

Political science? Strengthening science–policy dialogue in developing countries

Nicola Jones, Harry Jones and Cora Walsh

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Results of ODI research presented
in preliminary form for discussion
and critical comment

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in developing countries**

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List of acronyms

BSE	Bovine Spongiform Encephalopathy
CFC	Chlorofluorocarbon
CFPA	China Foundation for Poverty Alleviation
CGEE	Center for Management and Strategic Studies (Brazil)
CHBRP	California Health Benefits Review Programme
CHSRF	Canadian Health Services Research Foundation
DEFRA	Department for Environment, Food and Rural Affairs (UK)
DFID	Department for International Development (UK)
EBPDN	Evidence-based Policy in Development Network
FAO	UN Food and Agriculture Organization
GIS	Geographical Information System
GM	Genetically Modified
HoC	House of Commons (UK)
IAC	InterAcademy Council
IDS	Institute of Development Studies
IFAD	International Fund for Agricultural Development
INASP	International Network for the Availability of Scientific Publications
MENA	Middle East and North Africa
MMR	Measles, Mumps and Rubella (vaccine)
MRC	Medical Research Council (UK)
NGO	Nongovernmental Organisation
ODI	Overseas Development Institute
PRSP	Poverty Reduction Strategy Paper
R&D	Research and Development
RAPID	Research and Policy in Development programme (ODI)
S&T	Science and Technology
ST&I	Science, Technology and Innovation
UK	United Kingdom
UN	United Nations
UNDP	UN Development Program
UNESCO	UN Educational, Scientific and Cultural Organization
UNICEF	UN Children's Fund
US	United States
WHO	World Health Organization

Executive summary

Overview

Science and technology are playing an increasingly important role in the policy process. The value of science and technological information is already well-established in the fields of health, agriculture and natural resource management, but issues such as climate change, food security and biotechnology have recently attracted a high profile in international policy debates about sustainable development and poverty reduction. These trends are set against a background of increasing international interest in and rhetorical commitment to evidence-informed policy dialogue and processes as a means to improve development policy and practice. Surprisingly, however, there is a dearth of research that systematically examines the science–policy interface in developing countries. Even fewer analysts have sought to offer practical strategies and recommendations for strengthening linkages between scientific knowledge and the policy process.

This study contributes to filling this gap by providing a multi-layered analysis of the science–policy interface in developing countries. It draws on work carried out by the Overseas Development Institute (ODI) Research and Policy in Development (RAPID) programme and a number of partners, commissioned by SciDev.Net, a UK Department for International Development (DFID)-funded knowledge intermediary working towards improved uptake of scientific and technological information in development policy and practice. The analysis combines theoretical and empirical strands, comparing Northern and Southern contexts and drawing out theoretical insights as well as providing practical recommendations for action. It focuses on three broad questions: What is the patterning of relationships between scientific researchers, policy decision-makers and intermediaries in developing country contexts? What are the challenges and opportunities for strengthening these linkages? What types of strategies exist or could potentially be adopted to improve evidence-informed policy processes?

Representing the views of over 600 respondents from researcher, policy-maker and intermediary organisation communities from the North and South, the findings confirm the need to tackle systemic barriers to institutionalising evidence-informed policy processes in the field of science, technology and innovation for development. They also shed light on ways in which the quality of policy dialogues on science and technology could be strengthened in order to enhance their value for pro-poor sustainable development policy and practice.

Research methodology

The methodology adopted in this study combined quantitative and qualitative methods in a phased approach. First, a systematic literature review was employed, based on a modified version of the expert-recommended systematic literature review approach pioneered by the Canadian Health Services Research Foundation (CHSRF). The review sought to map out the characteristics of the science–policy interface in developing country contexts and strategies to improve the quality of interaction among scientists, policy-makers and intermediaries. Second, expert interviews were used to complement these findings and to explore in greater depth the enabling and constraining factors that shape science–policy debates and processes in the developing world. Given a general dearth of country-specific studies on the science–policy interface in developing countries, ODI and the International Network for the Availability of Scientific Publications (INASP), together with country partners, also undertook seven country case studies in Asia, Latin America and sub-Saharan Africa to explore: i) relations between the scientific research and policy communities in each country; ii) the ways in which policy-makers access scientific and technical information; and iii) examples of success and failure in bridging science and policy, and also to iv) map potential means of collaboration for intermediary organisations working at the science and development policy interface.

In the second phase of the study, an international electronic survey was designed based on the hypotheses generated through the first phase of the review. More than 600 stakeholders from developed and developing country contexts participated in the survey. The survey results were analysed using largely descriptive statistics, disaggregating responses by sub-groups of respondents (policy-makers, intermediaries and researchers), as well as by region and income level.

Analysis and triangulation of evidence

The first half of the paper takes stock of existing knowledge on the science–policy interface and identifies six key tensions present to varying degrees in both developed and developing country contexts. These include: i) the politicisation of science on the one hand and the scientisation of policy on the other, ii) tension between engaged or ‘citizen’ scientists and neutral scientists who choose to remain outside policy discussions; iii) the demand for certainty from policy-makers versus the inherent uncertainty and risk-oriented nature of much scientific research; iv) divergent professional motivations and timescales among scientist and policy-maker communities; v) the need to promote specialised expertise versus calls to democratise knowledge so as to encourage greater public participation in science-related debates; and vi) a tension between Western-driven scientific paradigms and indigenous knowledge. This section also maps out a number of strategies identified in the literature to improve the interaction between researchers and policy-makers in an effort to harness more effectively the insights of science for policy purposes. Overall, what is striking about this literature is the relative dearth of empirical analysis in developing country contexts. This is particularly pronounced with regard to the role of ‘intermediary organisations’ or ‘knowledge translators’ and ‘knowledge brokers’ in bridging the science–policy divide.

The second half of the paper then turns to a triangulation of the primary research undertaken for this report – the international survey, expert interviews and country case studies. The following key themes emerged.

Poorly institutionalised evidence-based policy-making needs to be recognised and tackled

Evidence-based policy-making is poorly institutionalised as a process in developing country contexts. Owing to a lack of accountability and/or formal mechanisms for the integration of scientific knowledge into policy, scientific research is often used selectively at the discretion of policy-makers. Therefore, policy priorities often drive the usage of research, rather than research stimulating policy recommendations. Knowledge translators and knowledge brokers need to be mindful of this when developing strategies to communicate scientific, technological and innovation (ST&I) research findings to policy audiences.

Audience-appropriate information targeting is imperative

ST&I information must be targeted according to the needs of specific actors in the policy process and the stage in the policy process at which different actors use ST&I information. Science-oriented ministries were primarily interested in science for agenda setting and policy formulation, whereas non-science ministries relied more on scientific research at the policy implementation and evaluation stages.

Intermediary organisations are needed to act as knowledge brokers and capacity-builders for researcher and policy-making communities

Scientific researchers often conduct research in line with long-term goals, whereas policy-makers require information that responds to short-term goals. Researchers tend to use technical jargon and embrace uncertainty and risk, whereas politicians desire language that is policy-relevant. Accountability lines differ as well, with researchers answering to funders, and policy-makers to their constituencies, stakeholders and political parties. There is therefore a strong need for intermediary organisations to act both as knowledge brokers at the science–development policy interface and as capacity-builders for both researchers and policy-makers. However, the degree of unmet need is such

that few successful pathways forward have been identified. This suggests that various options could usefully be piloted and evaluated.

Interaction and deliberation rather than uni-directional research dissemination is needed to bridge the ST&I researcher policy-maker gap

In order to bridge the gap between ST&I research and policy-making, there is a strong need to go beyond the dissemination of research findings. Instead, greater interaction, discussion and deliberation between researchers and policy-makers are called for. While online formats were considered useful, face-to-face interactions were preferred by most policy-makers.

Policy-engaged scientists are critically important

The complexities of the policy environment often intimidate researchers, owing to the risks of the politicisation of science as well as a limited understanding of the policy-making process. However, there is a strong desire on the part of Southern policy-makers in particular for scientific findings to be complemented by policy-relevant recommendations. Policy-makers and development practitioners would be able to make greater use of scientific research findings if scientists would engage more openly with the resulting policy implications and present a range of possible policy options. Particularly when government priorities lie in social science areas, such as poverty reduction, the relevance of scientific information for development policy must be communicated.

Improving public understanding of ST&I will facilitate better policy dialogues

There is a strong interest by policy-makers and researchers in greater public participation in ST&I-related policy debates, facilitated by initiatives to improve public understanding of ST&I so as to promote the emergence of a more informed and engaged public. However, although fears about the risks of the democratisation of scientific knowledge identified in the theoretical literature were largely not borne out by developing policy actors active at the science–policy interface, the challenges involved in reconciling Western scientific knowledge and indigenous conceptualisations of knowledge were recognised as considerable.

1. Introduction

Science-related issues, such as climate change, food security and biotechnology, and their relevance for development and poverty reduction, are attracting growing international attention. At the same time, the value of science and technological information to development is already well-established in fields such as health, agriculture and natural resource management. These trends are set against a background of increasing international interest in and rhetorical commitment to evidence-informed policy dialogue and processes as a means to improve development policy and practice. Surprisingly, however, there is a dearth of research that systematically examines the science–policy interface in developing countries. Even fewer analysts have sought to offer practical strategies and recommendations for strengthening these processes.

This study contributes to filling this gap by providing a multi-layered analysis of the science–policy interface in developing countries. It draws on work carried out by the Overseas Development Institute (ODI) Research and Policy in Development (RAPID) programme commissioned by SciDev.Net, a knowledge intermediary working towards improved uptake of scientific and technological information in development policy and practice. The analysis combines theoretical and empirical strands, comparing Northern and Southern contexts and drawing out theoretical insights, as well as providing practical recommendations for action. It focuses on three broad questions: What is the patterning of relationships among scientific researchers, policy decision-makers and intermediaries in developing country contexts? What are the challenges and opportunities for strengthening these linkages? What types of strategies exist or could potentially be adopted to improve evidence-informed policy processes?

The paper is structured as follows. In Section 2, we outline the methodology used to carry out the study, highlighting the value of our multi-pronged approach. Section 3 examines existing literature on the science–policy interface, reviewing key challenges – presented as six tensions – and strategies to tackle these. Section 4 presents the results of our empirical investigations, exploring the findings of an international survey, key informant interviews and seven country case studies in relation to the tensions and strategies highlighted by the literature. Section 5 concludes.

2. Methodology

The methodology adopted in this study combined quantitative and qualitative methods in a phased approach.

2.1 Literature review

This study began by employing a modified version of the expert-recommended systematic literature review approach pioneered by the Canadian Health Services Research Foundation (CHSRF) (see Lomas et al. 2005).¹ This methodology is a highly comprehensive way of investigating literature on topics that may be spread over a number of different disciplines. It combines carefully targeted searching efforts with expert contributions in a process that is based on fostering a virtuous circle that increases the flow of high-quality, relevant and cutting-edge information. This study entailed the following steps:

- First, an initial list of experts, organisations and papers was collated using contacts from ODI and SciDev.Net, papers and organisations identified by these contacts and web searches. The decision to include sources was made jointly, based on perceived relevance to the research questions. The sources formed the basis for an inception study that set out an analytical framework to guide the proceeding stages of the research.
- The database of contacts, literature and organisations was expanded through a ‘snowballing’ technique. Experts were contacted for recommendations for contacts, literature and organisations; literature was scoured for additional references as well as key authors and organisations; and organisations’ websites were searched for key informants, literature and other relevant organisations.
- The co-authors independently and then jointly selected 42 sources for review from the resulting database of sources, drawing on the analytical framework for the study. This review was facilitated using a qualitative data analysis package, MAX QDA. Through a process of coding texts, MAX QDA helped in synthesising the information and identifying themes and trends in the literature.

2.2 Expert interviews

Expert interviews were used to complement the literature review and to explore in greater depth the enabling and constraining factors that shape science–policy debates and processes in the developing world. The process saw 31 key informant telephone interviews, using an open-ended format that allowed participants to expand on the questions most pertinent to their context, experiences and conceptual understanding of the field. Questions were framed around broad dimensions of the science–policy interface: strategies for bridging scientific research and policy-making communities, communication channels and the appropriate role of intermediaries.

From a list of 143 possible experts generated from the snowball search (see above), a balance was reached of international and national policy-makers, researchers and academics and intermediaries. To complement the seven developing country case studies, experts were selected primarily from developed countries, the majority working either on international development policy issues or in developing country contexts. Informants included 11 policy-makers (two from multilateral institutions, nine national policy-makers), eight researchers (two natural scientists, six social scientists) and 12 intermediaries (nine of whom specialise in advocacy or capacity-building and three of whom work in media).

The expert interviews allowed us to triangulate and corroborate a number of emerging conclusions, including the general scarcity of analysis on boundary organisations in developing country contexts. In

¹ The methodology is described in detail in Appendix 1.

addition, key informants provided a number of insights that went beyond themes in the literature and suggested potential future directions for the field (see Section 4).

2.3 Country case studies

Given the dearth of country-specific studies on the science–policy interface in developing countries,² ODI and the International Network for the Availability of Scientific Publications (INASP), together with partners, undertook seven country case studies to explore: i) relations between scientific research and policy communities in each country; ii) ways in which policy-makers access scientific and technical information; and iii) examples of success and failure in bridging science and policy and also iv) to map potential means of collaboration for intermediary organisations working at the science and development policy interface. Local partners were selected to represent the following geographic regions: Latin America, sub-Saharan Africa and East, South and Southeast Asia.³ The seven partners included a mix of academic, civil society and government partner organisations:

- San Andrés University (Bolivia)
- Medicam, a health-related nongovernmental organisation (NGO) civil society umbrella organisation (Cambodia)
- The China Foundation for Poverty Alleviation (CFPA) (China)
- The Kwame Nkrumah University of Science and Technology (Ghana)
- Praxis Institute for Participatory Practices (India)
- Universidad Nacional Agraria (Nicaragua) and
- Civil Society for Poverty Reduction (Zambia)

Each partner organisation was responsible for coordinating the case study research process, which included the following components:

- Identifying key researchers, policy-makers and intermediaries in the science–policy interface;
- Conducting 20 semi-structured interviews with key informants (researchers, policy-makers and intermediaries) from a range of different science-related fields (local partners were encouraged to conduct interviews in person in order to probe and explore questions in greater depth);
- Facilitating a focus group meeting to explore and debate in more depth any issues emerging from the key informant interviews; and
- Preparing a country study report, including a rapid overview of the literature on the local science and policy environment.

Partners were provided with detailed guidance notes, including a questionnaire for stakeholder interviews. However, flexibility and local adaptation were encouraged.

2.4 Internal electronic survey

In the second phase of the study, an electronic survey was designed based on the hypotheses generated through the first phase of the review. These hypotheses related to five broad themes in the science–development policy interface:

- Understanding how science, technology and innovation-related (ST&I) policies are developed;
- Learning how countries can be supported in strengthening their ST&I systems;
- How ST&I can be used to achieve other development policy goals (e.g. in health, agriculture, poverty reduction, etc);
- Understanding how ST&I information is accessed for policy-making and what types of information are most useful/effective for policy actors working in different ST&I and non-ST&I policy arenas and different levels of government (regional, national and sub-national);

² The main exception to this is South Africa.

³ Representation was sought from the Middle East and North Africa (MENA) region, but time constraints meant that this case study did not take place.

- Developing an understanding of how an intermediary organisation can facilitate the communication process between ST&I and policy-making communities.

The survey was divided into two modules. The first module included questions pertaining to all stakeholders involved in the science–development policy interface, including: i) respondent’s profile; ii) access to information for evidence-based policy-making; iii) types of products for research communication; iv) desired outcomes of a web-based scientific–policy intermediary organisation; and v) relative influence of science on policy.

The second module was divided into three sections, each designed to target issues encountered by specific subsets of stakeholders: policy-makers, intermediary organisations and academics/researchers.⁴ Respondents were asked to answer only one of these three sections, depending on their professional background.⁵

Owing to the large projected sample size of the survey and the relatively short period of time allotted for analysis, the survey was largely quantitative in design. Most questions were formatted as ranking on a five level Likert-type scale (e.g. ‘How effective is each of the following options ... ?’ not effective, somewhat effective, satisfactorily effective, usually effective, highly effective). Ranking was chosen in order to be able to understand the relative importance of priority issues and to provide a more nuanced picture of responses, while retaining the ability to code a large quantity of responses. At the request of pilot respondents, extra space was provided for additional free-text comments so that participants could qualify their responses and give some qualitative depth to the more complex issues addressed in the survey. The survey was converted into an electronic survey using the free-access computer program N-Survey.

Stakeholders were identified as any group involved in the science–development policy interface, targeted through the following categories: academics/researchers; intermediary organisations; NGOs; donors; industry (research and development – R&D); legislators; science-related ministries; non-science-related ministries (e.g. health, social policy, rural development, etc); political advisors; international scientific bodies; and multilateral organisations. An initial database of stakeholders was generated based on contacts with profiled organisations, contacts from the Phase I expert interviews and country studies, as well as databases from ODI, the Evidence-based Policy in Development Network – EBPDN, INASP and SciDev.Net. An email/newsletter advertisement for the survey was sent to these contacts, and additional advertisements were placed on the EBPDN and INASP websites. From this starting point, a ‘snowballing’ technique was used for sampling, asking contacts to recommend further contacts within the field. Additionally, country partner organisations in China (CFPA), India (Praxis) and Brazil (the Center for Management and Strategic Studies – CGEE) carried out 16 interviews each with sub-national-level policy-makers. In total, the potential sample size reached 4,020.⁶ The total number of respondents for the survey was 617, indicating a response rate of 15% based on the potential sample size contacted. The survey was also distributed by three country partner organisations in order to target sub-national-level policy-makers and government officials. See Tables 1-3 for a breakdown of respondents.

⁴ For the purposes of this survey, we employed the following stakeholder group definitions: academic/researcher (those conducting primary scientific or technological research); intermediary organisation (those operating in the space between scientific research and policy-making, including NGOs, knowledge-brokering organisations, advocacy coalitions, etc); and policy-makers (those involved in policy-making at the international, regional, national or sub-national level).

⁵ For a complete copy of the survey questions, please see Appendix C.

⁶ This potential sample size is based on the known sizes of the database mailings and approximate numbers of peer mailings carried out through ‘snowballing’ from the initial core sample. This does not include the number of individuals potentially viewing the advertisements on websites, or ‘snowballing’ by respondents passing on the survey information to colleagues.

Table 1: Overview of respondents

Sub-groups of respondents	Number of respondents	% of total
Researchers	288	46.7
Intermediaries	214	34.7
Policy-makers	113	18.3
Sub-national policy-makers (subset of policy-makers)	41	6.6

Note: Total sample size: 617.

Table 2: Regional affiliation of respondents

Regional representation	Number of respondents	% of total
Sub-Saharan Africa	120	19.4
South Asia	110	17.8
Latin America	66	10.7
MENA	41	6.6
China and Southeast Asia	21	3.4
Developing countries total	394	63.9
Global North	224	36.3

Table 3: Organisational affiliation of respondents

Type of organisation	Number of respondents	% of total
Academic institution	202	32.7
Science-related ministry	107	17.3
NGO/advocacy group	87	14.1
Industry	25	4.1
Multilateral	25	4.1
Media organisation	24	3.9
Non-science-related ministry	23	3.7
International scientific panel	8	1.3
Legislature	7	1.1
Political advisory	4	0.6

The survey results were compiled and analysed using largely descriptive statistics, disaggregating responses by sub-groups of respondents (policy-makers, intermediaries and researchers), as well as by region and income level (i.e. low-income vs. middle-income countries). Results were then compared across these categories to find significant patterns and differences. Large differences between groups and variables were then tested for significance using the Chi-square test.

3. The science–policy interface: Taking stock of the literature

Knowledge from the natural sciences faces similar barriers to knowledge produced by other disciplines in terms of its uptake in policy processes. These difficulties include:

- A lack of political will
- Poor communication between researchers and policy-makers
- Limited responsiveness of research to current policy concerns
- Ineffective lobbying and inappropriate targeting and
- Limited researcher credibility in the eyes of policy-makers

However, certain features specific to science shape the opportunities and challenges in bridging scientific research and policy. On the one hand, the methodological rigour and objectivity of science often confers a higher degree of credibility on scientific information.⁷ There is also increasing global public attention to the sciences, owing to high-profile issues such as climate change, food security and genetically modified (GM) crops. On the other hand, there is often limited understanding of science and its relevance, and thus low capacity among policy-makers to engage with scientific issues, especially when compared with economics and the social sciences within public policy. Moreover, natural scientists tend to have comparatively less knowledge of policy processes, given the technical nature of their research.

