IAIAsa 2021 Conference Paper

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Five things we can learn from Scientific Assessment

Contents

1 Abstract

The disciplinary domains known as 'Impact Assessment' and 'Scientific Assessment' occupy fairly similar spaces at the contemporary Science-Policy Interface. At their essences, both concern themselves with providing the evidence-base to support decision-making with a view toward 'sustainable development'. Where Impact Assessment emerged primarily from the practitioner community in response to early environmental regulation in the 1970s in some developed countries, Scientific Assessment emerged about a decade later, to tackle meteorological issues of global importance, like ozone depletion and climate change. These two communities of practice share a few similarities. Primarily that they both wrestle with the complex challenges inherent to the 21st Century socio-ecological landscape. In this sense it is rather unfortunate that these communities seldom speak to one another. Following deep study of Scientific Assessments as part of my PhD research from 2017-2020, the purpose of this paper, drafted for IAIAsa 2021, is to explore which areas of Scientific Assessment are highly effective and then propose how these areas might be incorporated more into Impact Assessment practice, if possible and feasible. The five areas of practice I propose are: 1) peer review and specialist meetings, 2) multi-author teams, 3) integrated governance structures, 4) robust conceptual, methodological, and linguistic frameworks and 5) saliency through novel content communication techniques.

2 Introduction: Science-policy interfaces

Science-policy interfaces (SPIs) aim to generate solutions helpful for solving society's biggest problems. SPIs which inform political decision-making on projects, plans and programmes, assessed through the lens of sustainable development (Chanchitpricha and Bond, 2013), are called 'Impact Assessments'. According to Pope et al. (2013), there are six well-established 'types' of Impact Assessment, which have been used over the last half century or so. These are: Environmental Impact Assessment (EIA), Strategic Environmental Assessment (SEA), Health Impact Assessment (HIA), Policy Assessment, Social Impact Assessment (SIA) and Sustainability Assessment.

SPIs also encompass well-known institutional structures, like the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services (IPBES), called 'boundary organisations' because they straddle the liminal pace between science and policymaking. The primary knowledge production tool used by these boundary organisations is called 'Scientific Assessment' (Figure 1).

