Supplementary Materials

We Need a Global Science-Policy Body on Chemicals and Waste

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Section S1. The general structure of policy-making processes in international chemicals and waste governance, the roles of science-policy interface bodies therein, and major science-policy interface bodies in international chemicals and waste governance

Sound management of chemicals and waste needs action at all levels. National and local approaches and frameworks are needed to respond to geographical variations in preferences and capacities. However, many chemicals may undergo long-range transport across national borders via air, water and biota and/or through international trade of resources, products and waste. In such cases, joint international action by the source, transit, and recipient countries is required. International action can also help address prevalent issues, particularly where capacities and/or action at national and local levels are lacking. For example, many developing countries are overwhelmed by imported plastic waste, but may lack the capacity to establish their own legislation to address this problem. In this case, the most recent plastic waste and ban amendments under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal can play an important role in helping those developing country parties, including in the following two ways. First, developed countries that have ratified the amendments are not allowed to export hazardous plastic waste to developing countries. Second, all parties to the convention are forbidden to trade hazardous plastic waste with non-party states, in the absence of a separate agreement between countries that meets Basel Convention criteria (https://www.epa.gov/hwgenerators/new-international-requirements-export-and-import-plastic-recyclables-and-waste#fq5; https://ipen.org/documents/basel-ban-amendment-guide).

Like many other thematic areas in international environmental governance, international chemicals and waste governance typically follows a common policy-making process consisting of four steps: (1) identification/recognition of an issue of concern to be addressed by the international community (agenda setting), (2) development and adoption of policies and instruments by the international community such as a multilateral environmental agreement or a voluntary program to address the issue (policy formulation), (3) implementation of the policies and instruments (including transposition into national legislation and action), and (4) monitoring and evaluation of progress. Each step involves many factors in order to succeed (e.g. according to the Public Impact Fundamentals theory created by the Centre for Public Impact, there are at least nine such factors: public confidence, stakeholder engagement, political commitment, clear objectives, evidence, feasibility, management, measurement and alignment; https://www.centreforpublicimpact.org/achieving-public-impact/).

The science-policy interface is one piece of the puzzle needed for the success of this complex system. Scientific evidence can inform policy developments, and policy needs can incentivize policy-relevant scientific research. For the former, science-policy interface bodies can foster the role and contribution of science in each of the four steps, including: (1) conducting horizon scanning and early warning of potential issues of concern that may need to be addressed by the international community, (2) conducting scientific assessments that support policy-making (e.g. providing a mechanistic understanding of the issues, drivers and barriers, and recommendations for possible scientific, technical and policy solutions), (3) providing scientific, technical and socio-economic tools and building up national implementation capacity, and (4) guiding monitoring studies and conducting scientific evaluation of progress. The science-policy interface cannot replace the need for the international community to adopt and implement policies and instruments, nor replace national authorities and stakeholders to transpose the international policies and instruments and implement them on the ground. However, in each step above, the science-policy interface can also help to raise public awareness and confidence on the issues, and inform policymakers and business to honor their commitments.

Internationally, a number of subsidiary science-policy interface bodies have been established under various MEAs and intergovernmental organizations with clearly defined mandates (see Table S1).

Table S1. An overview of major international science-policy interface bodies on chemicals and waste and their mandate/functions.

	Associated MEA / host or sponsoring organization	**Mandates/functions**
Under MEAs		
Open-ended Working Group (OEWG)	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	(1) To assist the Conference of the Parties (COP) in developing and keeping under continuous review the implementation of the Convention's work plan, specific operational policies and decisions taken by the COP for the implementation of the Convention, as specified in Article 15; (2) to consider and advise the COP on issues relating to policy, technical, scientific, legal, institutional, administration, finance, budgetary and other aspects of the implementation of the Convention within the approved budget, including identification of the specific needs of different regions and subregions for training and technology transfer and to consider ways and means of ensuring the establishment and functioning of the Basel Convention Regional Centres for Training and Technology Transfer; (3) to prepare its work plan for consideration by the COP; (4) to report to the COP on the activities it has carried out between meetings of the COP (Decision VI/36).
Chemical Review Committee (CRC)	Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	To review chemicals and pesticide formulations, as nominated by any party to the convention, according to the criteria in Annexes II and IV respectively and make recommendations to the COP for listing such chemicals in Annex III (Paragraph 6, Article 18 of the Convention). Membership of the Committee shall consist of a limited number of government-designated experts in chemicals management. The members of the Committee shall be appointed on the basis of equitable geographical distribution, including ensuring a balance between developed and developing parties.
Persistent Organic Pollutants Review Committee (POPRC)	Stockholm Convention on Persistent Organic Pollutants	To perform the functions assigned to it by the COP, including the scientific review of the proposals and related information submitted by Parties to the Convention for listing new chemicals in Annex A, B, and/or C according to Article 8 of the Convention and to make recommendations to the COP.
Scientific Assessment Panel (SAP)	Montreal Protocol on Substances that Deplete the Ozone Layer	To undertake the review of the scientific knowledge in a timely manner as dictated by the needs of the Parties to the Protocol (Annex VI of the report of the First Meeting of the Parties), assess the status of the depletion of the ozone layer and relevant atmospheric science issues, and prepare a report every 3–4 years pursuant to Article 6 of the Protocol).
Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)	Convention on Long-Range Transboundary Air Pollution (CLRTAP)	To regularly provide governments and subsidiary bodies under the LRTAP Convention with qualified scientific information to support the development and further evaluation of the international protocols on emission reductions negotiated within the Convention. The scope includes assessing the transboundary transport of acidification and eutrophication and addressing the formation of ground level ozone, persistent organic pollutants, heavy metals and particulate matter.
Working Group on Effects		The Working Group focuses on the effects of nutrient nitrogen and acidifying air pollutants, tropospheric ozone, volatile organic compounds, particulate matter including black carbon, heavy metals and POPs on the environment and health. It also alerts the Executive Body to any perceived additional – or changed – threats caused by air pollution that might require policy response. The Working Group collects, assesses and further develops environment and health related knowledge and information on (a) the present status, long-term trends and dynamics, as well as the degree and geographical extent, of the impacts of air pollution, in particular but not exclusively its long-range transboundary impacts; (b) exposure-response relationships for agreed air pollutants; (c) critical loads, levels and limits for agreed air pollutants, and their links to observations; and, (d) the linkages between the effects of air pollution, biodiversity and the effects of changes in climate and land use.

Under intergovernmental organizations		
Global Alliance for the Development and Deployment of Products, Methods and Strategies as Alternatives to DDT for Disease Vector Control	Initially established under the Stockholm Convention, and now hosted by United Nations Environment Programme (UNEP)	To strengthen the base of knowledge available to inform policy formulation and decision making; to overcome the complexity and cost of deploying alternatives to DDT; to make available new alternative vector control chemicals; to develop non-chemical products and approaches for vector control (Decision SC-4/2 and Decision SC-5/6 of the Conference of the Parties to the Stockholm Convention).
Global Mercury Partnership	UNEP	To protect human health and the global environment from the release of mercury and its compounds by minimizing and, where feasible, ultimately eliminating global, anthropogenic mercury releases to air, water and land (UNEP Governing Council 25/5). The Partnership works closely with stakeholders to assist in the timely ratification and effective implementation of the Minamata Convention.
Advisory Group on the Environmental Exposure and Impact of EDCs	UNEP	To provide strategic and policy advice on approaches related to the implementation of UN Environment's activities concerning environmental exposure and impact of endocrine disrupting chemicals (EDCs). Members of the Advisory Group were invited by the SAICM Bureau (governments, major groups and other stakeholders including NGO, academia and industry). Individual experts were also invited to become members on the basis of expertise, previous work, and special interest on EDCs.
Global Chemicals Outlook (GCO)	UNEP	Technically, it is not a science-policy interface body per se, but rather a product prepared through an ad-hoc science-policy process involving scientists and experts from governments, intergovernmental organizations, industry, civil society organizations and academia. Both editions are responses to the requests from UNEP's governing body. For example, GCO II responds to the Decision 27/12 by UNEP's Governing Council ("to continue work on the Global Chemicals Outlook, particularly in areas where data were found to be lacking or inadequate, and to enhance transparency through regionally balanced stakeholder involvement, inter alia, with a view to developing in the future a tool for assessing progress towards the achievement of the sound management of chemicals and hazardous wastes, including the existing 2020 goal, taking into account and building upon other existing sources of information") and to the Resolution 2/7 by the UN Environment Assembly 2/7 ("including a summary for policymakers, addressing inter alia the work carried out particularly in relation to lacking or inadequate data to assess progress towards the 2020 goal, the development of non-chemical alternatives, and the linkages between chemicals and waste, in coordination with the *Global Waste Management Outlook*, and providing scientific input and options for implementation of actions to reach relevant Sustainable Development Goals and targets up to and beyond 2020 … ensure that the updated *Global Chemicals Outlook* addresses the issues which have been identified as emerging policy issues by the International Conference on Chemicals Management, as well as other issues where emerging evidence indicates a risk to human health and the environment").
Global Waste Management Outlook (GWMO)	UNEP and International Waste Management Association	Similarly to the GCOs, GWMO is an ad-hoc scientific global assessment on the state of waste management and a call for action to the international community. Prepared as a follow up to the Rio+20 Summit and as a response to UNEP Governing Council decision GC 27/12, the document established the rationale and the tools for taking a holistic approach towards waste management. The Outlook focused primarily on the "governance" issues which need to be addressed to establish a sustainable solution, including the regulatory and other policy instruments, the partnerships and the financing models.