In developing country contexts, the challenge of promoting the use of scientific information in policy processes is even more complex than in developed countries. First, personal relationships are a particularly salient factor in the uptake of research into policy in developing countries (Innvaer et al., 2002). Credibility is frequently premised on personal ties and trust, relegating standalone scientific findings to a less influential position relative to that in developed countries.

Second, the capacity of civil society and the general public to respond to scientific evidence in policy debates is more limited, owing to lower levels of education and of knowledge of science among the media (Joubert, 2001).

Third, there is often a ‘gulf’ between the culture of science and the general social culture in the South (Manzini, 2003). Indeed, in some contexts, science is mistrusted, portrayed as ‘corporate’, ‘imperialist’ or ‘totalitarian’ (Herring, 2007), or feared and resented owing to previous negative events, thus undermining the legitimacy of using scientific information. For instance, the widespread belief that scientists are responsible for nuclear and ecological disasters in the Asia–Pacific region has led to the mistrust of science in that area (Wiltshire, 2001). This trend results in a lower level of comfort among the public and policy-makers and less willingness to use scientific advice. A clear example of this can be seen in the debate over biotechnology in India, whereby mistrust and discontent over transgenic cotton crops led to a devaluation of scientific knowledge and pushed the government towards policies based on flawed evidence that could have adverse consequences for the poor (Herring, 2007).

The following discussion explores the science–policy interface in more depth, reviewing key challenges – which we present as six tensions – and strategies to tackle these. We focus primarily on developing country research but, owing to the fledgling state of this body of evidence, also incorporate developed country literature, as the latter yields broader and more detailed knowledge of the science–policy interface and serves as a foil to the insights of the developing country literature in the review process.

3.1 Characterising the science–policy interface

An overarching theme in the literature on the science–policy interface, from both developed and developing country contexts, involves the competing pressures and difficulties that must be overcome

⁷ It has been remarked that, in this way, science holds a privileged position in modern society (Weingart, 1999).

for scientific information to reliably influence the policy agenda. We have, therefore, framed the features of the science–policy interface in terms of tensions, which encapsulate the positions of scientists and policy-makers in relation to their own fields, to one another and to society at large. Although under closer scrutiny these tensions may turn out to be more complicated, involving possible tradeoffs between a number of different dimensions,⁸ they serve to highlight some key areas of debate.

3.1.1 Politicisation of science and scientisation of politics

The politicisation of science, whereby scientific research is manipulated for political gain, is a much discussed challenge in the literature about the science–policy interface. Analysts emphasise the need to recognise and tackle illegitimate pressure used to influence the findings of scientific research or the way it is disseminated, reported or interpreted. Often, the target of policy-makers’ and the public’s criticism shifts from the interpretation of scientific information to the research itself or the researcher. This process is frequently accompanied by the manipulation of scientific research and challenges to scientific autonomy, as discussed by Rosenstock (2002), who analyses attacks on science that are driven by vested interests committed to a predetermined outcome of the evidence.

One such trend can be seen in the increasing role of industry-sponsored research. At the extreme are instances in which industry sponsors research with the direct goal of countering existing scientific opinion. Economic interests may adversely affect scientific integrity by delaying or withholding research results and by directly or indirectly influencing the content of results. Such tactics are used to exploit scientific uncertainty and to deflect attention from what is known and from the actions that would credibly follow from that knowledge. Other approaches include the use of hidden identities and harassment. In addition, scientists may use their work to promote personal positions on policy issues, as Lackey (2006) finds in the field of ecological science, rather than allowing evidence to guide the development of sound policy. By challenging science and exposing potential personal biases infused in science in these ways, political forces can illegitimately undermine the credibility of scientific information in policy.

One example of encroachment on scientific autonomy can be found in the earlier example of the Bovine Spongiform Encephalopathy (BSE) saga, where there were suggestions that the process of using scientific advice in the UK was too open to political interference. A conflict of interests involving powerful industry players within the (then) Ministry of Agriculture, Fisheries and Food was compounded by a number of factors: the deliberations and interactions between scientists and policy-makers were not transparent; highly restrictive assumptions framing the process were not made explicit; and there was insufficient institutional separation between those providing political and scientific input (Millstone and van Zwanenberg 2001). Another example from the UK context highlights the risk of certain actors at the boundary (such as grant review boards or science and technology ministries) playing a negative role. Waterton (2005) (focusing on the UK context, including the Office of Science and Technology) argues that, in the process of negotiating between the policy-making and scientific spheres, questions may be framed in a way that rules out ‘good science’ in advance. This stems from the dominant role played by policy-makers who direct funds but typically lack sufficient scientific knowledge. It is therefore important to ‘police’ the science–policy boundary and for scientists to strive to ensure transparency. It is also key to have in place regulations to help strengthen and maintain scientific norms when negotiating engagements between researchers and policy-makers (Lackey 2006, Waterston 2005).

The politicisation of science goes hand-in-hand with the scientisation of politics. A phenomenon more in the developed country literature, the scientisation of politics is concerned with the increasing use of scientific evidence to justify political ends by removing scope for value-based political debate (Weingart, 1999; Hoppe, 1999). Scientific research and advice is now pervasive in developed country

⁸ For example, the tension between indigenous and Western scientific knowledge involves not only questions about the quality of policy and respect for peoples’ democratic rights, but also factors associated with the practicalities of incorporating multiple perspectives into policy debates, which can prolong the length of policy-making processes and perhaps even result in poorer (less focused) policy decisions.

policy debates. As a result, there is a tendency for much of what is at stake in a political debate to be presented as a 'technical' matter for apolitical dispassionate analysis, rather than a substantial matter involving values, ethics and argumentation. This 'technocratic' mode of policy-making that has emerged from the scientisation of politics relates back to a major trend in political thought (for example, Max Weber), described by some as the 'rationalisation of modern states', which has been criticised for ignoring the recursive, value-driven nature of the relationship between science and politics (see Habermas, 1966). It does not constitute a prominent issue in developing country literature, although it is emerging as a concern in some assessments of multilateral institutions' use of science. For instance, it is argued that environmental research is used to gloss over highly politicised aspects of the struggle for natural resources in poverty reduction strategy papers (PRSPs) (Waldman, 2005).

The scientisation of politics may lead to the misuse of science: scientific research can be used to hide value judgements behind political positions and to obscure contentious issues in difficult debates. Caveats and uncertainties inherent in scientific findings are often glossed over or ignored (Weingart, 1999) and, in general, research is purposely misused to give spurious justification for policies that may not otherwise be accepted. For example, Millstone and van Zwanenberg (2001) argue that the first scientific committee to advise on BSE in the UK was set up to provide political support to officials, providing spurious scientific legitimisation for policy decisions stakeholders might not otherwise accept. Another example can be seen in the tenuous links between policy on anti-social behaviour orders and the research upon which they are supposedly based (HoC S&T Committee, 2006). These misuses of science in politics have the overall effect of damaging the legitimacy of scientific information and, among some actors, even the credibility of science as a discipline.

3.1.2 Engagement vs objectivity

Much of the literature on evidence-based policy argues that policy engagement is crucial to facilitate research uptake in the policy process (e.g. Innvaer et al., 2002). This is an issue of contention for researchers from the natural sciences. Some argue that scientific engagement with policy undermines the core values of science: scientific research should be guided according to scientific principles alone and, given the risks of the politicisation of science, it is crucial to maintain a separation between scientists and policy-makers.

This position is taken by the environmental scientist Lackey (2006), who also contends that scientific credibility is threatened by the personal agendas of some scientists, who advocate personal positions on policy issues. He argues that, in order to promote objectivity and regain scientific credibility, scientists need to be strictly objective, simply providing neutral information to policy-makers without commenting on policy options. Similarly, Scott et al. (2007) argue that scientists presenting research with a preferred policy option – which many see as a standard element in giving relevant advice – in fact risk losing the opportunity to inform and influence policy processes owing to a loss of objectivity. Many researchers are unwilling to engage in policy dialogue because (with political encroachments on scientific autonomy) it is professionally safer to focus solely on research and risky to advocate on behalf of anything, even science.

However, Higgins et al (2006) point out that the escalating abuse and politicisation of science itself poses a threat to scientific objectivity: when scientists recoil too far from the policy implications of research, they leave a 'vacuum'. This is filled by politically motivated parties who offer their own interpretations and who, without credible opposition, may mislead the public towards their own goals. For example, the US media largely ignored instances of scientific abuse by the Bush administration, exemplified in its approach to climate change and its championing of abstinence-only sex education, until scientists began speaking out (ibid). Although the way in which such dynamics play out will be context-specific, this example highlights the fact that a certain level of engagement in policy dialogues may be needed to **protect** objectivity. This point is further reinforced by Bielak et al. (2008), who stress that there is a need for small 'c' communication that prioritises regular and sustained dialogues among policy-makers, scientists and intermediaries, rather than communication initiatives that seek to push out the 'right message'.

3.1.3 Space for risk and uncertainty vs demand for certainty in policy-making

The nature of scientific knowledge renders it challenging to translate scientific research findings into information relevant to policy-makers. Scientific findings tend to involve a number of caveats and to produce guidance that must be properly qualified with statements of uncertainty and risk. This is in conflict with the need for quick and secure procurement of reliable information for policy-making purposes. The stereotypical situation is that policy-makers get frustrated that scientists cannot give a quick, simple answer, whereas scientists find this an unrealistic expectation (Choi et al., 2005). The situation is often aggravated by the way that risk and uncertainty are portrayed by the media, which tend to present opposing views on each side of an argument, regardless of the relative weight of support for those opinions. This can lead to confusion and fear. For example, unusual hazards that pose relatively little danger occupy a disproportionate amount of media attention, as seen in the media coverage of the measles, mumps and rubella (MMR) vaccine, which was linked to autism in children. On the other hand, proven and extensive health risks are not so extensively covered (HoC S&T Committee, 2006). Thus, a major challenge in translating scientific information is to ensure that risks and uncertainty are properly understood and incorporated while ensuring that the information produced is usable in the political domain.

This difficulty of introducing risk and uncertainty into policy dialogues can be exacerbated by the politicisation of science, resulting in the ‘inflationary’ use of science. Here, scientific evidence serves to intensify controversies, as the use of expertise in policy-making is driven beyond the realm of consensual science to the research frontier, where knowledge claims are uncertain and contested. As different fields of science try to capture media attention, such ‘over-selling’ may threaten the credibility of science (Weingart, 1999). In a study of science and politics in international environmental regimes, for example, it was found that policy-makers perceived that it was important to draw on research-based knowledge even where the state of the scientific knowledge was recognised to be relatively poor (Andresen et al., 2000). The Global Climate Change Convention, the Convention on Long-range Transboundary Air Pollution (acid rain) and the international protocols on measures to prevent the depletion of stratospheric ozone all constitute examples where uncertainties and knowledge gaps have been exploited for tactical purposes in international negotiations. This suggests that conclusive evidence is not a necessary condition for policy action (ibid).

3.1.4 Scientists’ vs policy-makers’ focuses and timescales

Another key tension at the science–policy interface concerns the divergent timescales of scientists and policy-makers. The time-consuming nature of ‘pure’ scientific research does not fit well with the demands of politicians, who are often compelled to work to very tight constraints (Choi et al., 2005). It becomes a significant challenge to produce credible information that is also salient to policy decisions.

Perhaps not surprisingly, the focus of scientific research and the problems with which policy-makers must deal are also often misaligned. Scientific research projects are often too narrowly focused to have an impact on policy debates that typically span a wide range of issues from a number of disciplines (Scott, 2006). Making explicit linkages to socioeconomic trends and concepts is therefore critical when seeking to influence high-powered stakeholders with new scientific information (HoC S&T Committee, 2006, Lomas et al., 2005), as many actors see the primary value of science as a spur to economic transformation and growth (Leach and Scoones, 2006).

Leach and Scoones (2006) argue that, while universalised views of poverty problems and a one-way transfer of ‘quick fixes’ may be useful to mobilise global resources, these approaches can ‘badly miss their mark’ if global initiatives are not linked to local definitions of problems and solutions. Similarly, Clark and Juma (2002) highlight the frequent disjuncture between the scale at which science and technology solutions tend to be designed and the level at which problems are best addressed, arguing that donor-driven, science-driven and technology-driven programmes often do not best serve the aims of sustainable development. This is also mirrored in the tensions between the need for large-scale and immediate investment of donor aid in Africa and the importance of instigating more time-consuming

‘bottom-up’, participatory communication processes with poor people in Africa in order to ensure citizen-relevant policies (Commission for Africa, 2005).

3.1.5 Specialised expertise vs democratised but diluted knowledge

Because of the salience of a range of different factors (economic, cultural, social, political) and different types of knowledge (scientific and colloquial evidence) to many policy issues, many advocate the need to democratise the knowledge base upon which policy is based (e.g. Lomas et al., 2005). The failure to effectively combine scientific and technological knowledge with local knowledge and cultural framing has contributed to the poor implementation of a number of development projects (Manzini, 2003).

This can be seen in the example of a British Medical Research Council (MRC) project in The Gambia, where tests carried out as part of medical trials were misconstrued by many as feeding an ‘economy of blood’, despite the development of a detailed programme of integration into the community (Fairhead et al., 2006). The negative attitudes of the Gambian villagers towards the MRC were rooted in a complex series of cultural framings which the MRC mistakenly dismissed as a culture of ‘the occult’.

The general salience of local knowledge and the importance of citizens’ participation in ensuring that science and technology can be truly pro-poor is emphasised by Leach and Scoones (2006). The authors argue that the focus on science and technology for development has fallen too much on its role in spurring economic growth or in providing a ‘universal fix’ that has a widespread impact on poverty, at the expense of poor people’s priorities. Accordingly, to ensure real pro-poor development, it is important to empower citizens to provide inputs to affect upstream choice of policies and downstream delivery. This approach is illustrated in the example of the participatory use of geographical information systems (GIS) in South African water service delivery, where GIS was used to incorporate citizen expertise as well as expert data into models of water quality, enhancing the understanding of the local communities as well as the surveyor and allowing local groups to engage on a more level footing with outside agencies (ibid).

However, the integration of different knowledge bases and the democratisation of scientific advice is not a straightforward matter and could involve tradeoffs. There is a difficult balance to strike in taking care not to overly ‘dilute’ scientific knowledge in the policy-making process, as this can compromise its credibility and instrumental value. Clark and Juma (2002) highlight the tension between needing to integrate elements of scientific advisory functions with the need for specialisation to drive scientific advances. Others (e.g. Cash et al., 2003), although generally in favour of the diversification of knowledge bases, caution that the capacity of current communication mechanisms within the various knowledge systems is inadequate to rule out excessive dilution of scientific knowledge. These risks are likely to be exacerbated in developing country contexts, where there is typically less political ‘pay-off’ to using scientific information to justify policy decisions (Ogbu, 2006).

Democratisation may also come at a price regarding the relevance of the resulting information, owing to the time consumed by participatory processes. Leach and Scoones (2006) highlight the lengthy nature of such processes, conceding that ‘decision-makers should allow long timeframes for participation and ensure that the least powerful are able to express themselves’. In addition, the pluralisation of knowledge bases can cause debate to stagnate rather than encourage it, as policy-makers, constrained by time and overwhelmed by conflicting sources of information, are likely to make snap decisions by selecting what is most appropriate to their political leanings (Liberatore and Funtowicz, 2003).

A way forward is proposed by Bielak et al. (2008), who argue that there needs to be a shift in the communication of science, one which moves beyond an outdated aim to broadcast simplified consensual messages to more nuanced dialogic and iterative approaches:

Communicating science, therefore, has expanded to include *knowledge translation* in which science information is packaged to the preferences, channels and timescales of particular audiences, and *knowledge*

brokering in which intermediaries (knowledge brokers) link the producers and users of knowledge to strengthen the generation, dissemination and eventual use of that knowledge.

Such an approach involving regular and tailored small ‘c’ communication would arguably reduce timescales for consultation, as would capacity-building on science research and its application for intermediaries and the media, which have the potential to support such communication systems.

3.1.6 Indigenous knowledge vs Western scientific knowledge

Closely related to debates on the democratisation of knowledge, there is growing attention to the cultural framing of science in policy-making. The fact that natural science is a predominantly Northern-driven knowledge base (Fairhead et al., 2006) is a predominant theme in the developing country literature. A number of analysts underscore the need to incorporate indigenous knowledge bases and local understanding of issues into developing policies, rather than having policies established through a centrally controlled, top-down process (Leach and Scoones, 2006). This concern relates to a vision of science and technology as ‘imperialist’ or ‘totalitarian’, illegitimately overriding local knowledge and priorities. The ethical side of this debate is implicit in many of the sources advocating participation: ensuring local participation and the incorporation of indigenous knowledge is important because this is a ‘key democratic right’ (Liberatore and Funtowicz, 2003).

It is to be noted that Southern knowledge should not be perceived as necessarily synonymous with ‘indigenous’ knowledge: increasingly, many developing countries have the capacity to produce their own scientific knowledge. However, the fact that scientific agendas and career paths tend to be driven by global and Northern priorities holds up this generalisation to a certain extent and, in more politicised contexts, scientists are often painted as corporate ‘puppets’ of Northern masters (Herring, 2007).

Mediating between indigenous and scientific knowledge is a complex task, however. Two key strands of this challenge are: i) the desire of indigenous communities for their knowledge to have equal status to that of Western knowledge; and ii) a simultaneous demand to have improved access to Western knowledge itself.

It is often concluded in the literature on developing country contexts that Western processes and methods of scientific innovation cannot easily be amalgamated with those of indigenous communities. Although finding mechanisms to integrate these divergent knowledge bases has attracted considerable theoretical interest, empirical case studies suggest that such an endeavour is difficult to implement. Fundamental differences in outlook can be a significant obstacle. For example, a belief in reincarnation calls into question the distinction between the ‘natural’ and ‘cultural’ realms employed by the UN Educational, Scientific and Cultural Organization (UNESCO) in determining the status of (and hence type of support for) World Heritage Sites in some cultures (Wiltshire, 2001). Other concerns relate to the scalability of participatory research findings: although they may be pertinent to local decision-making they may have more limited salience at the national level.⁹

3.2 Strategies for engaging at the science–policy interface

Much of the literature on the science–policy interface concludes by advocating for intermediaries to remedy the divide between scientists and policy-makers. For instance, Cash et al. (2003) argue for ‘boundary organisations’ mandated to act as intermediaries between the arenas of science and policy, involving specialised roles for managing the boundary, with clear lines of accountability to distinct arenas on both sides of the boundary, and providing a forum in which information can be co-produced. Other examples can be found in Choi et al. (2005), Scott (2006) and Box and Engelhard (2006). However, although there is a wide consensus on the need for intermediary organisations, there is no consensus on what they should do. There are a number of suggested strategies to address the

⁹ Personal correspondence with Louise Shaxson, 2008.

problems outlined in the preceding section, but no clear guidance as to the relative importance of each problem or strategy. There is also very little empirical investigation into the workings of boundary organisations. This is probably because of the limited number of existing science–policy intermediaries, which constrains the opportunities for conducting detailed studies into the practicalities of working at the science–policy boundary, and limited demand, especially on the part of donors, for such research.

Nevertheless, a number of strategies are proposed in the literature for strengthening the science–policy interface:

- Maintaining levels of credibility
- Enhancing salience and legitimacy, in particularly through mediation activities
- Promoting deliberative and participatory approaches and
- Supporting capacity-building and institutional reform

3.2.1 Managing the boundary for credibility, salience and legitimacy

Cash et al. (2003) provide a rare comprehensive look at the science–development policy boundary. They argue that efforts to mobilise scientific and technological information for sustainable development are more likely to be successful when the boundary is managed in ways that simultaneously enhance the salience, credibility and legitimacy of the information produced. Credibility involves the authority of the evidence and arguments; salience deals with the relevance of the information to the context-specific needs of decision-makers; and legitimacy reflects the perception that the production of information has been unbiased, fair in its treatment of opposing views and respectful of stakeholders’ divergent beliefs and/or democratic channels and processes.

The authors outline three important functions at the science–policy boundary – communication, translation and mediation – which provide a useful categorisation of the issues involved in getting scientific information into policy.

