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Designing effective assessments: The role of participation, science and governance, and focus

Report of a workshop co-organised by the European Environment Agency and the Global Environmental Assessment Project, Copenhagen, Denmark, 1 to 3 March 2001

Experts´corner

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The EEA's Experts' corner reports

The European Environment Agency (EEA) is mandated to provide information to the Community and the Member States, that will help them to identify, frame, implement and evaluate policies, legislation and other measures on the environment, and to keep the public properly informed about the state of the environment.

In order to provide possible inputs to the developing work programme of the EEA, and to stimulate debate on issues that may contribute to the identification, framing and evaluation of environmental policy measures, the EEA, from time to time, asks independent experts to summarise their views on topical or upcoming issues, so that the EEA can consider publishing them as Experts' corner reports.

Experts' corner reports do not necessarily reflect the views of the EEA, or of any other EU institution: they are the opinions of the author only. However, they are intended to facilitate the broader dissemination of more recent environmental information that may provide useful inputs into the developing environmental agenda. The EEA hopes, therefore, that they will be of interest to the Community, Member States and other environmental stakeholders, whose comments on the contents it would welcome.

This report benefited from consultation with the participants at the workshop. Jill Jaeger, International Human Dimension Programme on Global Environment Change and Bill Clark, Global Environmental Assessment Programme are acknowledged in particular for their support, assistance and comments on earlier drafts.

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Preface

The Mission of the EEA is to help achieve significant and measurable improvement in Europe's environment through the provision of timely targeted, relevant and reliable information to policymaking agents and the public. But how will we know whether we are achieving this task?

An important first step is to find out what the relevant research community is saying about the effectiveness of the sort of scientific assessment reports that the EEA and others, like the Intergovernmental Panel on Climate Change, produce.

In March of this year the Agency and Harvard University's Global Environment Assessment research programme (GEA) co-organised a workshop on designing effectiveness assessments, with contributions from the European Forum on Integrated Environment Assessment (EFIEA), which is funded under the European Commission's Research Programme. Participants examined case studies, including the EEA's reports on *Europe's Environment at the Turn of the Century* and *Chemicals In Europe: Low Doses. High Stakes?* in the context of the US and EU research results.

This current report, written as an EEA Experts' corner by Noelle Eckley, a Fulbright scholar who shared her experience with us for a year, contains a wealth of insights into the science /policy/stakeholder interface that have been derived from over 30 research papers and from the workshop conclusions. Whilst measuring effectiveness is very difficult, (and researchers have avoided the pitfalls of using just one definition), it seems that those assessment reports that are not perceived by users as credible, salient and legitimate are less effective than those that are. The main design parameters for effective reports concern the participation of partners, clients and stakeholders in the development of the report, the institutional architecture that structures links between scientists, policymakers and the public, and the focus of the report.

There are some rich pickings in this report for the producers and users of assessment reports to consider and digest, particularly those from the Accession countries who need to 'leapfrog' over the sometimes-costly experiences of the EU.

For example, how broad should be the focus of assessment reports? Multi-causality and 'everything connects' supports the broadest possible focus but this can mean a loss of credibility as scientific disciplines at such different stages of maturity as atmospheric physics and scenario analysis are brought together in one assessment. The most effective focus can depend on the question being addressed, but if that is too narrowly focused then important phenomena such as secondary, or spillover, benefits can be lost. A recent assessment of acidification mitigation in Europe, for example, found that its costs were much higher if the spillover effects on climate change mitigation, from reductions in fossil fuel emissions, were not brought into focus. The report notes that decisions on focus involve value choices, which, along with the treatment of uncertainties and other assumptions, should be made explicit in any effective report.

Should assessment reports contain recommendations for action? The participants differed on this with some not wanting to mix science with policy whilst others noted the impossibility of avoiding 'soft policy signalling' if the report was to support the 'framing' of any issue, such as chemicals or climate change. One option that could help improve decision-making is for reports to include the policy options that are under consideration with assessments of their impacts.

The workshop noted the critical importance of having 'boundary organisations' that can link and be accountable to the different worlds of science and policymaking, which is a task that we at the EEA are trying to perform.

I hope this report will help all those involved in such "boundary" and assessment work to improve their performance. I would like to thank Noelle Eckley for preparing this report; Jill Jaeger and Bill Clarke for their work and cooperation in the March workshop and for supporting this follow up, as well as workshop participants and EEA staff who contributed to this report.

Domingo Jiménez Beltrán
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Contents

1. Introduction: Context of the workshop

How can environmental assessments be conducted more effectively? What lessons might those designing environmental assessments learn from the experiences of others? From 1 to 3 March 2001, a group of 30 practitioners and scholars of environmental assessment processes met in Copenhagen to discuss these questions at a workshop entitled 'Designing effective assessments: The role of participation, science and governance, and focus'. The workshop was co-organised by the European Environment Agency (EEA) and the Global Environmental Assessment (GEA) Project, with contributions from the European Forum on Integrated Environmental Assessment (EFIEA).

There has been increasing interest in collecting and analysing the experiences of different assessment processes, in order to determine whether generalisable lessons can be drawn about what sorts of assessment design choices are available and which ones tend to lead to more effective assessments. Over the past five years, the Global Environmental Assessment Project has attempted to address these questions, as part of a broader effort to explore the relationships among science, policy, assessment, and management in societies' efforts to address global environmental change. Understanding the effects and effectiveness of assessment, distinguishing more from less effective assessments, and analysing what makes certain assessments more effective than others have been a central challenge of the GEA Project. Based at Harvard University, the project has engaged an international, interdisciplinary group of researchers, and examined assessments on issues such as climate change, ozone depletion, tropospheric air pollution, biodiversity, and chemicals ([1]). It has examined over 12 assessment processes from around the world, and this has resulted in over 30 research papers. Over the same period, the EEA has conducted three major comprehensive assessments of Europe's environment and a large number of specific thematic assessments (e.g. European air quality; tropospheric ozone; biodiversity; the Mediterranean; chemicals and the environment; soil; transport and the environment) ([2]). The EFIEA project, funded under the European Commission's fifth research framework programme, has operated over a similar period and aims to improve the current practices of integrated environmental assessment ([3]).