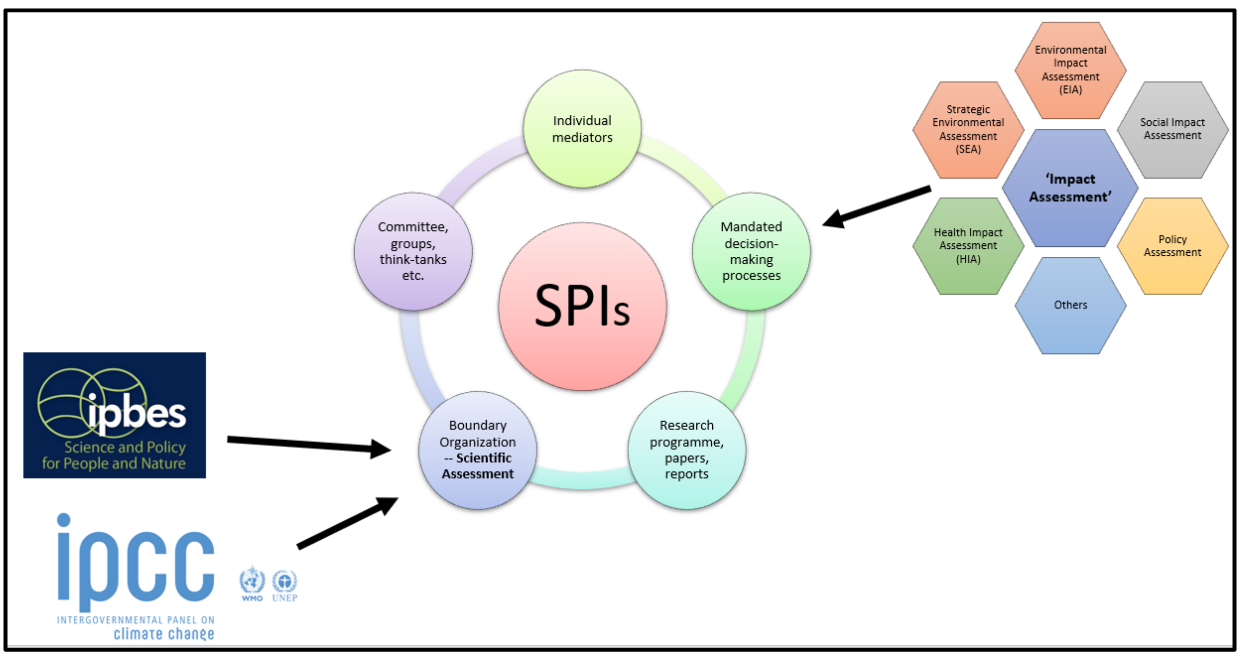


Figure 1: Modern SPIs which have been developed over the past 50 years. Impact Assessment generally focuses on the project or local scale within legislated frameworks and are undertaken by practitioners. Scientific Assessments are more open-ended knowledge production processes, often being undertaken at regional or global scale, and mostly by researchers.

3 What are Scientific Assessments?

I use the term Scientific Assessment in spite of its apparent ambiguity, since anything involving 'science' and 'assessment-making' could be considered a Scientific Assessment (Mitchell et al., 2006). But in this instance, I am referring to a rather specific type of process, which emerged within the global science-policy interface community in the late 1980s and early 1990s in the meteorological sciences looking at topical issues like as ozone depletion and climate change (Jabbour and Flachsland, 2017).

Scientific Assessments have been used to assess the state of knowledge for issues widely considered to be important to humanity. While a blanket homogeneity across scientific assessment practice has never really existed (Hel and Biermann, 2017), the widespread application of these processes over the last 30 years has revealed some quintessential elements:

1. A focus on rational evidence synthesis (Mach and Field, 2017) using large, balanced, multi-, inter- and increasingly transdisciplinary author teams, drawn from different sectors of society (NRC, 2007), offering diverse viewpoints on social problems, and their potential solutions (Kowarsch *et al.*, 2016);
2. Adherence to double-loop content generation procedures with multiple, iterative (Sarkki *et al.*, 2015) and deliberative (Kowarsch *et al.*, 2016) knowledge production opportunities, between content generators and users; coupled with rigorous and transparent peer and stakeholder review opportunities (NRC, 2007); and
3. Guidance offered by integrated, broadly representative governance structures, which must include the legitimising oversight of politically elected officials with a decision-making mandate to ensure politically relevant questions frame the scope of the assessment (Scholes, Schreiner and Snyman-Van der Walt, 2017).

Since the early 1990s, Scientific Assessment use has dramatically increased. So too has the number of human and financial resources dedicated toward their execution year on year. By 2017, 143 global scale scientific assessment processes had been initiated. There is an increasing social and political awareness of sustainability problems means that users have increasingly high expectations that Scientific assessments must deliver accurate syntheses and also meaningful solutions (Jabbour and Flachsland, 2017).

4 What are Scientific Assessments good at?

As part of my PhD research, I spent three years studying these Scientific Assessment processes. I applied a case-study mixed methods approach to six Scientific Assessment cases – two at global scale, two at regional scale and two at national scale. The approach integrated quantitative and qualitative data from a systematic review of the literature (n = 162), an online survey (n = 674), semi-structured interviews (n = 49) and drawing from our own experience from involvement in Scientific Assessments. The key results of this research are presented in Figure 2 below.