- **Communication** refers to the importance of two-way, active, iterative and inclusive communication between experts and decision-makers, in order to strengthen research-informed policy dialogues.
- **Translation** involves the way that messages, having been communicated via various channels and actors, are framed in the appropriate way to guarantee full comprehension by and benefit to all relevant stakeholders.
- Finally, **mediation** is required where the conflicts and tradeoffs between different actors and surrounding the three dimensions of scientific information in the policy process cannot be resolved by simply improving understanding.

Although the topics of communication and translation are addressed explicitly in a large portion of the literature, this is not the case for mediation. However, there are strategies proposed in the literature that can be grouped conveniently under mediation.

First, although Cash et al. (2003) argue strongly that dual accountability of boundary managers is crucial to building effective information flows, other analysts offer solutions that would involve a body being accountable to just the scientific ‘side’ of the boundary. In this regard, the risk of the ‘inflationary use of science’ makes it important to control the flow of scientific information into the policy process. One approach advocated in the literature is the establishment of a higher body representing the scientific community in order to adjudicate disputes. Another solution could be to set up an organisation that establishes consensus on scientific issues to feed into policy (Weingart, 1999). Bodies made up of the scientific community could also effectively act to ‘police’ the use of science in policy processes (Rosenstock, 2002). As we have seen, technical concerns in the research are being used to obscure fractious elements of political debates. For example, a number of analysts contend that environmental science is used in PRSP narratives to ‘project an illusion of natural resources that require better management and enhanced legislation to ensure that poor people benefit, while overlooking highly political struggles over environmental control and rights to resources’ (Waldman,

2005). There are calls for science to ‘speak out’ in such situations, where policy controversies involve disagreements about largely non-scientific matters (van Eeten, 1999; Lackey, 2006).

Similarly, the responsibility lies with scientists themselves on several levels. First, it is critical that they pay careful attention to the fact–value distinction to ensure that their advice is viewed as objective and to diminish the politicisation of science (Lackey, 2006). To support this, boundary organisations could ‘peer review’ policy for scientific content, publishing successful and unsuccessful experiences in policy-making for critical peer review and for reference by other scientists and policy-makers (Choi et al., 2005).¹⁰

Second, just as scientists yearn to ‘police’ the use of their research in the policy process, it is important that the questions underpinning scientific research are also reviewed for their policy relevance. Bielak et al. (2008) emphasise that achieving greater congruence between the questions posed by science and the answers needed by policy-makers is best achieved through frequent and iterative dialogue. Given the rapidly changing nature of the political landscape, feasible policy ‘options’ are likely to evolve at an unpredictable pace; only through close contact can scientists hope to understand these dynamics.

Finally, as part of a broader project to democratise knowledge, boundary management could also usefully include NGOs, which often have closer links to communities than do scientific associations. In the economic policy arena, through deliberate capacity-building initiatives and dedicated funding, NGO capacities to participate in policy debates surrounding PRSP development and implementation as well as budget analysis and monitoring (de Renzio and Krafchik, 2007) have been significantly enhanced over the past decade. A similar approach of capacity strengthening for NGOs engaged in science policy-related issues could also be considered in order to promote greater accountability of both the scientific research and the policy-maker communities.

3.2.2 Deliberative and participatory approaches

A number of analysts in the field call for the introduction of participatory and deliberative processes as a mechanism to guide the strengthening of the science–policy interface. These involve bringing together key stakeholders so as to combine different types of evidence, to incorporate diverse opinions and to ground decisions in relevant, feasible and implementable advice (Culyer and Lomas, 2006). This typically involves workshops, consultations, roundtables, etc and can result in the joint production of models, scenarios and assessment reports (Cash et al., 2003).

Although there are similarities between what is proposed as participatory and deliberative processes, and though in many situations an approach could be described as both participatory and deliberative, the two diverge in important ways. Participatory processes are focused largely on engaging the poor in ‘bottom-up’ processes of decision-making and policy formation. Participatory processes are advocated by many within development debates (see, for example, Leach and Scoones, 2006) as critical to writing and implementing successful science and technology policy in developing countries, because they help orient programmes towards pro-poor priorities. They bring ‘scientific, social, cultural and ethical’ perspectives to the process (Hove, 2000) and provide an opportunity for citizens to challenge and interrogate the positions of expert outsiders and/or domestic elites.

Deliberative processes, as recommended by Lomas et al. (2005), also incorporate diverse opinions into science–policy deliberations. However, these typically involve face-to-face meetings, at which scientists and policy-makers convene to discuss and debate pressing policy issues. Culyer and Lomas (2006) define the goals of the procedure as: providing guidance informed by relevant scientific evidence that is interpreted in a relevant context wherever possible with context-sensitive scientific

¹⁰ To some extent, this is already being done in the state of California. Legislation has been passed enabling state university researchers to review proposed legislation/mandates on health insurance, moving clinical decision-making away from legislative bodies prone to interest group and/or entrepreneurial politics (Oliver and Singer, 2006). The California Health Benefits Review Programme (CHBRP) was established in 2002 and assigned to the University of California to run (ibid).

evidence and, where not, by the best available colloquial evidence. Deliberative processes act as an iterative and recursive channel for evaluation and re-evaluation of prevalent issues in scientific research (either new empirical findings or a re-examination of ‘old’ evidence) and policy-making. Cash et al. (2003) argue that these processes can increase credibility, by bringing multiple types of expertise to the table; salience, by engaging end-users in defining data needs; and legitimacy, by providing multiple stakeholders with more transparent access to the information production process.

Although there is considerable optimism for the promise of these approaches, some potential problems with participatory processes have been identified. A detailed review by the CHSRF finds a lack of evidence regarding the effectiveness of deliberative mechanisms. Participatory approaches tend to be unclear on the details of the degree and nature of involvement of each sphere of society. Rowe and Frewer (2005) encapsulate the broader debate with regard to this problem when they argue that the range of power sharing between scientists and stakeholders, the flow of communication, the scale of the problem and the degree of participation vary widely among disparate participatory processes. They suggest that ‘public engagement’ is a more appropriate term than ‘public participation’ and that its adoption would better represent the current state of participatory processes that resist attempts to be defined by an overarching model for developing nations. This engagement would involve ensuring that information flows both ways between members of the public and the government and, rather than simple raw opinions being conveyed, the key dimensions of effective engagement are the extent to which full, relevant information is elicited from all appropriate sources, transferred to appropriate recipients and combined to give an aggregate/consensual response.

In the case of deliberative processes, it is possible that controversial policy debates may be aggravated (van Eeten, 1999). Opening up debate may highlight the nature of the deadlock rather than contributing to its resolution. This in turn may aggravate the conflicts in timescale that already confront scientists and policy-makers, and worsen relations by creating a climate of even greater alienation. In addition, there is limited empirical evidence on how deliberative processes work¹¹ and how effective they may be compared with other decision-making procedures (Culyer and Lomas, 2006).

3.2.3 Capacity-building and institutional reform

Common to most analyses of the science–policy boundary is the assessment that there is a need for capacity-building and institutional reform (e.g. the US National Research Council Committee on Science and Technology in Foreign Assistance, 2006; Scott, 2006. Choi et al., 2005; IAC, 2004), in both the developed and developing world. A number of areas are identified for targeting capacity-building activities.

On the policy side of the boundary, the need to build policy-makers’ skills at interpreting scientific evidence and using external expertise (DEFRA 2006) is emphasised. Such efforts should be carried out in tandem with the promotion of scientific skills in government departments (HoC S&T Committee, 2006) to ensure that there is scientific research literacy to adequately assess the contribution of scientific evidence to broader policy questions. Such an investment would have the effect of improving the efficiency and effectiveness of the ‘translation’ process required to bridge scientific research into policy.

It is also important to build the communication capacities of scientists working both outside and within government ministries, so as to help make their efforts at policy engagement more effective. This would involve improving scientists’ understanding of the policy process and policy audience’s knowledge needs, and would allow them to more effectively target their knowledge production and communication activities while maintaining realistic expectations as to the outcomes of their engagement (Scott, 2006). Bielak et al. (2008) document concrete ways in which such individual and organisational capacities could be strengthened. Specific activities include writing science summaries; developing internal and external newsletters; profiling national science assessments; enhancing web-based communication and presence; undertaking science writing in sector newsletters; and brokering workshops between policy decision-makers, policy analysts and scientists.

¹¹ Aside from some notable examples, e.g. Andresen et al. (2000), which tend to focus on international and Northern-driven arenas (e.g. acid rain and chlorofluorocarbons – CFCs), rather than deliberation based in, driven by or addressing problems of the South.

Broader institutional reforms are also important. These could range from developing databases to allow better organisation of research activities and plain language summaries of outputs and subject-specific expertise so knowledge can be quickly accessed and packaged, to establishing specific knowledge brokering units within government ministries to raise the profile and resources devoted to such activities; from providing communication training and mentoring for science researchers¹² to changing the hiring profiles of government policy analysts to include personnel who already have knowledge translation and brokering skillsets. They might also include re-conceptualising research products, not as completed projects but instead as ‘live investments’ to be periodically revisited, and promoting the regular consideration of indigenous knowledge by creating incentive structures for non-expert citizens to share their experiential knowledge (Bielak et al., 2008).

The public constitutes another key target for potentially fruitful capacity strengthening. As highlighted earlier, in developing countries there tend to be lower levels of general education, combined with limited understanding of science or even an active resentment or fear of it. There is, therefore, a need to demystify science for those who are economically and politically active in order to allow them to hold decision-makers accountable and to drive forward public debate (Joubert 2001). This is also required if participatory and deliberative processes are to become locally embedded and could be remedied through tailored public education (Joubert 2001, Wiltshire 2001, IAC 2004).¹³

There is also a broader need to build the base capacity of the ‘whole system’ involved in the developing country science–policy boundary (Clark and Juma, 2002; Keeley and Scoones, 2003). The importance of the overall ‘public sphere’, where actors in policy-making converge, is emphasised (Edwards, 1999). This would imply that it is important to build the capacity not just of the main actors (policy-makers, the scientific community and the public), but also of the organisations involved in their coming together: there is a need for capacity-building for journalists and those involved in radio and TV as well as civil society organisations (Castillo, 2000; Joubert, 2001).

One element of this institutional capacity-building that requires particular attention is the need for research institutions and policy-makers alike to cultivate a more flexible and iterative approach to interactions at the science–policy boundary. Clark and Juma (2006), for example, argue that it is essential to reform existing research organisations in order to strike a better balance between flexibility and stability, allowing them to learn through time and adapt policies as necessary.¹⁴

Related to this, one way to help bridge the gap between science and policy is to consider systematically potential future policy issues. Foresight-generating activities, such as horizon scanning, are recommended to help make political debates more sensitive to scientific issues. A number of commentators argue that increasing the time horizon of such debates will allow for a more robust exploration of the issues (e.g. DEFRA, 2006), mitigating the difficulties caused by the longer timescale of scientific research relative to policy-makers’ incentives.

¹² A recently introduced bill in the US House of Representatives seeks to provide communications skills for US-trained scientists to ensure that they are better prepared to engage in dialogue on technical topics with policy-makers and business leaders. This has yet to be approved and implemented.

¹³ One attempt to gain insight into such targeting has been undertaken by Raza et al. (2002), who define ‘cultural distance’, or the distance that a worldview attitude, perception or idea generated within one cultural context travels on a timescale for its democratisation within the thought structure of other cultural groups. They propose a method for empirically measuring cultural distance and suggest ways that this could be used to nuance the targeting of scientific education in order to be sensitive to the specific idea being communicated as well as the capacities of particular groups.

¹⁴ One possible model is the use of expert taskforces that are commissioned to address specific problems in a timely fashion. Another entails a combination of these two approaches and involves organisations with secretariats that provide permanence and/or organisational stability coupled with temporary teams that provide flexible problem-solving capacity. McNie (2006) and others propose a third option, adaptive management, as a solution to the need to develop policies quickly and the uncertain nature of scientific evidence. This process is premised on ‘the notion that policies are just experiments and that the outcomes of the experiments constitute opportunities for learning and improving the subsequent decisions’ (Holling, 1978) and the concept that policies are not permanent features but rather represent opportunities for learning and adapting the policies to new information.

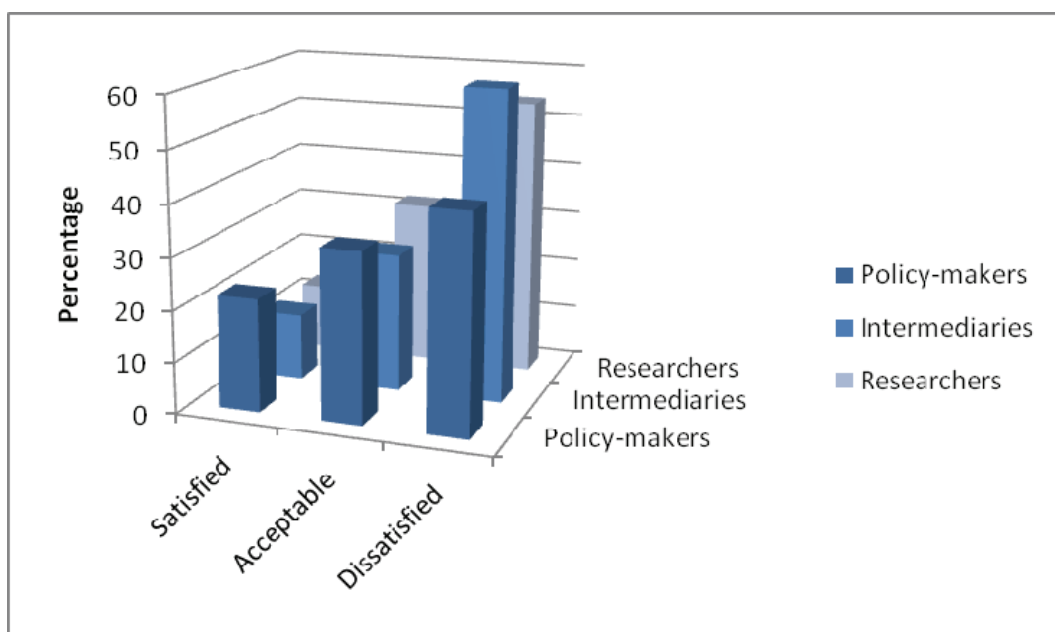
4. The science–policy interface in the developing world: Triangulating new evidence

Although analyses on the science–policy interface have produced a number of useful analytical frameworks for understanding the issues involved in bridging science and technological evidence and policy debates and processes, there is a dearth of wide-ranging empirical exploration of these issues. This is particularly the case with regard to the need for a broad picture of concrete solutions to problems related to the science–policy interface and of the actual workings of boundary organisations. There is some literature on the workings of the interface in particular areas, such as ozone policies and climate change (e.g. Andresen, 2000), but the areas of focus are invariably Northern-driven issues. There is no literature comparing different approaches or providing an overview of policy approaches to improving the science–policy interface.

This lacuna is even more pronounced in the case of developing country contexts: there are some good individual country case studies, but there is little analysis of the problems faced by scientists and policy-makers in the developing world more broadly, and even less discussion about what needs to be done to remedy these. This section seeks to contribute to addressing this lacuna by presenting findings from an international survey, country case studies and expert key informant interviews about the science–policy interface in the developing world.

Overall, our findings suggest that there is a consensus that the communication of scientific information for evidence-based policy-making is poorly institutionalised in developing country contexts. The results throughout the international survey and country case studies highlight significant potential for greater communication across the science–policy interface and underline the obstacles with which policy-makers, researchers and intermediaries must contend in the effort to improve the communication process for better evidence-based policy influence. For example, international survey respondents expressed a high level of dissatisfaction with the degree to which policy decisions are informed by ST&I research evidence: 60% of respondents from intermediary organisations, 54% of researchers and 42% of policy-makers. These findings indicate that researchers are more aware than policy-makers of the scope for improving the degree to which scientific information could be incorporated into development policy and the importance of strengthening channels of uptake.

Figure 1: Satisfaction with degree to which policy is based on ST&I evidence (all respondents)



Our findings suggest that the limited uptake of ST&I information in development policy dialogue and decision-making processes owes largely to systemic obstacles, including:

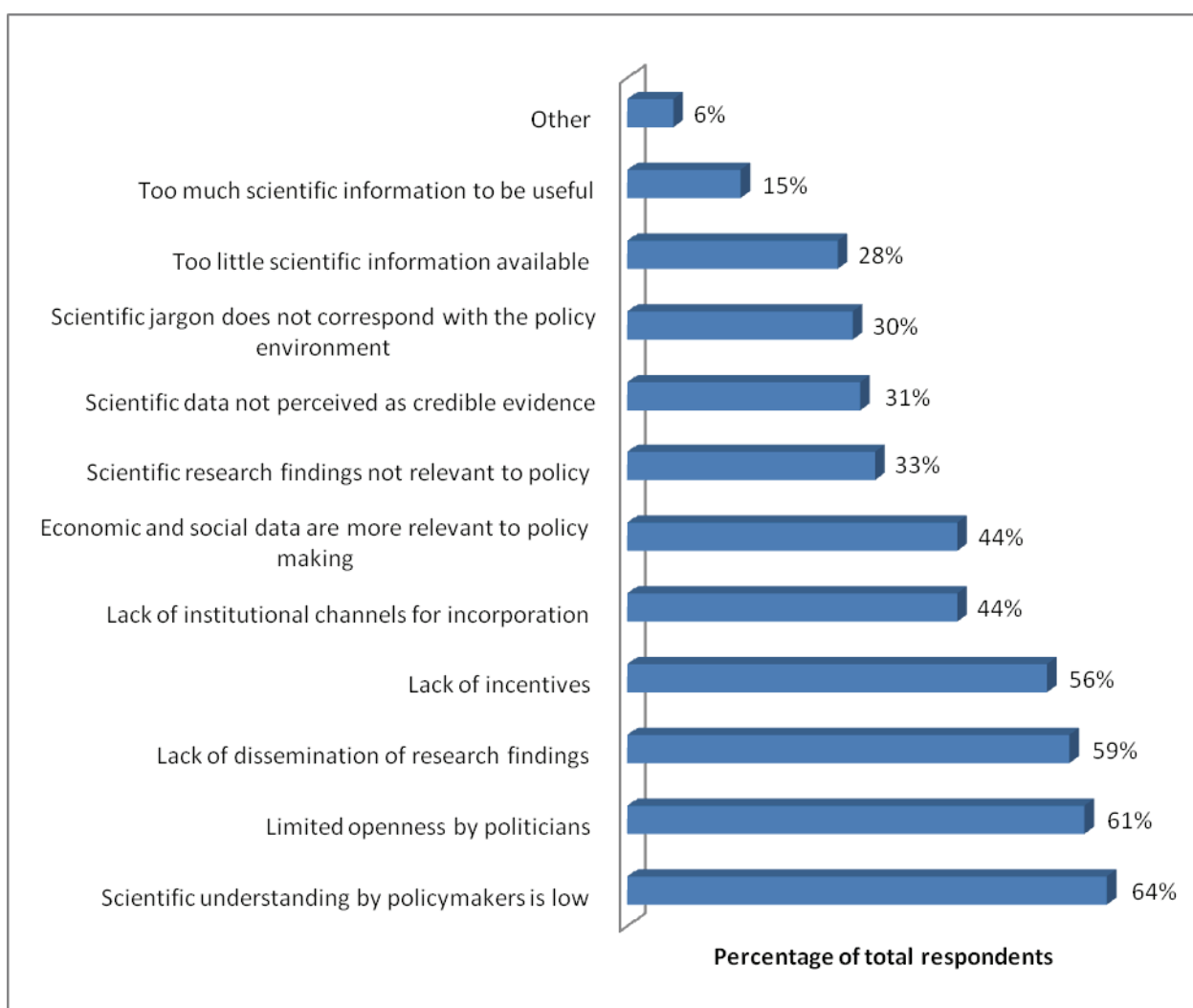
- Low levels of scientific understanding by policy-makers (64% of all survey respondents)
- Limited openness by politicians to using ST&I information (61%)
- Limited dissemination of research findings (59%)
- A lack of incentives for the use of ST&I in development policy-making (56%) and
- A lack of institutional channels for the incorporation of ST&I information into policy (44%, see Figure 2).

Not surprisingly, significantly higher numbers of respondents in developing countries identified these obstacles as a concern. These systemic problems will require coordinated and holistic efforts by national governments, international actors and nongovernmental actors alike.

Expert informants emphasised that the interface between the natural sciences and development policy is inadequately understood. The results of this survey and country case studies therefore offer important insights into the functioning, obstacles and future paths to take to promote increased uptake of ST&I information in policy dialogue, particularly in developing countries.

