TRANSFORMING RELATIONS BETWEEN SCIENCE, POLICY AND SOCIETY FOR SUSTAINABLE FUTURES?

Timo Y. Maas

Propositions

1. A knowledge culture aimed at figuring out 'who is correct' serves vested interests.
   (this thesis)

2. Transformative change requires less important science-policy arrangements.
   (this thesis)

3. Relations between science, policy and society are too important to be left to the experts.

4. Beneficial co-production requires embracing the multiplicity present within each participant.

5. A (re)appreciation for not-precisely-knowing and normativity is long overdue.

6. The more conclusive the proposition, the more mistrust it merits.

Propositions belonging to the thesis, entitled

Transforming relations between science, policy and society for sustainable futures?

Timo Yoram Maas
Wageningen, 9 November 2023

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Timo Y. Maas

Thesis Committee

Promotor
Prof. Dr E. Turnhout
Professor of Science, Technology and Policy Studies
University of Twente, Enschede

Co-promotor
Dr A. Pauwelussen
Assistant professor, Environmental Policy Group
Wageningen University & Research

Other members
Prof. Dr A. Dewulf, Wageningen University & Research
Prof. Dr H. Bulkeley, Durham University, UK and Utrecht University
Prof. Dr A. Stirling, University of Sussex, UK
Dr E. de Hoop, VU Amsterdam

This research was conducted under the auspices of the Graduate School Wageningen School of Social Sciences

Transforming relations between science, policy and society for sustainable futures?

Timo Y. Maas

Thesis
submitted in fulfilment of the requirements for the degree of doctor
at Wageningen University
by the authority of the Rector Magnificus,
Prof. Dr A.P.J. Mol,
in the presence of the
Thesis Committee appointed by the Academic Board
to be defended in public
on Thursday 9 November 2023
at 1.30p.m. in the Omnia Auditorium.

Timo Y. Maas
Transforming relations between science, policy and society for sustainable futures?
208 pages.

PhD thesis, Wageningen University, Wageningen, the Netherlands (2023)
With references, with summary in English and Dutch

ISBN 978-94-6447-801-3
DOI https://doi.org/10.18174/634784

"Het probleem is alleen dat alles begrijpen
nog niet betekent dat alles je duidelijk is", [1]

— Mohamed Mbougar Sarr, *De diepst verborgen herinnering van de mens*
[The Most Secret Memory of Men]

[1] "*The problem is that understanding everything does not yet mean that everything is clear to you"* (my translation)

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Acknowledgements

Of course, it is a cliché to say that the fact that this thesis bears only my name obscures the work of many others. But some clichés are also deeply-felt truths for which our vocabulary simply falls short. (Few experiences make that more evident than the clichés one gets flooded with upon parenthood; so many are trite but true). I am certainly very grateful to all the people that made this thesis possible.

First of all, I wouldn't have been able to write this thesis if it weren't for Marcel Kok. From your enthusiasm when I first called you about a job opening at PBL that I was hoping could be combined with a PhD thesis, to your efforts to retain me at PBL on a permanent contract, your role has been indispensable. Thank you, Marcel, for always encouraging and challenging me to get 'in the mud', and for always thinking along creatively.

To my supervisors, Esther and Annet: thank you for always being open to wherever I was taking things, and for your patience in periods I was otherwise occupied and felt they weren't going anywhere. I have always experienced our meetings as very constructive and inspiring, even if – by necessity and convenience – they have essentially all been online. Esther, you have a remarkable gift of giving spot-on literature suggestions that enabled me to take vague and unstructured ideas to a much more fundamental level. Annet, thank you for always pushing me to clarify further. Thanks to you this thesis is (hopefully somewhat) accessible and comprehensible.

At PBL, I am grateful to the support and freedom Bram and Ton gave me, ensuring that the combination of PBL work and PhD time would be – as much as possible – secured. My position, and thus this thesis, would not have existed without the framework agreement between PBL and the Netherlands Ministry of Foreign Affairs. I am lucky to have Karen as my counterpart at the Ministry, thank you Karen for our pleasant collaboration.

Many thanks to my co-authors and collaborators, this thesis greatly benefits from your contributions. It was a bit of a dive in the deep end to start out with a multi-authored paper; Jasper and Sandra, thank you for helping to get it afloat, and to the entire group for bringing it ashore. Writing a reflection note-turned-Science policy forum was another adventure; thank you Jessica, Jeroen and Anna, Fabrice and Bob. I also want to point out the cross-fertilization through PBL projects and colleagues that is invisible by looking just at chapter co-authors. Bas, Astrid and Lisa, this thesis certainly contains many thoughts sparked by our discussions on the impact project. Paul, there have been few moments in my time at PBL during which we didn't have at least one project together.

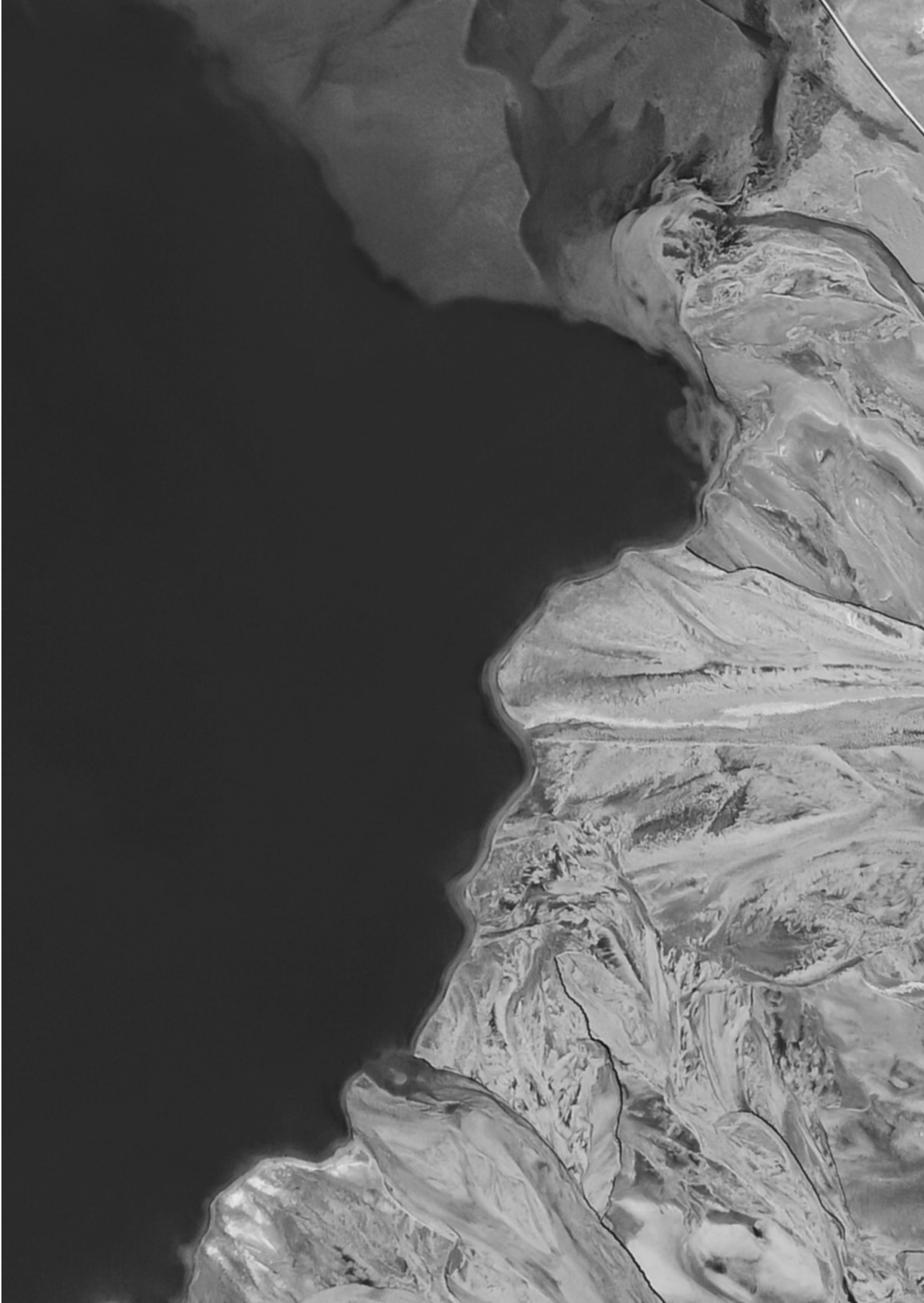
Working with the group of PBL-researchers involved with the framework agreement made it easy to move through PBL's different departments. Thank you Andries, Annelies, Anteneh, Arno, Frank, Hester, Johan, Like, Mark, Sophie, Stefan, and Willem, including for letting me (ab)use our regular meetings as a sounding board.

I am indebted to everyone I interviewed and spoke to informally for kindly sharing their views with me, even if I cannot mention them all by name. This thesis has benefited from countless direct and tangential conversations with colleagues at PBL and elsewhere. To mention just a few: Bernike, there is a thread from the 2018 WTMC Summerschool all the way to us discussing my introductory chapter this spring. Noam, many thanks for the inspiring chats and your invaluable comments on parts of this work. Maarten and Arlette, you'll recognize how our letter to the future director inspired parts of this thesis. Finally, a special mention to NLG and NLG-Youngish for coffee breaks and lunch conversations about work and other things.

Thank you to the friends who have both distracted me *from* and inspired me *for* this thesis. Jurriaan, thank you for taking such pleasure in disagreeing with me. Your insistence on arguing the opposite of whatever I am arguing forces me to sharpen my arguments and provides a constant reminder of multiple perspectives. Heather, thank you for always being there from afar. Katja, please never stop sending postcards with your musings on life.

Family are the people you're stuck with for better or worse. In my case, I'm very lucky to be stuck with this particular bunch. Without the support of my parents-in-law over the past years, I certainly couldn't have written this thesis. Thank you Jakkus for ensuring a steady supply of quality cheese. Joke, thank you for taking care of Lena on Tuesdays (and all the other times and sleepovers that allowed us to catch our breath). Jaap, playing Pandemic got us through the lockdowns. It is impossible to name all the ways my parents have made this thesis possible. Thank you both for having set the example you have. Harro, your subtle attempts to nudge me towards STS have paid off. Geerte, maybe now I'll have time again to take books off your hand; I know how much space for new additions is craved. Jonne, though we certainly have our own dynamic of brother-sister competition, thankfully our bond is so much more than that. I am proud and glad to have you by my side.

Finally, the past years have certainly been eventful at home. I hope that finishing this thesis will get us into slightly calmer waters. Dear Kaat, thank you for indulging me without letting it all go to my head. I love the humour, calmness and wonder you bring to the journey we've embarked on together. Lena, you ensured this thesis wouldn't get in the way of more important things in life. Seeing you grow, change, and learn never ceases to amaze me. Thanks for all the high-fives in the final stages. And Melle, your impending arrival highlighted the importance of me finishing this. The best kind of deadline anyone could wish for. I'm looking forward to what the future brings the four of us.



Chapter 1.
General introduction

General introduction

Yes, I worry sometimes. Will we manage to figure out how to live ethically and sustainably on this planet? So when I see suggestions raised that improving relations between science, policy and society might contribute to 'transformative change' for sustainability, I am intrigued. And when an opportunity presents itself to examine this question in a thesis, who am I to pass it up?

Urging knowledge for environmental sustainability and transformative change

Pressing sustainability challenges have prompted a range of calls for transformative change to address these issues (see e.g. Feola, 2015; Patterson et al., 2017; IPBES, 2019a; Scoones et al., 2020; Lucas et al., 2020; Turnhout et al., 2021; UNEP, 2021; Visseren-Hamakers et al., 2021; IPCC, 2023; Fisher et al., 2022; Visseren-Hamakers and Kok, 2022). Many such calls include the idea that there is a particular role to play for science-policy arrangements in supporting transformative change. In this thesis, I define science-policy arrangements as particular ways of organizing relations between science, policy and society. As such, this thesis is not about all of 'science' (as if such a singular and unified enterprise would exist in the first place), let alone all of 'policy' or 'society'. Instead, I focus on arrangements in which there is a more or less explicit aim to influence formal decision-making processes especially in the context of questions around environmental sustainability.[2]

Indeed, calls are emerging for a repositioning and repurposing of such arrangements to not just help understand and describe the world, but to actively facilitate bringing about transformative change to address sustainability challenges (e.g. Cornell et al., 2013; Kowarsch et al., 2017b; Pearce et al., 2018; Wyborn et al., 2019; Turnhout et al., 2019; Arnott et al., 2020; van der Hel, 2020; Arnott and Lemos, 2021; Gustafsson and Hysing, 2022). In this thesis, I view transformative change as an emerging and unstable discourse that emphasizes the need to address sustainability challenges like climate change and biodiversity loss. It is a discourse that, despite seeming to be more talk than walk so far, I take to hold promising potential. This potential stems from an openness to call into question dominant structures and patterns of societal behaviour, and examine interdependencies, intentionality, and normative desirability

[2] This means that this thesis is *not* about 'science policy'/'policy for science', i.e. the formal policies regulating (academic) science and the ways scientific institutions are governed and funded.

(Scoones et al., 2020). This openness also concerns science-policy arrangements and their ability to reflect on the effects that they have and their willingness to examine how their processes contribute to these effects (Smith and Stirling, 2007; Pallet and Chilvers, 2013; Borie et al., 2020). Crucially, and as I will discuss later in this thesis, I think the potential of transformative change lies in that it challenges assumptions of neutrality.