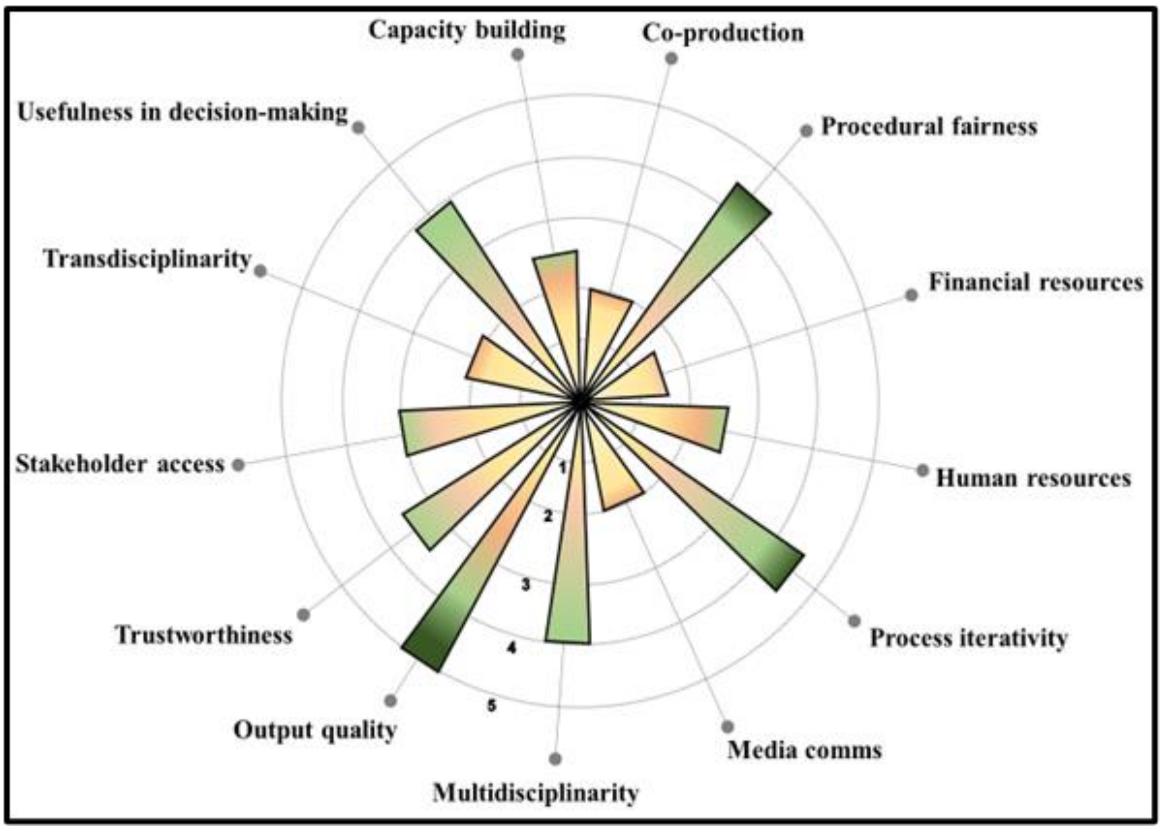


Figure 2: Synthesis, across evidence sources, of the contribution of various indicators to the effectiveness of Scientific Assessments, where 5 is most effective and 1 is least effective. I concluded in my PhD that specific areas of strength include the ability to engage multidisciplinary teams in iterative knowledge production procedures in a transparent way, producing high-quality scientific outputs which policymakers generally find useful and which garner a high degree of stakeholder trust.

5 Five things we can learn from Scientific Assessment

Based on these findings, for this conference paper, drafted for IAIAsa21, I suggest that Impact Assessment might be able to learn a thing or two from the effective aspects of Scientific Assessment. Five specific areas are proposed and explained below.

5.1 Peer review & specialist meetings

Peer review and, or combined with, specialist team meetings in Impact Assessment are rather rare – especially in EIA processes which are subject to tight timelines and budgets. During SEA processes, it is more common, but still by no means widely practiced. No peer review diminishes scientific credibility (Singh et al., 2020), while lack of specialists interaction, in groups and one-on-one, is a major impediment to multi- and inter-disciplinarity.

In Scientific Assessments, peer review is major feature of the process. The primary steps in the Scientific Assessment multi-loop content generation and review system include the following: Firstly, an initial author meeting provides an opportunity to develop comradery and a collegial atmosphere at the outset of a multi-year and potentially challenging project. Participants building trust and networks of cooperation have the potential to provide a more productive work environment that those characterised by infighting and hostility.

The key output generated from this engagement is the so-called 'Zero Order Draft' (ZOD). The ZOD reveals the scope and structure of the Scientific Assessment in terms of its key questions, its spatial and temporal scale and the most appropriate methods for answering the pertinent questions. These guide the development of the First Order Draft (FOD). The FOD is a reasonably complete 'first cut' draft of a chapter, including references, sketches of the intended figures, and draft tables. The FOD materials are distributed by the management groups to independent reviewers. The number of comments pre-chapter of the FOD sometimes reaches thousand, from hundreds of reviewers.