At the workshop, three case studies were considered: air pollution in Europe; the EEA's 1999 'Turn of the century' assessment; and chemicals assessment in Europe (European Environment Agency, 1998). These were discussed in the context of a framework presented by the GEA Project, within which designers of environmental assessments might evaluate the effectiveness of such assessments. The workshop addressed three major themes that were identified by the first four and a half years of GEA research to be critical design choices influencing the credibility, salience, and legitimacy of environmental assessments. These were the issues of participation (who is involved in assessment processes); science and governance (how are assessments conducted, particularly with respect to the interactions between scientific experts and policy-makers); and focus (what is within, or excluded from, the assessment's scope). After presentations of three case studies of assessments, participants discussed the workshop themes in three parallel working group sessions. The following report presents and discusses in detail the discussions of the working groups and the synthesis session on the third day of the workshop, which presented reports from working groups and reactions from practitioners on the three themes.

The report is organised as follows: by way of background, Section 2 provides a framework for evaluating assessments that was used in discussions at the workshop. The following three sections correspond to the three themes of the workshop — participation, science and governance, and focus — and present the findings of the working groups on how these 'design' variables influence the effectiveness of assessments. The final section concludes by identifying issues that cut across the three themes, and discussing the ramifications of the workshop's conclusions for those who design environmental assessments.

([1]). More information on the Global Environmental Assessment Project, and copies of project discussion papers, are available on its web page (http://environment.harvard.edu/gea).
([2]). See http://eea.eu.int.
([3]).See http://www.efiea.org.

2. Background: A framework for evaluating assessments

In policy arenas where decisions and issues change over time, and many different things can simultaneously drive the progress of decision-making, it is difficult to identify the impact of any one influence. In the case of information and scientific assessments, this is a particular challenge. However, through its work, the GEA Project has mapped several different ways in which assessments can affect the policy process, and has developed a framework within which assessments and their influence might be better understood.

Scientific assessment processes that seek to inform policy-makers are increasingly common, and are of growing importance in decision-making on environmental issues. The most recent assessment conducted by the Intergovernmental Panel on Climate Change (IPCC) involved over 1 000 scientists in an elaborate process of drafting, reviewing, and communicating scientific findings to a worldwide audience. The European Environment Agency's reports on the European environment collect, analyse, and report data on the state and direction of environmental quality in the entire European region. Models and integrated assessments conducted for the Convention on Long-Range Transboundary Air Pollution (CLRTAP) give feedback to negotiators on policy options. All of these are scientific assessments — they are processes by which scientific or expert information is organised, evaluated, integrated, and presented with the intention of informing decision-making. However, the ways in which different assessments are conducted vary greatly. Some assessments, such as that of the IPCC, are highly formalised processes which involve only expert scientists in defined disciplines. In contrast, other assessments involve scientists and political stakeholders. Where the IPCC process draws clear distinctions between scientists and policy-makers, and produces lengthy reports, in others, such as the CLRTAP assessment process, the science–policy distinction is less clear, and the process produces few formal reports. Assessment processes are conducted in different sorts of institutional settings; they define the scope of relevant questions for their analysis; they mobilise certain kinds of expertise; and they interpret findings in particular ways. These differences among assessment processes reflect different choices by those commissioning and designing scientific assessment processes.

Assessments can have many different impacts on the policy process. Some assessments change the framing of a particular issue — for example, whether the climate problem is looked at as one of energy policy or one of vulnerability to climate changes and instability. Assessments can change the terms of a policy debate (e.g. by introducing new policy options), or identify needs for research and development. They can prompt new participants to be concerned about an issue, or change the interests, behaviour, or strategies of participants who are already engaged. Assessments can also influence decision-makers who can enact policies that eventually result in environmental impacts.

The next few subsections present a framework developed by the GEA Project that facilitates discussions about effective assessments, which has proved helpful in evaluating the varying cases and experiences examined by the project and discussed at the Copenhagen workshop.

2.1. Assessments and their effectiveness

The idea that assessments should be 'effective' makes intuitive sense; however, in practice, it is difficult to define what, exactly, effectiveness means. What is effective for one party or interest group may not be effective for another. Those analysing assessments can also have different impressions of what is or is not effective. Effectiveness to some might mean cost-effectiveness; to others it might mean whether improvements occurred in the natural environment. Still others might be concerned only with whether an assessment fulfilled political objectives. No definition of effectiveness is primary or exclusive.

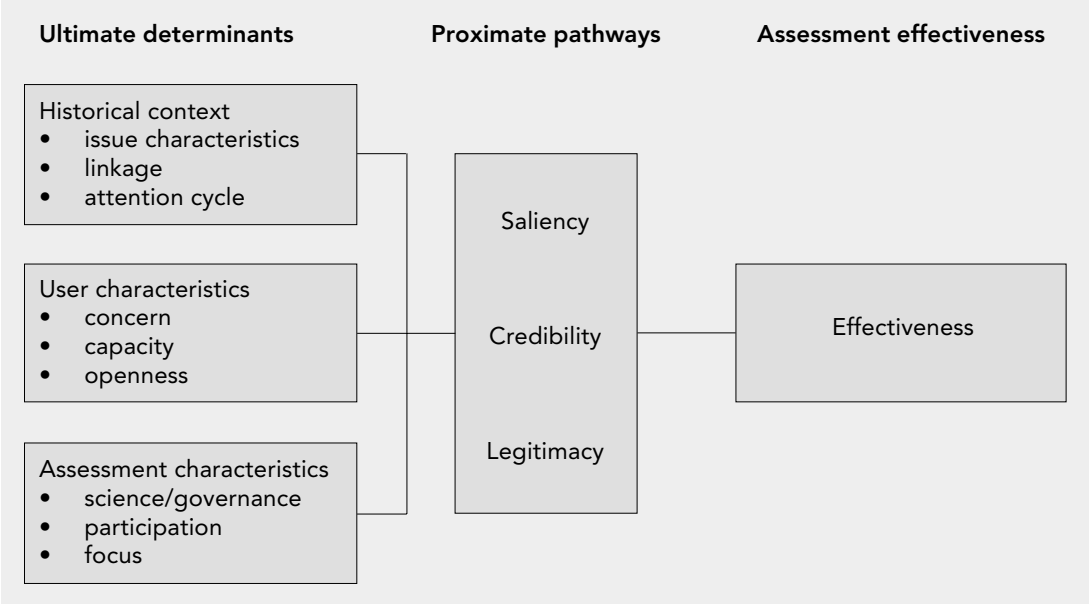
The GEA Project has struggled with thequestion of how to evaluate the effectiveness of environmental assessments. On the one hand, it is impossible to pin down a single definition of effectiveness. On the other hand, those involved in processes