Notwithstanding the potential of transformative change, it is still far from self-explanatory what it means for science-policy arrangements to be able to facilitate transformative change. Of course, it is not new to attribute an explicit role to science-policy arrangements as agents of change (agents of transformation, in this case), and it is certainly not something to praise unconditionally. After all, the complicity of science-policy arrangements in policy projects that enabled the exploitation of people and nature has been critiqued for decades (Said, 1978; Scott, 1998; Ghosh, 2021). Nonetheless, given the world's current predicament of climate disruption and biodiversity loss threatening an unravelling 'fabric of life' (Díaz, 2022), and the contribution of science in demonstrating this predicament, it is not surprising that the question emerges how science-policy arrangements can contribute to making things better, not worse (cf. Sarewitz, 2004). There is no shortage of enthusiasm for this: individual researchers, universities and other knowledge institutes are all declaring their eagerness to have societal impact and contribute to addressing sustainability challenges. Large groups of policymakers and the public are equally advocating for such a contribution, and research funders increasingly ask for impact or valorisation statements (van der Hel, 2016; Efstathiou, 2016; de Jong et al., 2016; Balaban and de Jong, 2023). Certainly, some of this enthusiasm may be instrumental and opportunistic, but I agree with others who have argued that the *possibility* of transformations to contribute to more desirable futures is to be fostered (Stirling 2014; Blythe et al., 2018).

It is worth noting that also other fields are increasingly highlighting the need to explicitly address the questions of what worlds we want to live in and how they can contribute. For instance, in innovation policy, the traditional view of 'the more innovation, the better' is being replaced by calls for innovation that is both more *targeted* towards what results innovations should bring about, as well as more *reflexive* of the conditions that help to bring about these innovations themselves (Stilgoe et al., 2013; Schot and Steinmueller, 2018; Diercks et al., 2019; Mazzucato, 2021). Moreover, this (re)introduction of questions of desirability and directionality also enables an interest in deliberately disposing undesirable ways of doing as a feature of transformations (e.g. Turnheim and Geels, 2012; Feola et al., 2021; Koretsky, 2022), which indicates a symmetry between promoting the new and ending the old.

The repositioning and repurposing of science-policy arrangements to facilitate transformative change touches upon common debates concerning the relations between science, policy and society in literature in policy analysis and science and technology studies (STS), among others. Examples include studies of global environmental assessments (Turnhout et al., 2016; Borie et al., 2021), government science advisors (Obermeister, 2020, 2022; Palmer et al., 2019), expert commissions (Bijker et al., 2009; Owens, 2015), government research institutes (Halffman, 2009; Huitema and Turnhout, 2009) and transdisciplinary research programs (van der Hel, 2016). This literature not only seeks to make sense of science-policy arrangements as empirically observed, but can arguably also be seen to contribute to shaping science-policy arrangements – be it directly or indirectly, intentionally or accidentally, substantially or infinitesimally. For this reason, this literature provides valuable insights for discussing (new) possibilities for rearranging science-policy-society relations for transformative change. For instance, relevant contributions have focused on describing and/or prescribing changes in knowledge production in order to respond to societal complexity and ambiguity (e.g. Funtowicz and Ravetz, 1993; Gibbons et al., 1994; Nowotny et al., 2001; Hessels and van Lente, 2009). Others have highlighted the paradoxes implied in the authoritative position of scientific advice, and the practices of boundary work and stage management through which this position is attained and maintained (Weingart, 1999; Hilgartner, 2000; Bijker et al., 2009; Owens, 2015). More recently, attention has turned to the societal impact of research, including by policymakers and administrators. This has spurred a diversity of work encompassing modes and mechanisms of impact, such as institutional policies geared at stimulating it, a range of methods to evaluate it (e.g. Reed et al., 2018, 2021; Riousset et al., 2017; Machen, 2019; Spaapen and van Drooge, 2011; Smit and Hessels, 2021; de Jong and Balaban, 2022; van Wessel, 2018), and concrete advice to researchers wishing to have it (e.g. Oliver and Cairney, 2019).

At the same time, one cannot help but wonder whether these insights have been heeded much outside of their direct academic communities. It is especially difficult to shake the movie 'Groundhog Day' from one's mind when viewing contemporary societal concerns about a presumed 'post-truth society'. The post-truth panic seems to be a rerun of earlier heated discussions about the construction of truth and the inevitable entanglement of facts and values (Theocharis and Psimopoulos, 1987; Latour 1999, 2004a; Shapin, 1999; Fuller, 2017; Jasanoff and Simmet, 2017; Marres, 2018). The fact that these insights about non-neutrality keep being disregarded in wider discourse is antithetical to the potential transformative change holds – a potential that lies in challenging assumptions of neutrality. Consequently, also efforts to

improve science-policy arrangements in light of transformative change need to be regarded with scrutiny. Can we rest assured that science-policy arrangements are being repurposed to be fit to facilitate transformative change?

The 'more is better' view of effective science-policy arrangements

With regard to both whether science-policy arrangements are currently able to facilitate transformative change, and whether they are currently being repositioned in that direction, I think scepticism is warranted. This scepticism regarding both these aspects – current state and future prospect – stems from the same reason: I discern a persistence of particular problematic assumptions about what knowledge is, what policy is, and how the two are and should be related. Put succinctly, these assumptions are that knowledge is neutral and value-free, and that knowledge and policy are separate and sequential (see also Stirling, 2016). Because of this desire for separation and purification they can also be called 'modernist assumptions' (Latour, 1993; Kunseler, 2017). I hold the persistence of these modernist assumptions to present a barrier to coming to terms with fundamental insights about relations between science, policy and society. As a result, they lock science, policy, and society into specific arrangements that fall short of being able to significantly contribute to transformative change. In this section, I explain the persistence of these assumptions and how they prevent the repurposing of science-policy arrangements for transformative change. I start by discussing the linear model of science-policy arrangements, in which these problematic assumptions are most readily discernible, and which remains highly obdurate despite being widely seen as inadequate. Subsequently, I discuss three alternative strategies to shape science-policy arrangements that seek to overcome the linear model's inadequacies. I end this section by explaining why also these alternative strategies fall short of making science-policy arrangements fit to facilitate transformative change.

Modernist assumptions about science and how it should relate to policy and society are most emblematically embodied by what is known as the 'linear model' of science-policy arrangements. This long-outdated, but ever-dominant, model considers knowledge to unidirectionally lead to more effective action (Pielke, 2007; Pregernig, 2014; Boswell and Smith, 2017). Because it considers facts to be separable from values (Owens, 2015), the linear model holds that (more) science can and will solve political controversies and lead to action (Beck, 2011). As many have pointed out, it is remarkable how obdurate the linear model is in shaping

science-policy arrangements in practice, given the amount of critique it has endured (Pregernig, 2014; Owens, 2015; Kunseler, 2016; Kowalczewska and Behagel, 2019; Sienkiewicz and Mair, 2020; Karhunmaa, 2020). Its assumption that fact and value can be neatly separated has been long shown to be untenable (Sarewitz, 2004; Jasanoff, 2004).[3] Moreover, its 'first know, then act'-assumption has been critiqued for leading to a misguided focus on scientific consensus about a single, putatively knowable world (Hulme, 2010; Van der Sluijs et al., 2010; Castree et al., 2014; Pearce et al., 2017; Escobar, 2020), which has shown itself to be highly susceptible to sabotage by vested interests (Oreskes and Conway, 2010). Given these fundamental inadequacies, it is not surprising that science-policy scholars have long sought better ways to describe and improve science-policy arrangements and proposed alternative strategies to connect knowledge to action. While these efforts have yielded valuable insights and lessons on how to shape science-policy arrangements, it has been argued that these are not always sufficiently and adequately mobilized (Oliver and Boaz, 2019). Here, I seek to add to and extend these arguments by contending that also these alternative strategies can come to show persistence of problematic assumptions and thereby continue to lead to a 'more is better' view of effective science-policy arrangements, which limits the ability to reposition and repurpose science-policy arrangements. To illustrate this point, I will first discuss three examples of such alternative strategies, before explaining why they still fall short: 1) the CRELE criteria; 2) the concepts of boundary work and knowledge brokerage; and 3) a conflation between knowledge that is 'coproduced' and knowledge that is 'usable'.

The CRELE criteria – short for credibility, relevance (also: salience), and legitimacy – are a keystone concept to many practical attempts to shape science-policy arrangements. They have been introduced by Cash et al. (2003) to point to the multiple and interrelated demands for effective knowledge: whether it is perceived as scientifically robust (credibility), whether it is perceived to respond to decision-makers' needs (relevance), and whether it is perceived to treat different values, interests, and beliefs fairly (legitimacy). To define and demarcate such criteria is not straightforward. To illustrate this, there have been several studies since the introduction of CRELE that have suggested to add other criteria (e.g. Sarkki et al., 2015), or to redefine CRELE from the perspective of policymakers (Dunn and Laing, 2017). Moreover, while these criteria can be useful as a heuristic tool to understand how science-policy arrangements have to navigate different and competing demands (Sarkki et al., 2014; Kunseler et al., 2015), it is important to recognize that they are not just analytical concepts about what

[3] Importantly, the need to abandon the idea of neutrality does not mean integrity ceases to matter, and that conflicts of interest and corruptibility would suddenly become acceptable.

constitutes effective knowledge, they are also used to shape knowledge production processes in practice. For instance, they feature in various documents setting out options for the future of the Global Environment Outlook, following a 2019-2022 Steering Committee on that subject (UNEP, 2020, 2022). This means that these concepts have a double role, one is descriptive and analytical, the other prescriptive and instrumental.

It is in this instrumental role that I think there is a risk that these concepts become essentialized, leading them to present a barrier for repurposing science-policy arrangements by locking them into particular conceptions of what makes knowledge credible, relevant and legitimate. As others have suggested, such an essentializing move can happen when the CRELE criteria shift from being approached as an emergent property of the process of knowledge production to being an attribute of the knowledge itself (Kunseler et al., 2015; Turnhout et al., 2019). In this shift, CRELE stops being a concept that points to the tensions inherent to these criteria, tensions that are to be negotiated and balanced throughout knowledge production processes, and instead makes it seems as if knowledge can be uncontestably credible, relevant and legitimate all at the same time, for everyone. This, in turn, can result in a preoccupation with procedural design in order to ensure that knowledge processes result in knowledge that conforms to these criteria, as has been pointed out before (Van der Hel and Biermann, 2017; Owens, 2015; Tangney, 2017). However, this preoccupation can become a barrier to change when it cements current perceptions, preferences, and interpretations of these criteria; when it defines credibility by currently dominant scientific paradigms, relevance by current policy frameworks, and legitimacy by current interests. As Muiderman (2022) has shown, when perceptions of relevant knowledge are cemented, researchers are likely to stick to producing knowledge that is considered relevant in the here and now, and abstain from developing scenarios of potentially transformative futures. In other words, overlooking the fundamental ambiguity and contingency of how and when knowledge comes to be seen as credible, relevant, and legitimate, limits the potential of CRELE to inform a discussion on what science-policy arrangements are desirable.

A second example of how a barrier to changing arrangements may arise can be found in the uptake of the concept of boundary work in science-policy arrangements. In particular, how concepts of boundary work and boundary organization have started to be increasingly used to refer to specific repertoires – expectations about how to operate in science-policy arrangements. Boundary work is the term introduced by Gieryn (1983) to refer to the practice of creating and maintaining a separation between science and non-science. This means that the difference between science and policy is not reducible to any essential characteristic, but is

rather the accomplishment of an ongoing process (Owens, 2015). As Pesch et al. (2012) highlight, this implies that any perceived stability in the position of this separation should be seen as no more than a temporary and conditional achievement. Boundary organizations, in turn, exist at the position of this separation. They involve the participation of actors from both sides of the boundary and in that way, facilitate collaboration between them without calling the boundary itself into question (Guston, 2001). Similarly to the CRELE criteria, these concepts may have two possible uses; one descriptive and analytical, the other prescriptive and instrumental. The latter is captured in terms for repertoires like boundary spanning, bridging or knowledge brokerage (e.g. Turnhout et al., 2013; Gluckman et al. ,2021), which can be summarized as the skill of synthesizing and transferring scientific knowledge to policymakers. In line with the aforementioned enthusiasm for science to have societal impact, this focus on skills strikes a chord amongst individuals in and around science-policy arrangements, not least through the popularity of insightful publications such as Pielke's (2007) *Honest Broker,* with its accessible account of different and variously preferable ways of brokering.[4] Approaching knowledge brokerage as a skill also enables the study of it as a (learned) professional competency. As Obermeister (2020) rightly points out, valuable insights for science-policy arrangements can be derived by studying how and what these professionals learn individually and in their wider organizational and professional cultures (see also Obermeister, 2022).

At the same time, Turnhout et al. (2014) argue that when conceptual insights on boundary work and brokerage repertoires are interpreted through dominant norms of efficiency, they are at risk of being turned into 'managerial tools'. Such a managerial approach seeks to organize relations between science, policy and society so as to optimize the uptake of knowledge. However, it moves the important political implications of science-policy arrangements to the background. Specifically, managerial approaches ignore that science-policy arrangements are always in the business of establishing and maintaining boundaries between science and politics (Miller, 2001). Managerial approaches gloss over a key empirical insight from the boundary work literature, namely that the simultaneous achievement of science and policy ('fact and value') as both entangled *and* separate. Separate worlds of science and policy exist *because* boundary work has separated them (Halffman 2003; Bijker et al., 2009). A corollary of this insight is that particular ways of arranging these worlds have their own ideological connotations and political effects (Halffman and Hoppe, 2005). This means the risk of a managerial approach to boundary concepts is that a focus on the efficiency of science-policy relations

[4] I say variously preferable, because Pielke's account is not only descriptive, but also prescriptive, as indicated by his use of the term 'honest'.

replaces the needed reflection on what knowledge is produced, what impacts this generates, and who benefits from or is harmed by this (Turnhout et al., 2014). I recognize this risk in two ways. First, singling out brokerage as a professional competency within specific research institutes may lead to relieving other researchers from the need to be reflexive about how their research is inevitably partial and situated. Second, managerial approaches can reify a particular two-world model of science and policy. This foregoes the insight that the temporary and conditional achievement of a stable boundary also carries a potential for change; the idea that alternative science-policy arrangements are possible.