Responding to the peer review comments on the FOD (both by incorporating changes into the draft, and by informing the reviewer of the action taken) is one of the primary purposes of the second author meeting. This provides an opportunity for the multi-author teams to work through the comments received on the chapters by the peer reviewers, to enhance the quality of their work and ensure the technical adequacy of material. This meeting also offers the teams an opportunity to debate and organise how they wish to respond to the reviewers and how they will go about redrafting their text in preparation for the SOD (Figure 3).

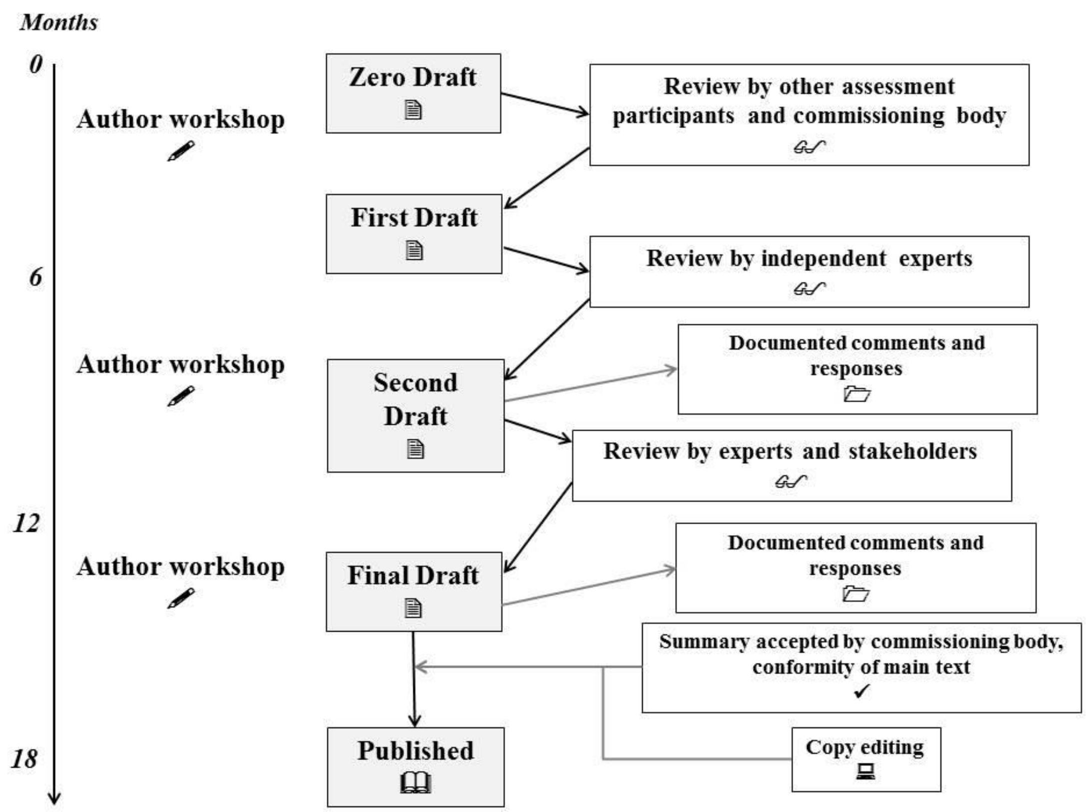


Figure 3: A Scientific Assessment usually takes in the region of 18-24 months, including three writing workshops (left). Along with the independent peer review (right), these allow for high levels of collaboration and interactivity through ZOD, FOD, SOD and final drafts.

The SOD chapters include content revisions to the FOD. The SOD can therefore differ quite substantially from the FOD, and usually includes new material. The SOD is the draft of the Scientific Assessment which is released more widely for general stakeholder comment; and subsequent drafts are not expected to include large amounts of new material, just refinements of material already presented in the SOD. This means that the cut-off date for cited literature usually corresponds to the date of finalisation of the SOD.