of scientific assessment can often identify assessments which they deem particularly effective, as well as those which they feel have been ineffective. The project's research in a variety of areas has looked at a variety of ways to understand assessments' influence on policy. Different definitions of 'effectiveness' have been proposed and used. One way, in particular, in which the GEA Project has conceptualised assessments' influence is by examining their effect on an 'issue domain' such as climate change or long-range air pollution (Clark et al., forthcoming). However, the project has not developed a 'definition' of effectiveness; indeed, it would be nearly impossible to develop one which encompassed the variety of possible effects that assessment might have. It has looked instead to identifying those qualities that make assessment potentially more influential, allowing for the range of influences described above, and with reference to a particular user of the assessment.

One helpful way to tackle the 'effectiveness' question is to look at its opposite — it is often much easier to identify assessments that have been ineffective at influencing policy, and to examine the reasons why they failed. In this way, through examining a broad range of assessments on different environmental issues, the GEA Project has found that the 'pitfalls' for assessments fall into three categories — and, by mapping these pitfalls, has identified three attributes that distinguish what participants consider more effective assessments from those that are less effective. These attributes are termed by the project 'credibility', 'salience', and 'legitimacy'. An assessment that is viewed as more credible, salient, and legitimate to a particular user, therefore, is more likely to change his or her beliefs, and thus be effective for that user. These terms are explained below.

Credibility is intended to reflect the scientific and technical believability of the assessment to a defined user of that assessment, often in the scientific community. More credible assessments have done better at ensuring this sort of technical adequacy. An assessment that lacks credibility, for example, might be challenged by scientists for being based on shoddy methods, for ignoring important empirical evidence or for drawing inappropriate conclusions from the range of available empirical data. One might imagine the conclusions of an assessment being questioned because a user of that assessment believed that a laboratory measurement was in error, a crucial process was omitted in an atmospheric model, or an inappropriate analytical methodology was employed. Criticisms such as these would question the credibility of an assessment. Credibility can be gained based on the process by which the information in the assessment was created, or by the credentials or other characteristics of those producing the assessment. For example, if a user in the scientific community knows that good laboratory practice has been followed, he or she is more

A conceptual framework for considering effective assessments Figure 2.1.



likely to attribute credibility to results. If a particular assessment is done by a well-known, highly regarded scientist, a user might be more likely to consider that assessment credible because of its source.

Salience ([4]), or relevance, is intended to reflect the ability of an assessment to address the particular concerns of a user. An assessment is salient to a user if that user is aware of the assessment, and if that user deems that assessment relevant to current policy or behavioural decisions. One example of an assessment that lacks salience is a process which simply produces a report that remains on a shelf in perpetuity, never referred to nor heard from again. Another example is an assessment that asks questions to which a particular user is not interested in the answers. A user might, for example, commission an assessment about acidification to inform a decision about regulating electricity generation; if the resulting assessment focuses on the mechanisms of pollutant transport, it will likely not be salient to that user.

Legitimacy is a measure of the political acceptability or perceived fairness of an assessment to a user. A legitimate assessment process is one which has been conducted in a manner that allows users to be satisfied that their interests have been taken into account, and that the process has been a fair one. So-called 'global' assessments may be questioned by less powerful countries because they feel their input was not included or that their interests were ignored; this corresponds to a lack of legitimacy. Participants must believe that their interests, concerns, views, and perspectives were included and given appropriate weight and consideration in an assessment if they are to grant the assessment legitimacy.

The project's research has indicated that assessments often fail to be effective for particular users because they are weak with respect to one or more of these attributes; those assessments that users view as more effective, on the other hand, tend to be more credible, salient, and legitimate to them.

([4]) From Oxford English Dictionary, Second edition: salience (noun) 2a: the fact, quality or condition of being salient ... b: the quality or fact of being more prominent in a person's awareness or in his memory of past experience; salient (adjective): 5b: standing out from the rest, prominent, conspicuous.

2.2. Assessment design parameters

Changing the ways in which an assessment is conducted can have significant effects on its credibility, salience, and legitimacy to particular users — and, thus, to its effectiveness. Sometimes, these attributes reinforce each other: for example, an effort to increase legitimacy by taking into account the concerns of a particular stakeholder group may also have the effect of increasing an assessment's salience to those in that group. Sometimes, they can conflict: an effort to ensure legitimacy by including a broad range of interests may lead to the perception that scientific credibility was compromised. It is these sorts of trade-offs — often the result of decisions to design assessments in particular ways — that the project has explored in its research, and that were explored in more detail at the Copenhagen workshop.

The three themes selected for discussion at the workshop — participation, science and governance, and focus — represent three areas in which project research has found that design choices were particularly important. These three categories of assessment design have significant influences on the credibility, salience, and legitimacy of assessments to users, and often involve trade-offs among the three attributes. Of course, there are other influences on salience, credibility, and legitimacy, not all of which are design choices. Other influences include the historical context of the assessment, and the characteristics of the assessment's intended user. An assessment's historical context includes the characteristics of the issue area and its position on policy agendas (including its possible linkage to other issues of concern to decision-makers). Characteristics of the user include whether they are interested in the issue and/or the assessment, their capacity to understand and process an assessment's results, and their openness to different sources of advice (including other assessments of the same issue). Figure 2.1 summarises the framework for analysis, highlighting the design choices examined at the workshop and their pathways to influencing effectiveness.

Within the three case studies presented at the workshop, practitioners were asked to address focused questions and illustrate how design choices are made in that assessment or issue area. The questions posed to the workshop are listed below, and explained by reference to some of the design choices made in the assessment case studies introduced at the workshop.

Participation: How do decisions about who participates, and with what capacities, in both the framing and production of an

assessment affect the trade-off among its credibility, legitimacy and salience?

Who participates in an assessment can have significant effects on an assessment's credibility, legitimacy, and salience. Participation in assessment can be structured in different ways. For example, an assessment can be conducted with participation from interest groups and stakeholders. Scientific participation can include scientists from different disciplines, and exclude others. Certain interest groups might be represented, and others might not participate. Also, different user communities might be better represented than others. Participants bring different capacities to the table — variations in capacity to devote time and resources to the assessment itself, or in the ability of the participant to add substantively to the debate.