Chemical Risk Assessment Network (CRAN)	World Health Organization (WHO)	To provide a forum for scientific and technical exchange, facilitate and contribute to capacity building, promote best practices and the harmonization of methodologies, assist in the identification of research needs and promote the application of new science in risk assessment practices, assist in the identification of emerging risks to human health from chemicals, share information about work programmes to avoid duplication of effort, and upon request, assist WHO in the development of training and other materials in support of the above (see homepage).
International Programme on Chemicals Safety	Established by WHO, UNEP and the International Labour Organization (ILO), and executed by WHO	To conduct evaluations of risks posed by priority chemicals to human health and environmental integrity, to establish the scientific basis for the safe use of chemicals by means of health and environmental risk assessment (normative functions) and to strengthen national capabilities (technical cooperation) to respond to chemical emergencies and deal with the harmful effects of exposure to chemicals (resolutions WHA30.47, WHA31.28 and EB63.R19).
Environment, Health and Safety Programme	Organisation for Economic Co-operation and Development (OECD)	It is overseen by the Joint Meeting of the Chemicals Committee and Working Party on Chemicals, Pesticides and Biotechnology. It includes eleven main subsidiary bodies, namely Working Group of National Co-ordinators of the Test Guidelines Programme, Working Group on Good Laboratory Practice, Working Party on Exposure Assessment, Risk Management Programme, Working Party on Hazard Assessment, Working Group on Pesticides, Working Group on Biocides, Working Group on Chemical Accidents, Working Group on Pollutant Release and Transfer Registers, Working Group on the Harmonisation of Regulatory Oversight in Biotechnology, Working Group for the Safety of Novel Foods and Feed, and Working Party on Manufactured Nanomaterials. To continue specific work that needs input from experts, the Joint Meeting and its Working Groups establish various sub-groups with specific time-limited mandates to study specific issues, to oversee defined projects, or develop proposal.
Joint Expert Committee on Food Additives	Food and Agriculture Organization (FAO) and WHO	To evaluate the safety of food additives, contaminants, naturally occurring toxicants and residues of veterinary drugs in food.
Joint Meeting on Pesticide Residues	FAO and WHO	To conduct scientific evaluation of pesticide residues in food, to provide advice on the acceptable levels of pesticide residues in food moving in international trade, to review analytical aspects of pesticides, to review toxicological data and estimate acceptable daily intakes (ADIs) for humans of the pesticides under consideration.
Panel of Experts on Pesticide Management	FAO and WHO	It combines the FAO Panel of Experts on Pesticide Management and the WHO Panel of Experts on Vector Biology and Control. It advises on matters pertaining to pesticide regulation, management and use, and alerts to new developments, problems or issues that otherwise merit attention.
Joint Meeting on Pesticide Specifications	FAO and WHO	To produce recommendations to FAO and/or WHO on the adoption, extension, modification or withdrawal of specifications and to develop guidance and procedures in establishing pesticide specifications and equivalence determination which has also its relevance to the registration and quality control of pesticide in national or regional authorities.
Scientific and Technical Advisory Panel	Global Environment Facility (GEF)	To provide objective, strategic scientific and technical advice on GEF policies, operational strategies, programs and on projects and programmatic approaches; maintains a database of institutions, networks and individual scientists to provide the necessary expertise and advice for the GEF; briefs the GEF Council members on the Panel's work and emerging scientific and technical issues
International Resource Panel (IRP)	UNEP	To prepare independent, coherent and authoritative scientific studies and assessments of policy relevance on the sustainable use and management of natural resources and in particular their environmental impacts over the full life cycle, to inform international policy discourse and development on emerging challenges and opportunities for the sustainable use, management of and equitable access to natural resources.

Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP)	International Maritime Organization (IMO, as the host), FAO, UNESCO-IOC, WMO, IAEA, UN, UNEP, UNIDO, UNDP, ISA	As a mechanism for coordination and collaboration among ten UN organizations, to conduct and support marine environmental assessments; to undertake in-depth studies, analyses, and reviews of specific topics; and to identify emerging issues regarding the state of the marine environment, providing authoritative, independent, interdisciplinary scientific advice to organizations and governments to support the protection and sustainable use of the marine environment.
Sub-Committee of Experts on the Globally Harmonized System (GHS)	Globally Harmonized System of Classification and Labelling of Chemicals (GHS)	To act as custodian of the GHS, managing and giving direction to the harmonization process; to keep the system up to date, considering the need to introduce changes to ensure its continued relevance and practical utility, and determining the need for and timing of the updating of technical criteria; to promote understanding and use of the system and encourage feedback; to make the system available for worldwide use and application; to make guidance available on the application of the system, and on the interpretation and use of technical criteria to support consistency of application; to prepare work programmes and submit recommendations to the Committee on the Transport of Dangerous Goods and the Globally Harmonized System of Classification and Labelling of Chemicals (CETDGGHS) (Resolution 1999/65 as in E/1999/INF/2/Add.3; ST/SG/AC.10/30/Rev.4)
Arctic Monitoring and Assessment Programme (AMAP)	Arctic Council	To monitor and assess the status of the Arctic region with respect to pollution and climate change issues; to document levels and trends, pathways and processes, and effects on ecosystems and humans, and propose actions to reduce associated threats for consideration by governments; and, to produce sound science-based, policy-relevant assessments and public outreach products to inform policy and decision-making processes. AMAP's work is directed by the Ministers of the Arctic council and their Senior Arctic Officials, who have requested AMAP to also support international processes that work to reduce the global threats from contaminants and climate change. These include the Framework Convention on Climate Change, the Stockholm Convention on Persistent Organic Pollutants, the Minamata Convention on Mercury, and CLRTAP.
Under international non-governmental organizations		
International Panel on Chemical Pollution (IPCP)	IPCP is an international network of scientists working on various aspects of chemical pollution.	To initiate, prepare and disseminate condensed state-of-the-science documentation on all aspects of environmentally relevant chemicals, to act internationally and in countries with particular needs for improving knowledge regarding chemicals for them to manage issues related to chemicals, to offer the scientific expertise accumulated within IPCP to international organizations, national governments and other parties for discussions and review of all aspects of the scientific basis for regional and/or global management of chemicals.

References: (1) Wexler, P.; van der Kolk, J.; Mohapatra, A.; Agarwal, R. Chemicals, Environment, Health. A Global Management Perspective. **2012**, 1–810. CRC Press, Taylor & Francis Group. Boca Raton, Florida, USA. ISBN: 978-1-4200-8470-2; (2) Wang, Z.; Summerson, I.; Lai, A.; Boucher, J. M.; Scheringer, M. Strengthening the Science-Policy Interface in International Chemicals Governance: A Mapping and Gap Analysis. **2019**, 1–156. https://zenodo.org/record/2559189#.X3Tany1h3ao; (3) Selin, H. Global Governance of Hazardous Chemicals. Challenges of Multilevel Management. **2010.** MIT Press. ISBN: 9780262013956; (4) Kohler, P.M. Science Advice and Global Environmental Governance: Expert Institutions and the Implementation of International Environmental Treaties. **2020**. Anthem Press. ISBN: 9781785271465

Below we provide additional notes taken from some peer-reviewed scientific articles that have analyzed the roles and impacts of science-policy interface bodies (including the general need for scientific knowledge to enter into policymaking) in other international environmental governance areas such as the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). These notes aim to illustrate a wealth of knowledge on this matter in the literature and are not exhaustive nor complete.

Further reading materials include: UNEP, 2017. Strengthening the Science-policy Interface: A Gap Analysis. https://wedocs.unep.org/bitstream/handle/20.500.11822/22261/Gap_Analysis_2017.pdf; Kohler, P.M. *Science Advice and Global Environmental Governance: Expert Institutions and the Implementation of International Environmental Treaties*. 2020. Anthem Press. ISBN: 9781785271465; Perrez, F. X. The Role of the United Nations Environment Assembly in Emerging Issues of International Environmental Law. *Sustainability* 2020, *12* (14), 5680.

Vasileiadou, E.; Heimeriks, G.; Petersen, A. C. Exploring the impact of the IPCC Assessment Reports on science. *Environ Sci Policy* **2011**, *14* (8), 1052–1061 (https://doi.org/10.1016/j.envsci.2011.07.002):

- The IPCC has arguably been very influential in bringing the issue of climate change to the attention of policymakers and the media all over the world. (p. 1052)
- It is important to note here the political importance of the subsequent IPCC Assessment Reports; they have been very instrumental in intergovernmental climate policy making. In particular, the assessments of the human contribution to climate change have been important. The Third Assessment Report (AS2001) concluded that most of the recent warming is "likely" to be caused by anthropogenic greenhouse gases. That assessment report constituted a significant change from the qualitative statement of the Second Assessment Report (AR1996: "the balance of evidence suggests a discernible human influence on global climate") to a probabilistic expression. While the AR1996 paved the way for the Kyoto Protocol, the AR2001 was probably instrumental in getting that Protocol sealed in the Bonn Agreement. (p. 1059)
- In parallel to the political importance of the IPCC, the impact of IPCC reports on scientific knowledge, as reflected by the references to the IPCC reports, has been growing steadily and independently from the overall increase of scientific publications on climate change. Even though there was a relative decline of the impact of AR1996, compared to that of AR1990, the impacts of both AR2001 and AR2007 were substantially higher. This seems to provide some support for the 'hegemonic' role of the IPCC, at least as authoritative resource of climate change related knowledge claims. (p. 1059)
- The IPCC has a considerable impact on science, as contributor of knowledge claims … It provides an authoritative resource of climate change knowledge not only internally (in disciplines closely studying climate change, such as e.g., meteorology) but also for other disciplines. (p. 1059)

Turnhout, E.; Bloomfield, B.; Hulme, M.; Vogel, J.; Wynne, B. Listen to the voices of experience. *Nature* **2012**, *488* (7412), 454–455 (https://doi.org/10.1038/488454a)

- Another reason why climate policies have been hard to enact is the IPCC's implicit assumption that the key actors will assent to top-down knowledge and that national and global institutions are synonymous with "the policy world". Legislation is essential, but for global issues such as climate and biodiversity it is not sufficient. (p. 455)
- Ending practices that destroy biodiversity – such as uncontrolled mono-crop agriculture or large-scale deforestation – requires diverse and locally appropriate actions. The IPBES must therefore forge productive and trusted connections between organized global knowledge and the many biodiversity actors operating at multiple levels and scales. (p. 455)

Gluckman, P. The science-policy interface. *Science* **2016**, *353* (6303), 969 (https://10.1126/science.aai8837)