Even when the question of what alternative science-policy arrangements could look like is asked and answered, their transformative potential may be lost to an overly instrumental operationalization. This is visible in a third example, when the potential of knowledge co-production is reduced to the production of usable knowledge. Co-production is now widely embraced as a mode of knowledge production that is seen as having potential to address sustainability problems (Lemos et al., 2018; Sienkiewicz and Mair, 2020; Chambers et al., 2021; Brouwers et al., 2022). However, there is a risk that the rationale around this potential is narrowed down to the ostensible high usability of co-produced knowledge (Dilling and Lemos, 2011; Reed et al., 2014; Porter and Clark, 2023). As Lemos et al. (2018) warn, co-production is not an end in itself, as "not all co-production leads to inclusion, use, or desirable use and not all knowledge needs to be co-produced" (p. 723). In other words, conflating co-production with usability creates similar problems as the other two examples. Foregrounding usability risks losing sight of the political question of usable to/by whom. Thereby, an instrumental interpretation of co-production ignores the entanglement of science and politics that is at the basis of much of the intellectual history of co-production (Miller and Wyborn, 2018; Wyborn et al., 2019; Turnhout et al., 2020), and risks turning co-productionist commitments to participation into a checkbox exercise (Chilvers and Kearnes, 2020). Crucially, my argument is not that participation, co-design, or co-creation is always problematic. There are many participatory forms of knowledge production with all kinds of value and contributions to make (e.g. Shirk et al., 2012; Hessels, 2022). The relevant question for this thesis, however, is to what extent these forms also hold the potential to contribute to facilitating transformative change.

Indeed, for all these three strategies – CRELE, boundary work and knowledge brokerage, and co-production – the question I am interested in is whether they enable science-policy arrangements to be able to facilitate transformative change. All three can be seen as attempts to shape science-policy arrangements for the better. Nonetheless, taking into account the limitations that arise in each of these approaches when applied managerially, I suggest that even though

they might make science-policy arrangements *better*, these improvements are not *good enough* for such a transformative role. While these approaches all acknowledge science-policy arrangements to be bi-directional and about interaction, their managerial applications allow the aforementioned problematic assumptions to persist (see also Stirling, 2016; West et al., 2019; Chilvers and Kearnes, 2020). To the extent that fact and value interact, the focus remains on bringing them together as two separate domains; i.e. facts are still facts, values still values, but they must speak to each other as efficiently as possible. Similarly, knowing and acting might be recognized to exist in parallel, but they remain separate, with the foremost objective being their seamless interaction. As a result, these managerial applications narrow the objective of science-policy arrangements down to achieving 'more' use, 'more' impact, 'more' influence on policy (Oliver and Boaz, 2019; Oliver and Cairney, 2019). This equation of effectiveness with use, big with good, and more with better foregoes the seemingly obvious point that not all impact is created equal. Some impacts are better than others, some influences more desirable than others. In other words, this 'more is better'-view foregoes the question of desirable use: use by whom and to what end? Leaving this question unasked allows changes implied in a role for science-policy arrangements for transformative change to remain off the agenda. The key to understanding why these problematic assumptions are able to persist lies in a third assumption that is much more difficult to discern. So far, the assumptions I discussed are foremostly about knowledge and how it is seen to relate to policy. Conversely, this third assumption is foremostly about policy, but carries important implications for its relation to knowledge and as such, for science-policy arrangements. In the next section, I explain this assumption and why it enables the other assumptions to persist.

Un-assuming policy and governance

So far, I have argued that the persistence of problematic assumptions about knowledge, policy, and how they relate stands in the way of repurposing science-policy arrangements for transformative change. At the same time, it is important to realize that these assumptions are not just about what knowledge is, but also about policy. This joint understanding lies at the heart of what Stirling (2016) calls 'knowing-doing-governing'. Indeed, he argues not only that scientific knowledge is still commonly and naïvely assumed to be neutral and value-free, and that the assumption that knowledge and action are separate and sequential seems to be nearly unquestionable beyond the immediate vicinity of STS thought.[5] But he also connects this to a

[5] And unfortunately, as Noam Obermeister soberingly commented on an earlier version of this chapter: "nobody cares about STS outside of STS".

persisting view of governance that he dubs 'seeing like power' (alluding to Scott, 1998). Here, we arrive at the third problematic modernist assumption in science-policy arrangements: the idea that (transformative) governance follows from the exercise of a singular, concentrated agency that is driven by deliberate intentionality. Or, as Bulkeley (2015) similarly explains, the assumption that governance is somehow accomplished by power which is held by distinct (primarily state) actors.

Before discussing the implications of this third assumption, and how it enables the other two to persist, it is worth pointing out how remarkable the obduracy of this view is, in light of over two decades of research on a shift from 'government to governance' (e.g. Hajer, 2003; Bulkeley, 2005; Swyngedouw, 2005; Rhodes, 2007; Ostrom, 2010; Bevir, 2010; Hajer et al., 2015), i.e. the notion that political agency is distributed across many different levels of government and types of actors. Indeed, and especially in the context of transformative change, I think science-policy arrangements have yet to come to terms with the widely described shift from government to governance and what this implies for how societal change is seen to happen (Stirling, 2014; Beck and Mahony, 2018; Burch et al., 2019; Visseren-Hamakers et al., 2021; Feola et al., 2021). Of course, in this regard the term science-policy arrangement itself is already woefully inadequate, because of the close association between the term policy and state government. I hope the reader will forgive me for leaving this point hanging going forward, and that they will appreciate my attempt to instead keep terminology as homogenous as possible. More importantly, I think the shift from government to governance makes the challenge of conceptualizing the effectiveness of science-policy arrangements in other ways an even more urgent and fundamental one. Such an alternative conceptualization will have to acknowledge that science-policy arrangements are not always central to change (e.g. Sarewitz, 2004; Hulme, 2015; Pearce et al., 2017), but have influence that is generally difficult to attribute in a diffuse and distributed governance landscape, making their influence best described as 'atmospheric influence' (Owens, 2012).

However, and vitally, it would be a mistake to address this third assumption by simply broadening the use and transfer of knowledge to a wider set of actors. Instead, I think the crucial point that Stirling's (2016) conjunction of knowing-doing-governing makes visible is that this third assumption also enables the other two problematic assumptions to persist (see also Sokolova, 2023). Viewing governance as deterministic and singular ignores the presence of pluralism in both agency and intentionality. Consequently, it causes a depoliticization of governance, replacing political debates over ends and desirability with technical discussions over means and necessity (Stirling, 2016). This depoliticized view of governance has important

consequences for science-policy arrangements in view of transformative change, as it seeks arrangements that can act as a device for 'deterministic control' (Stirling, 2016). Such devices leave little room for acknowledging facts and values to be intertwined, let alone for considering knowledge and action *not* to be separate and sequential. As a result of this deterministic view, even when science-policy arrangements set out to include a plurality of values and intentionalities, they may in practice still fall for the temptation of prioritizing knowledge as necessary condition for acting, using ostensibly neutral and objective approaches (Muiderman et al., 2022, 2023). In other words, there is a highly symbiotic relation between the combined assumption that value-free knowledge is separate and prior to depoliticized governance, which has consequences for the ability of science-policy arrangements to contribute to transformative change.

The depoliticization of governance has been referred to have led to a 'post-political condition' and is argued to foreclose potential avenues for change (Mouffe, 2000; Stirling, 2008; Swyngedouw, 2010, 2011; Graeber and Wengrow, 2021). And since, as many commentators have noted, sustainability transitions and transformative change require confronting questions of politics and power head-on (Hendriks, 2009; Meadowcroft, 2009; Avelino, 2017; Blythe et al., 2018), it is therefore ironic that tendencies to depoliticize decision-making have been argued to be particularly profound in the environmental domain (Swyngedouw, 2010, 2011; Machin, 2013).[6] Although this continued depoliticization of environmental governance is enabled by the marginalization of critical social science approaches like STS or political ecology in environmental research (Lahsen and Turnhout, 2022), STS research itself has at times also contributed to depoliticization, especially when it remains agnostic to the normative and political implications of its own work, a point already raised twenty years ago by Bijker (2003). Given the importance ascribed to science-policy arrangements in contemporary democracies, I think we'd do well to set the bar high when we want transformative change to be a real possibility. This means that the political needs to return not just to governance, but also to knowledge, and to science-policy arrangements. This requires alternative approaches to studying and shaping science-policy arrangements that do not rest on the problematic assumptions I have described.

[6] In the Netherlands, the tendency to depoliticize has arguably spread much further, and has been the subject of wide critique (e.g. Schinkel, 2012; Tjeenk Willink, 2021; Kieft, 2022).

The road to alternatives

If we are to mobilize science-policy arrangements for transformative change, we need to put lingering problematic assumptions and their concomitant aversion to politics and power behind us once and for all. We need to not just acknowledge the performativity of the *idea* of separability despite its hybrids (Latour, 1993), but also drop the idea of science and policy as self-contained objects altogether, and take their 'contaminated diversity' as our starting point (Tsing, 2015). This is a starting point because this thesis aims to move beyond self-congratulatory analytical superiority – beyond being the critic who is always right (Latour, 2004a). It is not enough to merely demonstrate that we are dealing with hybrids, we need to find ways of reconciliation, ways to live with them openly and visibly (Haraway, 2016; Latour, 2018). Can we think of alternative science-policy arrangements which do not feign neutrality, which recognize that political agency is emergent and distributed (Stirling, 2016), and which can thereby fulfil a meaningful role in transformative change? There is no shortage of thinking that we can mobilize to think through this question. A range of what may be called 'critical' perspectives on science-policy arrangements exists, which go beyond taken-for-granted assumptions about science, policy and society. Such studies have, amongst others, pointed to various logics of decision-making and how they guide the shaping of science-policy arrangements (Montana, 2020; Dewulf et al., 2020), highlighted the importance of reflexive and plural expert practices (Stirling, 2010; Beck et al., 2014; Castree et al., 2014; Lövbrand et al., 2015), and advocated for applying democratic norms to scientific practices (e.g. Turnhout et al., 2019). Also Pielke, in his aforementioned *Honest Broker* (2007), reflects extensively on the hybridity of science and policy. Yet, while these 'critical' perspectives demonstrate the implications *of* existing practices, the implications *for* those practices are not always self-evident. Taking their effects into account, the question emerges how science-policy arrangements could/should change to facilitate transformative change?

I think the 'ontological turn' in STS can be instructive in this regard. It asks us to attend to how the 'whatness of things' is accomplished, and how things are enacted in practices of multiplicity (Woolgar and Lezaun, 2013,p. 465, 2015; Law and Mol, 2002; Mol, 2002). Recognizing this multiplicity implores us to go beyond the questions of what is 'true' knowledge or what is the 'right' way of arranging science-policy-society relations, to also ask questions about their effects, appropriateness and desirability (Mol, 2002; Law and Urry, 2004; Latour, 2004b). In other words, how can we tell desirable and undesirable science-policy arrangements apart?

Evidently, raising this question makes the arranging of science-policy-society relations an explicitly political one.

The politicization of science and science-policy-society relations is both a challenge and an opportunity. It is a challenge, because dominant norms of scientific neutrality held across science, policy and society tend to quickly foreclose open discussion of this question (Lahsen and Turnhout, 2021; Turnhout and Lahsen, 2022). It is also an opportunity, when recognizing that enabling change requires alternative political options to be visible in the first place (Graeber and Wengrow, 2021). For science-policy arrangements, I take this turn to imply a change from a universalizing search for what a science-policy arrangement *is* to the question of how, and by whom, science-policy arrangements are variously enacted in practice (Halffman, 2003; Pallet and Chilvers, 2015). What are, in short, the ontological politics of science-policy arrangements (cf. Mol, 2002)? Exploring this question requires acknowledging a plurality of arrangements which are themselves co-produced with particular ideologies and knowledge practices (Halffman and Hoppe, 2005; Meehan et al., 2018; Montana, 2020; Borie et al., 2021). It also involves recognizing Smit and Hessels' (2021) point that the way science-policy arrangements are evaluated simultaneously shapes their practices. Consequently, I think that explicit attention to the ontological politics of science-policy arrangements can be a way to respond to calls for techniques that help to dismantle ossified boundaries and hierarchies that continue to allow unhelpful science-policy arrangements to remain in place and inhibit potential for change (Mahony, 2020).