In the case of chemicals assessment in Europe, chemicals risk assessments include only the European Commission and European Chemicals Bureau, Member States, and industry. Participation does not include non-governmental organisations (NGOs), the public, or academia. In the European Environment Agency's 'Turn of the century' assessment, there was little involvement with the non-government sector. In the Convention on Long-Range Transboundary Air Pollution and the 'Clean air for Europe' (CAFE) programme, the two initiatives examined in the European air pollution case study, stakeholders are involved in the assessment process. In the 'Turn of the century' assessment, the EEA focused on cooperation with the European Commission, as opposed to Member States. This made it salient to the European Commission, but had unforeseen effects on the way the report was received by Member States.

Science and governance: How does the institutional architecture of the assessment affect the relationships (a) between policy-users and scientific experts, and the trade-off among salience, credibility, and legitimacy, and (b) between politicians and the public, so as to maximise well-founded public trust in science and governance?

Managing the interactions between policy-users and scientific experts is a significant challenge for any assessment effort that seeks to communicate scientific findings in ways that are useful for decision-makers. These interactions take place in different institutional settings: some of these are formal organisations; others are more informal sets of rules and procedures. The interface between science and policy is often an unclear, shifting one, not a clear boundary. Some analysts have observed that this interface and the categories of science and policy themselves are often negotiated and constructed as part of assessment efforts, and that there is indeed no non-arbitrary 'boundary' .

There are several models of science–policy interaction, and institutional settings, upon which assessment designers can draw. Institutions can be set up to facilitate a wide range of such interactions. On the one hand, an assessment process might decide to insulate a group of scientists from any interaction with policy-makers until a commissioned assessment has been completed and peer reviewed (e.g. IPCC or US National Academy of Science studies). This might serve to increase the scientific credibility of such an assessment; however, its salience may suffer, because the questions that continue to be of interest to scientists might no longer be relevant to policy decisions. On the other hand, an assessment might be conducted entirely through political negotiation — which might increase its legitimacy to different stakeholders, whose interests have been negotiated, but harm its credibility to the scientific community.

Of course, most assessments fall somewhere in between those two extremes. In the case of the 'Turn of the century' report, the EEA attempted to establish its salience and trust by setting up a steering committee with the European Commission. In CLRTAP assessments, the borders between scientific and political decisions are diffuse. These decisions on how to construct the institutional architecture of an assessment process can have significant ramifications on how this communication occurs, its results for the assessment's relevance or salience, and the perceived independence of the experts (and, often connected, the assessment's credibility).

Focus: How can assessments be broad enough to reflect interconnected reality, yet focused enough to be effective?

Those designing assessments can choose to focus on a range of different issues. An assessment in the area of climate change, for example, might be focused broadly on

emissions, atmospheric concentrations, and impacts, or might be focused quite narrowly on methane emissions from agriculture. More broadly focused assessments can be multidisciplinary, address very complex environmental issues, and/or involve scientists and decision-makers from a variety of backgrounds. Technology assessments are often very narrowly focused — analysing, for example, different methods of reducing pollutant emissions from power generation. How narrowly to focus an assessment — what to bring in, what to leave out, and how the issue is framed — often derives from the work of those doing assessments. Some consensus-based assessments choose to leave out issues where there cannot be agreement; other assessments might make their scope as wide as possible. Among other effects, a broader scope can encourage more communities to take an interest in an emerging issue.

Risk assessments of chemicals are focused narrowly — they usually address only one chemical or a group of very closely related substance. On the other hand, the EEA's 'Turn of the century' report incorporates chapters on such varied topics as air pollution, soil degradation, economic development, greenhouse gases, and ozone-depleting substances. Assessment models used in CLRTAP negotiations have been developed over the past 20 years to take into account the influences of multiple pollutants and multiple effects, and to incorporate costs of relevant control measures.

The following three sections look in more detail at the three workshop themes. They share a common structure — first introducing the issue and ways to understand the different design choices involved (Subsection 1), then looking at the ways these choices influence credibility, salience, and legitimacy (Subsections 2, 3, and 4), and, finally, addressing one or more cross-cutting themes and/or complicating factors (Subsection 5).

3. Participation

3.1. Conceptualising participation

Participation can serve several different functions in assessment processes. Examination of different assessments has shown that people and organisations participate in assessment for very different reasons. Some participants engage in assessment processes because they are committed to the development of a particular issue domain. Others participate because they want to enhance the reputation of their organisations. Still others might have an interest in promoting a particular assessment outcome or policy option. Participation can involve both stakeholders and interests and different fields of expertise. How and why participants choose to engage in assessment processes can have a variety of effects, and often bring credibility, legitimacy, and salience into conflict.

Discussions about participation confirmed a number of important insights during the workshop. Experiences discussed challenged the assumption of many assessment designers that more participation is always better — in assessments, it is not always 'the more, the merrier'. Participation was seen to influence all three attributes of more effective assessments — credibility, salience and legitimacy.

Participants (and potential participants) in assessment processes can helpfully be grouped into four separate categories. These categories are as follows.

- *Partners:* These are people or groups involved in the production of the assessment. For example, in the 'Turn of the century' assessment, the Euro pean Environment Agency and its topic centres fall into this category.

- *Clients:* They are the assessment's intended audience of users. The European Commission is the primary client for many of the European Environment Agency's reports, including the 'Turn of the century' report.

- *Stakeholders*: While they are not partners or clients, stakeholders include anyone who has an interest in the outcome of an assessment. Envi ronmental NGOs are stakeholders in European chemicals assessments.

- *Other users:* Those other than clients who use assessment results fall into this category. While they make use of the assessment, they do not have influence on its production. They could include academics, researchers, and consult ants, among others.

Of these groups, partners, clients, and stakeholders may be involved in the design and conducting of the assessment. Their participation can take different forms, and can occur at different stages of an assessment process. If one pictures an assessment as a 100 metre sprint, strategies and techniques are quite different depending on whether one is in the first 5 metres, the last 5 metres, or in the middle. Likewise, the effect of participation in assessment processes is highly dependent on the stage the assessment process is in.