- Often forgotten is that policy-making is messy. Although a tidy, analytically driven cycle of policy-making might seem logical to scientists trained in the tradition of hypothesis generation and testing, policy-making is instead a networked process in which scientific evidence is one of many inputs … Policy decisions involve balancing empirical data with other arguments. (p. 969)
- The place of science is distinguished from other policy inputs by its relative objectivity obtained through formal processes designed to limit bias in data collection and analysis. (p. 969)

Löfmarck, E.; Lidskog, R. Bumping against the boundary: IPBES and the knowledge divide. *Environ Sci Policy* **2017**, *69*, 22–28 (https://doi.org/10.1016/j.envsci.2016.12.008)

- There is today a new landscape of international environmental governance, one where expert organizations are needed, not only to assess and synthesize rapidly accumulating knowledge, but also to make knowledge policy-relevant in order to tackle environmental challenges. At the same time, there is recognition that scientific knowledge is a necessary, but not sufficient condition for developing relevant and viable policies. This has led to a growing focus on strengthening the interfaces not only between science and policy, but also between science, policy and society at large. (p. 28)

Jabbour, J.; Flachsland, C. 40 years of global environmental assessments: A retrospective analysis. *Environ Sci Policy* **2017**, *77*, 193–202. (https://doi.org/10.1016/j.envsci.2017.05.001)

- Well-designed GEA [global environmental assessment] processes are widely viewed as powerful, legitimate tools with the potential to catalyze cooperation and arrive at consensual evidence-based knowledge … Climate change, stratospheric ozone depletion, and biodiversity loss are among the most iconic examples. For each of these global challenges, a succession of GEAs has provided the scientific foundations and evidentiary basis for multilateral intervention. (p. 193)

Beck, S.; Mahony, M. The IPCC and the politics of anticipation. *Nature Climate change* **2017**, *7* (5), 311–313 (https://doi.org/10.1038/nclimate3264)

- By organizing solution-oriented assessment not just around different representative concentration pathways and inferred technologies but around different pathways of societal transformation, the IPCC can play a key role in facilitating dialogue about policy alternatives and their political implications. The IPCC is an incredibly powerful actor in climate politics. It is an important player in making futures, not just forecasting them – a role likely to intensify in a new solution-oriented mode. By taking responsibility for this role, the IPCC can continue to exercise its political power wisely, by keeping the possibility space of political action open for negotiation among a diversity of actors and options. (p. 313)
- The IPCC could open up consideration of alternative technological possibilities, of future pathways of climate policies, and alternatives to current policy orthodoxies. Such openness

could help to improve scientific understanding of and solutions to these complex problems, as well as address challenges such as uncertainty and ignorance. This openness also invites a broader range of academic disciplines to contribute to exploring more flexible, more inclusive, and arguably, more effective approaches to societal transformation. (p.312)

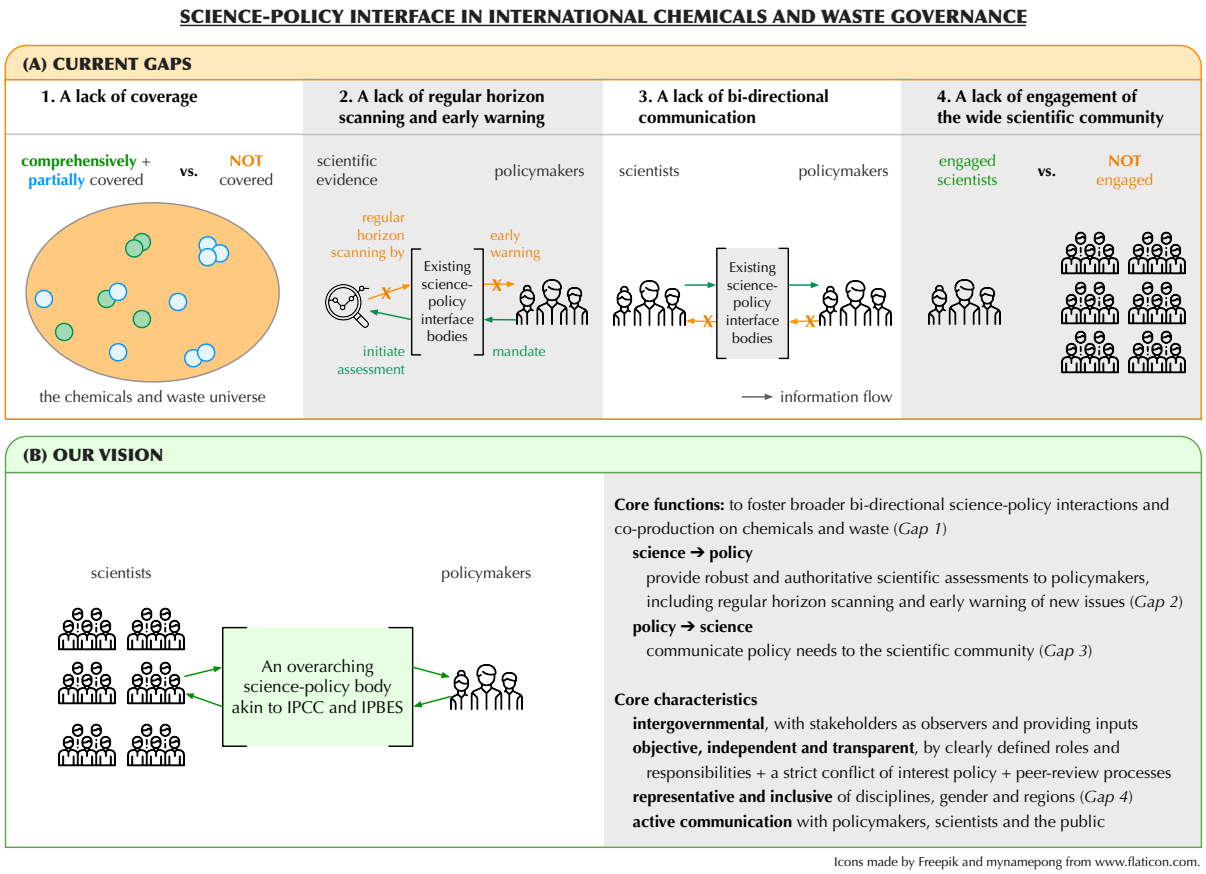
Riousset, P.; Flachsland, C.; Kowarsch, M. Global environmental assessments: Impact mechanisms. *Environ Sci Policy* **2017**, *77*, 260–267 (https://doi.org/10.1016/j.envsci.2017.02.006)

- GEAs [Global environmental assessments] should be conceived as a means of contributing substantive insights and scientific facts to policy-making. They also operate as platforms for confronting and enriching environmental coordinative discourses, including disputed options, to address environmental issues. Consequently, enhancing the opportunities by which researchers and government representatives, in multilateral agreements, exchange knowledge in an iterative manner, is decisive to their success. Creating more space for interactions between researchers, policy-makers and stakeholders might help better exploit this potential in the future. While there seems to be an increasing consensus on environmental challenges, the search for appropriate solutions might benefit from such spaces for interactions. (p. 266)
- By ensuring a broad participation, and the cross-fertilization of policy fields and sources of knowledge across national and administrative boundaries, solution-oriented (and other) GEAs can facilitate various forms of policy learning. This learning can influence the beliefs, values and behavior of the diverse actors who contribute to coordinative and communicative discourses in multiple national constituencies. The institutional design of an assessment should consciously account for the mechanisms by which they exert influence via interpersonal interactions, in order to maximize their potential. (p. 266)
- By engaging with policy-makers and stakeholders, researchers learn how to produce and communicate their research in a policy-relevant manner. Assessments should be specifically designed to enhance these capacities, as they contribute to policy-relevant research in the future. (p. 266)

Van der Molen, F. How knowledge enables governance: The coproduction of environmental governance capacity. *Environ Sci Policy* **2018**, *87*, 18–25. (https://doi.org/10.1016/j.envsci.2018.05.016)

- The literature has widely acknowledged that the creation, mobilization, and utilization of knowledge are crucial issues with respect to environmental governance. (p. 18)
- The recent literature usually conceptualizes such boundaries and interfaces as dynamic, interactive, and socially constructed phenomena … What has received less attention is that knowledge can also be seen as an intrinsic element of governance. (p. 18–19)
- Moreover, knowledge can be understood to be a constitutive element of the various capacities that are needed in order to govern sustainable human-environment interactions. (p. 24)
- Building well-informed environmental governance arrangements is not just a matter of managing the interfaces between knowledge and governance; it is also a matter of capacity-building in order to enable the reflexivity of governance arrangements. (p. 24)

Figure S1. Overview of current gaps in the science-policy interface in international chemicals and waste governance and our vision for an overarching science-policy mechanism



Icons made by Freepik and mynamepong from www.flaticon.com.

Section S2. Additional examples of major gaps in the science-policy interface on chemicals and waste at the international level

Here we provide additional examples and information for the Section on "Four Major Gaps in the Current Science-Policy Landscape" in the main text (we have underlined especially relevant text):

- Examples 1 and 2 on Pages 10–11 show current calls in specific sub-fields of international chemicals and waste governance on strengthening science-policy interface actions, reflecting the current lack of coverage by existing science-policy interface bodies (Gap 1).
- Examples 3, 4 and 5 on Pages 11–13 provide more details in relation to the sentence "in some cases, a lack of comprehensive scientific assessments has also provided space for intentionally misrepresented information due to conflict of interest" under Gap 1 in the main text. More examples can be found in Karlsson, M. Chemicals denial-a challenge to science and policy. *Sustainability* **2019**, *11*(17), 4785 (https://doi.org/10.3390/su11174785), and Goldberg, R. F. and Vandenberg L. N. Distract, delay, disrupt: examples of manufactured doubt from five industries. *Reviews on Environmental Health* **2019**, *34*(4), (https://doi.org/10.1515/reveh-2019-0004).
- Example 6 on Page 13 illustrates possible negative impacts on the effectiveness of policy-making that may be caused by the current lack of engagement of the social sciences (Gap 4).
- Examples 7, 8 and 9 on Pages 14–16 reflect that current gaps in the science-policy interface related to international chemicals and waste governance cannot be overcome by existing science-policy interface bodies, or national and regional regulatory agencies.