The third author meeting allows the teams to check the review comments and assign writing and response responsibilities in preparation of the final draft. All comments and responses on the FOD and SOD are captured in a structured online repository and made freely available to all stakeholders so that there is a traceable record of all documents and text changes. At the same time preparation of the final draft Summary for Policymakers (SPM) commences (see below text on SPM).

5.2 Multi-author teams

During Impact Assessments, especially EIA, the conventional arrangement is to contract with one specialist to draft a disciplinary specific assessment chapter e.g. biodiversity, visual, socio-economic etc. These specialists are drawn from a pool of suppliers generally known by the Environmental Assessment Practitioner (EAP) managing the EIA process.

In the case of Scientific Assessment, multi-author teams are used. Authors comprising the multi-author teams require acknowledged expertise (though not necessarily as scientists, narrowly defined) and should be drawn from a range of sectors such as research institutions, government, NGOs, universities, a range of geographical regions. In contrast to Impact Assessment, authors are nominated according to their formal qualifications, publications and experience, as well as widespread peer-group consensus based on their track record of valuable contributions on the topic. Gender balance is also considered.

The issues to be addressed in Scientific Assessments are outlined by the stakeholders, through the scoping process. The detailed content of each chapter is developed by large and diverse teams of experts, within the framework of the scoping document, which typically goes at least to sub-chapter level. Subjective judgements regarding the interpretation of the evidence and literature are often required in Scientific Assessments, but these are made explicit, along with statements of confidence (Mach and Field, 2017). Balance and the elimination of bias is sought as far as possible.

The most established means is by establishing broad multi-author teams representing a range of interests and/or positions, coupled with extensive and transparent review (Scholes *et al.*, 2016). The objective is to fairly represent the range of valid (i.e., legitimated by peers and supported by evidence) evaluations, not necessarily to converge on a single consensus outcome. Scientific Assessments are independently reviewed by other experts and by stakeholders, often amounting to thousands of documented comments and responses, all of which are available in the public domain.

5.3 Integrated governance structures

Governance is how society, or groups within it, organise to make decisions (IOG, 2019). In the context of Scientific Assessments, good governance depends on building legitimacy in the eyes of the stakeholders. This is usually achieved by establishing a 'Board' of credible people, representative of diverse organisations which represent a plurality of views. These people may be drawn approximately equally from government, the private sector, academia and civil society (Figure 4). Their mandate is to 'approve' certain process or content aspects of the Scientific Assessment. The Board, in collaboration with the Secretariat, forms a relationship with a wider base of stakeholders from society interested in the issue. The intention is to thus allow for the full expression of stakeholder values within the authorised project governance structures (Scholes, Schreiner and Snyman-Van der Walt, 2017).

