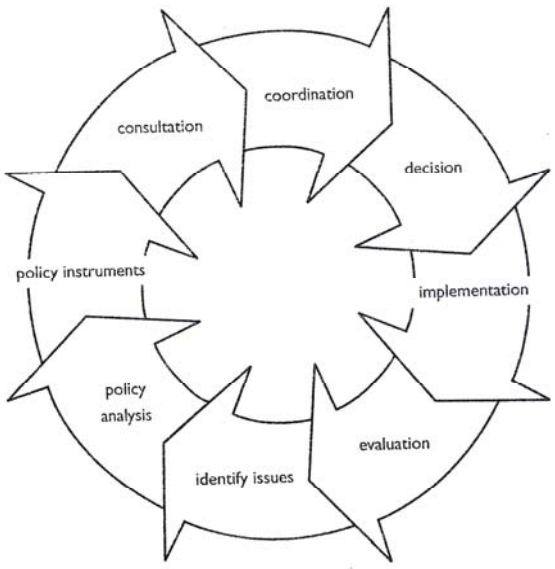

Figure 2. Key elements of a 'policy cycle' (Bridgman and Davis, 2004: 26) (reproduced with permission)

In a technical-rational approach, research can provide expert input into one or more stages – identifying the problem or issue, perhaps through needs assessment; identifying causes; analysing current policy and comparing policy options, often through cost-effectiveness or cost-benefit analysis and through the use of scenarios to examine

possible long-term outcomes; possibly assisting in consultations with stakeholders; and evaluating interventions. The technical rational model explains one aspect of policy making, which may be more or less dominant depending on the issue. For policy making on specialist issues where there are few political considerations, technical-rational concerns hold the greatest sway. This would occur in situations where competing interest groups, pressures from opposition parties and related factors do not loom large. When the technical-rational aspects of policy making dominate, the main challenges for researchers are effective communication, timeliness and the quality of their work. Most commonly though, the technical-rational process is a sub-theme rather than the leading aspect of policy making. In other words, considerations of evidence are part of the mix, but political factors are more influential, and we deal with this in more detail below.

The worst scenario for researchers is when there is a façade of a technical-rational approach and instead evidence is strategically used by politicians to hide the vested interests of the powerful and over-ride popular preferences, as illustrated in Case 3.

> **CASE 3. Using a technical-rational approach to hide powerful vested interests**
>
> In examining the history of the construction of the Aswan Dam in Egypt in the early 20th century, Mitchell (2002) argued that framing the problems of poverty and food shortages as a rational consequence of 'too many people in a small river valley' allowed political leaders to gloss over the unequal distribution of the land. The technical-rational framing excluded considerations of redistribution and land reform, with the result that the elites maintained their power and the new arable land created by irrigation from the Aswan Dam did little to alleviate the problems.

A better appreciation of the political aspects of policy making is therefore crucial. It is also worth noting that whereas research has a clear role in the technical-rational aspects of policy making, it has no self-evident role in the political aspects.

5.2. Power and pressure group facets of policy making

The reality of most government policy making is that *"political considerations are all-pervading"* (Edwards, 2004: 7) and the power of elite networks cannot be underestimated (Lewis, 2006). Thus, power and pressure groups are key aspects of policy making, with vested interests exerting influence on agenda setting, as well as on the choice of options adopted. Theories such as Sabatier's Advocacy Coalition Framework (Sabatier, 1988; Sabatier and Jenkins-Smith, 1993) explain how power is built by bringing together multiple parties with coinciding interests on a particular issue. Such coalitions may be long-standing or they may be temporary and issue-specific, especially when the partners have opposing positions on other issues. Sometimes policy is created through the overwhelming dominance of one coalition. At other times there are competing coalitions and the resulting policy is a compromise rather than an outright win for either side. The situation is commonly complicated with several alliances, whose interactions change as political circumstances evolve. Case 4 illustrates the complexities of multi-faceted regulatory environments where there are multiple, shifting advocacy coalitions, working across a range of issues.

CASE 4. Multiple issues, shifting alliances

The aspirations of private sector biotechnology companies to open new agricultural markets in developing countries have led to new alliances and new impetus for policy development. In countries such as India collaborations between wealthy biotechnology companies and public research institutions have offered the promise of new technologies for greater production, access to advanced research facilities, robust new markets for seed and agricultural inputs, and the opportunities to develop sophisticated strategic and legal skills (Byerlee and Fischer, 2002). Competing alliances, such as those headed by The Institute for Food and Development Policy—Food First (www.foodfirst.org) challenge these purported benefits. They argue that biotechnology poses significant risks with few or no benefits for the poor, and that corporate approaches fail to deal with underlying issues of inequality and poverty. These two perspectives present conflicting moral positions as well as conflicting interpretations of science and political leanings. Yet this polarization is only part of a far more complex picture. In India, Scoones (2003) has documented a range of debates being fostered by the advance of biotechnology, including over its usefulness, the changing nature of agriculture including the control of food production by multinationals, the role of state governments in a federal system, and the place of regulation in Indian society. These debates embody contests over science, over politics and values, and over procedures and process, where different groups form different alliances at different times to take strategic advantage of unfolding political opportunities. Scoones (2003: 1) describes this as *"a process of co-construction of regulatory policy, operating in a hybrid world between science, business and policy…"*.