Example 1 illustrates current science-policy gaps in the sub-field of marine litter and microplastics. The report of the second meeting of the ad hoc Open-Ended Expert Group on Marine Litter and Microplastics (UNEP/AHEG/2018/2/5; https://papersmart.unon.org/resolution/uploads/k1900428.pdf) notes that

> the experts agreed that there was a need to strengthen the science-policy interface at the international level and to do more to support evidence-based approaches, improve understanding of the impacts of plastic litter on the marine environment, and promote local, national, regional and global action to eliminate marine litter. (p. 6)

Four options were proposed and discussed: (a) "consider modalities for the establishment of a global knowledge hub"; (b) "consider the establishment of a scientific and technical advisory group"; (c) "explore an interagency examination of health and environmental aspects in relation to marine litter and microplastics with a source-to-sea approach as well as an examination of costs and benefits in relation to job transition"; and (d) "consider preparing a compendium of relevant existing and planned industry initiatives to enhance transparency and calibrate partnership opportunities, as well as examples of existing national-level actions such as extended producer responsibility to supplement the compendium". (p. 6)

It further notes that

> the experts discussed various options and approaches for enhanced coordination and governance. They identified a number of principles that should guide follow-up in this area,

> including the following: Responses to the problem of marine litter and microplastics should be aligned with the 2030 Agenda for Sustainable Development and its Sustainable Development Goals. Political will is essential for effective outcomes. Information and research are critical enablers. The overall approach should be comprehensive and holistic, transparent and evidence-based. It should incorporate sea-based and land-based sources, the circular economy perspective and the full-life-cycle approach. It should target the elimination and prevention of plastic waste and marine litter, and should include immediate as well as sustained, long-term action. It should be supported by and grounded in a science-policy interface; international cooperation; multi-stakeholder engagement; and the realities of differences in regional and local contexts and (technical/financial) capacities. (p. 7)

Example 2 illustrates science-policy gaps under the UN Strategic Approach to International Chemicals Management (SAICM), a voluntary multi-stakeholder, multi-sectoral policy framework on sound management of chemicals and waste around the world (http://www.saicm.org).

SAICM's overall objective was the achievement of the sound management of chemicals throughout their life cycle so that by the year 2020, chemicals are produced and used in ways that minimize significant adverse impacts on the environment and human health. Its *Independent Evaluation of the Strategic Approach from 2006–2015* notes that

> despite the multi-stakeholder ambition of SAICM, several important groups of stakeholders are missing from the SAICM process and structure, in particular academia. Offers were made at ICCM2 [the second session of the International Conference on Chemicals Management] to host a scientific meeting prior to ICCM3 but these were declined. No scientific body is integrated into SAICM to support its work. (http://www.saicm.org/Portals/12/Documents/reporting/FinalReport_Independent-Evaluation-SAICM-2006-2015.pdf, paragraph 418).

Example 3 notes that discussion on scientific matters under SAICM may be (mis-)represented by stakeholders other than scientists themselves, as shown in the *Report of the International Conference on Chemicals Management on the work of its fourth session* (SAICM/ICCM.4/15*; http://www.saicm.org/Portals/12/documents/meetings/ICCM4/doc/K1606013_e.pdf). A footnote was requested by the International Council of Chemical Associations, CropLife International and the United States Council for International Business to "note that the methodology and conclusions of the report [*State of the Science of Endocrine Disrupting Chemicals – 2012* by UNEP and WHO] remain contentious among certain scientific groups" with no (scientific) evidence provided for this statement.

Example 4 is in relation to doubt-mongering and strategies to address it, taken from Oreskes, N.; Conway, E. M. Defeating the merchants of doubt. *Nature* 2010, 465 (7299), 686–687 (https://doi.org/10.1038/465686a).

- Doubt-mongering is an old strategy. It works because if people think the science is contentious, they are unlikely to support public policies that rely on that science. As we recount in our new book, *Merchants of Doubt*, it is a strategy that has been pursued – often by the same people – to combat the ideas that cigarette smoking causes cancer, that acid rain or the ozone hole is caused by man-made pollution, that the pesticide DDT should have been banned, that the world is warming or, if warming, that we ought to be worried. Yet, despite this long history, scientists are still ill-equipped, and ill-prepared, to deal with doubt-mongering. (p. 686)
- How can researchers respond to organized, sophisticated and persistent attempts to undermine science? It is not easy. Many scientists have been intimidated into staying silent, fearful of personal attacks. Others have simply ignored fallacious reports and claims, hoping they would go away. Those who engage in discussion discover a frustrating situation. Whatever facts one supplies, the sceptics continue to challenge them or offer alternative explanations. One cannot call one's opponent a liar because it just seems desperate and *ad hominem*. Nor does it work to debate their points, because that feeds into the "controversy" framework: the sceptics say there is a debate, you say there isn't – voilà, they have proved their point. (p. 687)
- For many years, contrarians insisted that concern over anthropogenic global warming was just the latest environmental fad, and the science was unsettled. This isn't true. In the words of the National Academy in 1979:"A plethora of studies from diverse sources indicates a consensus that climate changes will result from man's combustion of fossil fuels and changes in land use." History also refutes the often-quoted canard that scientists previously had a consensus that the world was cooling. Those who make this claim usually point to a one-page piece published in the American magazine *Newsweek* in 1975, that spelled out scientific concerns over a mid-century Northern-Hemisphere cooling trend. However, not only was there no consensus at that time that the world was cooling, but the bulk of the published peer-reivewed literature argued for anthropogenic warming. (p. 687)
- We are not saying that clear communication will inexorably lead to an informed public, which will in turn suddenly precipitate informed policies. It's more complicated than that. Yet improving communication is a step that can make a difference. In addition, if the public is to learn that science is "messy" and full of uncertainty – which can help to improve public trust in the system – they should also learn that sensible decision-making involves acting on the best information available. Peer-reviewed literature and the agreed opinions of expert bodies can and should be granted reasonable trust. (p. 687)

Example 5 is in relation to the negative impacts caused by conflicts of interest and strategies to address conflicts of interest, taken from Baur, X.; Soskolne, C. L.; Bero, L. A. How can the integrity of occupational and environmental health research be maintained in the presence of conflicting interests? *Environmental Health* **2019**, *18* (1), 93–10 (https://doi.org/10.1186/s12940-019-0527-x).

- The risk of malfeasance arises when a secondary interest (such as that of personal financial gain) could adversely affect a primary interest (such as the duty to produce valid research). A COI [conflict of interest] may be financial (e.g. stock ownership, consulting feeds) or non-financial (e.g. personal relationships). COI is not in itself a bias or a corrupt decision but, rather, a set of circumstances that poses a risk for primary obligations being compromised

by succumbing – consciously or even subconsciously – to the influence of other interests. The existence of a COI does not imply that a scientist is improperly motivated; his/her perspective, however, may become biased. (p. 3)

- Practice of corporate malfeasance include: Contamination of editorial boards of peer-reviewed scientific journals with industry apologists resulting in the publication of poorly-designed research studies that produce some biased results that mislead readers and flood the literature with invalid science; interference with the activities of national regulatory bodies (e.g. USEPA, EFSA) and international review panels (e.g. WHO/IARC) and other independent organizations engaged in safeguarding occupational and public health; constructing roadblocks, e.g. by capitalizing on uncertainty to undermine scientific consensus for much-needed government regulation of carcinogenic, endocrine-disrupting and/or immunotoxic agents widely present in the workplace and the environment, including air toxics, pesticides and toxic metals; the promotion of "causation" criteria that lack foundation and effectively block workers' access to legal remedies for harms from occupational exposures resulting in morbidity and premature mortality; violating standards of professional conduct by seducing reputable scientists with financial incentives that make them beholden to serve the corporate agenda. (p.8)
- It is not possible to eliminate the production of all bad science. But it is possible to prevent the use of the outcomes of bad science in decision-making processes and in assessments of health hazards and risks. Fairly evaluating published research in the process of peer-review is becoming increasingly challenging in a world that is characterized by infiltration of powerful interests at all levels of science ... Applying the principle of COI declaration for every person involved at each level of decision-making may create the necessary transparency to identify and address distortions by the regulated community. Research evidence that is used to inform policy should be evaluated according to criteria that are the consensus of the independent scientific community, and not the industry being evaluated. (p. 6)
- Effective strategies to avoid personal COIs are needed. These include the elimination of secondary interests, accompanied by prevailing full transparency, fairness, proportionality and accountability.

Example 6 illustrates possible negative impacts on the effectiveness of policy-making that may be caused by the current lack of engagement of the wider scientific community in terms of disciplines (e.g. interpretive social sciences, more practice-oriented fields of law and public policy), taken from Selin, H.; Keane, S. E.; Wang, S.; Selin, N. E.; Davis, K.; Bally, D. Linking science and policy to support the implementation of the Minamata Convention on Mercury. *Ambio* **2018**, *47* (2), 198–215 (https://doi.org/10.1007/s13280-017-1003-x).

> Educational campaigns in Africa discovered that women still use Hg-containing skin lightening products despite the health risks because women with fair skin are perceived to be more attractive by prevailing social standards (Agorku et al. 2016). Because these social pressures have not been adequately addressed, legislation in several countries against these products has been difficult to implement." (p. 208)

Example 7 illustrates current science-policy gaps under the Basel, Rotterdam and Stockholm Conventions, where science-policy interface bodies have been established with specific mandates, but the science-policy interface need to be further strengthened.

In developing the draft *Road Map for Science to Action for Further Engaging Parties and Other Stakeholders in an Informed Dialogue for Enhanced Science-Based Action in the Implementation of the Conventions*, the Secretariat of the Convention conducted an online survey in 2016 (http://www.brsmeas.org/Decisionmaking/COPsandExCOPs/2017COPs/2017COPs/MeetingDocuments/tabid/5385/language/en-US/Default.aspx; UNEP/CHW/13/INF/50).

A total of 127 respondents (72 from governments, 6 from intergovernmental organizations, 9 from convention regional centres, 11 from industry, 13 from civil society, 13 from academia and 3 from others; 31 from developed countries and 96 from developing countries and countries with economies in transition) provided information on the challenges and opportunities in bringing science and policy together.