We begin by presenting results that highlight stakeholders' experiences of various tensions across the science–policy boundary. The analysis then goes on to discuss results illustrating both obstacles and opportunities in the communication of scientific knowledge for development policy-making.

Figure 2: Obstacles to the uptake of scientific information in development policy-making

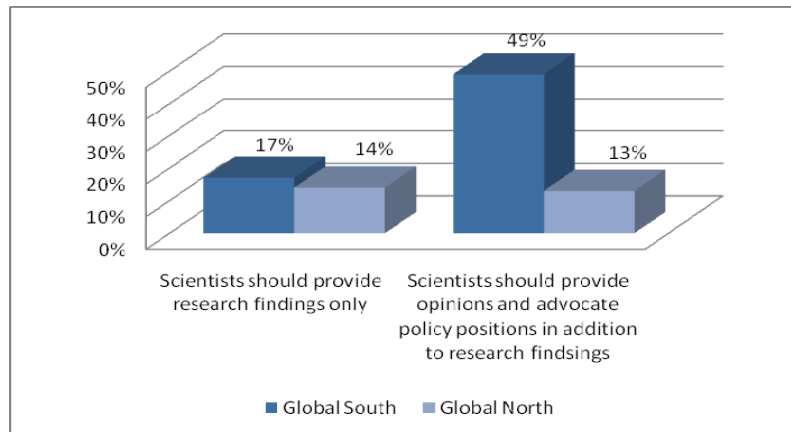


4.1 Tensions across the science–policy boundary

4.1.1 Engagement vs. objectivity

Although the potential loss to ‘pure’ science of objectivity through engagement in policy processes is identified as a concern in the literature, our survey results showed strong support (particularly in developing countries) for greater engagement of researchers with policy debates.

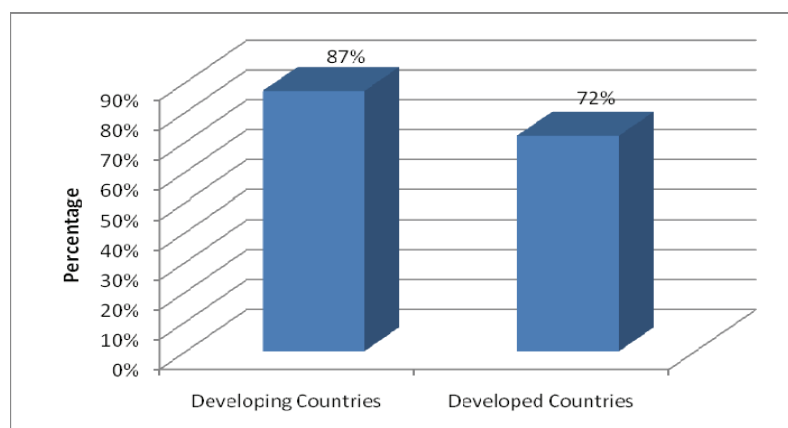
Figure 3: Scientists as neutral information providers or also engaging in policy debates



Policy-makers and development practitioners are interested in scientific findings, but emphasised that they would be able to make greater use of such research if scientists would engage more openly with the resulting policy implications of their findings.

The overwhelming majority of policy-makers expressed a preference for scientists to provide opinions about the policy implications of their results. Additionally, when offered a range of choices regarding potential services from an intermediary organisation, the majority of respondents indicated that opinion articles written by experts on policy-relevant topics would be useful (87% in developed countries and 72% in developing countries). These results were further corroborated by key informant interviews, in which a number of interviewees indicated that policy engagement constituted a key activity to bridge divides at the science–policy interface, and that the analysis of potential social, political and economic implications of research would increase effectiveness in reaching policy audiences.

Figure 4: Respondents preferring expert opinion articles on topics relevant to policy issues (%)



Those in the North and the South both valued scientists’ opinions regarding the implications of research, although Northern respondents preferred this to be in conjunction with ‘objective’ research findings, indicating a greater emphasis on scientific neutrality in the North than in the South.

Furthermore, when asked what specific factors would facilitate the uptake of ST&I information into policy-making, the two favoured options (following the availability of in-depth ST&I information for policy-makers) were deliberation between researchers and policy-makers and advocacy by researchers. Importantly, support for these factors was significantly higher in developing countries than in developed countries.

Our country case studies supported these findings, emphasising the importance of policy engagement, including framing research information as policy-relevant messages and recommendations, as a mechanism for promoting the relevance of ST&I in policy decision-making. In Cambodia, for instance, the most common enabling factor for the uptake of ST&I information into policy development is conducting research on topics proposed by government policy-makers or credible donors (e.g. the World Bank). As Cambodia is an impoverished post-conflict society, political priorities centre on the process of reconstructing and rehabilitating the country in socioeconomic terms, and policy-makers are therefore inclined to utilise research information that is orientated towards problem solving.

Box 1: Linking scientific evidence to political agendas in Ghana

An important obstacle identified in the Ghanaian context is that policy influence is not determined by quality evidence alone and is inhibited by multiple external influences, such as political incentives and financial priority setting. Focus group participants pointed out that a researcher's ability to influence policy is often hampered by having political views at odds with those of policy-makers; regardless of the quality of evidence presented, a policy-maker will disregard it if he/she disagrees with the political views of the researcher. Central government officials and ministers often have the power to sway policy directions irrespective of external advocacy for the use of science. Central government officials are therefore an important entry point in effectively integrating scientific information into policy, but are also difficult to target owing to limited political will, typically low levels of scientific understanding and a high degree of external pressure felt from financially powerful donors.

On the other hand, Ghanaian researchers' limited understanding of the policy-making process was perceived to hinder their ability to translate research findings to be of practical use for policy-makers. Often, if the policy relevance of research is not easily accessible to policy-makers and does not offer an actionable solution, the information will be discarded in line with efforts to expedite the policy-making process.

While the communication of research findings is thus essential for building science-policy linkages, effective communication and dissemination processes have yet to be established in Ghana. Possible opportunities identified in focus group discussions include building capacity for communication; networking among research and policy communities may benefit from partnering with multilateral institutions (e.g. the UN Development Program – UNDP, the World Health Organization – WHO, the International Fund for Agricultural Development – IFAD, the UN Food and Agriculture Organization – FAO, the UN Children's Fund – UNICEF, UNESCO, the World Bank) and select bilateral donors that currently have an influence on the government's decision-making process owing to their international credibility and financial clout.

Case study authors: Helena Asamoah Hassan and Samuel Smith Esseh.

4.1.2 Politicisation of science

Despite the acknowledged need and support for increased engagement between ST&I researcher and policy-maker communities, such a situation is prone to political obstacles. Our survey results showed that a lack of openness by politicians to ST&I information in policy decision-making was the second most cited obstacle to the uptake of ST&I information (61% of all respondents, 66% of researchers, 54% of policy-makers).¹⁵ This is not necessarily a reflection of stubbornness or vested interests, however. As one expert interviewee noted, policy-makers are often elected on the basis of particular policy pledges and may see that her/his democratic legitimacy rests upon supporting a particular piece of legislation (irrespective of new information).

The lack of an institutionalised evidence-based decision-making system means that the political aspects of research evidence often shape its usage in policy-making. One expert informant, for example, emphasised that the most important factor in facilitating the uptake of scientific research is whether it has perceived economic and social benefits (such as technology that will reduce drudgery or

¹⁵ Not statistically significant: $X^2=2.41$, $p<0.25$.

improve health). Conversely, the most important constraining factor was identified as research findings that have difficult political or ethical implications (such as the difficulties surrounding GM crops). However, there is also a threat of misuse towards political ends. In this vein, country case studies revealed that politicians will often only partially implement research evidence, or will gloss over the caveats of the evidence in order to legitimise policy decisions or will only release results of which they are supportive (e.g. see the Cambodia case in Box 4). The politicisation of research evidence occurs not only through its usage in the policy process but also within the academic sphere. In the Nicaraguan case study, informants felt that a lack of transparency and widespread politicisation of research by the government had led to secrecy and rivalries among research colleagues, inhibiting the sharing of research findings.

In general, developing an appreciation of these patterns of influence within the policy-making cycle is critical to understanding the most effective points of entry for facilitating evidence-based policy. For example, in the Ghana case study, focus group participants emphasised that, owing to an authoritarian approach to policy-making, ministry officials, such as deputy director generals, have the greatest leverage through their responsibility for allocating and delivering state resources. Any successful research uptake will depend upon the support of these senior officials. Several expert informants concurred that this was a general trend – memo writers, political researchers, speechwriters and advisors are often more influential than ministers themselves.

In another example, from China, successful infusion of evidence into policy has capitalised upon the political sway that prominent scientists hold with government officials located within the highly centralised bureaucracy. Officials are often reluctant to open up the policy process to researchers, therefore personal linkages between scientists and officials are often the most efficient ways to influence policy. The example of scientists conducting letter-writing campaigns to influence the direction of the aviation industry was cited as a particularly well-known success case and is explained in more detail in Box 6.

Indeed, in some ways, more closed political systems may facilitate more direct uptake of scientific knowledge. One expert informant contrasted the example of communist Russia, when target audiences and national political agendas were limited and easily identifiable, with the present day, where influence is now more challenging, as it involves ‘winning over’ a plurality of actors and overcoming possible institutional veto points as well as navigating diverse global scientific (and other) discourses.

4.1.3 Differing timescales and incentives of politicians and researchers

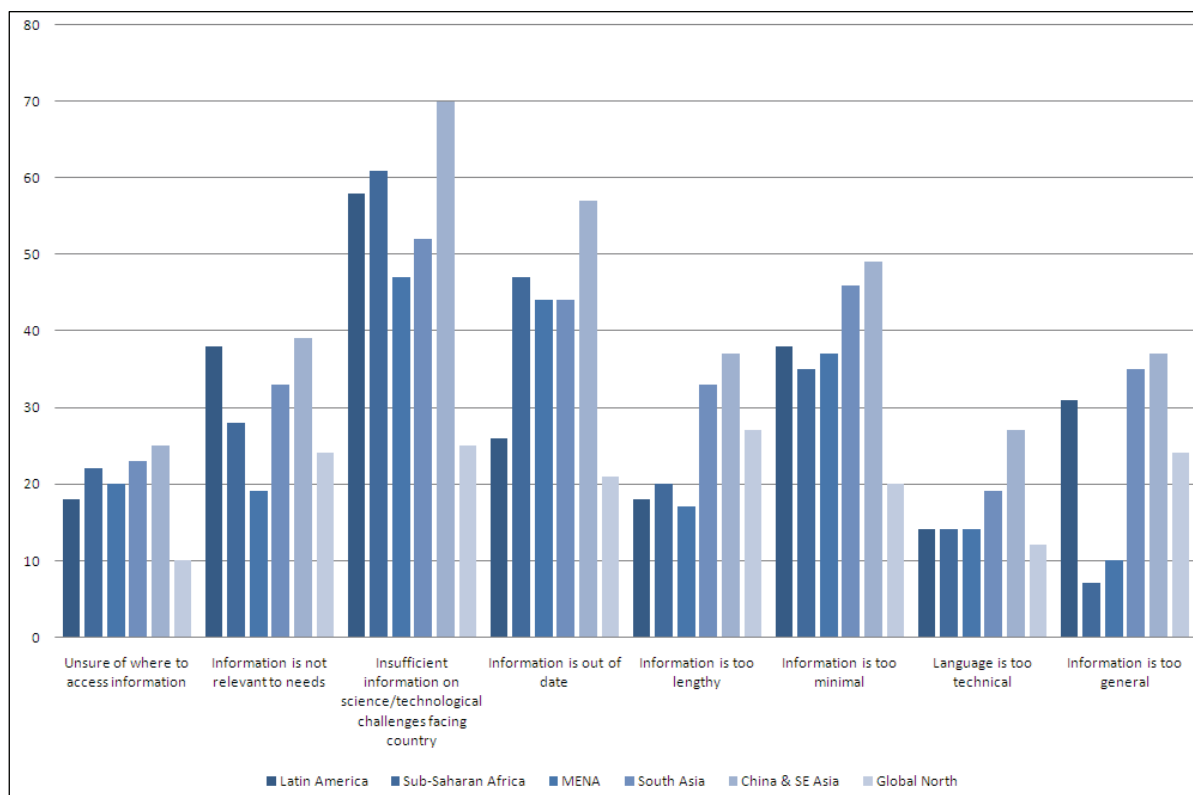
A general consensus from the expert interviews was that a major challenge is the narrow focus and long timescales of scientific research compared with political priorities. In the same vein, the most important challenges to ST&I information access identified by survey respondents related to the quantity, timeliness and depth of information provided, as well as the amount of time it took to find and absorb relevant findings.

Not surprisingly, developed country respondents expressed the lowest rates of difficulties compared with other regions in accessing ST&I information. However, similar to developing country respondents, developed country respondents highlighted a need for information to be more specific (24% of developed country respondents) and stated that information is often too lengthy to easily utilise (27%).

Insufficient and dated information were the most often cited obstacles to accessing ST&I information in developing country regions, particularly in China and Southeast Asia (70% and 57%, respectively, much higher than average). Considering that respondents from China and Southeast Asia also expressed the highest interest in utilising ST&I information for policy purposes, this suggests a particularly strong need to increase support for data collection, analysis and dissemination in the region. Insufficient availability, out-of-date material and lack of relevancy were rated as important barriers throughout developing country regions, with sub-Saharan Africa and Latin America following closely behind China and Southeast Asia (Figure 5). Multiple country case studies raised the issue that investment in

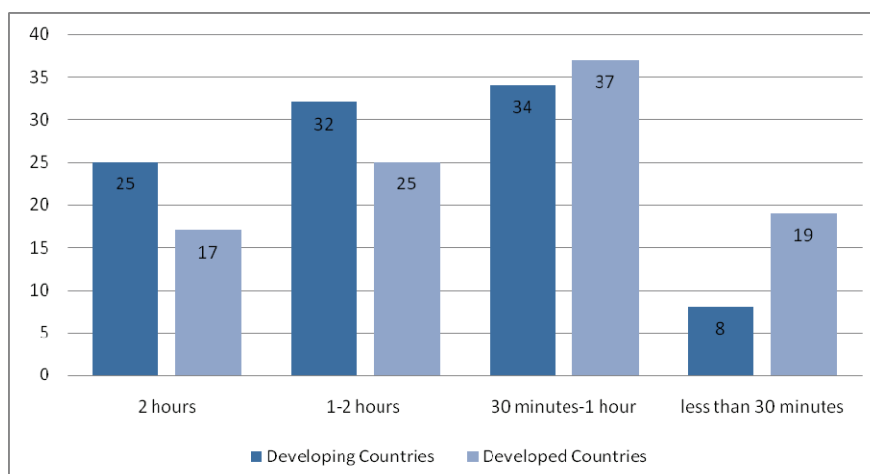
scientific research is under-funded in terms of both data collection and analysis. Researchers are not given sufficient support or incentives for innovation and there is a lack of a national ethos regarding the importance of scientific research in policy-making.

Figure 5: Obstacles in accessing S&T information



The need for a greater quantity of information must be seen against the short timescales of policy-makers. Policy-makers have little time available to seek out and absorb information: as one expert put it, policy-makers do not have the time or capacity to sit and ask themselves what a new piece of scientific research tells them about social policy. Therefore, information must be condensed and engaging and highlight possible policy implications. Most of those accessing information desired a format that would communicate the most important messages in 30 minutes to one hour, with slightly fewer respondents taking one to two hours to access information. Visually engaging information also emerged as critical, with 83% of respondents favouring graphs or complementary explanatory diagrams.

Figure 6: Average time spent accessing S&T information for each policy issue



Furthermore, timescales and goal horizons are substantially different for policy-makers and researchers, as illustrated by the country case studies. As elected policy-makers are held accountable – at least in theory – by their constituencies and political parties, they must fulfil short-term policy goals to provide tangible solutions to problems. Government officials are often motivated by similar short-term goals, as emphasised by the country case studies as well as the broader literature. They seek to please their superiors through political alignments and by delivering on donor agency priorities and operating according to principles of secrecy and confidentiality.

Conversely, it was emphasised that scientific research operates on a timescale dictated by the research process of hypothesis testing, making it difficult to appropriate scientific research findings in a timely fashion for policy decisions. To address this, several experts advocated for institutionalising long-term planning (activities such as horizon scanning) in order to improve the uptake of science into policy.

This need for policy-makers to deliver short-term results is also manifested in respondents’ desire for more information specific to their particular policy context. Respondents from the Global North found internationally relevant information most useful, whereas those from the Global South found regionally specific information of greater value (particularly in South Asia, China and Southeast Asia, see Figure 7). This perhaps reflects the prioritisation of local development and/ or the fact that respondents in the North have greater access to locally relevant information through other channels.

Figure 7: Policy-makers preferences for level of ST&I information specificity

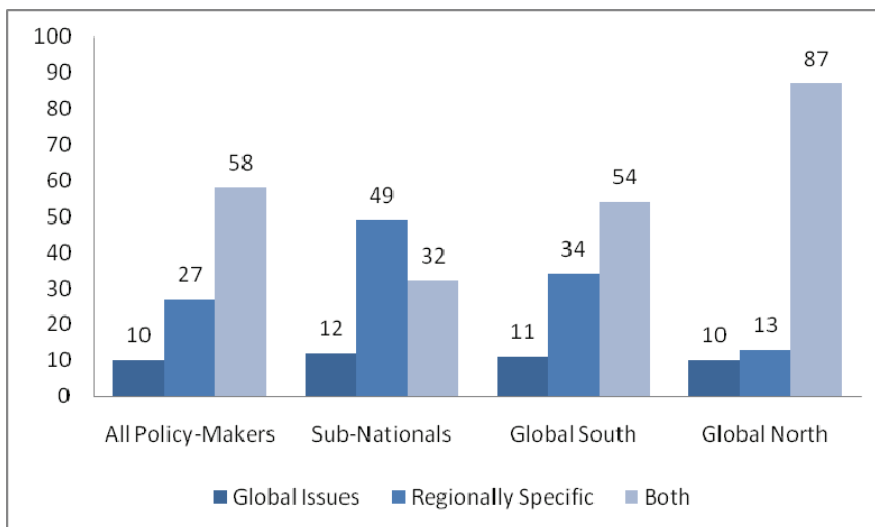
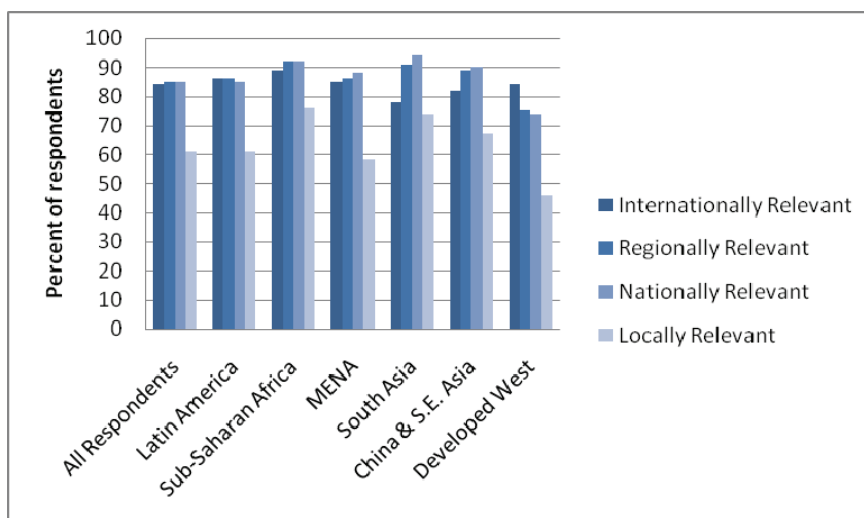


Figure 8: Preferences for level of S&T information specificity



Similarly, policy-makers' need to deliver on policy agendas was reflected in survey results: socioeconomic data were identified as being more directly relevant to policy-making than scientific information (44% of survey respondents). Scientific information was most often sought out by respondents for application to environmental issues (75%), followed by natural resource management (67%) and, third, socioeconomic policy (61%).

As expert key informants emphasised, it is crucial to highlight the link between science and innovation, productivity and growth. The importance of this linkage was confirmed in the Zambian case study, where – as in many low-income countries – poverty alleviation takes priority over all other objectives (see Box 2). Furthermore, policy-makers are preoccupied with developing solutions to economic problems and immediate poverty alleviation, rather than applying the results of scientific research in policies that may not demonstrate beneficial results for decades.