My interest in how science-policy arrangements are enacted also explains why until now I have refrained from using the term science-policy interface or equating them with boundary organizations. Of course, this is partially a semantic discussion. Although the reader will find all of these terms used throughout this thesis, sometimes as de facto synonyms – if only because it is rarely helpful to indulge in a lengthy semantic discussion – it is helpful to explain this choice here. From the discussion so far, my objections to the term 'interface' are not difficult to guess: it is a static term that essentializes the very two-world model I seek to leave behind. The reason to refrain from the term 'organization' takes a bit longer to explain. Guston's (2001) original definition of the term boundary organization stresses the involvement of actors on either side of the science-policy boundary. Combined with Halffman's (2003) description of a boundary as the result of routinised practices (boundary work), the term boundary organization has a lot going for it. However, and to repeat my earlier point, also boundary organizations have become managerialised and translated into formal and informal organizational structures and rules that can ensure that boundary organizations are effective and

efficient. In contrast, the term arrangements, among others through its association with assemblage thinking (Philips, 2006; Anderson et al., 2012), provides a way to approach relations between science, policy and society that is less linear and more dynamic. I hope this term allows a flexible and messy understanding of ongoing reproduction and reshaping of science-policy relations.[7]

Finally, formulating alternative enactments of science-policy arrangements cannot be separated from the politics of transformative change, and specifically the question of what these politics mean for how science-policy arrangements deal with the combined assumption that value-free knowledge is separate and prior to depoliticized governance (see sections *'More is better'* and *'Un-assuming policy and governance'*). What does it imply for shaping science-policy arrangements for transformative change to accept that all neutrality is a mirage, that knowledge and action are not separate and sequential, and that action does not depend on a singular depoliticized agency? In other words, what does it mean to enact science-policy arrangements in a context that is considered inherently political, and thus, not value-free? While critical perspectives on science-policy arrangements are generally very good in flagging the issue of politics (Turnhout et al., 2016; Brown, 2015), they have arguably found it more difficult to formulate concrete potential solutions for dealing with this issue.[8] I think the starting point to an answer can be found by taking up calls for more substantive engagement with the meaning of democratic political theory for the practice of science-policy arrangements (de Vries, 2007; Marres and Lezaun, 2011; Chilvers and Kearnes, 2020). Such an engagement can help to formulate more concrete solutions to the fact that an "overwhelming display of knowledge" cannot overcome conflicting worldviews and dissent (Hulme, 2018, p. 335); solutions which move beyond the problematic modernist assumptions of knowing-doing-governing (Stirling, 2016). In other words, an engagement with the interrelations between democratic politics and transformative change can also help to formulate a contribution of science-policy arrangements to transformative change.

[7] At the same time, I am hesitant to use the term 'science-policy assemblages' in this thesis, mostly for the fear that many readers would find it even more vague than arrangement.

[8] Of course, for approaches to science-policy arrangements that continue to view science and politics as neatly separate domains, this entire point is a non-issue. On the contrary, any solutions that are seen to upset that separation in any way are seen to carry the danger of harming the authority and 'neutral' position of science (Lahsen and Turnhout, 2021).

Research objectives and research questions

To briefly recap the argument of this introductory chapter thus far: I departed from the discourse of transformative change, which I consider to be an unstable[9] but potentially promising answer to the mess we've made of this world. Within this discourse, I observe calls for the explicit repositioning and repurposing of science-policy arrangements as enabler of such change. However, I am sceptical both of whether science-policy arrangements are currently fit for this purpose, and of whether they are being sufficiently shaped to be so. This scepticism stems from my view that a persistence of three problematic modernist assumptions about knowledge, politics and policy limits the ability to shape science-policy arrangements in desirable directions. These three assumptions are strongly interrelated and can be summarized as (1) the assumption that knowledge is neutral and value-free, (2) the assumption that knowledge is separate from and prior to action, and (3) the assumption that action depends on the exercise of a singular, concentrated agency that is driven by deliberate intentionality. Together, these assumptions leave the fundamental question about desirability unasked and unanswered – 'what are the science-policy arrangements we want for transformative change?'. In turn, I have suggested science-policy arrangements for transformative change require putting these modernist assumptions aside and I have highlighted that 'critical approaches' to science-policy arrangements that focus on enactment and emphasize pluralism, politics, and power offer important insights that can be mobilized for this. At the same time, these critical approaches have arguably focused more on describing current practices and their problematics, and have only limitedly succeeded in providing practical points of entry to change for the better. Consequently, I suggested alternative analyses of science-policy arrangements that engage democratic political theory in relation to transformative change can help constitute more desirable alternatives; alternatives in which science-policy arrangements are fit to facilitate transformative change.

My objective in this thesis is to articulate an effort to repurpose science-policy arrangements for transformative change for sustainability. To this end, I take the aspects highlighted above to formulate three interrelated research questions. I reflect on these questions, their interrelatedness and the answers they have yielded in the final chapter of this thesis but perhaps it is appropriate to already provide a qualification. I cannot guarantee my contribution and questions will yield any kind of definitive answer or insight into necessary and/or sufficient conditions, and nor is it my ambition to do so. As I will discuss in more detail in **Chapter 6**, to

[9] And as we'll see later in this thesis, there are good reasons to hope this instability persists.

aspire to that would reproduce the problematic assumptions that depoliticized knowledge will lead to fruitful and coherent change.

My first question asks: '*Through what division of roles and responsibilities are science-policy arrangements enacted?*'. This is primarily a descriptive question, through which I aim to understand the obduracy of the linear model in practice. By attending to the division of roles and responsibilities, I seek to reintroduce a symmetrical understanding of actors in science-policy arrangements. Moreover, by focusing on enactments – the practices that constitute science-policy arrangements – I expect to be able to show that even behind an ostensibly singular science-policy 'interface', a more plural set of arrangements co-exists. Taken together, I hope that a more in-depth understanding of this division of labour and plurality helps to not just inform answers to what may be desirable and undesirable arrangements, but also to how to foster the first while disposing of the second (**RQ1**).

My second question asks: '*What does the diversity of actors involved in transformative change mean for how to conceptualize the effectiveness of science-policy arrangements?*'. With this question, I aim to contribute to the aforementioned need for science-policy arrangements to come to terms with the shift from government to governance. After all, if we take the governance of sustainability issues to have become a polycentric affair, it seems untenable to continue to conceive of effectiveness as a static and one-sided achievement. Instead, an understanding is needed that positions science-policy arrangements in relation to a wide variety of actors, without needlessly privileging the position and authority of science-policy arrangements themselves (**RQ2**).

My third question asks: '*What does the political dimension of transformative change mean for how science-policy arrangements are to be enacted?*'. I consciously phrase this as a prescriptive question, which relates back to the explicit directionality embedded in the idea of repurposing science-policy arrangements for transformative change. If we indeed find that to be a *desirable* role for science-policy arrangements, and we take seriously arguments about the political dimension of transformative change, then surely this must have consequences for the way science-policy arrangements operate. Through this final question I thus aim to contribute to explicating what is ultimately at stake in ideas of repurposing (**RQ3**).

Research design and methodological approach

I answer these research questions through four distinct qualitative case studies that developed as part of my work as a researcher at PBL Netherlands Environmental Assessment Agency (PBL, see Box 1). Cases studies are a well-established approach in STS and human geography. Perhaps they are so well-established that both the theoretical underpinning to this research design and practical choices made in the research process are prone to becoming no more than a sentence or footnote in research papers (Hitchings & Latham 2019, 2021). So too in the subsequent chapters of this thesis, which makes it all the more opportune to take advantage of the relatively unrestricted space in this introduction to reflect and explicate my thinking and methodological approach. I start by briefly discussing my understanding of knowledge and reality (epistemology and ontology), and continue by reflecting on my research design in the form of case studies and an elaboration on my approach to empirical materials and analysis, including some reflections on ethics and practical aspects to my approach.

Box 1: PBL Netherlands Environmental Assessment Agency
PBL is a government research agency for environmental policy analysis. Its mission is to "improv[e] the quality of political and administrative decision-making" (PBL website, n.d.). PBL has a prominent role in Dutch policy debates, and has been the subject of earlier work by external analysts (Halffman, 2009; Huitema and Turnhout, 2009; Pesch et al., 2012). More recently, other researchers employed (semi-)directly by PBL have studied how the institute tries to co-accommodate modernist and reflexive views of science-policy arrangements (Kunseler, 2017), as well as how it attempts to normalize reflexive evaluation methods as part of its methodological repertoire (Verwoerd, 2022). These dynamics in the institute also reflect its own – variously (un)certain and (in)determinate – attempts to reposition, as induced both by internal recognition of a changing context and external advice to do so (see e.g. Verwoerd and Kunseler, 2021; PBL, 2022b; Review Committee PBL, 2017, 2022; Kunseler and Dammers, 2023).

Regarding my ontological and epistemological positioning, I take my cues from post-structuralism, constructivism and interpretivism. Three rather large and somewhat intimidating terms, which to me boil down to a relatively straightforward set of views on what research is

and does, and how my position as a researcher relates to it. They indicate a point of departure that questions of what something is and does are never entirely fixed but are ever-changing and subject to contestation (Gottweis, 2003; Jorgensen and Philips, 2011). These questions persist regardless of the amount of (human and non-human) work that is involved in attempts to achieve temporary closure and stabilization (de Vries, 2016), and result in an interest to empirically understand *how* things come to have meaning (Yanow, 2015). Here, it is also important to point out that I feel like constructivists are often falsely seen to not believe in reality (cf. Latour, 1999). Rather, I think Sismondo (2017) rightly emphasizes that the STS tenet "it could be otherwise" does not mean it could *easily* be otherwise (see also Law, 2004). For me, the fundamental consequence of my point of departure is that it is a rather pointless endeavour to focus on answering what is 'true', and much more important to analyse the effects of whatever we take to be 'true'.

The case studies included in this thesis are (1) the science-policy arrangement constituted by a collaboration between the Dutch Ministry of Foreign Affairs and PBL (**Chapter 2**), (2) effectiveness strategies of global environmental assessments as a particular enactment of science-policy arrangements (**Chapter 3**), (3) a study of how knowledge is expected to be used in decision-making, focusing on Dutch initiatives for a beyond-GDP concept (**Chapter 4**), and (4) reflection on proposals for a new global science-policy body for food policy (**Chapter 5**). The **outline section** below explains the background and specifics of each case in more detail. In all four cases, PBL – and me personally – can be seen as involved in attempts to shape science-policy arrangements. Together, I consider them to be a set of paradigmatic cases, suitable for learning and theory development (Flyvbjerg, 2006). They are all cases which somehow resist existing theory, i.e. whose explanation cannot be reduced an instance of a known phenomenon (Barry, 2010). Consequently, theoretical learning can happen in explaining what a case is a case *of* (Abbott, 2001, cited in Berlant, 2007). This approach to case studies fits well with my research questions, which combine explanation (how are things) with imagination (how could they be otherwise).

In how I consider these case studies, I am further instructed by theory on discourse analysis. To avoid a full exposition of all the various branches and approaches in discourse analysis, I restrict myself to the insights which have most informed my work. Hajer and Versteeg (2005, p. 175) take discourse to denote the "ensemble of ideas, concepts and categories through which meaning is given to social and physical phenomena, and which is produced and reproduced through an identifiable set of practices" (Hajer and Versteeg 2005, p. 175). I use discourse analysis to make sense of how certain meanings become fixed and naturalized

(Jorgensen and Philips, 2011). But, as Howarth (2005) points out, discourse analysis aims not just to (re)describe such meanings, but also to problematize existing meanings, make invisible meanings visible, and to articulate alternative meanings. Again, this fits the ambition of this thesis to highlight where dominant approaches to science-policy arrangements are most brittle, and therefore susceptible to repurposing for transformative change.

Empirically, my case studies are informed primarily by semi-structured interviews with actors in science-policy arrangements, the researchers and policymakers through whom these arrangements are constituted. The use of interviews highlights that the materials used in my analysis are not simply data which I 'found', but are themselves the outcome of interactions between the respondents and myself (Whatmore, 2003). As a method, interviews fit my interest in the way science-policy arrangements take shape in practice, the kind of detail rarely found in formal documents (May, 2001; Hitchings, 2012). They are also suitable with regard to the characteristics of my respondents: highly educated people who are for the most part used to the social occasion of the interview (Hitchings and Latham, 2019). To put it differently, not only I, but also my respondents consider interviews a robust and valid method of knowledge generation. Respondents were approached over email and provided with an accompanying information letter, detailing the aim of the research and how their participation would be used. Anonymity was a point of attention, as many interviews served simultaneously as materials to PBL-projects and case studies in this thesis. For PBL studies, transparency about respondents was desirable, while also seeking to allow respondents to talk as openly as possible. For that reason, the PBL studies associated with this thesis contain lists of respondents, but not direct quotes. Conversely, (some of) the chapters in this thesis contain quotes, as they can be highly illustrative in the analysis, but have anonymized respondents. With some exceptions, the interviews were recorded and transcribed. For practical (time) reasons, most transcripts were made by an external company. In addition to interviews, my position as a researcher working in and actively shaping science-policy arrangements also enabled me to include a kind of ethnography-light into my analysis (see also the next section on **positionality**). While I did not apply any formal or highly structured (auto)ethnographical methods, my position in PBL provided me with everyday experiential knowledge and fieldnotes which helped me to target my research interests, ask particular interview questions, and guide my analysis.

My analysis of the empirical materials proceeded in an iterative cycle with conceptual and theoretical development. This iterative approach to coding helped me to develop analytical categories and linkages to theory, as well as prompting me to refine questions for future

interviews (Cope, 2010). I coded the interviews manually. Partially handwritten – scribbled in the margin of prints of transcripts and other notes taken during interviews – and partially digitally – by sorting transcript excepts, digital notes and codes in Word and Excel. For **Chapter 4**, I used Atlas.ti as an auxiliary tool for coding and sorting.