> Respondents from developing countries and countries with economies in transition indicated lower access to information than those from developed countries. The largest difference was for access to online reference libraries where only 27% of respondents from the developing countries and countries with economies in transition indicated they had access, compared to 68% of respondents from developed countries. A similar difference was found for use of geo-referenced data (24% compared to 62%). (p. 28)

The respondents highlighted several challenges in accessing and using scientific and technical information, including

- the cost of obtaining information – articles and journals that are not open access or databases that are only available on subscription or by membership;
- knowledge translation – making scientific information understandable to a general audience – so that it can be used effectively in decision-making;
- the need for additional information on alternatives as well as information on successful experiences in other countries;
- the lack of national capacity to review and access information including the capacity to undertake systematic reviews of the evidence (from elaborating the search strategy, appraisal of articles, and synthesis of the evidence;
- the lack of standard approaches which can make it difficult to compare data. (p. 28)

The respondents highlighted several shortcomings in the current modalities for scientific and technical information exchange, including

- the population at large is not aware of relevant information portals and websites;
- decisions are taken by small groups of technical committee members without sufficient input from others who also hold additional relevant information;
- greater effort is needed to ensure that scientific information is synthesized and presented clearly to be useful to decision makers and non-specialist stakeholders;
- language barriers that limit access to and exchange of information;

- need for greater cooperation between the experts of the Basel, Stockholm and Rotterdam Convention
- insufficient information relevant to developing countries, and lack of information on alternatives. (p.31)

The respondents made suggestions for enhanced mechanisms for knowledge and information sharing, including

- reach out to other science-policy groups to enhance collaboration, improving monitoring efforts, fill knowledge gaps and improve awareness of emerging issues;
- improve communication between science (researchers) and action (government, environmental agencies, etc.) by making the information more easily understood and relevant, including better guidance to foster more consistent interpretation of information and implementation of obligations. (p. 31 – 32)

The report further notes, "an improved science-policy interface could facilitate the decision-making in the BRS conventions and support their effective implementation" (p. 6).

Example 8 illustrates that current gaps in the science-policy interface related to international chemicals and waste governance cannot be overcome by science-policy interface bodies, or regulatory agencies, existing in developed countries.

One might argue that science-policy interface bodies, or regulatory agencies, existing in developed countries may be utilized to identify and inform the international community about new and emerging issues. However, that approach would have its own limitations. Foremost, those science-policy interface bodies, or regulatory agencies, will focus on issues that are directly relevant to them. This would leave issues in less developed economies at risk of being overlooked or disregarded. This has been observed, e.g., in the area of pesticides. Developed countries have developed strong regulatory frameworks to ban harmful pesticides for use in their territory and limit the residual levels of harmful pesticides in food to protect consumer health. However, recent studies (e.g. Mendez et al. *Science of the Total Environment* **2018**, 613–614, 1250–1262; https://doi.org/10.1016/j.scitotenv.2017.09.172) show that, indeed, such strategies have been effective in protecting farmers, consumers and the environment in developed countries, but they are not effective in protecting farmers and the environment in developing countries, where many food items are produced and traded globally and harmful pesticides are still being used. At issue here is that less developed economies lack capacity to enact legislation and monitor for compliance, but more fundamentally, they lack basic access to current information (e.g., given the high journal subscription fees) and capacity to review scientific evidence. An FAO survey in 2011 shows that 81 out of the 109 surveyed developing countries had no more than 2 technical staff responsible for pesticides registration and approval within the country (https://apps.who.int/iris/bitstream/handle/10665/329971/9789241516884-eng.pdf). Therefore, for such issues, an international science-policy interface body would be needed to assess the evidence in the global context and to inform policymakers around the world. Such an international science-policy approach would also be a sensible way to use resources to support countries by avoid duplicating efforts and re-inventing the wheel.

Example 9 further notes gaps in the regulatory systems in developed countries (including that supporting research behind the regulatory findings is not always available to the public, i.e. cannot be readily used by the public), taken from Gold, S. C.; Wagner, W. E. Filling gaps in science exposes gaps in chemical regulation. *Science* 2020, 368, 1066–1068 (https://doi.org/10.1126/science.abc1250)

In this article, the authors took chloroperfluorpolyether carboxylate compounds (ClPFPECAs) as an example and attempted to trace these compounds through the regulatory frameworks in the United States and European Union. The authors have learned three key lessons with regard to the US system.

- While regulatory attention is focused on eliminating high-profile chemical risks, less effort appears to be dedicated to analyzing the safety of substitute chemicals used to replace them. A number of scientists have raised general concerns about the need for rigorous comparative assessments of replacement chemicals, particularly within the PFAS [per- and polyfluoroalkyl substances] family … However, assessments for PFAS chemicals appear to have been conducted–at best–on an ad hoc basis and primarily through negotiated agreements. The resulting, publicly available research on PFAS chemicals is quite limited. (p. 1067)
- Some chemicals may fall through the cracks in the public tracking system in the United States, not because they are adequately assessed for toxicity but for other reasons. (p. 1068)
- For the 40,000-plus chemicals in commerce, the burden of chemical assessment rests almost entirely on a small group of EPA regulators … As a result, some, perhaps many, chemicals likely fall through the cracks. (p. 1068)

With regard to the regulatory systems in the EU, the authors found that

> ClPFPECAs are officially registered in two EU regulatory programs. As mentioned above, EFSA approved ClPFPECAs in the manufacture of nonstick coating products … And ClPFPECAs are listed—along with five hazard classifications—in the EU's notification (CLP) database. In neither case, however, is the supporting research behind these regulatory findings readily available to the public. (p. 1068)

Similarly, publicly available information under the EU's chemicals regulation does not provide information on the ClPFPECAs. The authors then concluded that

> Our examination of the U.S. and European regulatory programs raises more questions than answers about the extent to which ClPFPECAs are being tracked, studied, and regulated. Certainly the European Union has made more progress than has the United States in this regard … Still, the toxicological mysteries of ClPFPECAs – and thousands of other potentially toxic chemicals that are regulated (or perhaps not regulated) in ways that remain effectively inscrutable – suggest that we have a long way to go in designing effective and accountable chemical regulation, particularly in the United States. (p.1068)

Section S3. Examples of clear definitions of roles and responsibilities, conflict-of-interest policy and peer-review processes set by several intergovernmental science-policy interface bodies

This section provides four examples, namely (1) Intergovernmental Panel on Climate Change (IPCC), (2) Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), (3) Technology and Economic Assessment Panel and its technical options committees and temporary subsidiary bodies to the Montreal Protocol on Substances that Deplete the Ozone Layer, and (4) Persistent Organic Pollutants Review Committee to the Stockholm Convention. We have underlined especially relevant text.

Example 1: Intergovernmental Panel on Climate Change (IPCC)

The mandate and membership of the organization, and its work procedures, are described in the *Principles Governing IPCC Working* (https://www.ipcc.ch/site/assets/uploads/2018/09/ipcc-principles.pdf). In particular, Appendix A to the *Principles Governing IPCC Work* sets out the procedures for the preparation, review, acceptance, adoption, approval and publication of IPCC Reports (https://www.ipcc.ch/site/assets/uploads/2018/09/ipcc-principles-appendix-a-final.pdf). It includes three substantive Annexes, namely

- Annex 1. tasks and responsibilities for Lead Authors, Coordinating Lead Authors, Contributing Authors, Expert Reviewers and Review Editors of IPCC Reports and Government Focal Points;
- Annex 2. procedure on the use of literature in IPCC reports;
- Annex 3. IPCC protocol for addressing possible errors in IPCC assessment reports, synthesis reports, special reports and methodology reports).

The processes and procedures are "regularly reviewed and updated to ensure that they remain strong, transparent and reliable". (https://www.ipcc.ch/documentation/procedures/)

In addition,

> any non-profit body or agency qualified in matters covered by IPCC, whether national or international, governmental or intergovernmental, may be admitted as an IPCC Observer Organization. UN bodies and organizations are admitted as observers if they so request, and organizations with an existing observer status with the WMO or the UN may be considered as observers of IPCC, subject to acceptance by IPCC. IPCC has at present 30 Observer Organizations among UN bodies and organizations as participating organizations, and 131 non-UN observers.
>
> Representatives of observer organizations may attend sessions of IPCC and the plenary sessions of the IPCC Working Groups. They are also invited to encourage experts to review draft IPCC reports. These experts participate in the review process in their own name and not on behalf of the Observer Organization.
> (https://www.ipcc.ch/documentation/procedures/)

For policy and process for admitting observer organizations, see https://www.ipcc.ch/site/assets/uploads/2018/09/ipcc-principles-observer-org-1.pdf.

Furthermore, IPCC adopted and implemented a Conflict of Interest (COI) Policy in 2011 (https://www.ipcc.ch/site/assets/uploads/2018/09/ipcc-conflict-of-interest-2016.pdf).