Box 2: Differing timescales and priorities of researchers and policy-makers in Zambia

In Zambia, a lack of political will, limited understanding of the links between scientific evidence and policy and conflicts of interest between researchers and policy-makers were identified as the main hindrances to the uptake of scientific research findings. While researchers are focused on long-term research projects investigating problems, policy-makers are bound by the short-term needs of delivering policy solutions, particularly in a low-income context such as Zambia, where poverty reduction takes precedence over all else. For example, environmental research in Zambia has illustrated the damaging effects and extent of deforestation. However, there has been no policy directive to address this issue, most likely because wood serves as a cheap source of fuel for most poor households in the country.

The Environmental Council has made recommendations following research into the potential harmful effects of building steel plants near residential areas, yet the government has pushed through its agenda contrary to this. Economic gain was cited as always taking priority over scientific reasoning, with little capacity for accountability.

Researchers largely lack the capacity to lobby the government; the government often merely consults researchers in order to 'check the box' before instituting a policy. Civil society was therefore cited as being a better-placed stakeholder for advocacy activities; as such, the formation of researcher–civil society partnerships would enable greater evidence-based policy advocacy.

Although, in certain instances, some donors are perceived as being out of touch with local needs, the most significant actors in advocating for scientific research uptake in policy were identified as multilateral institutions and particularly UN agencies.

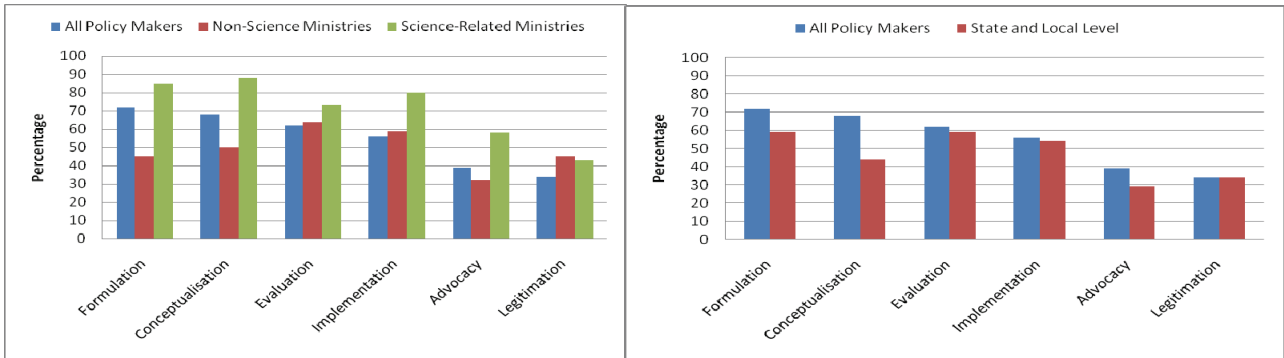
Case study author: Savior Mwambwa.

Informational needs were shown to differ significantly between types of ministries and levels of policy-making. Experts indicated that the use of scientific information in environmental and health ministries contrasted with the rest of government: although ministries of health and the environment use scientific information more regularly and are aware of the relevance it has for their work, other ministries use it much less and often need persuading of its relevance.

Similarly, the survey findings suggested that patterns of ST&I evidence use differed between science-related and non-science-related ministries. Non-science-related ministries reported employing scientific information primarily in the stages of policy evaluation (64%) and implementation (59%). This is in contrast with science-related ministries, which use scientific information primarily for policy conceptualisation (88%) and formulation (85%), followed by implementation (80%).

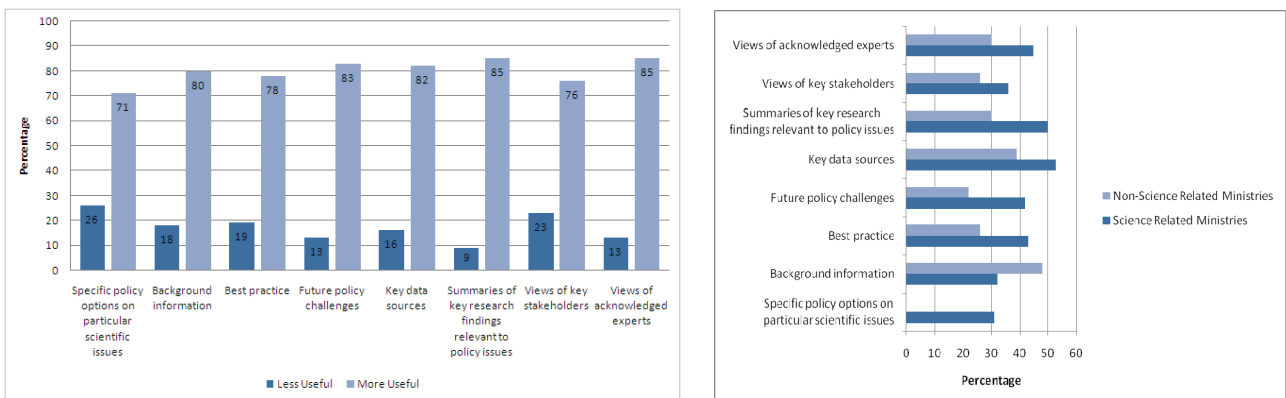
Because of small sample sizes (non-science ministries: n=22, science ministries: n=40), these findings need to be treated with some caution. Nevertheless, they suggest that non-science policy-makers use scientific information to legitimate, implement and evaluate policy decisions, whereas science-related ministries rely more heavily on scientific information to formulate policy.

Figure 9: Policy-makers using scientific information at various stages of the policy cycle



Differences also emerged in the perceived degree of usefulness of different categories of ST&I information among science-related and non-science-related ministries. Science-related ministry officials (n=107) preferred to access key data sources (53%) and summaries of research findings relevant to specific policy issues (50%), more so than non-science-related ministries (39% and 30% respectively).¹⁶ Conversely, non-science-related ministries (n=23) preferred background information on specific policy issues (48%), compared with just 32% from science-related ministries.¹⁷

Figure 10: Information types found useful by policy-makers in development policy decision-making



4.1.4 Specialised expertise vs. democratised knowledge

One prominent theme emphasised in the expert interviews was the fact that policy decisions are made based on a number of different dimensions, including social, political and economic factors, not just science. Some interviewees saw this ‘translation’ as a simple matter, but others argued that it requires multidisciplinary and/or a significant amount of consultation and social scientific analysis. Those with a more critical perspective feared that such translation processes risk diluting the credibility and usefulness of scientific information, as they necessitate making a number of interpretations and simplifications. Additionally, scientists whose professional incentive structures favour individual ownership might resist multidisciplinary processes as a threat to their specialisation, as was indicated by country case study respondents (e.g. Nicaragua and Bolivia), where pressures to advance individual careers (in an environment of limited scientific research investment) are often more salient than incentives to share information with peers across disciplines.

Overall, however, there was a general consensus that such consultation and translation is necessary, and that the general public and the media play a crucial role in ensuring that science is valued by

¹⁶ $\chi^2=2.25, p<0.25$.

¹⁷ $\chi^2=5.18, p<0.05$.

politicians. Although this was judged still to be a distant reality in many developing country contexts, over half of the Southern survey respondents indicated that scientifically informed public opinion would be a significant facilitating factor in the uptake of ST&I information into policy-making. This was corroborated by strong interest from all stakeholders, particularly those from developing countries, in greater public participation in ST&I-related policy debates, facilitated by initiatives to improve public understanding of ST&I so as to promote the emergence of a more informed and engaged public.

Figure 11: Extent to which respondents believed that increased participation of a scientifically-informed public will lead to improved development

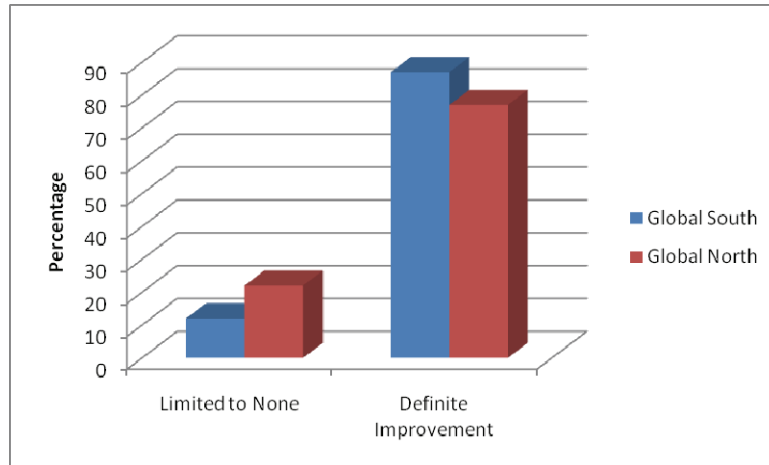
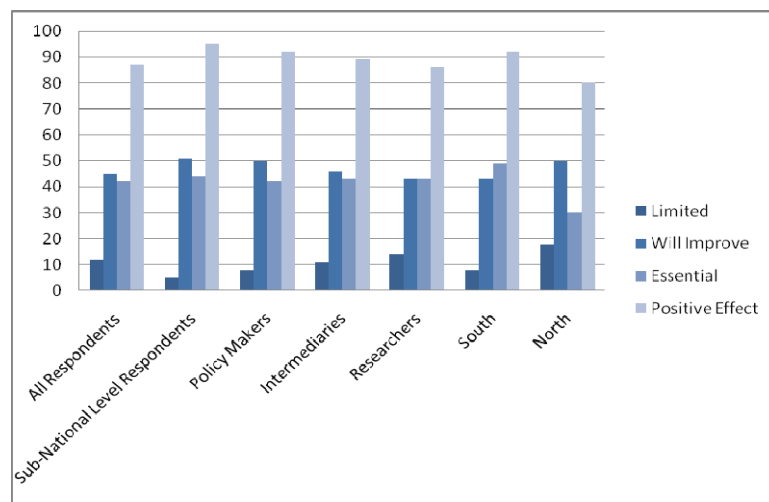


Figure 12: Value of public scientific understanding as perceived by different actors



Enhancing the role of greater public scientific knowledge so as to improve development outcomes was valued highly among all respondents, but with significantly higher support in the South than in the North,¹⁸ as indicated by both the survey statistics and text-based responses (shown in Box 3). Through participation, individuals increase their ownership of information and, as posited in the country studies, this acts as a means of generating public demand and accountability for the usage of scientific research by policy-makers in development. Developing country survey respondents emphasised that an informed public is one that can make decisions based upon evidence as to which policy agendas to support. Public participation can therefore constitute a facilitating factor for developing evidence-based policy processes and stimulating demand for research evidence based on local priorities. This requires communication between policy-makers and stakeholders; for this, survey respondents emphasised the potential expanded role for intermediaries and sub-national-level government.

¹⁸ $\chi^2 = 2.59, p < 0.1$.

Box 3: Importance of participatory policy-making processes

- *The public needs to be convinced and people cannot be convinced if they are not part of the debate/learning process. (Canada, policy analyst)*
- *A public that has confidence in the scientific community and feel that they (the public) are at the centre of the research agenda because of their participation will enable more effective policy-making. (UK, researcher)*
- *People not only have the right to know scientific matters, but also have the right to express their views on different matters. The scientifically and technologically informed public can actively take part in the opinion-making process. (India, policy-maker)*
- *Public opinion and participation is always valuable in all sorts of policy-making processes. Because the general public know better about the ground-level situation and ultimately these policies are aiming at their improvement. (India, local-level policy-maker)*
- *Again, ST&I policy-making should contemplate the interests and views of the various stakeholders (public and private sectors, academia, public and private researchers, policy and decision-makers, civic society, consumers, etc). The more they know about ST&I, the better policies should a country be able to develop. But, it is also essential to recognise the importance of decentralisation in this process of policy-making, with greater participation and more important roles for local, provincial and municipal governments and local constituencies. (Uruguay, technical advisor)*
- *Public participation is often drummed up by special interest groups. An informed public would be able to evaluate the concerns and actions of these groups and make their own informed decisions and contributions. (Canada, technical advisor)*
- *Public participation provides tacit knowledge and info that cannot be accessed without communication and interrelationships between stakeholders. (Nicaragua, policy advisor)*

4.2 Strategies

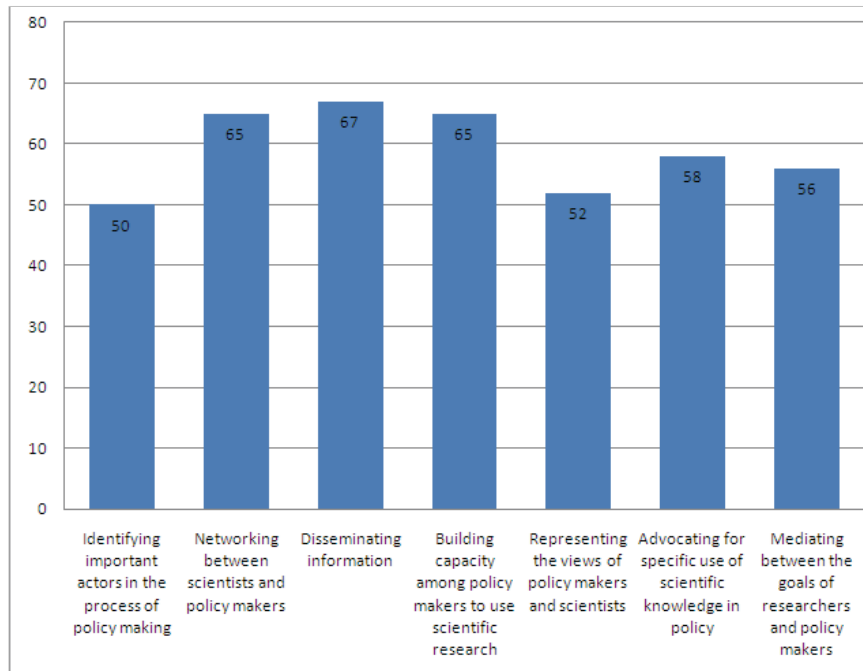
In order to address the weaknesses of the science–policy interface (Choi et al 2005, Scott 2006, Cash et al 2003, Box and Engelhard 2006), the literature calls for intermediary organisations to facilitate communication, translation and mediation. This need was corroborated strongly by the international survey and country case studies, particularly in developing country contexts.

4.2.1 Intermediary organisations as knowledge brokers and capacity-builders

The survey findings suggested a wide consensus on the need for intermediary organisations to serve as knowledge brokers at the science–development policy interface and as capacity-builders for both researchers and policy-makers. This was backed up by the expert informants; there was a strong consensus on the importance of capacity-building for scientists, policy-makers and intermediaries to use research-based evidence in the policy process. A wide range of activities, such as online courses, distance learning, in-person training, mentoring schemes, peer-to-peer learning and supporting networks, were suggested as mechanisms to build capacity in a number of areas.

However, there was a lower level of agreement on the most effective roles to be played by intermediaries, both in terms of knowledge brokers (information dissemination; advocacy for the use of scientific knowledge in policy; representing and mediating the views and goals of researchers and policy-makers; identifying important actors in the policy process; and networking between scientists and policy-makers) and capacity-building (building capacity among policy-makers to use scientific research).

Strong support for all possible roles of an intermediary indicated a largely unspecified need for the role of an intermediary, suggesting the importance of piloting various activities that intermediaries could potentially fulfil in different country and policy contexts.

Figure 13: Most important roles for an intermediary organisation (all respondents)**Box 4: Co-optation of science through communication linkages in Cambodia**

Similar to other post-conflict societies, and as highlighted by other developing country case studies in this report, Cambodia was described as focused upon socioeconomic rehabilitation, exacerbating the need for research to be aligned with government priorities and multilateral donors (perceived to be as influential as ministers) in order to encourage uptake.

Communication of research findings was described as most often conducted through dissemination seminars, gathering together researchers, civil society groups, development partners and the technical level of government ministries in a public forum. Prior to dissemination, however, research representatives must meet with senior government policy-makers to garner their agreement with the results. Legally, only the National Institute of Statistics (under the Ministry of Planning) has the authority to authorise research findings in Cambodia. Thus, although communication channels have been opened, this case study suggests scientific findings have become politicised and are utilised selectively, undermining the autonomy of science and its influence on policy.

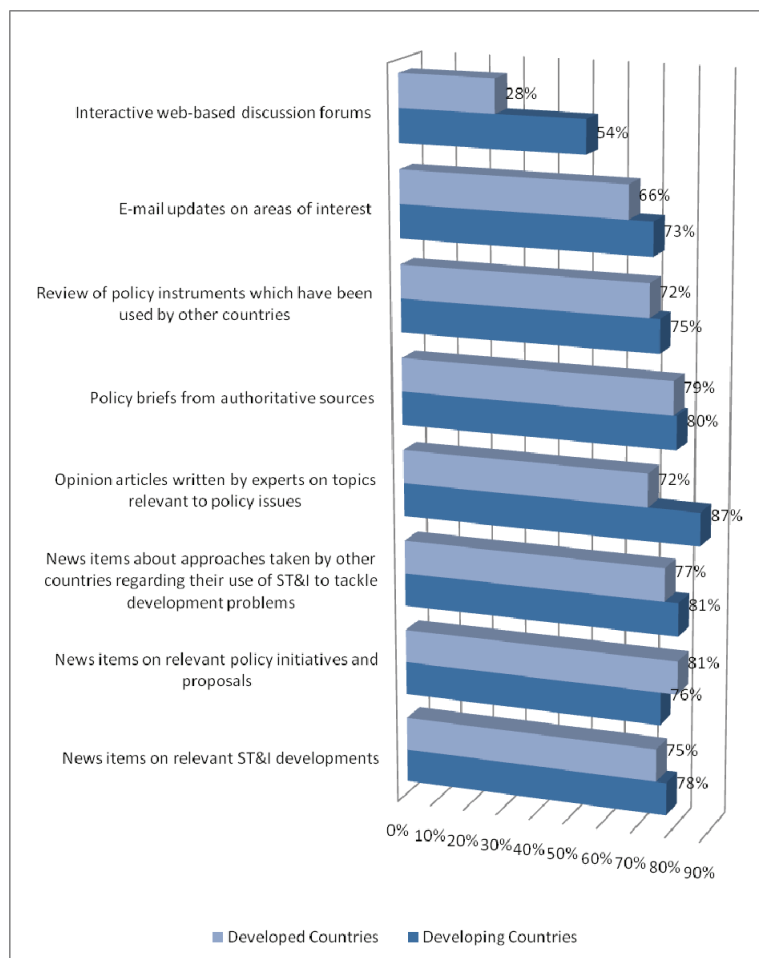
Case study author: Sin Somuny.

4.2.2 Audience-appropriate information targeting

It is critical to tailor information services and products to audience needs. Experts stressed the need to demystify key messages and increase their perceived policy relevance by carefully considering operating language, objectives, timeframe, contacts and mediums of communication. International survey responses further suggested that there is highest demand for short synthesis type products: news articles, policy briefs, background papers and topic summaries.

Developing country respondents in particular selected the following as most useful: opinion articles written by experts on topics relevant to policy issues (87%), news items about approaches taken by other countries regarding their use of ST&I to tackle development problems (81%) and policy briefs from authoritative sources (80%). The majority of respondents from developed countries also selected short synthesis products as most useful: news items on relevant policy initiatives and proposals (81%), policy briefs (79%) and news items about approaches taken by other countries (77%). Additionally, policy briefs and cases of best practice were preferred equally by policy-makers (18% and 20%, respectively, 58% preferred both), whereas interactive web-based discussion forums and email updates on areas of interest were the least preferred options, but still were of interest to more than half of developing country respondents.

Figure 14: Knowledge services that could be provided by a web-based intermediary organisation



Print publications are still the primary means of distribution in the South (73% of intermediaries use them), compared with website publications at 45%. In the North, website publication is substantially higher (72% of intermediaries), with print publication still high at 65%. These findings suggest that, although web-based access to materials is substantial, print publication remains an important means by which intermediary organisations target their audiences.