Positionality: me, myself, and PBL

Being an employee of the research institute that is also an actor in the analysis provided unique opportunities, but also complicated and multiplied my positionality. Originally, my position was created in the context of the collaboration between PBL and the Ministry of Foreign Affairs, department of development cooperation. The desire to add more in-depth reflection and analysis in the form of a PhD thesis was my own, while facilitated by PBL in terms of time and work package. This also implied I felt a need to create some kind of visible synergy between the work I was 'paid to do', and the work I 'wanted to (also) do'. This need was both self-created and imposed by PBL colleagues. It was self-created, through the conscious choice to pursue a PhD in a practical setting. Already in my application letter I remarked that I hoped to simultaneously increase scientific insight into the workings of institutes like PBL as well as contribute to PBL's internal practices. The felt need for synergy was imposed by others in often implicit ways, such as the remark by a manager in the job interview that my desire to pursue a PhD was a "contra-indication" (i.e., a reason *not* to hire me), fearing it would lead to too much thinking and too little action. Indeed, it is not self-evident that a relatively junior person is given space for (critical) comments on more strategic matters in an organization. Particularly not, when he is employed on a temporary contract in a subject matter (international cooperation) in the margins of that organization. In practice, I think the combination of PBL projects and PhD interests has worked surprisingly well, with each of the case studies in this thesis having direct and substantial overlap to a PBL project I was involved in.

Practical ways to organize synergy between this PhD and my position at PBL also emerged beyond the case studies this thesis collects. I took the lead on the renewal of the agreement underpinning the collaboration with the Ministry – meaning I could create (some) opportunities to institutionalize particular ways of doing this science-policy arrangement. I also participated in a project under the auspices of PBL's Chief Scientist, who was tasked with developing a more 'systematic' way to map PBL's 'impact' following the institute's 2017 external evaluation. Arguably, my explicit pursuit of a PhD thesis was also a way to create a personal kind of 'soft space' for institutional entrepreneurship, a way to think beyond current practices and make room for alternatives (cf. Garud et al., 2007; Hajer, 2017). This is why I describe my

positionality as multiple. There is a Timo coordinating the collaboration between PBL and the Ministry of Foreign Affairs, a Timo engaging in 'substantive' work on environment and development policy, a Timo involved in furthering PBL's thinking on impact, as well as a Timo who writes scientific papers which aim to critically reflect on these other roles.

Finally, the fact that PBL is a Dutch institute means that the Dutch science-policy and political context influences the kind of everyday thinking that goes into any piece of research. To some degree, this influence is direct, in relation to the Dutch foreign policy context that influences PBL's and my personal interaction with the Ministry of Foreign Affairs. Since 2012, Dutch governments have put under the responsibility of a single minister both development cooperation and international trade, two policy domains known for mutual frictions and contradictions. Occasionally these frictions and contradictions work their way into the PBL-MFA relationship, for instance when PBL-studies seem to take on an adjudicating role in (MFA-internal) policy debates between these different priorities. However, this broader context also has more indirect influences. Over the past years, environmental issues have found their way to the heart of the Dutch public and political debate, not least through court rulings against the Dutch state. The Netherlands is home to landmark court cases in climate litigation, such as by Dutch NGO Urgenda vs. the Dutch state (see e.g. van Zeben, 2015).[10] An equally consequential ruling by the highest general Dutch administrative court on nitrogen permits has led to various policy plans and ambitions as well as fierce protest by Dutch farmers, as primary targets of these plans.

In these public and political debates, the expertise of institutes including PBL is invoked in ways ranging from very positively to very critically. Somewhat paradoxically, this co-exists with rather dire reflections on the state of political debate in The Netherlands, with a range of commentators and advisory councils issuing highly critical notes on the tendency for depoliticized governance (e.g. Tjeenk Willink, 2021; Kieft, 2022; ROB, 2022). In few cases was this more evident than in the Dutch approach to handling the Covid-19 pandemic and the government's claim to 'follow the science', in which political choices become implicit and invisible (cf. Bacevic, 2020; WRR, 2022). Finally, it is relevant to note that in my 2016 MSc thesis, I analysed how a 2013 Dutch agreement on the energy transition came into being, touching both upon the role played by PBL as stabilizer, and on the limits faced by this traditional Dutch

[10] Friends of the Earth Netherlands is also currently litigating against Shell, with the case now to be heard by the court of appeals (Macchi and van Zeben, 2021).

neo-corporatist approach to effect change (Maas, 2016). Of course, I hope and think my analyses are meaningful beyond the Dutch context, but ultimately that is for readers to judge.

Outline of this thesis

I conclude this introductory chapter with a brief overview of the different chapters. **Chapter 2** examines the evolving collaboration between PBL and the Dutch Ministry of Foreign Affairs (MFA). This in-depth analysis of the science-policy arrangement established by this collaboration focuses primarily on the first research question (**RQ1**). The chapter is based on empirical materials collected over 2,5 years in which I was tasked with "strengthening" the PBL-MFA relationship. In addition to my personal experiences and fieldnotes this provided I conducted 29 interviews with PBL-researchers, policymakers at the MFA, as well as other stakeholders. This chapter provides a conceptual understanding of linear and co-productive models of science-policy arrangements. We[11] further conceptualize these arrangements as social practices, as a means to symmetrically analyse the way the science-policy arrangement is performed by a combination of individual, intersubjective and institutional factors. This conceptualization allows us to understand the obduracy of the linear model as stemming from the lack of an alternative imaginary spanning beyond individual researchers or policymakers, but as absent throughout the science-policy arrangement as social practice. We argue that in order to avoid the offloading of democratic responsibilities from policy actors to researchers, alternative imaginaries must depart from 'common, but differentiated responsibilities' for the science-policy arrangement, and accommodate the political dimensions and implications of these arrangements head-on.

Chapter 3 focuses primarily on the second research question (**RQ2**), by providing an alternative conceptualization of the effectiveness of global environmental assessments (GEAs). Highlighting that these assessments are as much about their process as their report, we open up an understanding of effectiveness as the potential *empowerment* of the wide variety of actors involved in polycentric environmental governance. While equal empowerment of all actors is impossible, it is crucial GEAs consider who and what they empower, and with what legitimacy. Even so, taking this perspective on effectiveness forward presents the accommodation of pluralism as important avenue to improving effectiveness, as a prerequisite for broad empowerment. The chapter originates in a wider PBL project on keeping such assessments fit for purpose (see Maas et al., 2020), and was written following a 1.5-day workshop organized in

[11] Here, below, and in Chapters 2 to 5 themselves, I use 'we' to acknowledge these chapters' co-authors.

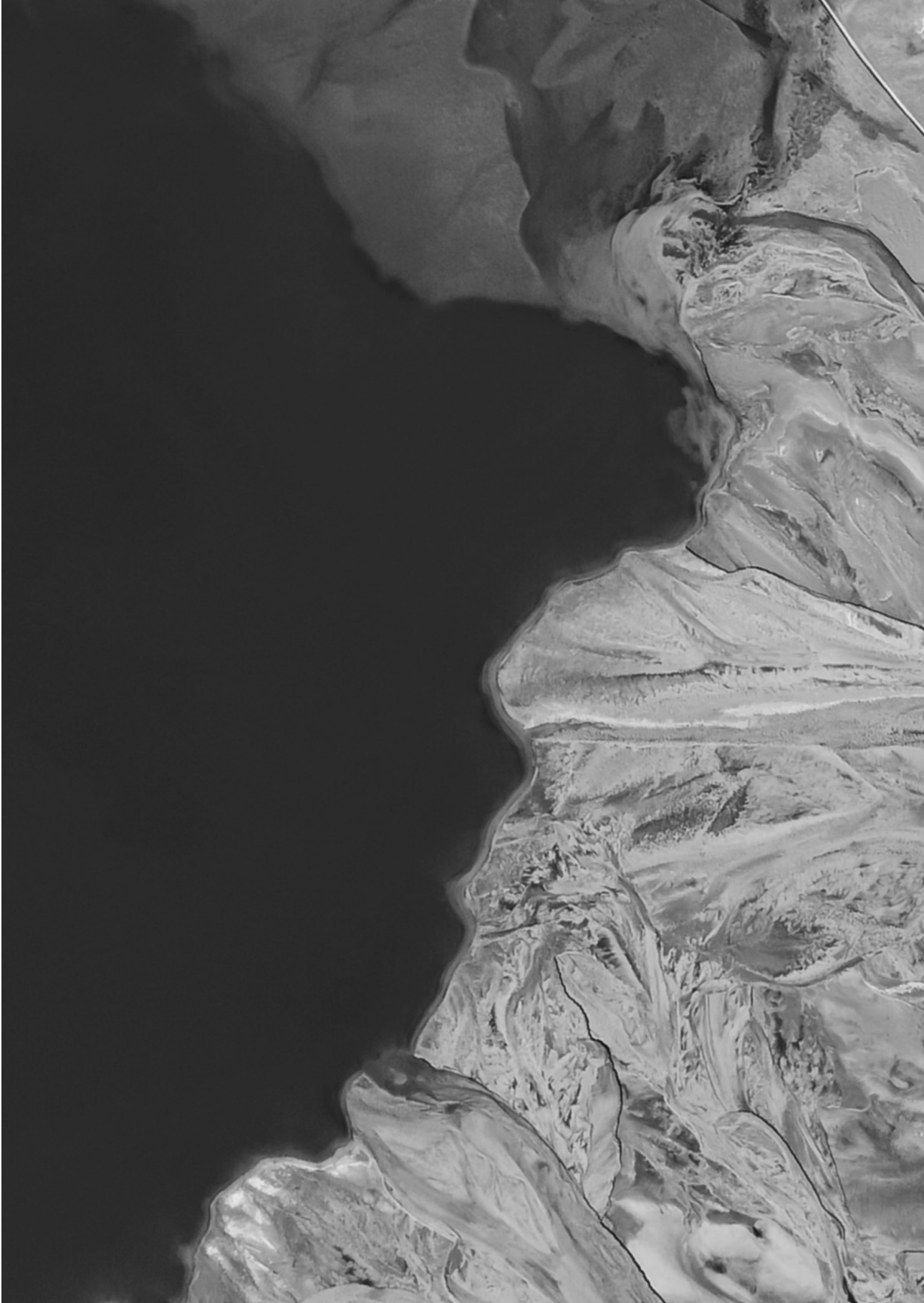
the context of this project. For the underlying PBL-report, I conducted an additional 21 interviews with researchers and policymakers involved in GEAs. PBL is regularly involved in the production of GEAs – e.g. through individual authors, scenario analyses, as collaborating centre or as host of a technical support unit – as well as in positioning them. For instance, through taking part in committees on the future of an assessment process, the scoping of an assessment, as well as through the direct link to the Dutch government as actor in international bodies overseeing assessment processes.

Chapter 4 further develops the importance of pluralist politics for change (**RQ3**), and highlights the contribution science-policy arrangements can make by providing *politicizing* expertise. The chapter is based on a case study of ongoing discussions to replace Gross Domestic Product (GDP) as common indicator of progress. In the Netherlands, attempts to operationalize 'beyond GDP' concepts in policymaking are centring on the concept of 'Broad Wellbeing', with PBL involved in multiple and different trajectories. Empirically, this chapter is based on 23 interviews with policymakers and researchers involved in different Dutch wellbeing initiatives as well as relevant reports and policy documents. By attending to the performativity-in-the-making of Broad Wellbeing we open up thinking about possible performances of this concept. Building on insights from ignorance studies, we develop the notion of 'knowledge accountability' to refer to the way in which decision-makers are expected to explain and justify how and what knowledge influenced their decision. Different logics of knowledge accountability – technocratic and political – are variously ignorant of politics. We argue these politics house a productive potential for (transformative) change, building on the work of John Dewey and Chantal Mouffe.

Chapter 5 contains a commentary on a potential new science-policy body for food policy, illustrating several key points in this thesis in the context of global discussions about a new science-policy arrangement. While we argue such an arrangement is problematic if seen as a silver bullet solution to improve the governance of a highly contentious policy domain, we suggest it can make a potential contribution to transforming global food policy when taking existing challenges in food science-policy arrangements into account and by committing to pluralism, equity and justice. The commentary was written after I – in my PBL role – was approached by the Dutch Ministries of Foreign Affairs and Agriculture, Nature and Food Quality who were seeking to make sense of global calls for a new expert panel on food, following the report on global environmental assessments (**Chapter 3**). This resulted in a brief reflection note (Roodhof et al., 2021) which we subsequently developed into a commentary to facilitate wider dissemination and debate. For the note and commentary, we drew on a

combination of six informant interviews and relevant literature, including proposals for an 'Intergovernmental Panel on Food Systems'. This chapter's origin story shows the importance of taking advantage of opportunities to create/make use of a window of opportunity to shape future science-policy arrangements.

Finally, **Chapter 6** provides a concluding discussion across this thesis. It answers the research questions across the different chapters, reflects on my methodological approach and positionality, and discusses this thesis' contributions and implications for studying and shaping relations between science, policy, and society. I conclude by reflecting on what these implications might mean for PBL.



Chapter 2.
Co-producing the science-policy interface: towards common but differentiated responsibilities

Published as:

Maas, Timo Y., Annet Pauwelussen, and Esther Turnhout. 2022. "Co-Producing the Science–Policy Interface: Towards Common but Differentiated Responsibilities." *Humanities and Social Sciences Communications* 9(1):93. doi: 10.1057/s41599-022-01108-5.

Co-producing the science-policy interface: towards common but differentiated responsibilities

Introduction

The world is facing several socio-ecological challenges, with issues like climate change and biodiversity loss having unequal impacts on humans and requiring urgent and integrated responses. It is generally uncontroversial to state *that* knowledge is required to formulate such responses. However, the question of *how* to produce and mobilise this knowledge both effectively and legitimately is less self-evident (Oliver and Boaz, 2019). A large variety of science-policy arrangements exists, for which the concept of boundary organisations has become an emblematic term (Guston, 2001). However, as pointed out by Pallet and Chilvers (2015), it is crucial to understand such arrangements as co-produced through particular practices enacted by different actors from science, policy and society. These science-policy practices embed particular assumptions about what expertise is useful and credible, and how expertise should relate to policy and society. Examining these assumptions and how they shape science-policy practices is important to understand and strengthen their effectiveness and legitimacy.