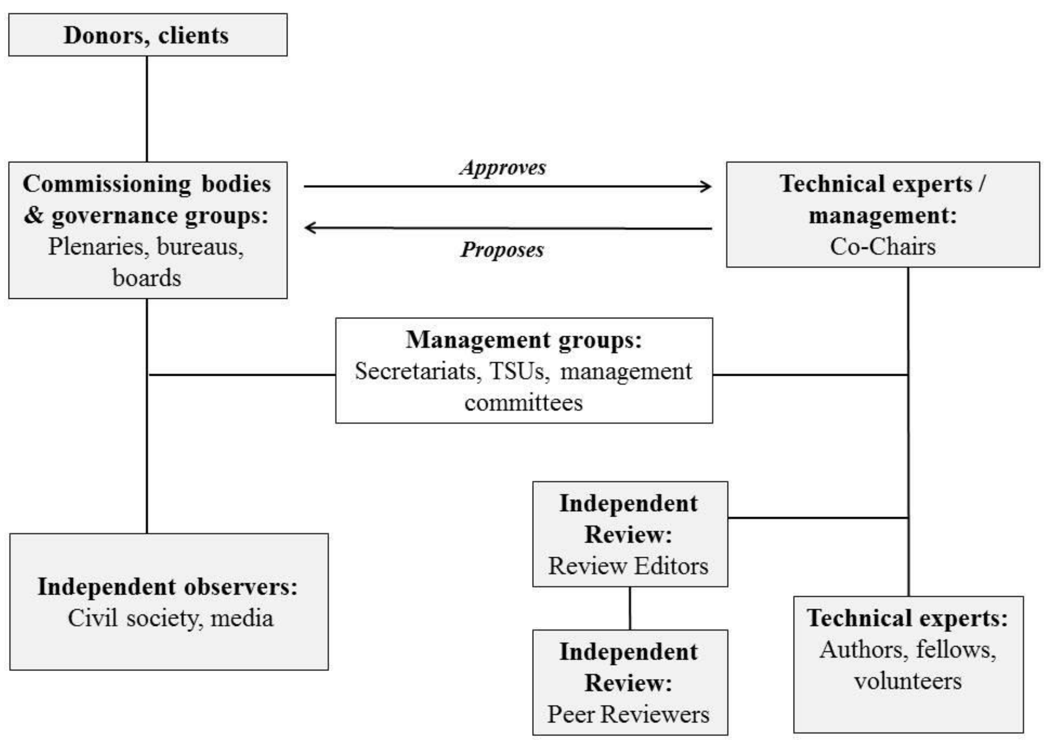


Figure 4: The various roles usually adopted within a large Scientific Assessment project. From a project governance perspective, the commission bodies represented by plenary, boards and bureaus (left) are

responsible for overall approval, while the technical experts and management committees (right) are responsible for content generation.

5.4 Conceptual, methodological and language frameworks

In EIA, the conceptual, methodological, and linguistic frameworks are usually quite rigid, set in place my instructive legislation. This has the advantage of generating consistency across the domain among its practitioners, but can promote inertia, stakeholder fatigue and boredom.

Scientific Assessments are in the tradition of often (but not always) generating novel frameworks each time they are undertaken, depending on the scope of the issue being assessed. The disadvantage of this is that it a large amount of human and financial resources to reach consensus on how the assessment should be undertaken – this takes time, as long as 12 months sometimes. The advantage of this exercise is that the frameworks generated, are tailored specifically to match the scope of the problem at hand.

For illustration, take IPCC WGII AR5, published in 2014. For the first time, an IPCC assessment featured the systematic employment of the concept of ‘risk’ to frame, assess and evaluate scenarios and response options (Figure 5). The use of risk as a concept and language was seen as an effective way of engaging audiences (Painter, 2015). The purpose of the risk-based approach used in WGII AR5 was to address climate change from a broad perspective, permitting the engagement, exploration and assessment of complex causal and impact pathways. The rationale was that since risk is widely understood by decision-makers, it should offer a structured way of framing trade-offs, in the face of uncertainty (Fløttum, Gasper and St. Clair, 2016).