5.3. Dynamic and unpredictable facets of policy making

The influential theorist Kingdon (2003) argues that policy making occurs in a 'cauldron' where 'problems', 'politics' and 'policy processes' are swirling around. In this dynamic environment, specific events will trigger a coalescence leading to policy action. Events which cause a particular problem to come to prominence and set policy agendas include indicators showing that it has become urgent and serious, incidents focusing attention on the problem, and/or symbolic values being attached to the problem. Events are also influenced by key political factors which include the national mood, how political forces are organized and how consensus is developed through bargaining with influential interest groups. In terms of the policy process itself, whether a problem gains attention depends on other problems it is competing with, the technical feasibility of taking action, and the public and political acceptability of the problem plus its likely solutions. According to Kingdon, from time to time a policy 'window' opens where these three streams align and bring about change. The importance of Kingdon's analysis is that it highlights the extent to which policy making is unpredictable. He argues that effective policy makers can be seen as entrepreneurs, who can spot when the time is right and effectively join the problem, the solution and the political constraints. An illustration of a policy window and its exploitation is presented in Case 5.

CASE 5. Exploiting a crisis

Kurtz (2004) analysed how the 1989 Exxon Valdez oil spill led to the passage of a radically revised Oil Pollution Act in 1990. Widespread media coverage, citizen outrage and a well-prepared range of environmental groups meant that the window

of opportunity created by the spill was exploited to the full. Importantly, this was also supported by a field of expertise and expert opinion that had developed over the previous two decades to now offer a sophisticated alternative voice to the industry experts who had previously dominated policy discourses.

5.4. Incrementalist dimensions of policy making

The examples used so far have been about major policy reform. Lindblom's (1959; 1979) seminal work on "incrementalism", recognises that much policy making is not about large-scale policy change, but instead involves small adjustments to existing policies, usually to compensate for some aspect that is not working as intended. He has famously described this as a process of "muddling through". Incrementalism cuts across the three other models and is relevant to each of them.

These four models only scratch the surface of the contributions to our understanding that theory can bring. In future investigations even more could be gained from models highlighting other aspects of policy making, as well as more complex theoretical analyses of policy, such as that undertaken by Keeley and Scoones (1999), which opens up a range of additional considerations and nuances, notably in regard to the social construction of scientific facts and how contingent actor-networks of both humans and non-humans can coalesce into particular research-policy communities.

6. Conclusions

In this final section we bring together the considerations we have highlighted above in the form of topics for further debate, theorising and empirical exploration. We argue that broadening the focus highlights areas which deserve more intense scrutiny and that this in turn will enhance the effectiveness of research support for policy decision making. The scrutiny we envisage needs to include both research and policy sectors in all their heterogeneity, as well a broad range of country, regional and global perspectives.

6.1. Should researchers choose a role in relation to policy?

Much of the research-policy interactions literature seems to be searching for a single answer for how researchers can best support policy makers. Instead, consideration of different facets of policy making suggests that there are different ways that researchers can position themselves in relation to the policy process. The theories we have discussed suggest that there are at least three key stances researchers can take. One is the independent expert, which is in line with the technical-rational aspects of policy making. Another is as the champion for a particular set of research findings, which is consistent with the power and pressure groups aspects of policy making. Third, researchers can aim to be insider confidants, who work closely with policy entrepreneurs to seize opportunities, which takes account of the unpredictable elements of policy making. We are certainly aware of colleagues who can be described as fitting these roles.

We suggest that there may be value in discussion and debate about the extent to which categorising such stances is helpful, as well as whether some are mutually incompatible. For example, we suggest that policy makers would see being an advocate as incompatible with being an independent expert. It would be helpful to know about

the benefits and risks of each role. Some of the risks involved in different forms of active engagement include difficulty keeping up with changing priorities, gagging or fear of gagging of research findings, inappropriate political pressure (Edwards, 2004), coping with the rough and tumble and messiness of policy making (Heyman, 2000), policy makers' drive to focus on policy solutions that are 'doable' and 'announceable' (Nathan et al., 2005) and the political targeting and denigration of researchers, whose research may bring policy or proposed policy change into question.