Whether partners, clients, and/or users have the capacity to participate as envisioned in environmental assessment is a critical issue. 'Capacity' can be scientific (whether a participant with sufficient expertise is available to attend meetings and interpret technical material), administrative (if sufficient organisational frameworks exist to process information and requests in a timely manner), or financial (the availability of funding for travel costs, salaries, or staff support). In the following sections, the ways in which capacity affects the three determinants of effectiveness are described in turn.

3.2. Participation and credibility

The choice of who participates in an assessment can have a significant influence on its credibility to the scientific community. One important issue involves whether a scientific assessment is conducted by scientists accountable to governments only, or by scientists participating in their individual capacities. (Of course, these are two possibilities among many. Scientists could participate in assessments

representing industry or non-governmental organisations as well, and an assessment process could include these participants as well as others.) These two examples, however, are illustrative.

Where scientists participate in their individual capacities, credibility is likely to benefit, especially among the scientific community. One example is the International Whaling Commission — when this forum was opened to independent scientists, the procedure and agenda changed. In the issue area of climate change, where the issue is particularly contested, the credibility of the Intergovernmental Panel on Climate Change benefited from having an exhaustive peer-review process that involved thousands of scientists participating in their individual capacities.

This sort of scientific participation can have significant drawbacks, however. One complication, in particular, is that it can increase controversy within the assessment process — controversy that may not focus on important issues for policy-makers. Increasing credibility in this way can have costs to salience, because questions important to scientists may not be those important to others who are interested in the issue (including the intended users of the assessment). Stakeholders may question whether an assessment conducted by scientists accountable to only their own professional communities took into account their views and circumstances. For example, the first round of the IPCC process ran into similar sorts of legitimacy-based criticisms.

Balancing these trade-offs requires consideration of the details of the issue at hand. In some cases, such as the CLRTAP negotiations, scientists who represent governments (and who often work in regulatory agencies) do have credibility in that context. For some issues, it may be only important to be credible enough for decisions to be taken. These are often the less controversial issues; whereas highly controversial issues, such as climate change, require a higher threshold of credibility. An CLRTAP-like participation system would likely not have been viewed as credible in the climate change area. Similarly, an IPCC-like system would have been too cumbersome, and promoted unnecessary controversy, in an issue area that has been regularly addressed for more than 20 years, as in the case of European air pollution.

3.3. Participation and salience

In the planning stages of the assessment, encouraging the participation of individuals and groups to whom the assessment is designed to be salient may be helpful. Experience suggests that if participants are engaged in the planning stages of an assessment — in the 'first 5 metres' of the assessment process — this will improve the likelihood that the assessment asks questions relevant to them. Such participants could include users in the policy-making community or interest groups such as NGOs. One example of this is the EEA's coordination with the European Commission in planning the 'Turn of the century' report. Following this strategy often requires close attention to the process that is used in the assessment to ensure that it retains its credibility.

Similarly, participation in the 'last 5 metres' can be critical to salience as well. Important forms of participation can occur even after an assessment (or an assessment product such as a report) has been completed. For example, users can participate in simulation exercises, query database systems, or use models. One example of an assessment that involves users in this way is the International Institute for Applied Systems Analysis (IIASA) RAINS (Regional Acidification Information and Simulation) model. Report-style assessments might promote this quality by making authors available for presentations and answering questions after a report is published. New technology is increasingly offering opportunities for such interactivity. The ability of an assessment to respond in a targeted way to specific questions posed by the user clearly has positive implications for the assessment's salience.

The sort of participation required to influence an assessment's salience is quite substantive. Experience has shown that a user's simply 'sitting and listening' in an assessment process is not enough for it to become salient to that user. Research on the use of IPCC assessments in India has shown that these assessments have not succeeded in being useful to decision-makers there. In global chemicals negotiations, country representatives were more likely to consider salient those assessments in which they had participated substantively .

Many participants do not have the capacity for such substantive engagement; if an

assessment is to be salient to them, capacity-building efforts must pay attention to ensuring the ability to participate actively. Merely providing funding to participate in a meeting and covering travel costs are not adequate for this purpose; substantive participation requires training, expertise, and administrative capacity as well as the ability to devote time to the assessment.

Encouraging such broad-based, substantive participation in assessments in order to increase salience also has its trade-offs. Specifically, a process that includes users and stakeholders, who often have clearly defined interests in the assessment's outcome, risks harming its credibility. The process could be perceived as 'politicised', threatening users' and others' perceptions of its technical quality.

3.4. Participation and legitimacy

In addition to helping to ensure salience, participation in the 'first 5 metres' of an assessment process can benefit an assessment's legitimacy. Those individuals and groups who participate in the planning stages of an assessment are more likely to perceive the process as fair, and one that takes into account their interests and viewpoints.

Research and experience in this area have suggested that the degree of substantive participation required for an assessment to be legitimate to parties is significantly less than that required for salience. In several cases, participation 'on paper' has seemed to suffice for a process to be legitimate to a party; that is, merely being included as an author (without much substantive input), or attending a meeting where an assessment was conducted or approved. This prompted one participant in the workshop to hypothesise that that process might be more important to assessment than content.

Simple representation, or ensuring that one's voice is heard, seems to have helped a number of assessment processes gain legitimacy. In the IPCC assessment reports, legitimacy to developing countries was increased when scientists from developing countries were included as co-authors of all the chapters — even if some of them did not actively shape the content of their chapters. Many assessments conducted by international organisations achieve legitimacy by being approved by these fully representative institutions. For example, the 'blue book' assessments issued in the ozone process under the auspices of the World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP), among others, were legitimate to parties involved in the global negotiations, despite the fact that they were conducted by scientists primarily from the United States and the United Kingdom ([5]). Because they were reviewed and came out under the authority of these international organisations, they achieved a legitimacy that a report from only the United States or the United Kingdom would not have.

Representation, however, is a tricky concept. It can be difficult to decide who is the best person or group to represent a certain point of view, or to represent the public at large. In international organisations, participation is most often based on country representation, with non-governmental organisations admitted as observers. It is common practice in US environmental decision-making processes to make special efforts to balance the input of industry and non-governmental organisations in regulatory appraisal. It is also difficult to decide who represents the public at large. Is it non-governmental organisations which have a broad membership or elected parliamentarians? Because the structure of most assessment processes favours the participation of organised interests, the voice of the 'public' — whatever that term may mean — is not often heard in these processes.