In academic debates on science-policy interactions, we discern a gradual shift from a linear model of science-policy arrangements towards more co-productive alternatives (Arnott and Lemos, 2021; Kunseler, 2017; Sienkiewicz and Mair, 2020; Turnhout et al., 2020; van der Hel, 2016). This shift responds to inadequacies in the linear model resulting from a problematic separation of facts and values and the messiness of policy processes (Owens, 2015). Conversely, co-productive alternatives acknowledge that all actors involved hold relevant knowledge and expertise, recognise the intertwined character of facts and values, and consider knowledge production to be embedded within processes of change rather than outside of them (Chambers et al., 2022; Turnhout et al., 2019; Wyborn et al., 2019). A crucial difference between linear and co-productive models lies in how they deal with political dynamics. In the linear model, a separation between science and politics is upheld through careful boundary work and stage management (Halffman, 2003; Hilgartner, 2000), with ostensibly straightforward criteria like credibility, relevance and legitimacy guiding knowledge production (Cash et al., 2003). Co-productive alternatives consider science and politics as inherently

inseparable and co-constituted, but face the challenge of using this view productively to improve effectiveness and legitimacy (Brown, 2015). Nonetheless, co-productive science-policy arrangements are argued to carry great promise in addressing sustainability transitions (Schneider et al., 2019). Especially their frequent emphasis on inter- and transdisciplinary collaboration has been widely adopted as hallmark of this promise, even if the practical and institutional development of this arguably leaves much to be desired (Chilvers and Kearnes, 2019; van der Hel, 2020).

Despite broad recognition of its shortcomings, and the potential of alternatives, the linear model remains prominent. Studies have shown how the linear model regularly continues to inform science-policy practices at public research institutes (Kunseler, 2016), in global environmental assessments (Borie et al., 2020; Castree et al., 2020), by scientists operating in the public debate (Karhunmaa, 2020), and in the way policymakers approach science-policy arrangements (Kowalczewska and Behagel, 2019; Thoni and Livingston, 2019). Markedly, the public outcry surrounding the concept of post-truth also shows little signs of co-productive alternatives becoming common practice (Jasanoff and Simmet, 2017; Marres, 2018). This persistence may relate to a discrepancy between the conceptual developments in science-policy theory and the degree to which these theoretical lessons are drawn on in practice (Oliver and Boaz, 2019), as well as to a reluctance within parts of the scientific enterprise to embrace the implications of these lessons (Lahsen and Turnhout, 2021). We think a better understanding of this persistence is required if we are to achieve more effective and legitimate science-policy practices. Such understanding will need to pay attention not only to the approaches to knowledge production taken by researchers, but also to the way policy demands materialise in the way science-policy practices are organised (Dunn and Laing, 2017).

In this chapter, we study the evolving relationship between the Dutch Ministry of Foreign Affairs and a government research institute for environmental policy analysis. The ministry and institute collaborate in repeating memoranda of understanding (MoU) to establish a joint science-policy arrangement. Since 2019, explicit efforts have been made in this arrangement from a shared sense that there is untapped potential for a stronger relationship. In our study of this arrangement, we focus on how linear and co-productive models of science-policy practices are enacted. By analysing how science-policy practices are co-produced, the chapter contributes to understanding the persistence of the linear model. In our discussion we use this understanding to highlight how efforts to make science-policy practices more effective and legitimate can only succeed by taking serious the roles and responsibilities of all actors

involved, illustrating the interconnectedness of transforming knowledge production, translation and mobilisation, and decision-making (Oliver and Boaz, 2019).

Conceptual framework

There is a wide body of literature discussing the different ways science-policy arrangements are organised (Guston, 2001; Wilsdon and Doubleday, 2015), including global environmental assessments (Borie et al., 2021; Maas et al., 2021, see **Chapter 3**; Turnhout et al., 2016), government science advisors (Obermeister, 2020; Palmer et al., 2019), expert commissions (Bijker et al., 2009; Owens, 2015), government research institutes (Halffman, 2009; Huitema and Turnhout, 2009) and transdisciplinary research programmes (van der Hel, 2016). Others have focused less on organisational matters and more on how individual scientists can operate in such arrangements (Oliver and Cairney, 2019; Pielke, 2007). All in all, literature has tended to focus on scientists and the organisations they are active in, which leaves the position of policymakers in these arrangements relatively under-examined.

Studying the roles of scientists as well as policy actors involved requires an analytical approach that allows for a more symmetrical perspective of how science-policy relations are co-produced. To this end, we conceive of science-policy relations as constituted in and through social practices. Social practices are routinised patterns of behaviour, combining "forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge" (Reckwitz, 2002, p. 249). A practice is more than a well-delineated action: practices are composed of multiple elements that cause it to exist beyond individual moments of enactment (Shove et al., 2012). As such, social practices can be seen to address the agency-structure debate by incorporating individual, intersubjective, and institutional factors. This combination yields a perspective that allows a better understanding of the actions of individual practitioners, while acknowledging their embedded agency. Practices thereby offer an analytical approach to study both the reproduction of particular models of science-policy relations as well as their transformation (Shove and Walker, 2010). We distinguish a *linear* and *co-productive* model of science-policy practices, noting that these form extremes on a spectrum of possible arrangements. While these two models co-exist, they are essentially incommensurable in what they see as required for effective and legitimate science-policy relations (Kunseler, 2017). Central to the linear model is the assumption that science and politics are neatly separable (Latour, 1993), whereas the co-productive model departs from the position that the production of knowledge and the social order are deeply intertwined (Jasanoff, 2004).

Building on the work of Shove et al. (2012), we can think of science-policy practices as composed of three elements: repertoires, competencies, and context, which we discuss in more detail below. Variation in science-policy practices, and in the models they mobilise and reproduce, follows from different ways in which these three elements are configured and interpreted, even if they serve a similar overall purpose. The next sections describe the characteristics of the three elements of science-policy practices and their relation to the linear and co-productive models in greater detail (see also summary overview in Table 1).

		Linear	**Co-productive**
Repertoire *How is one expected to operate in the science-policy practice?*	*Knowledge brokering*	Supplying, Bridging	Facilitating
	Logics of decision-making	Consequentiality and appropriateness	Meaning
Competencies *What makes practitioners able to perform the practice well?*		Boundary work & stage management	Co-productive agility
Context *In what ways do context factors stabilise the practice?*		Expert-driven policy context in which institutional and spatial configuration promotes separate domains of science and politics	Normatively-driven policy context in which institutional and spatial configuration promote conjunction of science and politics

***Table 1**. Summary overview of the characteristics of the linear and co-productive models of science-policy practices*

Repertoires

Repertoires present practitioners with an indication of how they are expected to operate in the science-policy arrangement. They offer a "vocabulary of justification" (Karhunmaa, 2020) by making "a more or less coherent statement about perspectives and concomitant activities" (Gilbert and Mulkay 1984 cited in Turnhout et al., 2013). Repertoires thus contain a conception of the link between knowledge production and use. In our analysis, we build on the repertoires of knowledge brokering identified by Turnhout et al. (2013) and combine them with Dewulf et al.'s (2020) logics of usable knowledge in decision-making (Dewulf et al., 2020). Table 2 summarises the three repertoires.

In the *supplying* repertoire, knowledge users are provided with relevant expertise or experts appropriate to answering users' questions (Turnhout et al., 2013). Interaction between producers and users of knowledge is restricted to elucidating the questions users hold. In this repertoire, decision-making is seen to follow a logic of consequentiality (Dewulf et al., 2020), which holds that decision-making is presumed to depend on science-based options and their consequences, from which a decision-maker will choose the best one in a rational process.

The supplying repertoire thus conforms to a linear science-policy practice. Knowledge production and knowledge use are separate activities, with the science-policy practice functioning as the locus through which knowledge from a wider reservoir of expertise flows into decision-making. This repertoire implies a view of knowledge as an intrinsically desirable good, of which more is always better, and works best when experts can deliver uncontested facts.

The *bridging* repertoire aims to bring the production and use of knowledge closer together. While they remain separate activities, they are seen to require intensive interaction to translate and transfer questions and answers (Turnhout et al., 2013). The science-policy practice is what enables these activities to interact. In this way, this repertoire relates to a decision-making logic of appropriateness (Dewulf et al., 2020). Here, decision-making is seen to follow institutionalised rules prescribing what to do in specific situations. The knowledge required for decisions is not just any knowledge, but knowledge that is produced in line with particular institutional and cultural rules itself (cf. Jasanoff, 2005) and which answers specific questions. Knowledge is still seen to be contained in a reservoir, but efforts focus not so much on transferring as much knowledge as possible to decision-making, but on ensuring that the right knowledge is communicated in the right way. This means that the bridging repertoire is useful for issues where the role of interpretation in knowledge production and use is acknowledged, by enabling the most fitting interpretation to be found. Since knowledge production itself is considered to take place outside the science-policy practice, this repertoire leans towards a linear model of the science-policy practice.

In the *facilitating* repertoire, the perspective on where knowledge is produced is altered and the boundary between knowledge production and use is blurred (Turnhout et al., 2013). All actors involved in the science-policy practice are seen to hold relevant knowledge and it is impossible to distinguish between active producers and passive recipients of knowledge (Smit and Hessels, 2021). This repertoire contains a decision-making logic of meaning, in which decision-making is considered to be a struggle over the relative significance of different possible dimensions of a problem (Dewulf et al., 2020). Here, knowledge is usable when it fits with existing frames, provides a meaningful new perspective, or facilitates a process of mutual learning between different frames. Consequently, this repertoire is useful for issues around which multiple contesting frames exist. In the facilitating repertoire, the science-policy practice becomes a site in which 'more-than-knowledge' is both produced and mobilised. With 'more-than-knowledge' we mean to highlight that the outcomes of this co-productive repertoire are not necessarily recognisable as knowledge in a traditional or formal sense (e.g. by being codified).

	Supplying	Bridging	Facilitating
Knowledge brokering repertoire	The science-policy practice aims to provide policymakers with knowledge produced by experts	The science-policy practice aims to answer questions policymakers have with relevant knowledge produced by experts	The science-policy practice enables policymakers and experts to collaborate to co-produce more-than-knowledge
Logic of decision-making	Logic of consequentiality: decisions are based on their expected consequences	Logic of appropriateness: decisions are based on rules prescribing what to do in what situation	Logic of meaning: decisions are based on what is meaningful to decision-makers

***Table 2**. Summary of the three repertoires, based on Turnhout et al. (2013) and Dewulf et al. (2020)*

Competencies

The repertoires not only indicate different expectations on how actors should operate in science-policy practices but also point to the competencies that are required of them, taking competencies to mean "the ability to do something well" (Cambridge English Dictionary, n.d.). Competencies can be derived from formal or informal training, as well as from on-the-job experience. For instance, there is a growing literature on learning processes among science advisors (Obermeister, 2020), that has e.g. analysed how broader concepts like boundary work translate from organisations to the approach taken by individual governmental science advisers (Palmer et al., 2019). Regardless of the model, competencies are not only held by those working in research positions, but also by those more closely situated towards decision-making. Both in the linear and co-productive model, competencies are demanded from all practitioners (Faasse et al., 2020). Nonetheless, differences in the competencies required from individual practitioners may exist in relation to their respective responsibilities and roles in the practice, including in relation to their professional expertise (Kuus, 2020).

The linear and co-productive model require different competencies from science-policy practitioners. In the linear model, careful stage management is required to avoid upsetting the unidirectional image of science→policy (rather than science↔policy) (Karhunmaa, 2020). This often means that good science-policy practitioners are seen as those able to communicate and translate between science and policy, including through building and maintaining high-trust relations that enable iterative exchanges between science and policy (Bednarek et al., 2018; Tinch et al., 2018; Young et al., 2014). In turn, such exchanges help practitioners to understand what would make for useful knowledge in a specific decision-making context, as well as what other actors and sources of knowledge influence that context. In line with both the supplying and bridging repertoires, these activities are not considered to produce knowledge, but merely to allow researchers to produce more relevant knowledge and to enable

the use of knowledge. Furthermore, terms like scientific literacy imply a pre-requisite to knowledge use, in which prospective users have the skills to understand and act according to scientific facts (see e.g. Bäckstrand, 2003; Wynne, 1995).

Conversely, competencies required in the co-productive model are founded on the ability of practitioners to combine both scientific and other forms of knowledge and to integrate them in practices of decision making (van Kerkhoff and Lebel, 2015). The term 'co-productive agility' (Chambers et al., 2022) emphasises the need for practitioners engaging in co-productive processes to be open and able to understand different viewpoints, be sensitive and responsive to changing objectives or new knowledge, and – crucially – constructively navigate the tensions that inevitably arise in such settings. Co-productive competencies thereby incorporate norms like humility and pluralism advanced for scientific practices (Turnhout et al., 2019), but highlight that these are required from all who enact the science-policy practice. In line with the facilitating repertoire, co-productive competencies thus underline the entwinement of knowledge and action, thereby recognising that the outcomes of co-productive processes go beyond what is traditionally understood as knowledge in a formal sense.