- The overall purpose of the policy is to protect the legitimacy, integrity, trust and credibility of IPCC and of those directly involved in the preparation of reports, and its activities. The staff of the IPCC Secretariat is subject to the disclosure and ethics policies of the WMO and UNEP.
- Individuals [including IPCC Chair and Vice-Chairs, other Bureau and Task Force Bureau members, authors with responsibilities for report content, review editors and staff of the Technical Support Units] must disclose circumstances that could lead a reasonable person to question an individual's objectivity, or whether an unfair advantage has been created, constitute a potential conflict of interest. The Conflict of Interest Policy is overseen by a Conflict of Interest Committee that comprises all elected members of the Executive Committee and two additional members with appropriate legal expertise appointed by the WMO and UNEP. The Panel approved the the Methods of Work of the COI Committee (https://www.ipcc.ch/site/assets/uploads/2019/01/coi_method_of_working.pdf) during its 35th Session (Geneva, June 2012) and amended it at its 44th Session (Bangkok, October 2016). (https://www.ipcc.ch/documentation/procedures/)

Multiple stages of review

are an essential part of the IPCC process to ensure a comprehensive, objective and transparent assessment of the current state of knowledge. Expert reviewers and governments are invited at different stages to comment on the scientific, technical and socio-economic assessment and the overall balance of the drafts. The review process includes wide participation, with hundreds of reviewers critiquing the accuracy and completeness of the scientific assessment contained in the drafts. (https://www.ipcc.ch/site/assets/uploads/2018/02/FS_review_process.pdf)

Example 2: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)

The *Functions, operating principles and institutional arrangements of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services* sets out IPBES's objective and functions (https://ipbes.net/sites/default/files/downloads/functions_operating_principles_and_institutional_arrangements_of_ipbes_2012.pdf). IPBES has established a detailed *Procedures for the preparation of Platform deliverables*, including detailed multi-step review processes (https://ipbes.net/sites/default/files/downloads/pdf/IPBES_Procedures_for_the_preparation_of_deliverables_consolidated.pdf). It also includes three substantive Appendices, namely

- Appendix I: tasks and responsibilities of report co-chairs, coordinating lead authors, lead authors, contributing authors, review editors and expert reviewers of Platform reports and other deliverables and of government-designated national focal points
- Appendix II: procedure on the use of literature in the reports of the Platform
- Appendix III: procedures for bringing indigenous and local knowledge into the Platform's assessments

Furthermore, IPBES adopted a *Conflict of interest policy and implementation procedures* in decision IPBES-3/3 (https://ipbes.net/sites/default/files/downloads/Conflict_of_interest_policy.pdf). It applies to the members of the Bureau, the Multidisciplinary Expert Panel and any other subsidiary bodies contributing to the development of deliverables, authors with responsibility for report content

(including report co-chairs, coordinating lead authors and lead authors), review editors and the professional staff to be hired to work in a technical support unit established by IPBES.

At previous sessions, observers have been admitted using an interim procedure set out in paragraph 22 of the report of its first session (IPBES/1/12; https://ipbes.net/sites/default/files/downloads/IPBES_1_12_En_0.pdf).

> The interim procedure provides that any body or organization qualified in matters covered by IPBES should inform the IPBES secretariat of its wish to be represented at sessions of the Plenary. (https://www.ipbes.net/accredited-organisations)

Example 3: Technology and Economic Assessment Panel and its technical options committees and temporary subsidiary bodies to the Montreal Protocol on Substances that Deplete the Ozone Layer

Decision XXIV/8 approved the terms of reference and the conflict of interest and disclosure policy for the Technology and Economic Assessment Panel (TEAP), its technical options committees (TOCs) and any temporary subsidiary bodies (TSBs); https://ozone.unep.org/treaties/montreal-protocol/meetings/twenty-fourth-meeting-parties/decisions/decision-xxiv8-terms-reference-code-conduct-and-disclosure-and-conflict-interest-guidelines?q=treaties/montreal-protocol/meetings/twenty-fourth-meeting-parties/decisions/decision-xxiv8-terms. It includes detailed description on the following aspects:

- scope of work, including
    - TEAP analyses and presents technical information and recommendations when specifically requested. It does not evaluate policy issues and does not recommend policy. TEAP presents technical and economic information relevant to policy. Furthermore, TEAP does not judge the merit or success of national plans, strategies, or regulations.
- size and balance, nominations, appointment of members of TEAP, co-chairs, appointment of members of TOCs, subsidiary bodies, termination of appointment, replacement
- guidelines for nominations and matrix of expertise, including
    - The TEAP/TOCs will publicize a matrix of expertise available and the expertise needed in the TEAP/TOCs so as to facilitate submission of appropriate nominations by the parties. The matrix must include the need for geographic and expertise balance and provide consistent information on expertise that is available and required.
- functioning of TEAP/TOCs/TSBs, including language, meetings, rules of procedure, observers and functioning by members
    - No observers will be permitted at TEAP, TOC or TSB meetings. However, anyone can present information to the TEAP/TOCs/TSBs with prior notice and can be heard personally if the TEAP/TOCs/TSBs consider it necessary.
    - The TEAP/TOCs/TSBs members function on a personal basis as experts, irrespective of the source of their nominations and accept no instruction from, nor function as representatives of Governments, industries, non-governmental organizations (NGOs) or other organizations.
- report of TEAP/TOCs/TSBs, including procedures, access, review by TEAP and comment by public

    - Any member of the public can comment to the co-chairs of the TOCs and TSBs with regard to their reports and they must respond as early as possible. If there is no response, these comments can be sent to the TEAP co-chairs for consideration by TEAP.
- code of conduct for Members of the TEAP and its bodies
- conflict of interest and disclosure guidelines, including
    - These guidelines are principle-based and do not provide an exhaustive list of criteria for the identification of conflicts.
    - Members are to disclose any potential conflicts of interest, including the source of any funding for their participation in the work of the TEAP, TOC and/or TSB. An illustrative list of other interests that should be disclosed is provide in Annex A to the guidelines.
- The conflict of interest and disclosure guidelines also set up procedures, including the involvement of the conflict resolution advisory body.

Example 4: Persistent Organic Pollutants Review Committee to the Stockholm Convention

The *Terms of reference of the Persistent Organic Pollutants Review Committee as amended by decision SC-4/20 and SC-5/11* (http://chm.pops.int/Portals/0/download.aspx?d=UNEP-POPS-POPRC.10-REL-TOR.English.pdf) includes details on the following aspects:

- mandate and membership, including
    - The members of the Committee shall be appointed on the basis of equitable geographical distribution, taking into account gender and the need for a balance between different types of expertise.
- invited experts and other participants, including
    - The meetings of the Committee shall be open to: (a) Parties to the Convention, which shall be treated as observers in accordance with the rules of procedure of the Conference of the Parties for the purpose of their participation in the committee; (b) observers, in accordance with the rules of procedure of the Conference of the Parties.
- conflict of interest, including
    - Each member of the Committee as well as each invited expert shall sign a declaration of interest as set out in [http://chm.pops.int/Procedures/Declarationofconflictsofinterest/tabid/3471/Default.aspx] prior to participating in the work of the Committee.
    - The Committee shall meet in closed session before the start of each meeting of the Committee to discuss any issues related to conflicts of interest of Committee members.
    - The Committee shall decide on individual cases of conflict of interest concerning experts invited to take part in the work of the Committee.
- confidentiality of data,
- officers of the Committee (i.e. election of the Chair and Vice-Chair),
- administrative and procedural matters, including
    - The Chair and the Vice-Chair of the Committee may exercise the right to vote.

Section S4. Notes on lessons learned on the institutional design of the science-policy interface in international environmental governance areas

Over the past decades, the institutional design of an effective science-policy interface has been, and is continuously being, extensively studied by scholars with diverse views, and tremendous practical experience has also been accumulated from different thematic areas such as climate change and biodiversity. Here, as a demonstration, we list some lessons learned and views expressed in terms of (1) inclusiveness and accommodating different knowledge systems by science-policy interface bodies (Pages 21–27), and (2) detailed recommendations for strengthening the institutional design of IPBES (Pages 27–30). These lessons learned provide additional background knowledge and operational recommendations, complementing the high-level recommendations on the institutional design in the main text. They generally support the corresponding high-level recommendations, although they may differ from each other on specific operational details.

This compilation of lessons learned is a mere tip of the iceberg of the wealth of knowledge and practical experience related to science-policy interfaces. Many lessons learned are closely related to the characteristics of their respective thematic areas, and thus cannot be directly "copied and pasted" into the chemicals and waste area. In future, the detailed institutional design of an overarching science-policy interface body on chemicals and waste can benefit from coordinated efforts by the scientific and policy communities in (regularly) reviewing and synthesizing this wealth of knowledge and practical experience. In particular, it may be worthwhile to assess the commonalities and differences of the chemicals and waste area to other international environmental governance thematic areas, in order to well design the institutional settings for the overarching science-policy interface body on chemicals and waste and improve it over time.

Further reading materials include (and are not limited to): Biermann, F.; Pattberg, P. (eds.), *Global Environmental Governance Reconsidered*. Cambridge: MIT Press. **2012**, ISBN: 9780262017664; Oppenheimer, M.; Oreskes, N.; Kowarsch, M.; Flachsland, C.; Garard, J.; Jabbour, J.; Riousset P. The treatment of divergent viewpoints in global environmental assessments. *Environ Sci Policy* **2017**, 77, 225–234; Gustafsson, K.M.; Lidskog, R. Boundary organizations and environmental governance: Performance, institutional design, and conceptual development. *Clim Risk Manag* **2018,** 19, 1–11; Jamieson, D.; Brysse, K.; O'Reilly, J.; Shindell, M.; Wazeck, M. Discerning Experts: *The Practices of Scientific Assessment for Environmental Policy*. Chicago: University of Chicago Press. **2019**, ISBN: 9780226602011.

Theme 1. Inclusiveness and accommodating different knowledge systems

Vasileiadou, E.; Heimeriks, G.; Petersen, A. C. Exploring the impact of the IPCC Assessment Reports on science. *Environ Sci Policy* **2011**, *14* (8), 1052–1061 (https://doi.org/10.1016/j.envsci.2011.07.002)

> Disciplinary differences of the knowledge summarized in the [IPCC] reports are being reflected in the references of the reports. Natural sciences are more important than social sciences; within natural sciences earth sciences (meteorology, geosciences, etc.) are more important than other sciences. Economics are more important than other social sciences. The study of the trend for each consecutive AR [Assessment Reports] shows that differences among disciplines decrease over time. There is indeed growing diversity of disciplines, as both growing variety of disciplines (more disciplines referring to the IPCC reports) as well as growing evenness of distribution (at least for the change between AR2001 to AR2007). For

specific disciplines, such as social sciences, economics, geosciences etc., their relative importance has been surprisingly stable over time. Others, such as ecology and water studies are growing, whereas the relative importance of meteorology is declining (but still the single most important discipline).