4.2.3 Targeting information to diverse audiences

Overall, our survey findings highlighted the importance of targeting ST&I information to different policy actors (in terms of the policy area of focus and level of government), and at different junctures of the policy cycle. Although this cannot be the onus of one single information provider, in assessing the boundary between ST&I research and policy-making communities as a whole it is important to understand which information products satisfy the needs of particular audience segments. Patterns of ST&I evidence use differed between science-related ministries and non-science-related ministries. As discussed earlier, non-science-related ministries reported employing scientific information primarily in the stages of policy evaluation and implementation, in contrast with science-related ministries' preference for scientific information mainly for policy conceptualisation and formulation. In particular, non-science ministries find information that facilitates the evaluation of policy decisions useful (e.g. policy briefs with key scientific conclusions supporting a policy direction), whereas science-related ministries find detailed scientific information to guide policy formation more valuable. The implication of these findings is that knowledge translators and brokers need to think carefully about how to tailor and package information so that it best meets these divergent needs, through either multiple information products or a single project designed to meet multiple needs.

Information should also be targeted to the needs of policy-makers at different levels in the government. Sub-national government officials were found to have a higher level of ST&I information demand: the demand from sub-national-level respondents was 71% on health issues (vs. 48% for all respondents); 88% (vs. 75%) on environmental issues; 80% (vs. 67%) on natural resource management; 66% (vs. 43%) on information and communication technologies; and 83% (vs. 61%) on socioeconomic policy. This interesting difference may owe to a survey bias, that within the small sample size of sub-national policy-makers (n=41), those volunteering to participate were likely to be those with a strong interest in the science–policy interface. However, another possible explanation is that policy-makers at the national level are reacting to a flood of scientific information and thus need to manage information flows rather than seek out greater information provision, whereas sub-national-level policy-makers may need more proactively to seek less plentiful, locally specific information.

Figure 15: Respondents seeking to apply S&T information across different sectors

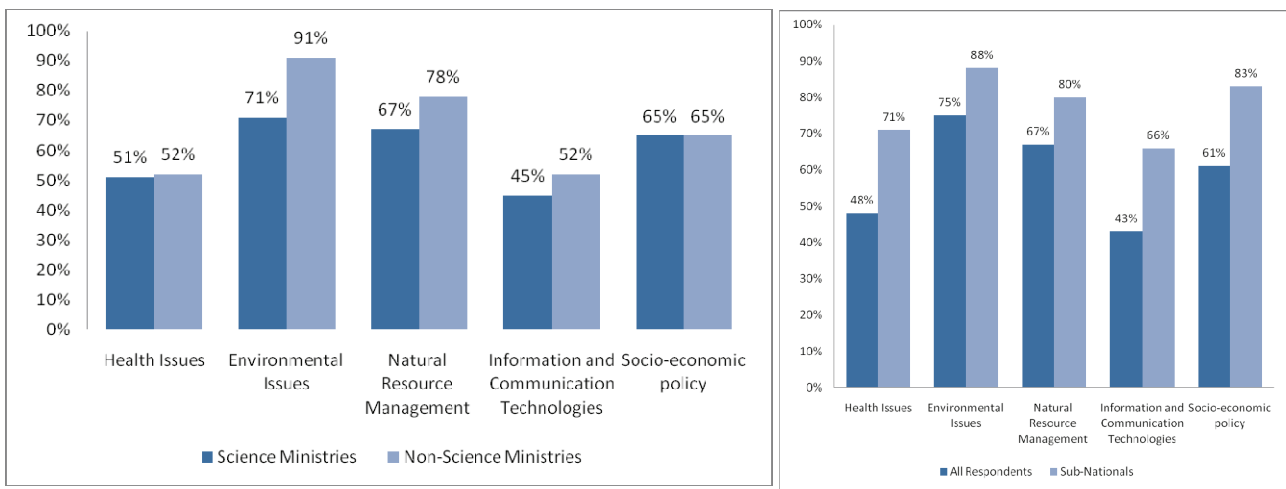


Figure 16: Areas where there is good science–policy collaboration, according to intermediary organisations

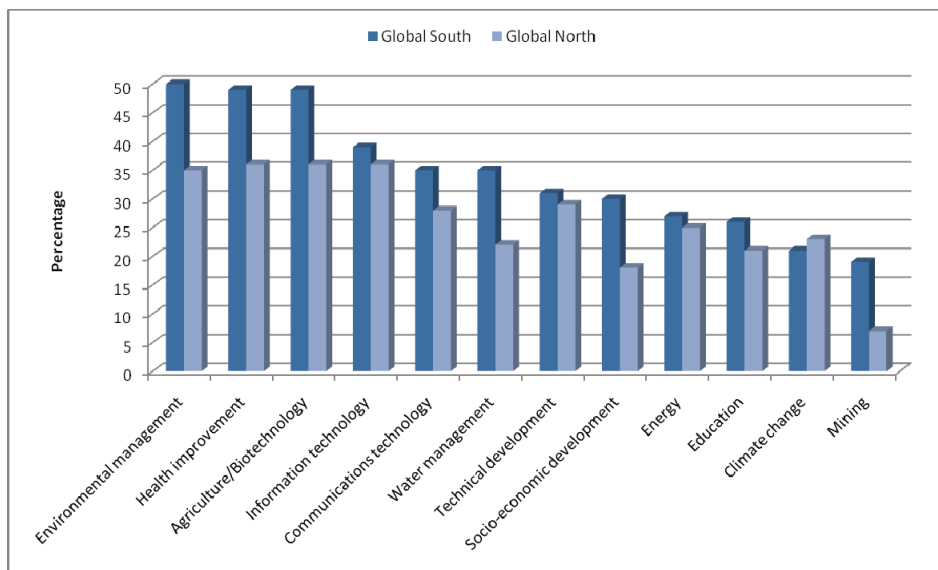
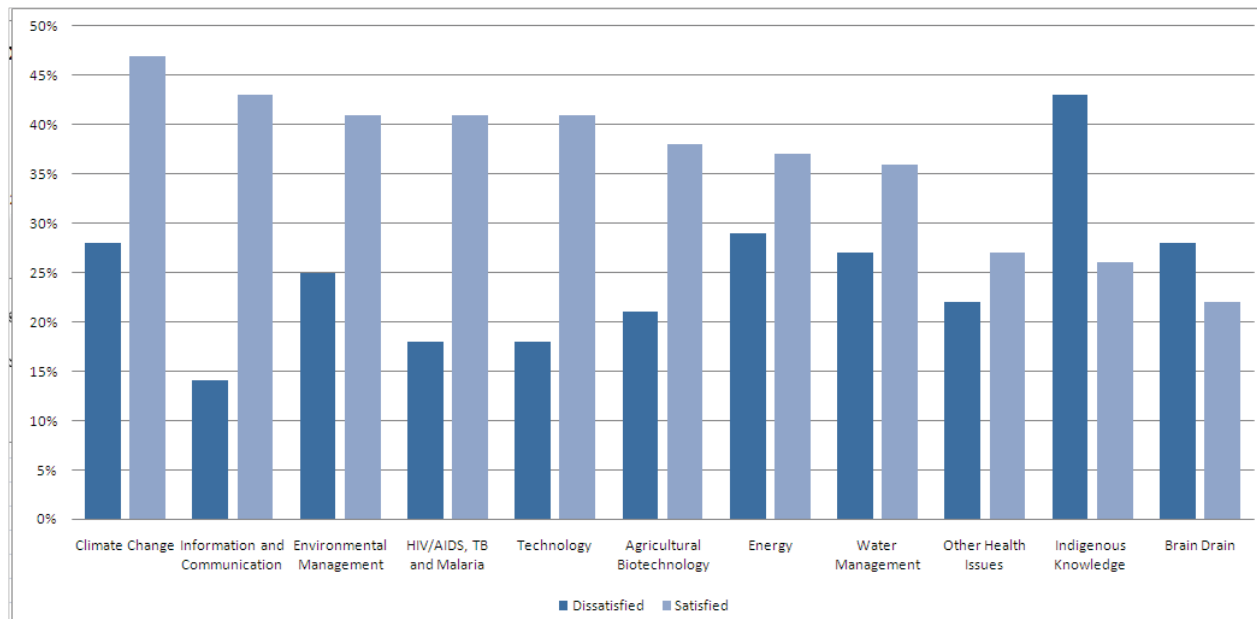


Figure 17: Satisfaction with the availability of ST&I information, by topic area

However, given the systemic obstacles identified (such as low scientific understanding by policy-makers; limited openness by politicians; a lack of incentives to use ST&I information; and the need for institutionalised communication channels for scientific information uptake), the role of intermediary organisations should go beyond information provision. All the potential roles surveyed for an intermediary organisation were ranked highly; in addition, disseminating information (which 67% thought was very important or essential), building capacity among policy-makers to use scientific research (65%) and networking between scientists and policy-makers (65%) were identified as critically important roles. This was backed up by expert informants, who stressed the need for activities such as networking and capacity-building as well as information provision. Stimulating and facilitating networks was frequently advocated, as well as the need to institutionalise discussion platforms. They also called for building scientists' capacities for engaging with policy processes, increasing scientific understanding within the policy-making process and enhancing institutional capacity

4.2.4 Managing the boundary: The importance of credibility

Ensuring credibility is critical for those working at the science–policy boundary. Respondents identified professional scientific organisations and international organisations as the most effective potential mediators between researcher and policy-maker communities. In the country studies, this was linked to a high degree of influence on national policy. Meanwhile, expert informants emphasised that the importance of personal ties in developing country politics means that there is an important role to be played by high-profile and policy-literate scientists.¹⁹ However, given that professional scientific organisations and international organisations do not necessarily include mediating at the science–policy interface as part of their organisational mandate, this suggests that there are yet many undefined roles to be filled in this area. Other possible knowledge broker candidates include policy advisors and donors, suggesting two additional audiences that research communicators need to target. Knowledge brokering between researchers and policy audiences was also viewed as an important role for web-based organisations to fill.

At the other end of the spectrum, media organisations, business organisations and advocacy organisations were rated poorly as knowledge brokers. Answers to open-ended questions in the survey indicated that media and advocacy organisations, while effective at raising issues, rarely provide

¹⁹ One expert informant remarked also that there are too few high-profile scientists in developing country context, as their career incentives tend to take them to Northern settings. This is part of the wider trend and critical problem of the 'brain drain'.

sufficient solid evidence for policy formulation. Again, this would indicate that it is critical for knowledge communicators to be careful about how they identify their organisation and its goals in order to ensure organisational credibility. This is not to suggest that media groups cannot be credible providers of information, but rather that credibility of information provision is not assumed among media organisations the way it is among international scientific organisations. Therefore, when acting as knowledge brokers, it may be critical for intermediary organisations to clearly indicate the authoritative source and authorship of their policy-relevant information as well as articulate other claims to credibility, such as a successful policy-influencing record.

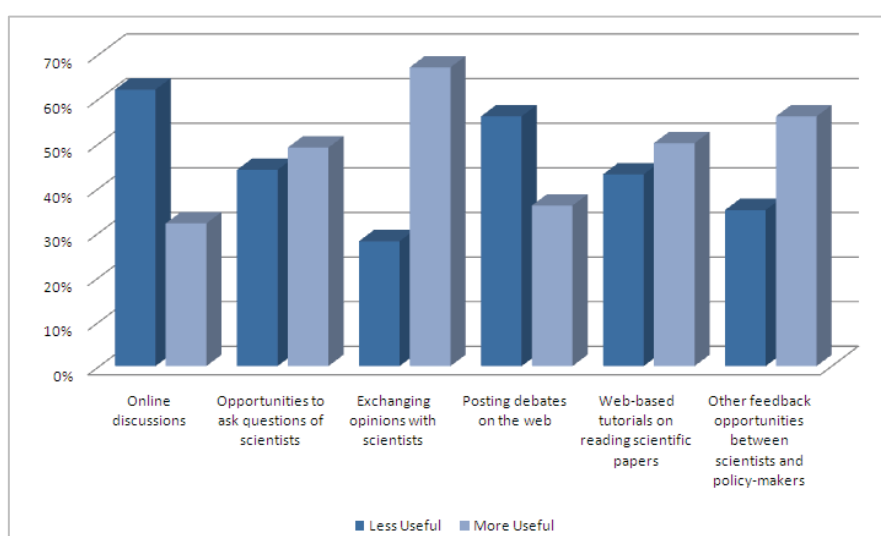
Table 4: Most effective mediators between ST&I research and policy-making

Group of respondents	Most effective groups	Least effective groups
All respondents	Professional scientific organisations (61%), international organisations (62%)	Media (19%) and corporate/business community (17%)
Policy-makers	Professional scientific organisations (69%), international organisations (67%), policy advisors (65%)	Corporate/business community (17%), media (12%), advocacy organisations (12%)
Intermediaries	International organisations (55%), professional scientific organisations (52%)	Media (20%), corporate/business community (15%)
Researchers	International organisations (65%), professional scientific organisations (65%)	Media (20%), corporate/business community (18%)

Box 5: Responses on the effectiveness of organisations mediating the science–policy interface

- *Depends on what you mean by effective. Effective at conveying information accurately, or effective at conveying information in an understandable form or effective in communicating a misrepresentation of evidence (e.g. business) or using selective evidence (e.g. advocacy groups)?* (Great Britain, think tank)
- *Effectiveness can create negative results. For example, the news media can ‘effectively’ spread correct scientific information and incorrect science myths.* (US)
- *The media and advocacy groups rarely provide adequate evidence/facts that policy-makers may rely on in doing their work. They are good in publicising the issues but often lack the evidence to take this forward.* (Sub-Saharan Africa, multilateral institution)
- *International organisations (are most effective) in the sense of being able to access international sources of information. Generally, local capacities are mediocre; in certain fields/sectors, there are individual competent organisations. Networking in-country is still quite poor, e.g. access of information and quality of primary information.* (Namibia, political advisor)

Figure 18: Policy-maker preferred mechanisms to enhance policy-maker–researcher engagement



Furthermore, the need identified in the literature to ‘police the boundary’ for the credible usage of science in policy processes is evident in that considerably more developing country respondents (52% vs. 30% in developed countries) were of the view that a lack of institutionalised channels for the incorporation of scientific information into policy constitutes an important obstacle. Moreover, as our key informants pointed out, although international scientific processes and organisations provide formal processes for getting science into policy, they are frequently superficial and powerless, or Northern-driven. Credible intermediaries are required to provide credible and legitimate pathways for the access to and usage of scientific information in developing country policies.

4.2.5 Promoting deliberation and participation

Given the overwhelming interest expressed in our survey and by the expert informants for increased interaction and deliberation between all actors in the science–development policy interface, it is important to qualify this need with specific recommendations. Three aspects of this are addressed in the remaining discussion of the survey findings:

- The potential role for intermediary organisations as knowledge brokers in the process of interaction
- The need for scientists to be engaged with policy issues and
- The need for an expanded focus on improving informed public participation regarding ST&I policy issues.

Our survey findings underscored the importance of encouraging deliberative processes, with intermediary organisations facilitating two-way communication between researcher and policy-maker communities rather than relying solely on more passive forms of information provision.

Of all respondents, 53% were of the view that opportunities for deliberation between scientific researcher and policy-making communities are essential to encourage greater and more effective uptake of ST&I information in policy processes.

Researchers also expressed a strong interest (particularly in developing countries) in intermediary organisations leading on networking initiatives (87% of developing country researchers) and providing guides on the policy-making process (75% of developing country researchers). Policy-maker respondents emphasised that they are more likely to use information if they feel engaged in the knowledge production and deliberation processes.

Specific mechanisms to encourage direct dialogue between scientists and policy-makers that were favoured include: exchanging opinions with scientists (67% of policy-makers) and feedback opportunities between scientists and policy-makers (56%).

It was felt that services requiring online participation would be slightly less helpful: 62% felt online discussions would be of limited utility and 56% felt this for posting debates on the web. In other words, face-to-face interaction and direct engagement emerged as the most preferred means to bridge the policy–research divide, with perhaps the important exception of China, as discussed in Box 6 below. Expert informants echoed this sentiment by stressing that direct contact often presents the most significant opportunity for scientific research to influence policy, but complementary interaction channels are also needed to overcome distance and time barriers.

Box 6: Importance of personal linkages for science communication in China

In China, case study findings suggest that, although media and other channels may be pursued, scientific findings are frequently presented to government officials directly. Some 75% of the study participants were of the view that written communication is the most effective means for communicating scientific and technological information to policy-makers, particularly if facilitated through personal linkages. This type of influence may be exerted through well-respected scientists writing letters directly to leaders regarding scientific issues. The uniqueness of Chinese communications channels likely owes to its strong central government and significant public and government support for innovation and productivity.

This type of communication is clearly illustrated in the case of the resumption of the Chinese civil aviation large carrier aircraft development programme in the 1980s. On 4 June 1984, 219 researchers from the Shanghai Institute of Aircraft jointly wrote a letter to the Party Central Committee, suggesting that, rather than spending substantial amounts of foreign exchange on assembling a dc9 super 80 aircraft, resources should be dedicated to developing a Chinese civil aviation industry. On 30 July 1986, again four scientists (Hu Xitao, Chen Yuan, Zhang A Zhou, and Ji Wenmei) jointly wrote 'Try Every Means as Early as Possible to Provide and Use Home-made Main Route Aircraft' to policy-makers, influencing the State Department's decision to develop a 'main route' airplane. Subsequent research and advocacy by scientists resulted in the continued development of large carrier aircraft programme and, in 2003, the nation formally established the related 'Mid- to Long-term Science and Technology Development Programme', including Special Demonstration Teams for the large aircraft project. As of 2006, the large aircraft programme has become one of the most important plans in the area of science and technology for the next 15 years.

Case study authors: Sun Yaqing and Liu Dongwen.

Additionally, the survey findings suggested that increased opportunities for communication between scientists and policy-makers would also facilitate other areas needed to strengthen the science–development policy interface: policy-maker leadership, advocacy by researchers and scientifically informed public opinion.