As was discussed in the previous section, increasing participation in order to gain legitimacy can also have negative implications for an assessment's credibility, if the process is perceived as too 'politicised'. If a process emphasises representation of a broad variety of individuals and groups, this may be done at the expense of facilitating substantive participation of a smaller subset of them, risking less salience. This can often be a resource-limited trade-off as well. Additionally, representative, legitimate, broad processes can take a lot of time and can often promote significant controversy. Therefore, a process designed to maximise legitimacy may dissolve into adversarial arguments and prevent an assessment from being completed.

3.5. Processes and participation changes

Balancing credibility, legitimacy, and salience in designing assessment processes depends very much on the issue at hand and

([5]). The blue books had the following sponsors: National Aeronautics and Space Administration; Federal Aviation Administration; National Oceanographic and Atmospheric Administration; United Nations Environment Programme; World Meteorological Organisation; European Commission; and German Federal Ministry of Research and Technology.

the goals of a particular assessment. Complications arise, however, because these issue processes are dynamic. Sometimes, new groups, with new issue frames, emerge in an assessment process; when participation in the issue area changes, the type of participation in relevant assessments often must change as well. An example of this comes from research into the transformation of the climate change issue from a concern of a small group of scientists urging policy attention to a full-blown international negotiation. Assessments done by small groups of experts in the former situation would not be legitimate once the issue had been transformed, because countries and interests brought into the debate had not been included in previous assessments. The IPCC process, in contrast, has a more transparent, representative character, and emerged in the transformed issue arena.

Another sort of participation change occurs when issues previously assessed or dealt with on a regional level become global concerns. Many issues are pushed onto the global agenda by one or more parties with an interest in the outcome, and early assessments are often carried out by individual nations with particular expertise. In the global ozone negotiations, state-of-the-art science had already been collected by individual parties, and the challenge was to use this information successfully in a global forum; this was achieved by the issuance of reports under international auspices. The addition of parties was also relevant for the issue of persistent organic pollutants — the issue was pushed by Canada, and was subject to a regional agreement in Europe and North America before global negotiations began. In this case, participation strategies were able to address concerns of legitimacy in using results of the regional assessment process when additional participants were added, but these assessments were not salient to those who did not participate substantively in their production. These cases represent further challenges, but also further support, for the linkages detailed above between participation in assessment processes and their credibility, salience, and legitimacy to users.

4. Science and governance

4.1. Conceptualising science and governance

Managing interactions between scientific experts and policy-makers (and their representatives) is a challenge that faces most environmental assessment processes. Assessments are carried out in institutions and organisations, which have different mandates, institutional structures, and rules. The fit of assessments to institutions depends on the state of the issue at hand (e.g. the level of political contestation about the issue, or the maturity of the science), the history of previous assessments, and the scope of the assessment (especially whether or not it includes policy recommendations). There are many different types of assessment as well — some of which fit better into particular institutions. Assessments, and the institutions within which they are conducted, can be accountable to various groups (e.g. to policy-makers, to the scientific community, or to both simultaneously). The institutions in which assessments are conducted, and the interactions between expertise and decision-making authority, can influence an assessment's credibility, salience, and legitimacy.

4.2. Science-governance and credibility

Whether assessments and the institutions in which they may take place are accountable to the scientific community, and the ways in which scientists interact with policy, affects the credibility of an assessment. Assessments that are primarily accountable to the scientific community are more likely to pay attention to ensuring credibility. An example of this is the assessments conducted by the US National Academy of Sciences. Scientists participating in these assessments respond primarily to incentives and criticisms from the scientific community, and policy-makers are not allowed under institutional rules to influence the proceedings, after providing a mandate for the assessment.

On the other hand, institutions primarily accountable to policy-makers — who have less of an incentive to ensure that their conclusions are extremely credible to scientists — have run into problems when their assessments are criticised on the basis of their credibility to the scientific community. Assessments intended more as decision tools rather than state-of-the-art scientific statements may have their credibility severely questioned, if they are examined relative to the standards of the latter. Which institution is chosen to conduct an assessment can depend on the maturity of the scientific field — fields that are relatively mature and less scientifically controversial may be more appropriate for institutions accountable to policy-makers. Decision-makers seeking assessments in issue areas characterised by a significant amount of scientific controversy may be wise to commission assessments from institutions accountable to the scientific community, to minimise credibility concerns.

Assessments conducted in those institutions primarily accountable to the scientific community, however, may increase their credibility at the expense of their salience and/or legitimacy. Scientists are likely to ask and answer questions that are interesting to them, rather than those interesting to policy-makers. Also, accountability primarily to the scientific community means that there is no incentive or advantage to take into account other interests and viewpoints. One example of this is the early IPCC reports, which are discussed above.

4.3. Science-governance and salience

While assessments accountable to scientists tend to pay more attention to credibility concerns, assessments primarily accountable to policy advocates are more likely to pay attention to ensuring salience to the needs of those policy-makers. Examples of such institutions include the now-defunct US Office of Technology Assessment, which served the US Congress with scientific assessments relevant to ongoing policy issues, and assessments requested by the European Commission. However, such assessments, which are focused on being salient to policy actors, might, as noted above, face severe challenges in establishing credibility to other actors, particularly to academic scientists.

The decision about which institution will produce a more salient assessment result

depends as well on the timing of an assessment with respect to 'windows of opportunity' in the policy community; this is also connected to the type of assessment to be conducted. The institution best suited to conduct assessment of a problem in the early stages of formulation is most often not the same institution most prepared to conduct a salient assessment of policy options. Such institutional choices must take into account the goals of the assessment, as well as the interests of the intended users.

Assessment processes that encourage iterative communication between scientific experts and policy-makers can increase salience, by ensuring that scientists continue to ask and answer the questions of interest to decision-makers. In the CLRTAP assessments, such procedures are routine — to the extent that it is even often hard to tell who is participating as a policy-maker and who as a scientist. This iterative communication process helps to ensure the assessment's salience. Such iterative assessment processes, as well as those which are structured as continuing, progressively improving assessments of the same issue, are often among the most effective. In particular, planned iteration can offer the security that issues can be revisited, or decisions can be taken at a later date, when they would otherwise pose serious challenges to short-term or one-time assessments, especially those that aim to produce a consensus report. This has been the case in the CLRTAP assessment process, where areas in which science was not yet fully mature have been assessed and addressed in later protocols.