Developed countries are overwhelmingly providing the publication context for most of the publications under study: it is indicative that eighteen out of the top twenty countries in the citation environment are developed countries. However, over time, and with each consecutive report the difference between developed and developing countries becomes less pronounced, probably because of a combined effect of globalization, together with growing realization and knowledge for the disproportionally large impact of climate change on developing countries. (p. 1059)

Turnhout, E.; Bloomfield, B.; Hulme, M.; Vogel, J.; Wynne, B. Listen to the voices of experience. *Nature* **2012**, *488* (7412), 454–455 (https://doi.org/10.1038/488454a)

- The IPCC focused on producing standardized assessments, with one view of what counts as relevant and valid knowledge for climate change: peer-reviewed science. This approach overshadowed arguably more important tasks: synthesizing wider perspectives about changing climates and spurring action by multiple policy actors. (p. 454)
- The knowledge of traditional and 'ordinary' citizens might not meet scientific criteria or be amenable to standardization, but ignoring or misappropriating such experience, undermines the possibilities for innovation[1]. For example, Jan Douwe van der Ploeg, an anthropologist at Wageningen University in the Netherlands, has shown how the agricultural revolution endangered the livelihoods of Andean hill farmers when the miracle crops did not deliver, and de-skilled them because it over-rode their local knowledge, which had led to sustainable yields for generations. (p. 454)
- Scientific and experience-based knowledge can come together. A good example is an initiative by the Natural History Museum in London in which fly-fishers' expertise has made official water-monitoring schemes more realistic and robust. (p. 454)
- Monetary, aesthetic and sacred values should be given equal prominence in policy discussions of what biodiversity and ecosystems offer to humans, for example. (p. 455)

Löfmarck, E.; Lidskog, R. Bumping against the boundary: IPBES and the knowledge divide. *Environ Sci Policy* **2017**, *69*, 22–28 (https://doi.org/10.1016/j.envsci.2016.12.008).

- IPBES is often described as an IPCC for biodiversity, but it differs from IPCC in its stress on stakeholder involvement and knowledge inclusion. (p. 23)
- Within contemporary environmental governance, there has been a growing dissatisfaction with historical practices that reinforces a divide between scientific knowledge and indigenous and local knowledge [ILK]. For example, IPCC has been criticized for treating peer-reviewed science as the only valid form of knowledge, thus excluding potentially valuable contributions and opportunities for innovation that lie outside the scope of scientific validation. (p. 23)

- ILK is often described as tied to the daily practices of local communities; this results in rich and detailed knowledge about pressing aspects of an issue. Science, on the other hand, produces more general representations of the world that are partly separated from people's daily lives. (p. 23)
- The reason for [inclusion of ILK] is that biodiversity and ecosystem services differ from many other environmental challenges in that they explicitly include values, and therefore cannot readily be quantified". "Thus, a fundamental characteristic of IPBES is that it aims to integrate scientific knowledge with alternative ways of knowing, including indigenous, traditional or other practical forms of knowledge. (p. 27)
- Accommodating knowledge from different knowledge systems poses substantial challenges. IPBES clearly is struggling to reconcile its aim of creating an open and collaborative atmosphere with the demands for structure set by the scientific format. In this sense, it remains within the scientific knowledge space implying that it is mainly ILK that have to travel from its context, thereby also have to be translated. (p. 27)
- [IPBES treats] both science and ILK as distinct entities, without much discussion on who and what gets to represent a particular knowledge system. Important to note is that the local and contextual character of knowledge should not only be attached to ILK. Science is also a heterogenous practice and includes many different disciplines and research traditions. (p. 27)
- The steering bodies of IPBES that includes experts (the Bureau and the Multidisciplinary Expert Panel, MEP) have biased scientific representation, with few social scientists, and those included is mainly representing the disciplines economy and management. By not including interpretative social sciences (as anthropology, sociology, philosophy of science) which deals with cultural issues (including cultural aspects of science itself), there is limited opportunities for more reflexive and self-critical processes about what should be counted as truth … but also for understanding what takes place in the assessment. (p. 27)
- The role of ILK holders in knowledge generation and in particular the challenge of finding functional criteria for knowledge validation both appear to be unresolved issues. (p. 27–28)
- IPBES has not yet found forms for dealing with contrasting rationalities, diverging ontological claims [what counts as real], and different criteria for knowledge validation. There is a great risk that ILK will become scientized, with only those parts of it that science can handle being used; i.e. that in the end knowledge integration will be subordinated to a single (scientific) knowledge system. (p. 28)

Jabbour, J.; Flachsland, C. 40 years of global environmental assessments: A retrospective analysis. *Environ Sci Policy* **2017**, *77*, 193–202. (https://doi.org/10.1016/j.envsci.2017.05.001)

- Knowledge producers and boundary institutions facilitating these highly complex deliberative processes are expected to address and manage an ever-expanding and increasingly inter- and trans-disciplinary knowledge base, extraordinarily large numbers of participants who represent increasingly diverse and diffuse actor-groups, more varied spatial, time and institutional scales, and new dynamics between the scientific and policy spheres. (p. 200)

One possibility for responding to these challenges is to advance a new generation of tools, models and frameworks better able to assemble, streamline, manage and integrate information, including those generated through different paradigms, to better support policy-relevant analysis … One option that is currently being explored at UNEP is to adapt aspects of integrated assessment processes to more networked, dynamic and inclusive knowledge generation through the use of digital-based knowledge platforms (e.g. Environment Live) … Also, responses to the challenges stemming from increasingly complex process management requirements … might include the provision of adequate GEA [global environmental assessment] management resources (e.g. operating budgets, number of dedicated staff) and capacities (e.g. ensuring skill upgrading and training of GEA practitioners and support staff, including in the area of policy assessment). Finally, some have suggested deliberately scaling-back the complexity of GEA in terms of a proliferation of their objectives, and instead focusing on shorter and more targeted products and processes. (p. 200)

- For GEAs to be effective, assessment processes themselves must change over time, and there are no one-size fits all analogs. GEAs must therefore be reflexive and respond to context-specific demands for knowledge. (p. 200)
- Assessment processes could increasingly engage with a complex solution space, and strive to develop and cultivate a widely accepted set of methods and tools to do so in a way that informs evidence-based policymaking by rigorously synthesizing and assessing available research." This "deserves more practical and theoretical consideration, including in policy research as well as in the empirical literature analyzing GEAs. (p. 200)

Minx, J. C.; Callaghan, M.; Lamb, W. F.; Garard, J.; Edenhofer, O. Learning about climate change solutions in the IPCC and beyond. *Environ Sci Policy* **2017**, *77*, 252–259 (https://doi.org/10.1016/j.envsci.2017.05.014).

- In times of big literature, scientific assessments need to be computer-assisted and apply big data methods to deal with the literature explosion. Initial and very basic research applications are starting to emerge … but much is to be learned from other fields. (p. 257)
- While current IPCC procedures do a good job of organizing inter alia author selection, review processes and report approval at the science-policy interface, they do not provide guidance for dealing transparently with the process of research synthesis. It is indispensable for the IPCC to bridge the procedural void and firmly establish systematic, meta-analytical review practices at the heart of IPCC assessments. (p. 257)
- We think that at least four cornerstones of research synthesis would need to be firmly established, in a procedural manner … (1) define a transparent set of policy questions for IPCC assessments … (2) identify all relevant literature through a systematic and reproducible search strategy … (3) critically assess the quality of the available evidence … (4) use explicit, qualitative and quantitative methods of research synthesis. (p. 257)
- Preparing the IPCC for the future would involve a whole series of supplementary action. This includes a broadening of the IPCC authorship not only to involve more scholars from the social sciences and humanities, but also to include experts on research synthesis, scientometrics and computational linguistics among others … Moreover, it would be

possible to systematically address problems of regional balance in the IPCC authorship by using data mining techniques for the identification of experts across regions with the required scientific credentials. (p. 258)

- Yet, the capacity of the IPCC to provide research synthesis within the assessment process is extremely limited. It is fundamentally dependent on the scientific communities to provide aggregated knowledge palatable for assessment. (p. 258)
- The ability of the IPCC to produce policy-relevant assessments fundamentally depends on changes in the structure and organization of climate change research in the social sciences, where systematic, collaborative, meta-analytical research efforts become part of the scientific routine. (p. 258)
- The IPCC will also need to support this cultural shift towards more synthetic approach in the social sciences and engage into an intensive dialogue with the relevant scientific communities. (p. 258)
- We need to acknowledge that systematic review practices are no panacea in and of themselves … Systematic review practices within the IPCC would make the job for authors even more laborious unless specific and precise research questions were formulated. However, whether this is politically feasible and how the required procedural changes can be implemented within the decision-making structure of the IPCC remains uncertain. (p. 258)
- Despite all their shortcomings, IPCC assessments remain among the most rigorous ever conducted. (p. 258)
- [A cultural transition towards systematic research synthesis] has fostered knowledge accumulation in medicine, education and psychology and firmly established systematic research synthesis as a credible basis for policy advice. We believe that this is the best way forward for assessment on climate change and other global environmental problems in general, and on the exploration of solutions and creation of knowledge maps for policy in particular. (p. 258)

Pearce, W.; Mahony, M.; Raman, S. Science advice for global challenges: Learning from trade-offs in the IPCC. *Environ Sci Policy* **2018**, *80*, 125–131 (https://doi.org/10.1016/j.envsci.2017.11.017).

- The IPCC's treatment of the social complexities of climate change impacts has nonetheless evolved over time, even if concepts like inequality or justice are yet to become key organising concerns. Debates have ranged over how to bring in the knowledges and experiences of people on the "frontline" of climate change, for instance, in the Arctic. This might mean revising how expert authors are selected and included … or how different types of knowledge are rendered credible and thus proper for inclusion. The IPCC's controversial 2010 mistake regarding the timescale for Himalayan glaciers melting away brought to the fore questions about the inclusion of "grey literature" in assessments – literature which may not have been through the vetting procedures of scientific peer review, but which may nonetheless feature important insights from places where accredited scientists may have yet to tread … The subsequent tightening of the IPCC's guidelines on utilising grey literature has introduced new quality control measures. This may enable

certain findings to receive the kind of validation usually bestowed by peer review, but it may also risk the exclusion of certain forms of knowledge from the assessment process. (p. 127)

- There are trade-offs to consider in designing similar institutions and processes of scientific assessment and advice. We highlight three

  i) ***global vs local***: between scientific knowledge that speaks of abstract global systems to a global audience, and knowledge that pertains more closely to local settings where the drivers and impacts of global change are more directly experienced. This dynamic plays out differently across the IPCC's Working Groups, and reflects global distributions of expertise and knowledge which the IPCC cannot itself do much to change. However, regionally-focused assessments could help integrate more locally relevant information into the IPCC process.

  ii) ***scientific disinterestedness vs policy relevance***: … The IPCC has long guarded the norm 'policy relevant, never policy prescriptive', but steering clear from values-based questions has diminished IPCC reports' practical utility, particularly within adaptation and mitigation where "is" and 'ought' are often entangled …

  iii) ***consensus vs. plurality***: … Consensus-seeking may enhance scientific authority, and please policymakers who value non-ambiguous statement … but can also, as shown above, lead to important omissions of uncertain findings, or of conflict and disagreement. Social science research has shown that it is wrong to assume that decision-makers value only unanimity and certainty, and that scientific consensus provides a poor starting point for political progress … Mediating between conflicting opinions and handling uncertainty is the bread and butter of politics; and scientific advisory process may benefit from acknowledging points of disagreement … Hence, the IPCC model is not easily transferable to other global challenges. Global (as opposed to national) science advice involves different design and problem framing choices that should be openly considered by a range of actors, and at the earliest available opportunity. (p. 127–128)

Díaz-Reviriego, I.; Turnhout, E.; Beck, S. Participation and inclusiveness in the Intergovernmental Science–Policy Platform on Biodiversity and Ecosystem Services. *Nature Sustainability* **2019**, *2* (6), 457–464 (https://doi.org/10.1038/s41893-019-0290-6).