Figure 19: Policy-makers' views on appropriate roles for intermediary organisations

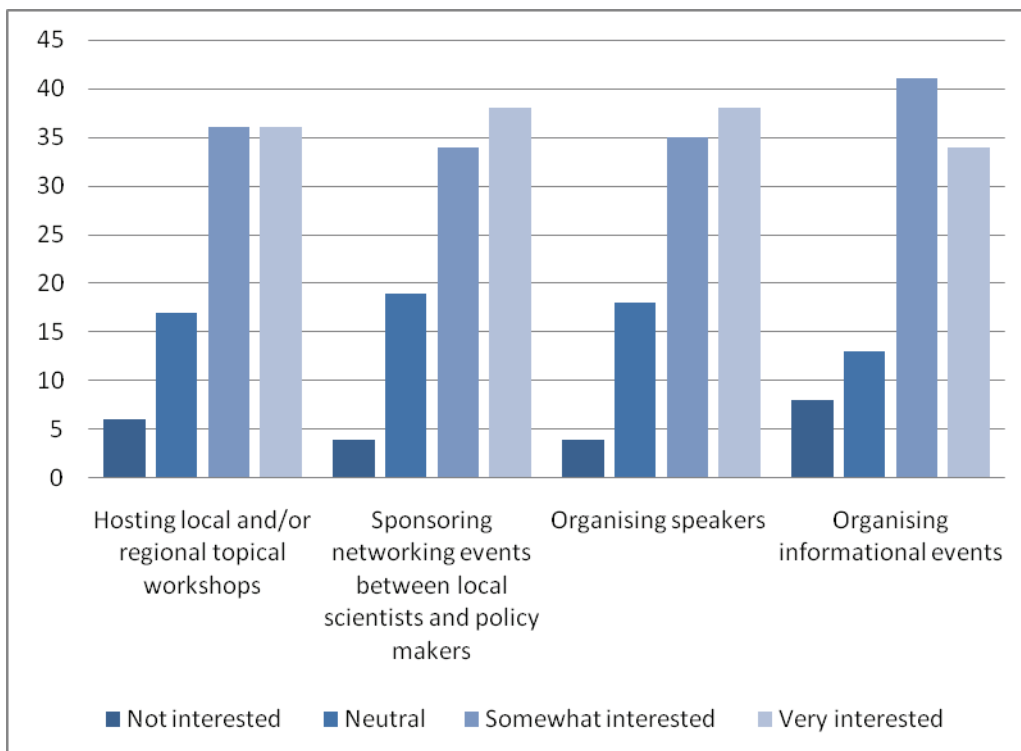
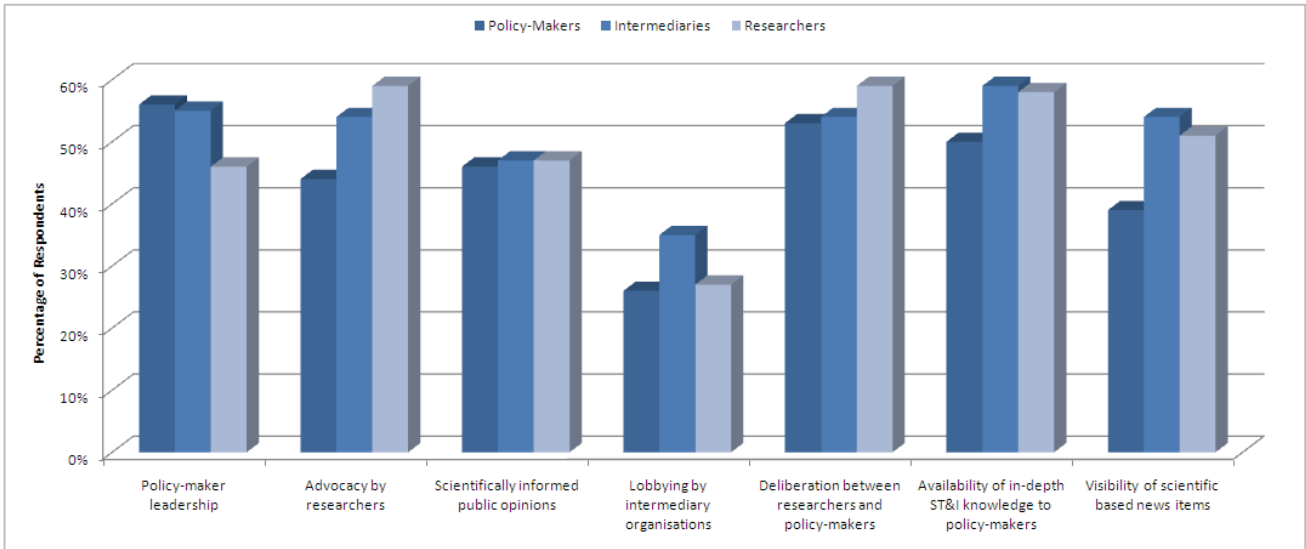


Figure 20: Facilitating factors for interaction between research and policy-making communities



4.2.6 Call for capacity-building among researchers and the public

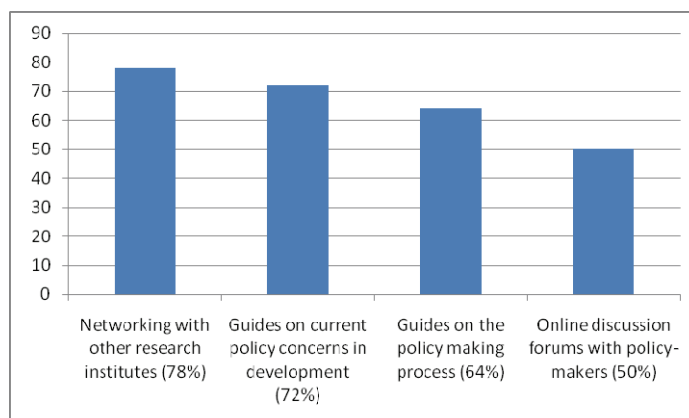
Greater participation and deliberation go hand-in-hand with efforts to build capacity among stakeholders. Although researchers emerged as critical of policy-makers’ limited interest in and understanding of scientific research, many also recognised that they could take steps to improve their engagement with the policy process.

Some 33% of researchers admitted that they were dissatisfied with their knowledge of the policy-making process and expressed a strong interest in improving related competencies, potentially through guides on the policy-making process and current policy concerns.

Expert informants suggested that intermediaries could help to bridge this gap by conducting capacity-building with researchers to respond to current political agendas, to build credibility and to consider the potential applications and implications of their research across sectors.

Networking and online discussions were also rated highly by researchers as mechanisms to improve their interaction with policy-makers and were strongly advocated by the expert informants. These interactions would increase the dissemination of research findings to policy-makers and potentially improve the credibility of scientific data in the eyes of policy-makers. By improving the capacity of researchers to target their research findings to the relevant points in the policy cycle, knowledge-brokering organisations could help increase the uptake of ST&I information into development policy.

Figure 21: Researcher interest in services that intermediary organisations could provide to enhance researcher/policy-maker community interaction



5. Conclusions

This study provides an in-depth and wide-ranging view of the science–policy interface in developed and developing countries. It includes a systematic overview of existing theory, together with important new empirical data. In doing so, it helps address some significant gaps in the literature. First, there is a dearth of studies that systematically examine the science–policy interface in Southern contexts; this study draws together the available literature on developing countries, using the broader literature on developed country contexts as a foil and to generate hypotheses. It then extends this analysis with new empirical findings. Second, our theoretical and empirical analysis addresses the current lack of studies comparing the science–policy interface in Northern and Southern contexts. Third, our systematic review approach offers new insights to existing theoretical work on the science–policy boundary. Finally, much of the existing literature is conceptual with few new empirical insights. Our paper begins to address this by bringing together a wide-ranging synthesis of the literature, combined with a detailed survey, expert informant interviews and in-country case studies.

Overall, our findings suggest that the use of science in evidence-based policy-making is poorly institutionalised in developing country contexts. This situation is similar to that of evidence-based policy-making in general in the South. However, the nature of science and its place in society brings with it some particular dynamics and challenges. These, in turn, serve to illustrate more starkly some of the challenges of evidence-based policy-making in general.

Foremost, **a strong consensus emerged from both the theoretical and the empirical results on the need for intermediaries and boundary organisations.** There is, however, less agreement on the role that such intermediaries should play: the literature provides a number of suggestions without any guidance on the relative importance of each role; our survey showed high support for all possible roles. This is indicative of the limited understanding of the science–policy interface, particularly the lack of empirical investigation into the practicalities of working at the science–policy boundary, compounded by a general lack of intermediaries and empirical experiences to draw on. As such, these findings point towards **the need to pilot roles that intermediaries could play, as a component of further research and/or action research at the science–policy interface.**

Looking in more detail at the landscape of the science–policy interface in the South, a number of trends echo the situation in Northern contexts, albeit to differing degrees:

- The **politicisation of science**, whereby scientific information is used purely as political capital and incorporated only where it supports policy-makers' preferred positions, is evident in both Southern and Northern contexts, but is possibly more widespread in developing countries owing to the lack of institutionalised processes of evidence-based policy-making and the greater importance of personal ties in politics.
- The **differing focus, timescales and incentives of policy-makers and scientists** also emerged as a significant theme in Southern contexts. As a challenge arising from the differing natures of scientific and policy disciplines, this tension echoes problems encountered in developed countries. Our survey indicated that time pressures faced by Southern policy-makers may be more acute than in the North, owing to governance issues and poor institutionalisation of evidence-based policy-making. Another distinction is that Southern policy-makers appear to have priorities that are more locally focused and require information that is more regionally specific. This is because scientific information is viewed primarily as a tool to address local concerns, particularly those bound up with socioeconomic development.
- There are also **different incentives and priorities among government agencies**, specifically between 'scientific' ministries (e.g. environment, health) and other line ministries. The former may be more inclined to use scientific information, although lacking in political power, whereas the latter may need to be convinced of the instrumental importance of scientific information to development.
- A major theme in the developed country literature was the **disjuncture between scientists' concern to identify and highlight elements of risk and uncertainty in research findings**

when engaging in policy dialogue and the demand for certainty in policy-making. Although some studies on developing countries and survey responses touched on this, it was less evident overall among Southern respondents. This is possibly because of the poor institutionalisation of evidence-based policy-making and/or lower levels of public scrutiny.

The science–policy interface in the South also differs from Northern contexts in important ways:

- There is **little mention of the scientisation of politics in Southern contexts.**²⁰ This can be explained by the generally lower level of scientific capacity and poor institutionalisation of EBP leading to significantly less use of science, and hence a lower prevalence of this more technocratic mode of policy-making.
- There is also **less concern about the dangers that policy engagement poses to scientific objectivity.** Our survey showed strong support in developing countries by researchers and policy-makers alike for greater engagement of researchers with policy debates. Country studies found that policy-makers operating under multiple pressures and influences will only adopt information that is relevant to their current policy concerns; this underlined the need for engagement. This may also be linked to the importance of face-to-face contact, which was emphasised in these contexts, and the difficulties policy-makers may face in applying scientific findings to their local situation.
- The **concern about the dilution of scientific knowledge in policy processes where science is ‘democratised’ appears to be of less relevance in developing countries,** despite significant concern in developed countries. This is related to the fact that scientific information is too rarely incorporated into policy-making. Moreover, translating and combining science with other sources of information and promoting scientifically informed public opinion were seen as major requirements for facilitating the uptake of science and technological information into policy-making.
- Finally, the **tension between indigenous knowledge and Western scientific knowledge** emerged as a concern unique to Southern contexts, where the legitimacy of scientific paradigms has typically been applied to the detriment of local priorities. Ideally, this should be resolved by facilitating the effective use of scientific information through appropriate cultural framing, combined with scientific findings that reflect salient local knowledge. The act of mediating between the two, however, must be acknowledged as a particularly complex task.

In terms of strategies proposed to overcome tensions and obstacles at the science–policy interface, there are several commonalities cutting across Northern and Southern contexts. These include: **supporting credible knowledge brokers** to mediate between scientists and policy-makers and **effectively tailoring information services and products to audience needs,** especially in developing country contexts, where making information relevant to local priorities is critical for uptake.

However, our study findings also point to a number of specific strategies that are critical to strengthening the science–policy interface in developing countries. These stand out as concrete priorities for action for potential intermediaries:

- **There is a strong need for capacity-building, institutional reform and public education.** System-wide capacity-building around the science–policy interface is necessary, targeted to the needs of diverse actors. Policy-makers need a better understanding of scientific information, along with civil servants in a number of ministries in national and local government. Similarly, scientists require a better understanding of policy processes in order to communicate research findings more effectively and to engage in a timely manner. Furthermore, in order to build demand for the uptake of scientific information into policy, there is a need to build scientific literacy capacities among the general public to improve meaningful participation of ordinary citizens in policy debates about science and technology issues.
- **The importance of deliberation and participation for effectively feeding scientific and technological information into policy was widely recognised.** This involves bringing together

²⁰ Exceptions to this tend to be characterised by examples from large multilateral organisations. It may be that the science–policy interface within multilaterals and bilaterals is somewhere between the Northern and Southern archetypes.

key stakeholders in order to combine different types of evidence, incorporate diverse opinions and ground policies and decisions in relevant and actionable advice. An intermediary facilitating face-to-face interactions and direct engagement could have a substantial impact in bridging research and policy.

- Related to this, **policy-makers expressed strong interest in greater access to advice from scientific experts regarding the policy relevance of their findings.** This could be linked to the lower prevalence of technocratic policy-making in the South and represents a call for greater engagement and applicability of research findings to policy concerns.

In sum, this study underscores a number of important challenges particular to bridging scientific and technological information and policy in developing countries. Poorly institutionalised evidence-based policy-making is in general compounded by lower levels of scientific capacity and of public education in science. Effectively applying (what can be characterised as) a ‘foreign’ paradigm requires sensitivity to culture, power structures and local knowledge. The various difficulties and tensions are interrelated and present a complex challenge, one which requires a system-wide view of the science–policy interface. However, although systemic obstacles do exist, there is a strong demand for intermediaries to play a greater role and for opportunities to strengthen interactions between science and policy.

The will to engage, the desire for deliberation, participation, opinion and advice and the demand for locally differentiated information all mark out promising avenues. These also provide opportunities to expand science–policy interactions through the incorporation of more Southern voices into debate and dialogue.

A note of caution must be sounded. Although engagement, deliberation, participation and advice represent important opportunities, they must be approached strategically and with realism regarding the power and politics involved in a specific context. The politicisation of science presents a significant risk and may be exacerbated in Southern contexts, owing to lower levels of education and weakly institutionalised evidence-based policy-making. The need for mediation activities, which would serve to reduce the politicisation of science, is not widely acknowledged; moreover, although the literature often touches on these issues, a systematic conceptualisation and synthesis of mediation is lacking.

There is also a dearth of practical policy approaches. It will therefore be important for intermediaries to explicitly address the question of mediation and to explore how levels of mutual credibility can be maintained through relevant accountability mechanisms and decision-making procedures. Incorporating these strategies is likely to enhance the impact intermediaries have in ensuring that scientific and technological information contributes effectively to poverty reduction.

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Appendix 1: Literature review methods

This study employed a modified version of the expert-recommended systematic literature review approach pioneered by the Canadian Health Services Research Foundation (CHSRF) (see Lomas et al., 2005). This methodology involved the following sequential steps:

- i) An initial list of contacts was identified, from SciDev.Net's past, present and future trustees, and a group of additional key individuals and relevant organisations were identified by Overseas Development (ODI) Research and Policy in Development (RAPID) staff. The starting point for the bibliography on the science–policy interface was suggestions for papers from the same key informants.
- ii) This initial bibliography was then expanded through a number of systematic web searches.
- iii) The list of literature and web resources was expanded by: checking through bibliographies of high-quality papers on the initial list and searching for any new keywords or phrases acquired from them; searching for papers by individuals already identified as key informants or important authors; trawling websites of identified organisations for useful documents; and looking at papers recommended by contacts.
- iv) An email was sent out to over 140 experts identified through the process described above, which asked if they would like to participate in identifying relevant literature for the study. The email proposed that they recommend five key documents on communication at the science–policy interface. This yielded a largely positive response and experts were often happy to highlight key articles or books. This process also proved to be an excellent way to confirm or bring into question the quality of articles that we had already sourced when they materialised or failed to materialise in the expert recommendations. The responses received were utilised to cross-reference articles that had already been recommended by experts in the list gathered in the inception phase of the study (the list of experts was approximately 20 and these were asked for initial recommendations), thus reaffirming the quality and relevance of the articles we would go on to select for the literature review.
- v) Drawing on an analytical framework detailing key questions to be explored in the study, the co-authors first independently and then jointly decided on the articles to be included in the annotated bibliography based on the abstracts of articles in the full bibliographic list. A total of 42 articles were reviewed, focusing on developing and developed country environments.
- vi) The analysis for the overarching literature review that draws on the 42 articles and books in the annotated bibliography was facilitated by the use of a qualitative software data package, Max QDA. The co-authors jointly decided on a coding structure and all of the developed and developing country sources were coded accordingly.

Appendix 2: Country case questionnaire

Overview

In eight Southern countries, local partners are to undertake a brief review of science–policy links in each country. 20 key informants are to be identified and interviewed (preferably in person) by the local partner, using the questionnaire below. Key informants should be a mix of researchers (primarily agricultural science, healthcare and nutrition, environmental science, natural resource management, technology and innovation and trade and intellectual property), policy-makers (both parliamentary select committee members and government civil servants (especially from ministries of science and technology, agriculture, health) and intermediaries (such as advocacy and pressure organisations, interest groups, media and communications organisations and lobbyists).

Additionally, it is anticipated that local partners will hold a half-day focus group discussion with 10–15 participants to further explore knowledge gaps that were not captured through the key informant interviews. General guidance will be provided for hosting the focus group, but with scope for local partner autonomy in organisation and delivery.

The following outputs are required. These will include a brief summary report of the science–policy interface in the country (approximately two to three pages), a brief workshop report highlighting key conclusions (approximately four to five pages), a synthesis of key findings from the interviews (approximately three to five pages) and the interview transcripts/notes. All of these materials should be translated into English if the interviews are conducted in a local language. For guidance on the report format and content, please refer to the accompanying document.

Methodology

The main objective of the survey is to obtain in-depth knowledge of the policy environment and the ways in which research on the natural sciences and technology is integrated. We are interested in exploring both enabling factors and barriers to bridging science/technology and policy. Therefore, survey results should advance understandings of current policy decision-making, avenues for communicating scientific findings and effective mechanisms for influencing policy-making on science and technological issues.

The research project was designed drawing on ODI's RAPID framework (see http://www.odi.org.uk/RAPID/Tools/Toolkits/RAPID_Framework.html), which involves four core components:

- i) Analysing the **political context** (both formal political institutions and informal political culture)
- ii) **Linkages** between researchers and policy links (i.e. communications channels and forums, networks, ways in which research messages are framed)
- iii) Quality of **evidence** and the credibility of the messenger
- iv) **External influences** (e.g. donor presence, relative weight of international agencies) in a given country

It also benefited from insights from the CHSRF: http://www.chsrf.ca/other_documents/pdf/weighing_up_the_evidence_e.pdf.

With direction and support from UK-based project staff, local partner organisations will arrange and facilitate the survey and focus group with key informants between 2 and 16 July. Follow-up, data interpretation and short reports should be completed by 19 July.

Interview instructions

In order for us to make effective comparisons over time and across countries, the questionnaire combines pre-coded multiple-choice questions with semi-structured interview questions. For the multiple choice questions *please indicate which standard answer comes closest to describing your case.*

We are well aware that these standard questions cannot capture the full complexity of science and policy issues in different country contexts. Therefore, please provide additional comments to better explain the situation in your country where appropriate. ***It is important to answer all the questions. We expect that the questionnaire will take between 30 and 45 minutes to complete.***

Please note that, to focus the discussion, the survey is concerned only with the natural sciences and policy issues at the country level.

The importance of obtaining a diverse sample of experts cannot be overemphasised. When possible, interviews should be conducted with a balance of scientific researchers (covering a range of natural science disciplines and areas), policy-makers (both parliamentarians and civil servants [see above for more details]), academics interested in science policy and intermediaries (such as advocacy and pressure organisations, interest groups, scientific evidence-based coalition group members, media and communications organisations and lobbyists).

For common definitions and further resources, please see the Research and Policy in Development Tools at <http://www.odi.org.uk/RAPID/Tools/Index.html>.

Please refer to the complementary documents for recommendations on conducting interviews and focus groups. Any questions and concerns should be raised with Pamela Muckosy, Country Study Coordinator, Overseas Development Institute: p.muckosy@odi.org.uk, +44 (0) 20 7922 0300.

Questionnaire

Part I: Interviewee profile	
1. What is the name of your organisation?	
2. What is your position within the organisation?	
3. What type of organisation do you work for?	<input type="radio"/> NGO <input type="radio"/> Community group <input type="radio"/> Independent research institute/think tank <input type="radio"/> Government research institute/think tank <input type="radio"/> University-based research department <input type="radio"/> Freelance consultant (individual researcher) <input type="radio"/> Consulting company <input type="radio"/> Network <input type="radio"/> Other (please specify): _____
4. How many years of experience do you have with science and policy in your country?	
5. To what extent does your organisation seek to influence government policy in your country?	<input type="radio"/> 1 Not at all <input type="radio"/> 2 Partially <input type="radio"/> 3 Somewhat <input type="radio"/> 4 Very much <input type="radio"/> 5 It is a primary objective
Additional information? (e.g. Which type of policy? Which areas of science?)	