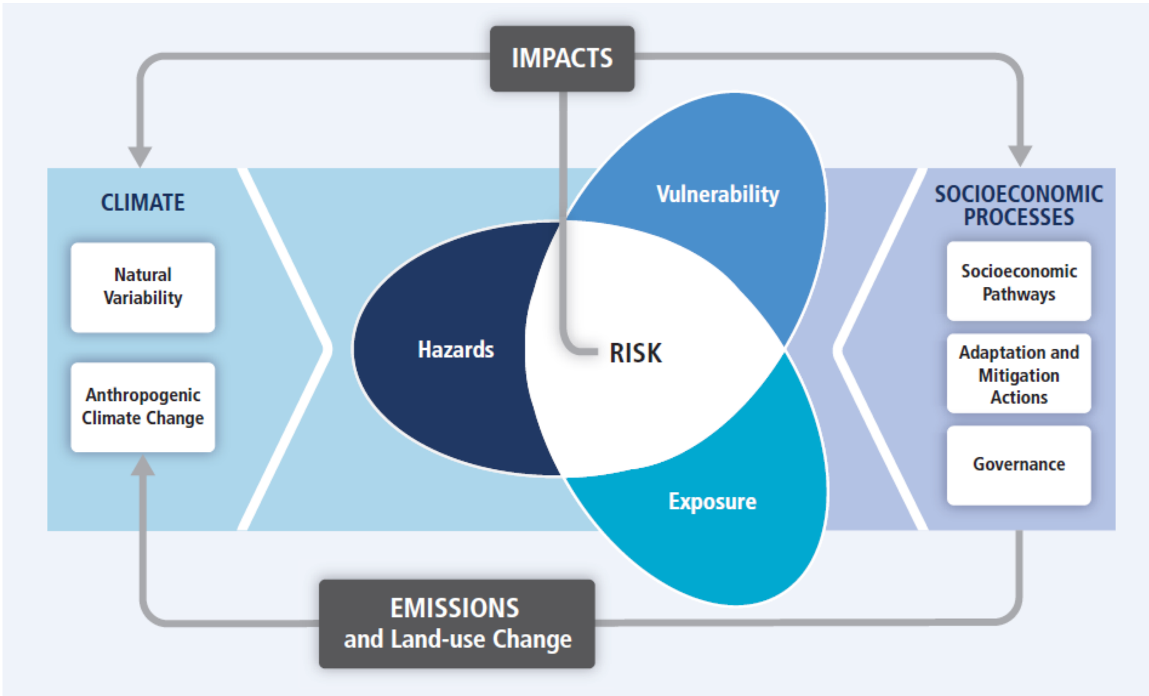


Figure 5: WGII AR5 conceptualised the risk of climate-related impacts as caused when climate-related hazards are exposed to vulnerable natural and human systems. This risk framing has become a feature of subsequent assessments.

In the case of IPBES, for consistency and coherency, all policy and stakeholder questions are analysed within the IPBES conceptual framework developed by Diaz *et al.* (2015) (Figure 6). The framework depicts the relationship between well-being, nature's benefits to people (or ecosystem services), human activities and their impacts to natural and social systems; and the human institutions which are responsible for managing human-nature interactions.

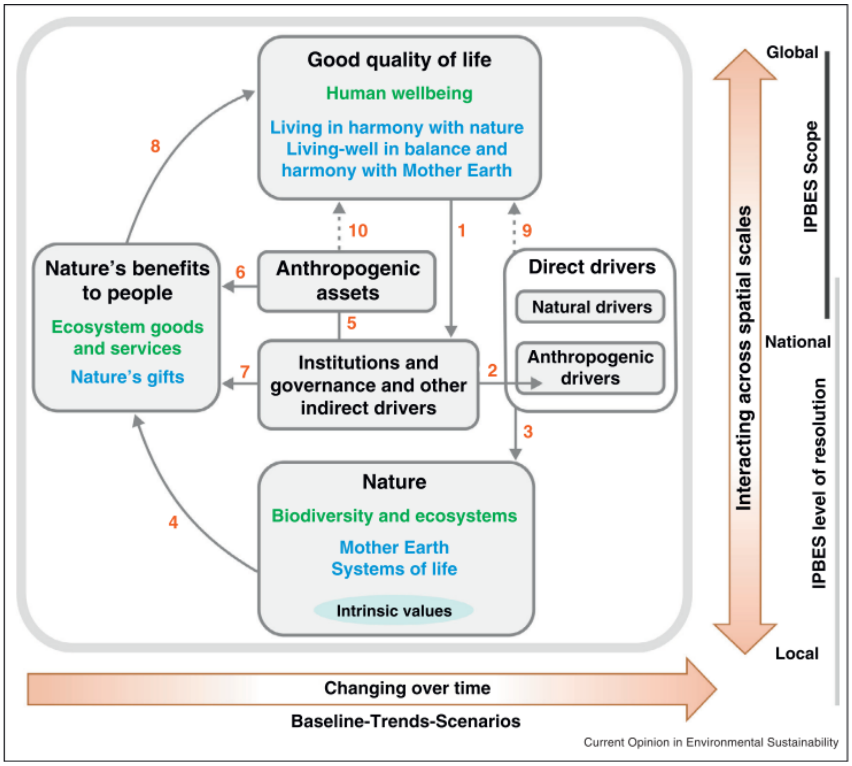


Figure 6: The IPBES conceptual framework (Diaz *et al*., 2015) provides an overall 'Ecosystem Services' model which was adopted by the chapter teams, to ensure consistent epistemological interpretation.