In an effort to increase salience, some assessments decide to include explicit policy recommendations. Experience shows that including policy recommendations in a scientific assessment can be dangerous — many otherwise successful assessments have run into problems because of the inclusion of particular policy recommendations or objectives. In particular, the consequences of including policy recommendations in an assessment that is primarily accountable to the scientific community can be profound. Making recommendations in such assessments is often viewed as a way of avoiding the risks of producing highly credible but irrelevant findings. But policy advocates often view policy recommendations in science-based assessments as an inappropriate intrusion into their 'territory', and reject such assessments as illegitimate.

While participants in the workshop reached no consensus on how the delicate issue of policy recommendations should be resolved, it was clear that the decision to include such recommendations — especially in assessments primarily accountable to the scientific community — should be treated more carefully than has often been the case. Participants discussed in detail the case of the European Environment Agency's report on chemicals in the European environment, entitled Chemicals in the European environment: Low doses, high stakes?. The report includes a final chapter entitled 'A new paradigm for chemicals management?' that recommends new integrated approaches to chemicals policy. The decision to include policy recommendations became a trade-off between an opportunity to frame debate, and a risk that the credibility of the report's substantive scientific findings would be compromised. Whereas some participants in the workshop saw the inclusion of policy recommendations in some situations as warranted, others were hesitant to endorse any in scientific assessments. It was clear from the discussion, however, that the institutional context of the assessment and the ramifications of a decision on whether or not to include policy recommendations are closely connected, and cannot be treated independently. Part of the solution to the policy recommendations dilemma may be the more systematic use in assessments of 'boundary organisations' that are jointly accountable to both the science and policy communities (see below).

4.4. Science-governance and legitimacy

Assessments primarily accountable to policy advocates are also more likely to pay attention to ensuring legitimacy. Policy advocates are lobbied by a wide variety of interest groups, which want to ensure their opinions and voices are heard and taken into account. Therefore, assessments conducted in institutions that are accountable to policy advocates have significant incentives to ensure that they are legitimate. In contrast, institutions accountable to scientists only have no similar incentives.

Iterative communication in assessment processes can benefit legitimacy as well as salience. Such communication can build

trust among participants in an assessment process; CLRTAP is an assessment process that is also particularly successful in this regard.

The legitimacy of one institution or another also depends on the degree of contestation in the issue. As was discussed in the previous section as a thought experiment on participation, it is unlikely that CLRTAP-like institutions could have been substituted successfully for the IPCC, or vice versa. Legitimacy is likely to be a more significant concern where the level of political contestation is high (such as in the climate regime. Where clear winners and losers are perceived in an assessment process, the choice of institution, and its lines of accountability, institutional choice has greater effects on an assessment's legitimacy.

4.5. Assessment, institutions, and boundary organisations

Assessment experience shows that the choice of an assessment's institutional setting matters a lot — not only by shaping the content of an assessment, but also by influencing the way in which an assessment is perceived. The workshop discussed the unique institutional setting of the European Environment Agency, as a producer of assessments designed to be relevant to policy-makers, in particular at the European Commission. Participants noted the ways in which the EEA's role poses several institutional challenges — for example, the decision to include policy recommendations in one assessment may have unintended effects on perceptions of the other assessments that the Agency produces.

Organisations that are accountable to both policy-users and scientific communities have helped to ensure effective assessments in many of the cases discussed at the workshop. The work of the GEA Project has revealed that some organisations have developed that seem to straddle the shifting divide between science and policy, helping to maintain scientific credibility while assuring political saliency. These boundary organisations have distinct lines of accountability to both science and politics, facilitate the transfer of usable knowledge between science and policy, and give both policy-makers and scientists the opportunity to construct the boundary between their domains. This concept of 'boundary organisations' found resonance with some workshop participants, while others saw additional roles that organisations managing science–policy interactions can play in effective assessment. There was disagreement about whether the European Environment Agency was a boundary organisation according to the GEA Project's definition; however, the EEA clearly sees itself as having a boundary-like role. How boundary organisations and institutions with boundary-like roles might function more effectively in assessment, in order to help balance the trade-offs among credibility, salience, and legitimacy, is a subject of further research.

5. Focus

5.1. Conceptualising focus

The management of global environmental risks can involve some or all of the functions of monitoring, risk assessment, option or response assessment, goal and strategy formulation, implementation, or evaluation. Assessments can also serve many different purposes in the policy process. Within these functions, those designing assessments can choose to focus on different aspects of an issue, frame an issue in different ways, or consider issues more narrowly or broadly.

Among those who conduct assessments, there is much discussion about 'integration', 'integrated assessment', and 'end-to-end assessments'. Conducting any assessment involves a choice of what to include in, and what to exclude from, analysis; such choices generally involve trade-offs on the assessment's credibility, salience, and legitimacy to particular users. The workshop discussed the experiences of a number of assessment processes that were broadly focused, and also several which had a more narrow focus. One example of a narrowly focused assessment discussed at the workshop was the Montreal Protocol's technology and environment assessment panels, which sought to identify alternatives to specific technological processes that used ozone-depleting chemicals. An example of a more broadly focused assessment process was the use in CLRTAP negotiations of the RAINS model, which incorporated information on pollutant emissions, transport, effects, and the cost of mitigation options. Both of these assessments were successful; however, their differences in focus meant that they were able to influence policy in different ways and in different situations.

Evidence suggests that, depending on the question being asked of the assessment, there are very important roles for both more narrowly focused and more broadly focused assessments. Narrowly focused assessments can be simpler, easier, and less costly. Broadly focused assessments can incorporate a greater number of relevant factors. Given the context for an assessment, the relevant question for designers becomes how broadly to focus the assessment's scope in order for it to be most effective.

5.2. Focus and credibility

Focusing an assessment more narrowly can increase its credibility by establishing and maintaining authority on an issue. For example, the European Environment Agency's assessment did just that in the case of greenhouse gases, securing the Agency's role in this area. The stratospheric ozone blue books, which focused quite narrowly on chlorine in the stratosphere (and not, for example, including assessment of effects or risks) established their authority by addressing only those issues where they could clearly establish scientific consensus. Successful assessments are often so because they skilfully avoid addressing issues so controversial or uncertain that virtually no assessment of the area would be considered credible.