Context

The context of a science-policy practice is crucial for the questions of *how* and *where* stabilisation of the practice occurs. The context is where the materiality of a practice can be located, by enabling and constraining particular compositions and possibilities of the practice (Schatzki, 2010). Thus, applied to our case, context is vital to the question which science-policy model can be mobilised in practice. We subdivide the context of science-policy practices into its institutional aspects, policy context, and spatial configuration. With institutional aspects, we refer to the statutory status, formal mandates and formal procedures limiting individual practitioners' manoeuvrability. For instance, are there formal directives in place describing a research institute's degree of independence when deciding what work to perform? The policy context around which a science-policy practice operates is formed by characteristics such as the scale at which the policy discussion is relevant (e.g. local, national, global), and the political and public debates surrounding the issue targeted. For example, less politically volatile issues may require different science-policy arrangements than highly contentious issues (Hisschemöller and Hoppe, 1995; Pielke, 2007). Furthermore, science-policy practices are influenced by their spatial configuration, i.e., how the practice is arranged in space. Through its spatial configuration, a science-policy practice and its practitioners are presented with (or withheld of) particular affordances (Mahony, 2020). For instance, Palmer

et al. (2019) cite a government chief scientist using the layout of their offices to lurk at the elevator to 'spontaneously' interact with a minister. Furthermore, there may be expectations of how a useful science-policy practice is to be arranged spatially that can influence how models of science-policy practices are shaped and reproduced (Smit, 2021). Compared to repertoires and competencies, context is what is most stable across individual practitioners and enactments of the practice, including through country- or institution-specific epistemologies, styles, or cultures (Borie et al., 2021; Halffman, 2005; Jasanoff, 2005). Despite this stability, the ways in which practitioners describe observed or desired contextual factors are informative about how they think science-policy practices should be organised.

Methods

Empirical materials for this study were collected over a 2,5-year timespan (2019-2021) starting with me being hired at PBL to strengthen the relationship between PBL Netherlands Environmental Assessment Agency (hereafter: PBL) and the Dutch Ministry of Foreign Affairs' Directorate-General for International Cooperation (hereafter: MFA). PBL is a governmental research institute for environmental policy analysis that echoes many of the characteristics of science-policy boundary organisations elsewhere and in other domains (Bijker et al., 2009; Guston, 2001; Owens, 2015). Its official mission is to "improv[e] the quality of political and administrative decision-making" (PBL website, n.d.). PBL has a prominent position in Dutch policy debates, stemming from a combination of its expertise, its authoritative status as independent and scientific institute, and its arbitrating and stabilising function in a historically corporatist and consensus-driven political culture (Halffman, 2009). Earlier work on the PBL has examined the different roles it assumes and boundary work practices it engages in (Huitema and Turnhout, 2009; Pesch et al., 2012) and has shown that staff have different views on how to organise science-policy relations (Kunseler, 2016). The MoU between PBL and the MFA aims to contribute to strategic policy development and strengthening of the scientific basis of policy at the intersection of environment and international development. The PBL-MFA science-policy practice is thus situated in a specific policy context, but shares many other characteristics with environmental science-policy practices of the PBL and in the Netherlands more broadly. Concretely, the MoU provides funding for roughly ten PBL researchers to conduct research projects that aim to provide input for policymaking processes at the MFA. The MoU is thus the setting of a paradigmatic case study that allows us to gain a finer understanding of the practice of a science-policy arrangement (Flyvbjerg, 2006; Hitchings and Latham, 2021).

In addition to the fieldnotes and experiential knowledge obtained by being situated in this particular practice, we conducted 29 semi-structured interviews with PBL researchers (R1-11), policymakers at the MFA (P1-11) and policymakers at other ministries and other stakeholders (S1-7). These interviews served foremostly to explicitly explore questions around the way these individuals organised and participated in the MoU's knowledge production. Following Hitchings (2012), interviews are suitable for talking about people's practices, particularly when being open to ask the "seemingly obvious". Nonetheless, it could be challenging to dig deep enough and avoiding to "bore" the informant (Kuus, 2014), which can be related to a combination of the fact that these informants are all highly educated as well as that they know the interviewer is himself an active participant in the practice he is asking questions about. In addition to this epistemological objective, the interviews also served an ethical purpose. TM's position as direct colleague meant that ideas and interpretations of this science-policy arrangement inevitably developed organically and 'through the grapevine' as well. In such cases, a formal interview provides an opportunity to openly discuss and exchange such ideas and interpretations, acknowledging that transparency about the project is an important factor to foster the trust necessary to gain deeper insight (Harvey, 2010). Finally, and in a similar vein, TM presented preliminary results to the group of PBL colleagues on several occasions and discussed them with an MFA representative in the context of an externally mandated evaluation of the MoU.

These data were analysed in an iterative coding process, sensitised by literature on science-policy interactions and societal impact analysis, which proceeded in tandem with the development of the conceptual framework as laid out in the previous section. In our analysis, we focused on the ways in which the three elements and their characteristics are reflected in the way our informants describe the science-policy practice. The illustrative quotes provided were translated from Dutch to English by the authors.

Results

Our findings show that the repertoires invoked, competencies called on and context factors in the PBL-MFA science-policy practice, largely reflect the linear model. Despite this general predisposition, we have also observed that expectations about roles and views differ between researchers and policymakers. Researchers tend to expect that policymakers play a more active role to fulfil the joint ambition to produce usable knowledge than is currently the case. Conversely, policymakers have difficulty positioning themselves as anything other than passive recipients of knowledge, seeking knowledge that is readily applicable without attributing

themselves a role of significance in producing that knowledge. Our findings are in line with other recent work that finds the linear model to be rather persistent in practice (Karhunmaa, 2020; Kowalczewska and Behagel, 2019; Kunseler, 2016). However, the inclusion of policymakers' perspectives in our analysis contributes to understanding why this persistence exists. In the following subsections, we present in more detail how repertoires, competencies and contextual factors feature in our informants' discussion of the PBL-MFA science-policy practice. While we describe the three elements separately for analytical purposes, we emphasise that they are intertwined in constituting the science-policy practice.

Repertoires

Interviews with researchers contain characteristics that correspond to a predominantly linear model, emphasising elements from the supplying and bridging repertoires, with the co-productive model surfacing through characteristics of the facilitating repertoire in some instances. Many researchers seek an active relationship with the policymakers they see as prime beneficiaries of their work. In line with the bridging repertoire, some argue such an active relationship is required to articulate and define research questions: "We should put in a lot of time at the front to discuss with policymakers what they want to know, why, and how it will feature in their decision-making" (R3). It is also seen as beneficial to tailor presentations to the specific needs of the audience, by discussing a draft set of slides or outline with a contact person. Echoing the logic of appropriateness found in the bridging repertoire, one researcher highlights how he adapts his terminology to the diverse frames of reference used by his policymaker counterparts:

> "In focusing my work, I talk to several policymakers to get them on board as much as possible. With some, this means talking in terms of data – like remote sensing or other types of geo-information – whereas others are more interested in governance and civil society. You have to find out what they find interesting. […] The right term to use in different policy domains can be very specific, while I might think they link quite nicely to each other." (R8)

Nevertheless, in line with the facilitating repertoire, one researcher explicitly mentions trying to amplify a diversity of voices in her work, so as to facilitate the exchange of different views: "In my opinion, the story becomes much stronger if you give a voice to different stakeholders and get insights from different angles" (R7). To this end, she puts considerable effort into building a network not just within the policy community, but also with a range of non-governmental organisations who hold various forms of expertise relating to her research focus.

Yet, characteristics of a linear model dominate. Sometimes very explicitly, with researchers pointing to a boundary between knowledge production and decision-making that PBL is not permitted to cross:

> "The mission of PBL is to get good knowledge to the tables of decision-makers. Clear, objective knowledge. What the decision is, is not our impact. We must not confuse this, because then we are political actors, which we are not. For us, the word 'impact' stops at 'being heard'; if they use our documents in policy preparation, we have impact." (R5)

But the linear model recurs more implicitly as well. For instance, an active relationship with policymakers can also be seen as instrumental to a supplying repertoire, by providing opportunities to transfer knowledge through direct interaction: "I talk to my policy contact person about every four weeks. Sometimes I also attend the policy cluster meeting to present something. I think these are the moments you make an impact" (R11). Another even more subtle aspect that can be seen to reflect a linear model is the emphasis on scenario studies and integrated assessment modelling in PBL. Notwithstanding the value and contribution such scenario studies can make to policymaking, they are but one approach to anticipating the future (Geels et al., 2016; van Beek et al., 2020). As one researcher expresses, this approach operates from a logic of consequentiality that may not be as prominent with policymakers as is presumed:

> "Our target group of policy makers wants to know what the problem is, and what will happen if they do X. 'What will my world look like in 2050 in that case?' 'And what will my world look like if I do Y?' That way, you can adjust your budget accordingly. But: we think they operate like that, but do they really?" (R4)

These points echo a paradox in science advice, in which co-productive principles like humility and participation inform a science-policy practice founded on a linear model. While this paradox has been identified within PBL and elsewhere (Karhunmaa, 2020; Kunseler, 2016), few studies have explicitly coupled it to the question of how policymakers operate in science-policy practices.

The repertoires invoked by policymakers in the PBL-MFA MoU also mostly speak to the linear model. Several policymakers express an explicit desire for "science-based" policy (P2) or "credible and objective data on the basis of which to write a policy advice" (P3). In line with a wider societal call for evidence-based policy and similar terms (Parkhurst, 2016), such a

desire assumes a neat separation between science and politics exists, and that depoliticising discussions through the use of knowledge is desirable: "I think most civil servants have the feeling that there is sufficient decision-making in politics based on gut feelings, assumptions, worldviews and human ideals. What we call fact free politics" (P3). As a consequence, decisions that can be construed as "science-based" are idealised. A PBL-researcher describing this struggle in determining how far to push the conclusions in his work laughs that "the MFA often wants you to push it as far as possible, so they have less to decide. Or to have clearer recommendations, that is always nice too" (R9). And recalling an instance in which the science-policy practice was seen to work particularly well, one policymaker said:

> "A PBL-report should be used to sharpen and shape your policy. Last year, some colleagues of mine had a discussion with a group of PBL-researchers, on climate policy. They almost completely adopted from that what they were supposed to do in terms of policy. Such cases show that impact can arise at a certain point. I can see people adopting the PBL way of thinking there now." (P5)

The supplying repertoire is evident when asking policymakers to reflect on the niche they think PBL can fulfil for the MFA. Many express a desire for PBL to work on what they describe as agenda-setting, in which PBL signals trends that may be relevant to the MFA's activities. In a way that is, as one policymaker puts it: "independent and ahead of the troops" (P11). Implicitly or explicitly, such an agenda-setting function means that the role of policymakers in the science-policy arrangement is foremostly as a recipient of information. It paints a picture of knowledge as being an object, a product that can be obtained through a simple market transaction (cf. Faasse et al., 2020), rather than something that is embodied by individuals and has to be mobilised through their sense-making. As one external stakeholder highlights: "the MoU should work as a research agenda: 'what do we collaborate on'? But the MFA likes to commission research" (S5). Tellingly, the main alternative identified to this agenda-setting function is one that closely resembles commissioned contract research: "PBL signals trends. We shouldn't stuff PBL with assignments, except for when there is a specific question, because of the opportunity costs we would incur" (P8). In this perspective, PBL is not necessarily the only party having knowledge "on offer", but can be seen as one of several potential internal or external sources:

> "Policy, maybe we should just call it choices. You have to substantiate these choices, and that requires knowledge. Sometimes that knowledge is experience found within the apparatus, sometimes it comes from external parties." (P1)

While this policymaker's approach to obtaining knowledge to substantiate choices can be seen to follow the linear model, it is interesting to note that she highlights the potential for internal knowledge – policymakers' experience – as another potential source. Arguably, this hints at the blurred boundary between knowledge users and producers found in the facilitating repertoire. Even so, whether this broader view of relevant knowledge has consequences for the science-policy practice depends on what competencies practitioners are called on.

Competencies

The prominence of the linear model among policymakers also becomes clear from the difficulty encountered when asking them to elaborate on their own role in the science-policy practice. Our findings show that few policymakers perceive themselves as an active participant, let alone co-producer of knowledge, in a science-policy practice. The key science-policy competency that is widely stressed to be held by MFA policymakers is strongly aligned with the supplying repertoire: they are described as quick learners or generalists who are able to rapidly absorb knowledge. Their perceived core task is to ensure that Dutch development resources are spent in an acceptable manner. MFA policymakers are used to change their posting about every four years, which means they must be able to quickly get up to speed on a new dossier. Consequently, attention is directed towards ensuring that researchers deliver knowledge in a format that is easily digestible. One policymaker for instance pleas for short publications like two-pagers, arguing that "as a policymaker, you must have your network sorted, so that those two-pagers reach you. Then you read them and take them with you" (P11). This suggests that the most important competencies for policymakers relate to a linear model, in which the science-policy practice supports the transfer of knowledge to policymaking.

Some other policymakers describe their role in a slightly more active way as "supporting and coaching, to indicate roughly in what direction questions and answers might be found" (P2). A more practical description of that role is given by a policymaker from another ministry: "Ideally, I come over for a cup of coffee to talk through your activities. Then I can indicate what my view is of what the project is about, or should be about, and what I think the approach could be" (S1). These descriptions can be seen to match a bridging repertoire in which researchers need to know what questions need answering. Nonetheless, in the MFA the idea seems to be rather alien that this relationship could go beyond a straightforward back-and-forth, to jointly explore potential knowledge needs (an approach that still mostly resembles the competencies called for by a bridging repertoire), or to engage in a dialogue with mutual

understanding or other forms of more-than-knowledge as its outcome (which would benefit from co-productive competencies):

> "When I suggested to a colleague that we might ask [PBL] for a [PBL-MFA] dialogue, I was met with confused looks, saying '*is that even possible??*'. We have to focus much more on that, the dialogue, because then we understand each other much better than by just sending you requests for knowledge. I need to identify the topics where we have a semi-need for knowledge that we don't have articulated, and which we can talk about." (P1)

This quote also highlights another point, namely that many policymakers find it difficult to know what it is they want to know, in other words: they struggle to articulate their knowledge needs or demands. Both researchers and policymakers recognise that being able to ask the questions that can help policymaking is not a given for the MFA: "We cannot leave articulating the knowledge demand to the MFA alone, we don't have the substantive knowledge that that would require but we do see where things are happening in general." (P5). A researcher also notes the need for collaboration in defining research questions: "Policymakers don't have the answers ready, but often neither do they have the questions. That's not a problem per se, but does ask for collaboration to get to these questions" (R3). Importantly, these statements suggest that the onus to engage in a process of demand articulation lies primarily with PBL researchers. Demand articulation thus requires stage management: while it is not considered a problem for policymakers to communicate with researchers, there should be no room for doubt that the *actual* knowledge production takes place independently, at PBL.