5.5 Saliency – reaching the audience

Saliency is an essential element of SPIs. The findings of a Scientific Assessment have to reach their audience in a format that is jargon-free and digestible to the average reader. For this reason, Summaries for Policymakers (SPMs)are often used in Scientific Assessments. An SPM generally accompanies the SOD when submitted for review and should address the questions raised in the scoping document in a succinct and intelligible way. The SPM provides in the region of fifteen to twenty top key messages and is ideally under 5 000 words. The SPM is highly synthesised and tells a condensed, implementation-oriented story of the state of knowledge as it pertains to the issue. The messages should ideally aim at conveying striking facts and numbers which the assessment has uncovered, and a limited range of action options with their consequences (IPBES, 2018). Other than the SPM, other communication techniques often adopted by Scientific Assessments include iconic diagrams, infographic videos, large press conferences and releases, stakeholder meetings, and fellowship programmes.

6 Discussion: Feasibility of using these approaches in Impact Assessment

The five areas of practice where Impact Assessment might borrow some of the tools from Scientific Assessment are 1) peer review and specialist meetings, 2) multi-author teams, 3) integrated governance structures, 4) robust conceptual, methodological and linguistic frameworks and 5) saliency through novel communication techniques (Figure 7).

In respect of 1, peer review can be easily incorporated into SEA much more. This might be challenging for the EAP in the context of an EIA due to budget and timeline constraints, although the challenges around timing can be mitigated to an extent by aligning peer review timelines with public commenting periods. With respect to cost, many peer reviews may only require a few hours of time (some may need more of course), but these services should be reasonably affordable for the average project proponent.

As regards 2, there need to be more author meetings through the Impact Assessment process to encourage multi- and inter-disciplinarity. I the multi-author model grows, there will be a need to include experts with local and indigenous knowledge (e.g. farmers) to add a transdisciplinary element. Including more and one specialist in the average EIA seems like a low-hanging fruit – it contributes toward both scientific credibility and cross-disciplinary interaction. The EAP can divide the work equally between the specialists so that the partnership model should be within the same cost range as the single specialist approach. It will mean more project management work of course, and the risk of disagreement and is always there, although this can be mitigated by selecting specialist how are both competent and not prima-donnas.

During EIAs it does not make much sense mandating a multi-actor governance group tom, for example, to oversee process credibility and integrity. In the case of SEA, the opposite is true, especially SEAs for hot button topics that are widely considered to be important. One experience in the South African context was undertaken for the Shale Gas Scientific Assessment, completed in 2016. A Process Custodians Group was constituted, drawn approximately equally from government, NGOs, the private sector including the oil and gas sector and the research community. Their specific mandate was to evaluate the following five key questions:

1. Did the assessment cover the material issues that are of concern to people?
2. Had the assessment followed the guidelines in the process document?
3. Did the author teams have the necessary expertise and show balance in their composition?
4. Were the identified expert reviewers independent, qualified, and balanced?

5. Were all the review comments received from expert and stakeholder reviewers addressed and were the responses adequately documented in a public repository?

Better conceptual, methodological and linguistic frameworks can be easily applied to Impact Assessment. For EIA there is no time to develop these in any useful sense, but many EIA deal with the same suite of concept. For example, the impacts and issues associated with solar PV development is arid parts of South Africa are extremely well known, as are the causal mechanisms and impacts associated with wind farms, seawater desalination plants, powerline, petrol station, road, infrastructure etc. I propose that for each of these 'sectors', it would be very useful if all associated EIAs operated from the same conceptual framework for impact pathways (for example, a Drivers, Pressures, State, Responses framework). The methodological and linguistic frameworks inherent to EIA are described in detail in the legislation, which limits flexibility and the ability to tailor an approach on a needs basis, although if an EAP is clever, there is some wriggle room. In SEAs, there is no excuse not to develop robust conceptual, methodological and linguistic frameworks, which are fit for purpose.

As regards saliency, one option is for EIS to forget about its huge reports (publish these online) and focus more on engaging summaries with appealing infographics and tables. This should be done to much larger effect in the case of SEA too, where the use of video must be seriously considered instead of large volume text reports.

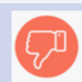
	Scientific Assessment best practices	EIA	SEA
1	Peer review		
2	Multi-author teams		
3	Multi-actor governance		
4	Better conceptual, methodological & language frameworks		
5	Saliency – summaries, diagrams, videos		

Figure 7: Summary of the five areas of practice where Impact Assessment can borrow from Scientific Assessment, as well as an indication of the feasibility of implementing these in EIAs and SEAs.

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