There are significant dangers to credibility in mixing in one assessment scientific fields with very different degrees of maturity — assessments that have attempted to do this have faced significant challenges. The danger here is that the rigorous, critical criteria used in the more mature field will be applied to research from the less mature field, which typically fails such a test. For example, if an assessment includes such very different fields as atmospheric physics and scenarios assessment, the very high standards of evidence and proof required in the former field might be used to question the latter, leaving the latter unable to respond to such criticism. Including both fields in the same assessment, with the same audience and the same critical reviewers, could be a source of credibility problems. It is also possible that the assessment product might be portrayed as very reliable based on the findings from the most mature field, which would leave it open to the criticism of overreaching. Either of these outcomes could destroy the credibility of the overall assessment.

Similar challenges face those designing and carrying out assessments in their decisions about how to address uncertainties. Broadly focused assessments often face challenges where there is a heavy emphasis on consensus — the more assumptions, methodologies, and areas of uncertainty, the

more difficult it is to maintain consensus. The choice of how to categorise uncertainty affects credibility as well. The IPCC, in its latest assessment report, chose to characterise uncertainty by linking qualitative labels such as 'likely' with numerical estimates of probability. Other assessments have turned to uncertainty analysis; still others have excluded very uncertain possibilities from assessments.

Narrowing an assessment can often contribute to its credibility by bounding the debate; however, this has some significant trade-offs. The risk is that relevant factors might be excluded — which can affect an assessment's salience. It can also ultimately be detrimental to an assessment's credibility, if excluding too many controversial factors resulted in a wrong explanation of environmental processes.

5.3. Focus and salience

More narrowly focused assessments can be more salient where geographic and/or sectoral specificity is important. If a decision-maker is interested in making air quality decisions in urban areas, for example, he or she is unlikely to use the RAINS model developed under the CLRTAP, because the model's resolution is too coarse. In addition, assessments that simultaneously take into account the influences of multiple sectors on an environmental endpoint might not be so easily disaggregated for the decision-maker who wants to make decisions about transport or agriculture. On the other hand, broadly focused assessments can be more salient by including more relevant factors, both increasing the audience for the assessment and the possibility that it will be relevant to several issues on a decision-maker's agenda. Such is the case in efforts to include economic analysis in environmental assessments; a successful example of this is the RAINS model. However, in an effort to be salient, and include every relevant influence, assessors run the risk of being less sure of scientific authority in any one area (due to the concerns discussed above as well as resource constraints).

5.4. Focus and legitimacy

Broadening the focus of an assessment to include multiple perspectives can be a way to increase its legitimacy. An example of this is integrated assessment techniques, which can include the input of multiple viewpoints as well as stakeholders. For example, an assessment of chemicals risk might not be seen as legitimate to consumers and the general public, if it focuses an assessment for regulatory policy on evidence only addressing workplace exposures. As discussed in the previous section, the choice of whether or not to include policy recommendations in a scientific assessment can have consequences for its legitimacy. Including more perspectives, of course, could threaten the credibility of an assessment, because the process might lose scientific authority or content.

5.5. Addressing multiple stresses and vulnerability

One of the new and significant challenges to assessment related to design decisions about focus involves addressing multiple stresses and vulnerability. There is an increasing perception that assessments to date in certain areas have been too simple, excluding relevant causal chains to the detriment of good environmental analysis and subsequent decision-making. An example of this is in the chemicals area. Most risk assessments of chemical substances are conducted for only one substance, while people and ecosystems are exposed to mixtures of several different chemicals. Recent research has suggested that the effects caused by a large number of chemicals that are interacting may bequite different from the sum of the individual effects of the constituent substances. However, assessments looking at these interactions must deal with exponentially increasing levels of complexity.

Whether an assessment is prospective (i.e. looking at the effect of a proposed human action on the environment) or retrospective (i.e. attempting to find out the causes of observed environmental degradation) can also affect its salience, credibility, and legitimacy. Some assessments have dealt with multiple stresses, and some new approaches such as reverse vulnerability analysis are being discussed. One of the significant challenges of such 'reverse' assessments is that initial decisions on the focus of the assessment are often value laden — for example, deciding what part of the environment is most important to protect. Which sorts of these assessments are advantageous in different policy contexts is a matter for further research.

There are, however, some insights from existing assessments that can help practitioners to devise strategies to deal with multi-causality. One of the main challenges is keeping the assessment comprehensible, and credible, given a large number of potential interactions. One way to tackle this, used in the assessment conducted by the Arctic Monitoring and Assessment Programme (AMAP), is to have periodic linkages between separate assessment efforts instead of one big comprehensive assessment.

6. Discussion and conclusions: Identification of further issues

The discussions at the workshop 'Designing effective assessments: The role of participation, science and governance, and focus' raised a number of important issues for further consideration both by analysts and by practitioners. A few participants noted that discussing lessons learned from previous assessments was somewhat like the 'pathology department', practitioners often take a 'surgery-room' orientation — tinkering with the workings of assessments while they are still in progress. At the workshop, practitioners expressed a desire for a handbook or set of guidelines on how to conduct effective assessments. Participants from the academic community identified a number of areas for further research, as well as adding several case study experiences to their work.

The workshop identified a number of issues for further research and discussion, which were not addressed in depth during the workshop. These issues might become fruitful topics for further targeted research papers and/or follow-up workshops. They include:

- the need for further research on how different countries use expertise and expert information in environmental decision-making. This is important within the European Union (with particular concern in the case of enlargement), among developed countries such as the United States and European countries, and between developed and developing countries;
- the role of the public in scientific assessment, in particular in promoting trust in science and governance;
- taking into account political orienta tions and objectives such as the 'pre cautionary principle' in assessment and decision-making processes;
- the role of boundary organisations and of institutions playing boundary-like roles in environmental assessment;
- assessing 'effectiveness' more system atically, and encouraging learning in assessment processes;
- addressing concerns of multi-causality and vulnerability.

The Global Environmental Assessment Project is currently in the process of putting together three books summarising its findings on a range of practical and theoretical questions. Information on the content and publication of these volumes can be found on the GEA web site (http://environment.harvard.edu/gea).

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