It would also be useful to have empirical evaluation of when particular stances are most effective, as well as the extent to which policy change relies on a balance between different researchers taking different positions. In other words does effective policy change rely on having some researchers as objective experts who can provide 'facts', some who are highly engaged advocates who are involved in the cut and thrust of lobbying and some who work on the 'inside', providing sounding boards as policy makers grapple with difficult decisions.

Such considerations are not only relevant for individual researchers, but also for research organisations, which may choose to require all their researchers to conform to a particular stance or which may seek to incorporate a range of stances. In terms of the risks associated with engagement, consideration also needs to be given to the roles and responsibilities of research institutions in shielding their research staff.

6.2. How do we enhance regional and global jurisdictional focus?

Many established theories of policy making tend to focus on the national level. However, most of the pressing environmental challenges do not respect country borders, so that the complexities in research support for policy making seen at a national level are magnified at the regional and global scales. How can research best support decision making on regional and global problems, where cross-country considerations mean the relevant policy makers and researchers may be numerous and diverse? In addition, the institutional arrangements for both policy making and research-policy engagement on regional and global scales may be absent or poorly defined.

6.3. How do we best deal with the challenges of limited research capacity?

Limited research capacity has many dimensions. As we have highlighted earlier, overall there are not and can never be enough researchers to tackle all the problems that society faces. Low income counties, in particular, have a dearth of researchers. In health this has led to the so-called 10/90 gap where less than 10% of the investment in global health research is devoted to problems that account for 90% of the global disease burden (Global Forum for Health Research, 2004). This leads to a number of questions that warrant widespread debate. How do we ensure equity in the problems that lead to mobilisation of research effort? It links back to the issue of global and regional focus and raises the question of how do we balance local, national, regional and global concerns? Limitations in research capacity are also important in achieving balance in researcher roles. This is not only relevant to the most effective proportions of independent experts, advocates and insider confidants, but also raises broader questions about 'enlightenment' researchers and policy critics. Should all researchers be engaged in relevant research – whether it is policy or commercial relevance? Or is there still room for researchers to follow their own hunches about what is important? And what about policy critics? Prewitt (1983: 294) suggested that *"Social science makes it most profound contribution to policymaking when it subverts rather than tries to*

accommodate itself to pre-existing policy premises". Given the limitations in numbers of researchers, what is the appropriate mix of policy-engaged, policy-critical and 'enlightenment' researchers? Can individual researchers apportion their own research into these three categories and what is the best balance?

6.4. How can we encourage evaluation of research-policy interactions?

We have discussed the dearth of evaluation of research-policy interactions and how that limits our ability to learn what works, when and why. How do we encourage a stronger evaluation culture? How do we balance the need for evaluation with limited research capacity? In other words how much research capacity should be diverted to evaluation? Improved evaluation of research-policy interactions is likely to also subject both research and policy to more scrutiny. We deal with the latter below. In terms of research, a stronger evaluation culture would be helpful in providing information for reflecting on the balance between different research roles, as well as ensuring that limited research capacity is used most effectively.

6.5. Should policy makers be more accountable for how they use evidence?

By and large our considerations in this paper have focused on researchers rather than policy makers, but the question could also be asked whether policy makers should be more accountable for how they use evidence? This would seem to have a number of benefits, but might also lead to a greater politicisation of research. A related question is whether democracy requires an effective balance of different kinds of researcher stances? Such considerations complement moves to make policy makers responsible for the creation of 'public value' (Moore, 1995), rather than being guided by fickle political whim. Creating public value requires periodic review of public sector functions and organizations in terms of their effectiveness in achieving their goals, along with the efficiency and fairness of their processes. It may mean recasting the mission, repositioning organizations or introducing new programs so that capabilities can be used more responsively and effectively in light of new political aspirations or changed social circumstances. These considerations are also linked to lack of evaluation, in this case of policy making more generally, as well as of research-policy interactions.

The central argument of this paper is that considerations of research-policy interactions have been too narrow and that broadening the focus raises critical questions which have yet to receive the attention they warrant. We have illustrated this by bringing together four areas which are generally treated separately: research-policy interactions, their evaluation, considerations of research amount and quality, and theories of policy making. The days when researchers gloried in the 'practical uselessness' of their investigations (Passmore, 1978) are well and truly over. However, there is not yet a well thought-through position on how research can best support policy making, particularly policy making which is aimed at effectively dealing with complex social and environmental problems. The profound likely impacts and urgency of a range of environmental problems both highlight this need and provide a stimulus for action. We want to encourage others to take a broad view and to join us in examining and debating key issues of research equity, research limitations and researcher stance vis-à-vis policy.

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