Our review has identified three main constraints on inclusiveness in IPBES: (1) existing institutional arrangements and procedures, (2) the dominance of natural science approaches, and (3) the role of consensus. These constraints have limited the diversity of participating experts and stakeholders, and they have also restricted the contribution of these experts and stakeholders by foreclosing the option of including incommensurable and dissenting perspectives and knowledges. In the IPBES context, several authors have pointed to the limitations of consensus-oriented procedures for enhancing inclusiveness and diversity and to the importance of developing novel ways to organize legitimate political and epistemological representation for coping with incommensurable and dissenting perspectives and knowledges. This will require a fundamental rethinking of procedures and practices of participation, representation and assessment. We suggest that opening up these procedures and practices to pluralism and contestation, rather than defending the –

philosophically as well as practically untenable – ideal of singular, value-free expertise … is an important step in the production of environmental expertise that is not only credible and salient, but also democratically legitimate …

This Review has contributed insights into the various barriers to inclusiveness in IPBES and has identified ways to overcome them. These potential ways forward require careful consideration of the risks as well as opportunities associated with them. We realize that not all of these will be considered feasible or desirable, since they potentially threaten dominant ideals about how science-policy interfaces should function and they challenge existing power relations, accepted principles such as consensus, and dominant ways of conducting assessments. (p. 462)

Theme 2: detailed recommendations on strengthening the institutional design of IPBES

Turnhout, E.; Bloomfield, B.; Hulme, M.; Vogel, J.; Wynne, B. Listen to the voices of experience. *Nature* **2012**, *488* (7412), 454–455 (https://doi.org/10.1038/488454a)

- We believe that the IPBES can [increase the available range of policy interventions to slow biodiversity loss at all scales] and need not become just another remote and disconnected international body, if it follows our nine recommendations.
    a. Operate not as a centralized global organization, but as global coordinator of a distributed network that can be sensitive to local knowledge, needs and conditions.
    b. Address all mandated functions simultaneously and in a balanced way so that non-elite actors are not placed in an end-of-pipe position.
    c. Facilitate broad discussion of the terms and methodologies used to define, understand, assess and conserve biodiversity; and be explicit about contested assumptions.
    d. Ensure diverse representation in activities and decisions. Expert panel should include natural scientists, social scientists, humanities researchers, biodiversity practitioners and indigenous-knowledge networks, with accreditation criteria and selection processes made public.
    e. Experiment with ways to validate and maintain quality control, such as sensible narratives and citizen panels.
    f. Embrace dissenting views and perspectives to build trust among represented parties – for example, through minority reporting instead of pursuing consensus.
    g. Work with trusted civic organizations and networks at the interface of science, citizens, business and culture.
    h. Having rolling and overlapping timetables for different products, rather than delivering a single “big-bang report” every six years.
    i. Reflect regularly to identify areas for improvement. (p. 455)

Díaz Reviriego, I.; Beck, S.; Darbi, M.; Hauck, J.; Hudson, C.; Janz, C.; Klenk, N.; Lidskog, R.; Marquard, E.; Montana, J.; et al. Five years of IPBES : Reflecting the achievements and challenges and identifying needs for its review towards a 2nd work programme. **2018**. Workshop report.

Helmholtz Centre for Environmental Research – UFZ Leipzig, Germany (http://oru.diva-portal.org/smash/get/diva2:1238437/FULLTEXT01.pdf).

- The IPCC had already developed sophisticated rules of procedures on how to conduct scientific assessments (such as quality control and conflict of interest policies) which could be easily transferred to IPBES. (p. 4)
- Thus far, IPBES has prioritized the assessment function, with almost 70% of the budget for the implementation of the work programme allocated to assessments … The prioritization of the assessment function is a result of several internal and external factors. One of these factors is path dependency, and particularly the legacy of the IPCC which counts as the "gold standard" for global environmental assessments and has served a template for IPBES … Well-established procedures were not available for the other functions (e.g. capacity building or policy support) which have led to the implementation of those functions lagging behind. Budget and resource constraints have also been an easy legitimization for prioritizing assessments over the other functions. Yet, the prioritization of assessments at the cost of the other functions has potentially reduced IPBES' political relevance and legitimacy to inform decision-making on the ground and consequently threatens its ability to achieve its ambitious aims. (p. 4)
- To improve the balance of functions, IPBES could ask governments and stakeholders to provide their requests more explicitly for all functions, and to provide arguments for the requests. The solicitation and scoping processes can benefit from longer periods of time, including additional feedback loops and informal spaces for interactions among policy-makers and stakeholders … A better share and allocation of resources among the different functions would also be essential to accomplish a balanced implementation of all IPBES functions. (p. 5)
- The balanced representation of genders and regional backgrounds was considered important and that should continue to be upheld. It was furthermore noted that the Open-ended Network of IPBES Stakeholders seemed to be a good way to inform IPBES decisions but that is often perceived as a 'loose satellite', and that IPBES should be more transparent and more explicit about knowledge gaps in individual chapters of the assessments earlier on in the process. (p. 5)
- The potential for the engagement of national focal points (NFP) at different levels of IPBES can foster the uptake of the final products: on the national level, focal points could facilitate dialogue across policy sectors; regionally, existing mechanisms/meetings that trigger science-policy interactions could be employed; at the global level, innovative ways to lead informal discussions with the same people as in the IPBES Plenary but in a 'Trondheim-type' setting could be explored. (p. 5)
- Regarding the involvement of policymakers in IPBES functions, it was emphasized that there is a need to find entry points for policymakers in the process for identifying and developing policy-tools, not necessarily linked with assessment results, and in capacity-building activities to discuss IPBES outputs. This would enable the identification of what can or cannot be used in policymaking. (p. 6)
- The nomination and selection procedures for the identification of experts were widely considered to lack transparency and diversity of experts' profiles. This is partly due to the

fact that operational criteria (e.g. if people are able to fulfil the task of coordinating) have to be taken into consideration alongside the official criteria for a balanced representation (e.g. gender, discipline, regional coverage). Furthermore, while in terms of numbers, nominations are sufficient, they are not sufficiently diverse, with male experts and natural science experts being overrepresented … Scholarly work has proposed that increase the diversity of profiles within the pool of nominated experts form which the MEP can do the final selection of experts … is worth considering. It also highlights the need to refine communication strategies … that convey clear messages of the role that different disciplines, knowledge forms and set of experiences can add to IPBES activities at different level. More generally, the ultimate goal should be to aim for a broad diversity of views – yet targeted – in a specific context (e.g. a thematic working group) rather than an overly 'formalized' representation of 'all' groups considered so far (regions, genders, disciplines) in all IPBES processes. (p. 7)

- In addition, the need for a 'service point' or similar apparatus was identified, which would coordinate and mediate among authors, and provide information and clarification on organizational matters and timelines. In some cases this is done by the TSUs (Technical Support Units) of the assessments, but these tend to be under-staffed. (p. 7)
- The peer review of IPBES draft deliverables was widely recognized to have substantial shortcomings, due partly to the tight deadlines for delivering drafts which leads to drafts being sent out when they are not yet mature enough for review … Furthermore, comments are sometimes also not properly taken into consideration. These issues derive from an underlying conflict between the review processes on the one hand and timing and deadlines on the other, with the timeframe often being far too tight to allow for a comprehensive review. Therefore, more time, and particularly better time management, is needed. (p. 8)
- The contributions of early-career researchers to IPBES' work were highly valued by the workshop participants. However, their work must receive greater recognition. (p. 8)
- Better acknowledgement of scholarly engagement is needed … A more proactive role on the part of IPBES in engaging external knowledge holders would be highly beneficial, for instance by communicating requests for data and knowledge considerably in advance. (p. 8)
- Greater scholarly involvement with [interactive online] platforms will lead to greater attention (and potentially resources further down the line). (p.8)
- To realize synergies between knowledge systems, the uptake of *non-indigenous* local knowledge and practical knowledge should be encouraged (parallel to the mobilization of indigenous knowledge) given that less attention has been paid to this type of knowledge and most focus has been on scientific knowledge and indigenous knowledge. (p. 10)
- To bring ILK more effectively into the assessments, the nomination and selection of IPLC [Indigenous Peoples and Local Communities] member as authors should be encouraged and a fellowship program dedicated to IPLC could also enhance their engagement. (p. 11)
- To promote the engagement of social sciences and humanities, their participation should be encouraged from the outset in the overall discussion of the work programme and the development of deliverables, namely during the scoping phase, in order to allow the co-

definition of relevant questions, concepts and deliverables. This should also enable social sciences and the humanities to get more easily engaged in later stages of the work. (p. 11)

- To improve ways to accommodate conflicting views the review should also record, reflect and propose the use of different knowledge synthesis methods. IPBES could also add the role of a "dissent facilitator", which could help to incorporate dissensus into assessments with strongly contested elements. (p. 11)