Part II: Scientific knowledge and policy interface	
<i>Political context and policy-making process</i>	
Political context	
1. In your experience, which individuals/ positions are most influential in shaping critical science-based policy decisions? Why? (i.e. Which government institutions/ministries and at national, regional or municipal level?)	
2. What are the key science-based areas prioritised by national and regional governments?	
3. Please rank the degree to which policy-makers direct/influence scientific research	<input type="radio"/> 1 Not at all/research topics are selected by independent researchers <input type="radio"/> 2 Partially <input type="radio"/> 3 Somewhat <input type="radio"/> 4 Very much <input type="radio"/> 5 Research topics are primary dictated by government policy-makers
4.a. Please rank the level of scientific knowledge of policy-makers in country	<input type="radio"/> 1 Very little scientific knowledge <input type="radio"/> 2 Partial <input type="radio"/> 3 Somewhat <input type="radio"/> 4 Very much <input type="radio"/> 5 Significant
4.b. Please rank the level of scientific knowledge of the scientific research community in country	<input type="radio"/> 1 Very little scientific knowledge <input type="radio"/> 2 Partial <input type="radio"/> 3 Somewhat <input type="radio"/> 4 Very much <input type="radio"/> 5 Significant
4.c. Please rank the level of scientific knowledge of the civil society groups and other intermediary groups in country	<input type="radio"/> 1 Very little scientific knowledge <input type="radio"/> 2 Partial <input type="radio"/> 3 Somewhat <input type="radio"/> 4 Very much <input type="radio"/> 5 Significant
5.a. If a researcher or intermediary, how would you rate the success of your organisation in influencing policy in your country?	<input type="radio"/> 1 Not at all successful <input type="radio"/> 2 Rarely <input type="radio"/> 3 Occasionally <input type="radio"/> 4 Often <input type="radio"/> 5 Very
5.b. If a policy-maker, how often does scientific evidence influence policy decisions?	<input type="radio"/> 1 Not at all successful <input type="radio"/> 2 Rarely <input type="radio"/> 3 Occasionally <input type="radio"/> 4 Often <input type="radio"/> 5 Very
Process	
6. In your experience, what policy-influencing tactics have been successful?	Response: _____ Additionally, please select from the following strategies that are commonly used: <ul style="list-style-type: none"> <input type="radio"/> Work on projects commissioned by policy-makers <input type="radio"/> Piloting alternative policy approaches <input type="radio"/> Commenting on draft policy documents <input type="radio"/> Organising policy seminars <input type="radio"/> Newsletter to policy-makers <input type="radio"/> Insider lobbying <input type="radio"/> Networking with other organisations <input type="radio"/> Publications on policy issues <input type="radio"/> Submitting articles in the media <input type="radio"/> Website <input type="radio"/> Providing training <input type="radio"/> Providing services

7. Who is the first point of contact for introducing scientific findings to policy decisions?	
8. What is the general time period given to commissioned researchers by policy-makers?	
9. What is the timeframe for having evidence submitted, analysed and responded to by policy-makers?	
10. In your experience, what barriers block scientific evidence from influencing policy?	
Evidence	
Research strategy	
11. In your experience, what mechanisms/strategies have given science/technology evidence legitimacy (or made the research results convincing)? Can you provide specific examples?	
12.a. Please rank your confidence that significant findings will be able to reach and impact government decision-making.	<input type="radio"/> 1 No confidence <input type="radio"/> 2 Little confidence <input type="radio"/> 3 Average confidence <input type="radio"/> 4 High confidence <input type="radio"/> 5 Significant confidence
12.b. Please explain the reason for your ranking and please give specific examples	
Communications strategy	
13.a. What sources/communication channels, particularly electronic, do different groups use to meet their information needs?	<input type="checkbox"/> News articles <input type="checkbox"/> Background papers <input type="checkbox"/> Opinion pieces <input type="checkbox"/> Policy briefs or in-depth overviews <input type="checkbox"/> Topic summaries <input type="checkbox"/> Links to key organisations <input type="checkbox"/> Other: _____
13.b. What are the respective strengths and weaknesses of these sources?	
14. What type and form of information is most easily accepted? Does this differ by target audience?	
15. What form does the most effective type of written communication take?	
Research and policy links	
16. Please comment on how researchers use external bodies to inform and influence policy-makers (such as advocacy or lobby groups, local constituents, NGOs, media, etc)?	
17. Please identify at least five leading groups actively engaged in scientific research and/or	

policy influence in the country	
18. What links, networks or partnerships exist between such external bodies/intermediaries? Please identify who they are	
19. How can intermediary groups assist researchers (and address weak links in effectively influencing policy)?	
<i>External influences</i>	
20. Who are the key international actors in science and technology areas? How influential are they in national-level policy-making?	
21. How does the uptake of international scientific evidence differ among national and local policy-makers?	
<i>Examples</i>	
22a. Please describe a specific case or best practices for research that has effectively influenced policy	
22b. Please describe a case of failure where science/technology evidence has been ignored by policy-makers.	
Additional comments?	

Appendix 3: ODI/SciDev.Net electronic international survey on the science–development policy interface

The following survey is part of a research project being conducted by ODI on behalf of SciDev.Net.

The survey is intended to generate information about the way that individuals engaged in all aspects of policy-making in developing countries make use of information about science and technology, and in particular to provide information about the most effective ways in which this information can be communicated.

We are particularly interested in learning about the use of scientific knowledge and technical information in areas of policy – such as health and environmental protection – where its importance is relatively obvious. But we are also keen to learn more about how such knowledge and information can stimulate greater evidence-based decision-making in all other areas of public policy, and how organisations such as SciDev.Net can contribute to this process.

We would be very grateful to receive your response to the survey, which should take no longer than 20 minutes to complete.

This questionnaire is divided into two parts.

Part A is a set of core questions that we would like everyone to answer.

*Part B contains a number of different modules for different types of research and policy actors – please only answer the module if you identify with that category, i.e. ‘academic/researcher’^{***}, ‘intermediary organisations’ or ‘policy-maker’.*

PART A

Section 1. Respondent’s profile: Basic information

1. *What is your name?*
2. *What is your country of residence?*
Please choose country name (drop-down box)
3. *Where did you hear about this survey?*
 - a. ODI website/newsletter
 - b. EBPDN network
 - c. INASP network
 - d. SciDev.Net
 - e. Email notification from ODI
 - f. Email notification from colleague
 - g. Other (please specify)
4. *What type of organisation/institution do you work for?*
 - a. Science-related ministry (e.g. Ministry of Health)
 - b. Non-science-related ministry (e.g. Social Policy)
 - c. Multilateral (e.g. UN body)
 - d. Political advisory
 - e. Legislature
 - f. NGO/intermediary organisation (e.g. International HIV/AIDS Alliance)

^{***} For the purposes of this survey, the following groups will be defined as: academic/researcher (those conducting primary scientific or technological research); intermediary organisation (those operating in the space between scientific research and policy-making, including NGOs, knowledge-brokering organisations, advocacy coalitions, etc); and policy-makers (those involved in policy-making at the international, regional, national or sub-national level).

- g. International scientific panel
- h. Industry
- i. Academic institution
- j. Media organisation
- k. Other (please specify)

5. *What is your position within the organisation?*

- a. Technical advisor
- b. Policy advisor
- c. Managerial
- d. Administrative
- e. Researcher
- f. Analyst
- g. Programme development
- h. Monitoring and evaluation
- i. Other (please specify)

Section 2. Accessing information for evidence-based policy-making

6. *How helpful are each of the following sources of information for you in making decisions (or recommendations) on science- and technology-related issues? (e.g. If you are a researcher, which sources are helpful for you in making research agenda decisions?)*

Source of information	Never useful	Sometimes useful	Usually useful	Always useful
Public opinion polls				
Policy briefs created by trusted advisers				
Policy briefs created by intermediary organisations				
Scientific papers				
Topic summaries				
Scientific data				
Media coverage				
Focus groups				
Other (please specify)				

7. *How often do you use scientific knowledge and technical information in your work?*

- a. Frequently
- b. Regularly
- c. Occasionally
- d. Never

8. *In which policy areas do you usually seek relevant information about science and technology?*

Please tick all that apply

Policy area	
Health issues	✓
Environmental issues	
Natural resource management (e.g. water, land)	
Information and communication technologies	
Socioeconomic policy	
All of the above	
Other (please specify)	

9. *How satisfied are you with the level of access you have to scientific information and technological knowledge relevant to the policy issues with which you are engaged?*

- 5- Highly satisfied
- 4- Satisfied
- 3- Acceptable
- 2- Dissatisfied
- 1- Greatly dissatisfied

10. *Currently, how effective are the following intermediary organisations between scientific and technological research and policy in your country?*

Intermediary group	Not effective	Sometimes effective	Satisfactorily effective	Usually effective	Highly effective
Media					
Advocacy groups and coalitions					
Professional scientific organisations					
NGOs					
Networking organisations					
Policy advisors					
Corporate/business community					
International organisations					
Other (please specify)					

If you would like to elaborate, please do so here:

11. *What obstacles have you encountered in accessing scientific knowledge and technological information relevant to your interests?*

Obstacles to accessing information	Never an obstacle	Sometimes an obstacle	Usually an obstacle	Always an obstacle
Unsure of where to access information				
Information is not relevant to needs				
Insufficient information on science/technological challenges facing my country/region				
Information is out of date				
Information is too lengthy				
Information is too minimal				
Language is too technical				
Information is too general				

If you would like, please elaborate on your answer, or discuss other obstacles here:

12. *In your opinion, how credible is each of the following sources in providing scientific knowledge and technological information that is relevant to evidence-based policy?*

Please place a tick in the appropriate column for each source

Source of information	Not credible	Sometimes credible	Acceptable	Highly credible
Government				
Independent policy research institute				
Published scientific research				
Universities				
Print media sources (e.g. news stories)				
Professional scientific organisations				
Electronic media				
Local civil society organisations				
NGOs				

Should any particular group's perceived credibility be improved? Do you have suggestions on how this might be achieved? (Please state which group you are referring to)

Section 3. Types of product

13. *What could a free access web-based organisation provide that would help you access scientific and technological knowledge relevant to your work?*

Please place a tick in the appropriate column for each type of product

Section 4. Desired outcomes of a web-based scientific–policy intermediary organisation

14. *How useful are the following types of information for your decisions related to development policy and practice?*

Please rate each type of information.

Type of product/service	Never useful	Sometimes useful	Usually useful	Always useful
News items on relevant scientific and technological developments				
New items on relevant policy initiatives and proposals				
News items about approaches taken by other countries and regions regarding their use of science and technology to tackle development problems (e.g. successful case examples, summary articles)				
Opinion articles written by experts on topics relevant to policy issues you are concerned with, and other informed stakeholders				
Policy briefs (short objective statements which set out the pros and cons of different policy options regarding issues relevant to your problems) prepared by authoritative sources				
Review of policy instruments which have been used by other countries to implement their science and technology policies				
Email updates on pre-selected areas of interest				
Interactive web-based discussion forums (e.g. discussion boards, comments)				
Other (please specify)				

Type of information	Never useful	Sometimes useful	Usually useful	Always useful
Learning about specific policy options on particular scientific issues				
Learning about the general regional and international background environment of specific policy issues (e.g. shifts in donor agency policies)				
Learning how other countries have handled similar policy issues (e.g. brain drain)				
Learning about future policy challenges (e.g. biofuels)				
Provision of key data sources relevant to specific policy issues (e.g. scientific data on climate change)				
Summaries of key research findings relevant to specific policy issues				
Learning about the views of key stakeholders (e.g. knowing how farmers or consumers view GMO technology)				
Learning about the views of acknowledged experts (e.g. opinions of independent scientific researchers)				

15. *When gathering scientific and technological information for your decisions, which levels of information specificity are useful?*

Level of information	Never useful	Sometimes useful	Usually useful	Always useful
Internationally relevant information				
Regionally relevant information				

Nationally relevant information				
Locally or municipally relevant information				

16. *How satisfied are you with the amount of science and technological evidence relevant to development policy and practice available on each of the following topics?*

Please place a tick in the appropriate column for each topic

Topic	Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very satisfied
Environmental management					
Agricultural biotechnology					
Brain drain					
HIV/AIDS, TB and malaria					
Other health issues					
Climate change					
Energy					
Information and communication					
Water management					
Indigenous knowledge use in sustainable development					
Technology					
Other science-based topics (please specify)					

17. *If you were accessing web-based policy briefs and scientific information, how much time on average would you spend reading information for each policy issue?*

- 2 hours or more
- 1-2 hours
- 30 minutes-1 hour
- less than 30 minutes

18. *If you were accessing web-based policy briefs and scientific information, which of the following types of graphical or visual representation of information would be helpful?*

Please select all that apply

- Graphs
- Pie charts
- Photos
- Explanatory diagrams
- Other (please specify)

19. *How important do you think scientific and technological information is for each of the following groups in decision-making regarding development policy?*

Please place a tick in the appropriate column for each group

Group	Not important	Somewhat important	Important	Very important	Essential
International multilateral institutions					
Donors					
Government ministers					
Legislators					
Political advisors					
Advocacy constituencies					
NGOs					
Business managers					
Corporate leaders					
General public					

20. *What should be the goal(s) of policy briefs on scientific and technological information?*

Please select all that apply

- a. Summarise relevant scientific and technical data
- b. Summarise scientific aspects of policy issues
- c. Summarise possible policy options and recommend a particular policy option backed by evidence
- d. Summarise the scientific debates on a particular issue
- e. Summarise the available science-based responses to a particular policy issue
- f. Provide details of resources for further information
- g. Other (please specify)

What other suggestions do you have for increasing the use of science, technology and innovation to achieve development goals (particularly in policy areas such as health, environmental management, industry, agriculture, socioeconomic development, etc)?

21. *To what extent do you think greater public knowledge about science and technology issues will lead to improved development?*
- a. Not at all
 - b. Limited
 - c. Positive
 - d. Essential

What could an intermediary organisation do to help your country, or countries in which you work, to strengthen policies that support scientific and technological knowledge development? (e.g. Provide advice on stimulating investment in ST&I? Support community outreach activities, such as science exhibitions?)

22. *To what degree do you think greater public participation in policy-making (based on generating a more scientifically and technologically informed public) will lead to more effective policy-making?*
- a. Not at all
 - b. Limited
 - c. Positive
 - d. Essential

Please explain the reason for your answer:

Section 5. Influence of science on policy

23. *How satisfied are you with the degree to which policy is based upon scientific knowledge and technological information in the country or countries in which you work?*
- 5- Highly satisfied
 - 4- Satisfied
 - 3- Acceptable
 - 2- Dissatisfied
 - 1- Greatly dissatisfied

24. *Please rate each of the following factors as for their importance as facilitating factors for the effective use of science in policy-making in the country or countries in which you work*

Facilitating factor	Not important	Somewhat important	Important	Very important	Essential
Policy-maker leadership in creating evidence-based policy					
Advocacy by scientific/researcher communities					
Scientifically informed public opinions					

Lobbying by intermediary organisations					
Deliberation between scientific/researcher and policy-making communities					
Availability of in-depth scientific knowledge and technological information to policy-makers					
Visibility of scientific knowledge based news items/current debates					
Other (please specify)					

25. *What is hindering the effective use of science in policy-making in the country or countries in which you work?*

Please rate each of the following as to how important an obstacle it is

Barriers to scientific and technological research uptake	Not important	Somewhat important	Important	Very important	Essential
Lack of institutional channels for incorporation					
Lack of dissemination of research findings beyond the scientific community					
Scientific data are not perceived as credible evidence					
Scientific research findings are not relevant to current policy issues					
Economic and social data are more relevant to policy-making					
There is too much scientific information to be useful					
There is too little scientific information available					
Scientific jargon does not correspond with the policy environment					
Limited openness by politicians, or interest in evidence-based policy					
Lack of incentives for adoption (i.e. lack of 'pull-through')					
Scientific understanding by policy-makers is low					
Other (please specify)					

26. *Which agencies and/or individuals are most effective in ensuring that scientific research is incorporated into economic and social development policy?*

Please rate each group as to their effectiveness

Actor	Not effective	Somewhat effective	Effective	Highly effective
Central government ministers				
Central government officials				
Legislators and their staff				
Local government officials				
Policy advisors				
Academic scientists				
Intermediary organisations				
Donors				
News media				
Other (please specify)				

27. *What are the most important roles for an intermediary organisation in science and policy-making?*

Please rate each of the following roles as to their importance

Intermediary organisation roles	Not important	Somewhat important	Important	Very important	Essential
Identifying important actors in the process of policy-making					
Networking between scientists and policy-makers					
Disseminating information					
Building capacity among policy-makers to use scientific research (e.g. workshops and online tutorials)					
Representing the views of policy-makers and scientists					
Advocating for specific use of scientific knowledge in policy					
Mediating between the goals of researchers and policy-makers					
Other (please specify)					

PART B

Respondents need only complete one of the following sections, please choose the section that is most relevant to your position ('policy-makers', 'intermediary organisations' or 'academics/researchers').

Section 6. For policy-makers

28. *At what stages of the policy process do you use scientific information?*

Please select all that apply

- a. Conceptualisation
- b. Formulation
- c. Implementation
- d. Legitimation
- e. Evaluation
- f. Advocacy
- g. Other (please specify)

29. *How satisfied are you with the level of contact you have with the scientific community?*

- 5- Highly satisfied
- 4- Satisfied
- 3- Acceptable
- 2- Dissatisfied
- 1- Greatly dissatisfied

30. *Which of the following services on a free-access, science-policy website would be helpful for increasing your engagement with the scientific research community?*

Please rate each of the following options

Service	Never useful	Sometimes useful	Usually useful	Always useful
Online discussions				
Opportunities to ask questions of scientists through articles				
Exchanging opinions with scientists				
Posting debates on the web				
Web-based tutorials on reading scientific papers				
Other feedback opportunities between scientists/policy-makers				
Other (please specify)				

31. *Would you prefer ...*

Please select 'a' or 'b' for each of the following; if necessary, write 'both':

- a. Having access to the original research sources of scientific findings? or
- b. Having access to summaries provided by an intermediary organisation?

- a. Scientists providing only research findings? or
- b. Scientists providing opinions and advocating policy positions in addition to research findings?

- a. Specialised expertise on different issues? or
- b. Promoting general awareness of basic scientific issues?

- a. Specific policy briefs on different issues? or
- b. Best practice examples of incorporating science into policy?

- a. Information regarding global issues? or
- b. Information that is regionally specific?

32. *How can a web-based intermediary organisation facilitate better face-to-face interactions between policy-makers and researchers?*

Please tick in the appropriate column for how interested you would be in each potential service

Type of event	Not interested	Neutral	Somewhat interested	Very interested
Hosting local and/or regional topical workshops				
Sponsoring networking events between local scientists and policy-makers				
Organising speakers (e.g. scientist presenting on recent research)				
Organising informational events (e.g. information fair on science and technology policy issues)				
Other (please specify)				

33. *Please describe any ways in which a greater 'two-way' process might be encouraged between policy-makers and scientific researchers:*

Section 7. Intermediary organisations (those operating between policy-making and scientific research, including NGOs, advocacy groups and networking organisations)

34. *Does your organisation produce policy papers and policy briefs on scientific or technological issues?*

Yes or no

35. *Where are these policy-relevant products disseminated?*

Please place tick in the central column for each group your organisation disseminates policy-relevant documents to

Group	✓
Science related ministries (e.g. Ministry of Health)	
Non-science-related ministries (e.g. Ministry of Education)	
Legislators	
Political advisors	
Advocacy constituencies	
NGOs	

Scientific organisations	
Business community	
General public	
Other (please specify)	

36. *By what means do you disseminate policy-relevant documents?*
Please select all that apply

	<input checked="" type="checkbox"/>
Email	<input type="checkbox"/>
Website publication	<input type="checkbox"/>
Print publications	<input type="checkbox"/>
News media/press releases	<input type="checkbox"/>
Journal articles	<input type="checkbox"/>
Other (please specify)	<input type="checkbox"/>

37. *Approximately how often do you use science and technology research-based information in your work?*

- Frequently
- Regularly
- Sometimes
- Never

38. *Please describe how your organisation encourages policy-makers to use scientific and technological information, including both formal and informal channels:*

39. *How satisfied are you with this process?*

- Highly satisfied
- Satisfied
- Acceptable
- Dissatisfied
- Greatly dissatisfied

40. *In which areas do you feel there is good science–policy collaboration in the country or countries in which you work?*

Please select all that apply

- Health improvement
- Technical development
- Education
- Agriculture/biotechnology
- Socioeconomic development
- Environmental management
- Climate change
- Energy
- Information technology
- Communications technology
- Water management
- Mining
- Other (please specify)

Section 8. Academics and researchers

41. *How satisfied are you with the engagement between developing country policy-makers and science and technology research communities in the country or countries in which you work?*

- Highly satisfied

- 4- Satisfied
- 3- Acceptable
- 2- Dissatisfied
- 1- Greatly dissatisfied

42. *If your research institution issues regular policy briefs aimed at policy-makers, are you satisfied with their quantity/frequency?*

- 5- Highly satisfied
- 4- Satisfied
- 3- Acceptable
- 2- Dissatisfied
- 1- Greatly dissatisfied

Please explain why:

43. *If your research institution issues regular policy briefs aimed at policy-makers, are you satisfied with their quality?*

- 5- Highly satisfied
- 4- Satisfied
- 3- Acceptable
- 2- Dissatisfied
- 1- Greatly dissatisfied

Please explain why:

44. *Do you feel you know enough about how the policy-making process works to know how to communicate your scientific and technological research findings to policy-makers effectively?*

- 5- Highly satisfied
- 4- Satisfied
- 3- Acceptable
- 2- Dissatisfied
- 1- Greatly dissatisfied

45. *How useful would the following services of a web-based intermediary organisation be to your role in facilitating evidence-based policy-making?*

Please place a tick in the appropriate column for each service option

Service	Not helpful	Somewhat helpful	Neutral	Very helpful	Essential
<i>Guides on current policy concerns</i> in development, and the relevant scientific knowledge and technical information					
<i>Guides on the policy-making process</i>					
<i>Online discussion forums</i> with policy-makers					
<i>Networking</i> with other research institutes					
<i>Other</i> (please specify below)					