The difficulties encountered with demand articulation also raise the question of what need for knowledge there is within the MFA in the first place. When prompted with this question, few informants are able to articulate this need other than it being an intrinsically desirable need. One policymaker contends this is a problematic stance:

> "Our policy field doesn't really have knowledge agendas or questions. Maybe there is no need for knowledge. Still, few people dare to say that there is enough knowledge. Everyone feels an intrinsic need for more knowledge, but it is difficult to determine where you want to go in terms of knowledge." (P6)

Other informants argue that authoritative knowledge is required to substantiate statements and claims in international diplomacy. In this view, a policymaker should ensure that "emotions" are kept separate from "substance" in the diplomatic process, with the former seen as

undesirable and to be limited as much as possible and the latter to be supplied by neutral, independent researchers. The role of the policymaker is thus to ensure that the diplomatic process is as much as possible about objective knowledge:

> "In negotiations, one part is about substance, and the other part is about emotions. The goal is to have the part about substance be as large as possible. So, if you can substantiate a certain ambition scientifically, your position becomes much stronger." (S2)

This ability to separate emotions from substance is founded on a strongly unidirectional view of science-policy relations and limits the scope for re-defining or re-interpreting policy problems and potential solutions with its accompanying norms of humility and pluralism. In this way, it draws strongly on linear rather than co-productive competencies.

Context

The competencies that informants see as required closely relate to the broader context of the science-policy practice. What is the role of knowledge in the policy domain the MFA focuses on? What does that require of each respective organisation? The same policymaker who problematised the view of knowledge as an intrinsic need suggests this view is related to the policy domain of international development. He claims it is possible to operate rather uninformedly in this domain, because complexity and indeterminacy are the default:

> "We are all deeply aware that our interventions are so steeped in complexity and unpredictability that the outcome can never be guaranteed anyway." (P6)

> "A large part of our work is inspired by realising that we do not know and understand everything." (P2)

By bringing up this complexity as a distinct feature of the MFA's policy domain these informants highlight the importance of the policy context to the science-policy practice. In this respect, there may be a difference between the MFA's policy domain of international development and the environmental policy domain PBL is used to operate in. The latter has been argued to often contain technocratic tendencies at the expense of normative debate (Biermann and Kim, 2020; Wesselink et al., 2013), at least in part stemming from the central role the natural sciences play in understanding environmental issues (Turnhout et al. 2019). Conversely, the policy domain of international development arguably has a history of normative debate (WRR, 2010), in which ideas of measurement and proof gained prominence more recently – as evidenced by for instance the awarding of the Nobel Memorial Prize in

Economics to Banerjee, Duflo and Kremer for their use of randomised controlled trials in development economics. Meanwhile, the Dutch MFA aims to increase the degree to which research feeds into its processes by employing a Chief Science Officer who is also a part-time professor (Koch, 2017). Such trends can be seen to create a policy context to the science-policy practice in which the importance ascribed to formal expertise is growing.

In line with this growing importance of formal expertise, the PBL-MFA MoU's objective to improve policymaking at the intersection between environment and international development can be seen to borrow from PBL's authoritative position in national environmental policymaking. This illustrates how institutional factors influence the science-policy practice, because this authoritative position is obtained through a combination of PBL's statutory status (there is a law dictating PBL's existence and mandate) and work on other environmental topics. Many researchers and policymakers highlight this position of PBL as a quintessential characteristic of the science-policy practice:

> "I am very enamoured of how PBL can operate as a knowledge supplier for us. […]. PBL in its position as independent research institute, with solid expertise, good access, and an international reputation. The models are validated and internationally renowned." (P5)

> "[Talking about a specific research project]. The MFA had a very polarised policy discussion internally on part of our climate strategy. To achieve a breakthrough, we needed an advice with sufficient authority. For that we sought a role for PBL comparable to its role in the national climate debate." (P2)

This leads various informants to point to the importance of visibility as an important factor in such an authoritative position. In some instances, the importance of visibility can be seen to be constructed as a precondition to develop a more collaborative relationship between PBL and the MFA, with one researcher describing the aims of their project to encompass "becoming a more natural partner to the MFA" (R11). In other instances, visibility seems to resemble brand awareness, in parallel with the idea that the MFA is primarily a consumer of externally produced knowledge. While such instances can be brought up with relatively little reflection, some researchers also more directly relate it to a question of institutional accountability, in which that which is most visible does not necessarily correspond to the most effective forms of knowledge production.

> "Beyond the individuals, you have to make sure that the ministry apparatus sees you at some point. 'Oh indeed, PBL'. The World Resources Institute [(another knowledge partner of the MFA)] has a high profile in the MFA. I notice that the PBL has a lower profile, and is less visible in the MFA. PBL could do more in terms of visibility, mightn't your director give a talk on the big themes, for instance?" (P5)

> "By being visible among other partners of the MFA, you try to ensure that people at the MFA are being told from different sides that what we do is useful." (R8)

> "Peer-reviewed publications are "handy" for your credibility. I think a combination of policy briefs and scientific publications is most effective. But as PBL, you want the occasional iconic publication as well; institutionally, you want to be able to showcase your work." (R1)

Another point that is widely mentioned and in which institutional and policy factors come together is the limited capacity in the MFA to engage in knowledge (co)production and mobilisation. Policymakers spend the majority of their time answering parliamentary questions, preparing for international summits, and operating the day-to-day requirements for the implementation of policy programmes. This leads to a lack of both the time and calmness required to think and reflect: "we are understaffed to really think strategically. People in government are too busy with the issues of the day. We have all these globally renowned advisory bodies with an awful lot of knowledge, but no time to do anything with it" (P9). This can also be seen to limit the degree to which co-productive competencies are called upon. This capacity issue is compounded by the individualistic learning culture at the MFA. There are few institutional mechanisms to absorb knowledge into the wider organisation, leaving the degree of engagement with knowledge largely to the interests and priorities of individual policymakers.

Regarding the final contextual factor, the spatial configuration of the science-policy practice, it is important to highlight the high proximity between PBL and the MFA in multiple ways (cf. Boschma, 2005). Several policymakers point out that PBL and its researchers are relatively approachable. PBL is also part of government – and thus seen to pursue similar goals – and knows the Dutch policy context better than most other knowledge institutes the MFA has a relationship with. This also lowers the barrier to request PBL to give a presentation or contribute to a meeting, although as mentioned this materialises irregularly. In fact, PBL moved to The Hague in 2016 to be located closer to the administrative centre, and the respective offices of PBL and the MFA are only a ten-minute walk apart – although the significance of

spatial distance has vanished over the past two years due to working from home requirements in response to Covid-19. Furthermore, PBL is regularly invited to contribute to inter-ministerial policymaking processes in which the MFA participates, creating encounters outside of the research projects defined within the MoU. Such encounters can create spaces of engagement where ideas can be exchanged and mobilised in a dialogue without necessarily seeking to produce knowledge that is codified – akin to the more-than-knowledge that is co-produced in the facilitating repertoire. At the same time, such encounters raise challenges for PBL in terms of being seen to conform to traditional expectations around objectivity, authority and independence. Precisely because these expectations are held by both researchers and policymakers, navigating these challenges requires co-productive competencies from all practitioners (cf. Kunseler and Tuinstra, 2017).

Discussion

Our findings suggest that the linear model of science-policy practices remains influential in the PBL-MFA science-policy practice. The repertoires invoked by practitioners largely reinforce a separation between facts and values, with knowledge being approached as a product to be obtained by the MFA and for which the science-policy interface provides a suitable point of transfer. The respective competencies for PBL and MFA practitioners continue this separation by the division of labour they imply, in which PBL produces knowledge for the MFA to use. In terms of the context, ongoing developments in line with the rhetoric of evidence-based policy suggest a search for knowledge as an objective truth rather than knowledge about value-based choices. This results in an emphasis on the authority and visibility of partners able to provide such knowledge.

At the same time, some points of entry for a more co-productive science-policy practice can also be discerned. Some researchers perceive the value of their work also in terms of making a diversity of perspectives visible by amplifying the expertise of others. One policymaker tries to spur colleagues to feel free to approach the PBL with yet-to-be-defined questions, in order to achieve a mutual understanding and engage in an iterative process of knowledge production. And the fact that PBL and the MFA are mutually approachable means the barriers for potential collaboration are low. Moreover, the structure of the relationship as a recurring MoU means that regular opportunities for change and innovation exist, because lessons learned and their respective requirements from both parties can be adopted in the renewal of the MoU.

However, what seems to be missing to turn these points of entry into a concrete shift to more co-productive modes of interaction is an imaginary of what an effective science-policy practice might look like if not linear. Crucially, the combination of individual, intersubjective and institutional factors in social practice theory shows that this imaginary is something that is not just missing at the level of individual practitioners – as if they themselves simply lack creativity or imagination – but is absent throughout the science-policy practice as distinct object of analysis. Indeed, the interplay between the elements of the practice imposes barriers for co-productive practices to emerge. Hence, the obduracy in the science-policy practice does not only stem from a context that favours the linear model, but also from an absence of co-productive imaginaries of the relation between knowledge production and use, including the contributions individual practitioners can make herein. For instance, while the limited capacity at the MFA clearly imposes a practical constraint to the potential intensity of interaction, there is little reason to assume that more capacity would result in changing science-policy practice, if this capacity is not also accompanied by an institutional culture that approaches competencies more symmetrically. Such a culture would recognise the need for policymakers to be able to engage in co-productive science-policy practices themselves. In other words, spur them to e.g. co-articulate research questions, contribute their expertise (and see it as worth contributing), and imagine forms of knowledge production beyond calling for shorter written reports. Instead, the separation between science and policy continues in descriptions in which researchers are expected to produce relevant research, and policymakers to quickly absorb existing knowledge and turn value-laden policy debates into science-based ones. Similarly, the researcher who aims to amplify a diversity of voices in her work faces an uphill battle in a context that prefers expertise that is ostensibly objective and independent. In this light, it is remarkable that the policy context of international development, with a history of normative debate, does not seem to prompt policymakers to invoke characteristics of the facilitating repertoire, considering its suitability for navigating contested issues. In sum, this means that despite the explicit attempts in the MoU to strengthen the PBL-MFA relationship, the science-policy practice shows little indication of shifting to a more co-productive model.

Common but differentiated responsibilities

In part the absence of a co-productive imaginary is due to the fact that while co-production has become a common ideal in local participatory processes, it has not yet become a convincing and actionable alternative to the linear model in science advice and science-policy interfaces more generally. In that domain, dominant imaginaries increasingly emphasise

interaction, as our findings also demonstrate, but do not fundamentally deviate from powerful assumptions of the linear model about objectivity, independence, and the need and possibility of separating facts and values. We believe that such a lack of alternative imaginaries stems, at least partly, from a wider shortcoming in science-policy theory and praxis, in which the focus tends to remain on what is required from the science side to enhance effectiveness while ignoring the policy part of the science-policy conjunction. While we do not think it is possible to provide a ready-made solution to this issue, an alternative imaginary of science-policy practices should start from the question of what different responsibilities the various actors involved have in achieving an effective practice. The one-sided focus on the science part side-lines this question and as a result, neglects to explicate what roles might be played by policymakers engaging in science-policy practices, what this implies in terms of competencies required, as well as how contextual factors and researchers themselves could stimulate this broader responsibility. After all, assuming that the science-policy practice is part of a wider democratic institutional arrangement, it should be at the core of policymakers' tasks to consider the question of "what is" and "what might be" in relation to "what ought to be". And ironically, the ostensible neat separation between science and politics actually leads to conflate "is" and "ought", as a wide body of research in STS and other disciplines has discussed (Brown, 2015; Forsyth, 2019; Jasanoff, 2004; Turnhout, 2018). This hidden conflation makes it possible for policymakers to offload their responsibility: after all, how can they be kept accountable for the consequences of decisions if they were merely doing what science tells them is best. Indeed, such a discrepancy in responsibilities means that science and knowledge production will be blamed for decisions that are considered unfavourable or seen to fail, eventually risking an equally undesirable overall discrediting of expertise (Hulme et al., 2020; Jasanoff and Simmet, 2017).

An alternative imaginary in which responsibilities are more legitimately shared requires science-policy practices to accommodate the political dimensions and implications of science-policy practices head-on. This involves explicating the politics embedded in and foregrounded by knowledge production and resisting policymakers offloading their responsibility onto researchers (Pielke, 2007; Stirling, 2010). Because knowledge production is always partial and uncertain, political and normative judgement is required to determine what course of action is most desirable (Hulme et al., 2020). This means it is important to "open up" knowledge production and present a diversity of explicitly value-laden decision-making options (Castree et al., 2020; Stirling, 2008). In other words, science-policy practices must make evident what political choices need to be made, what options might be available, and what

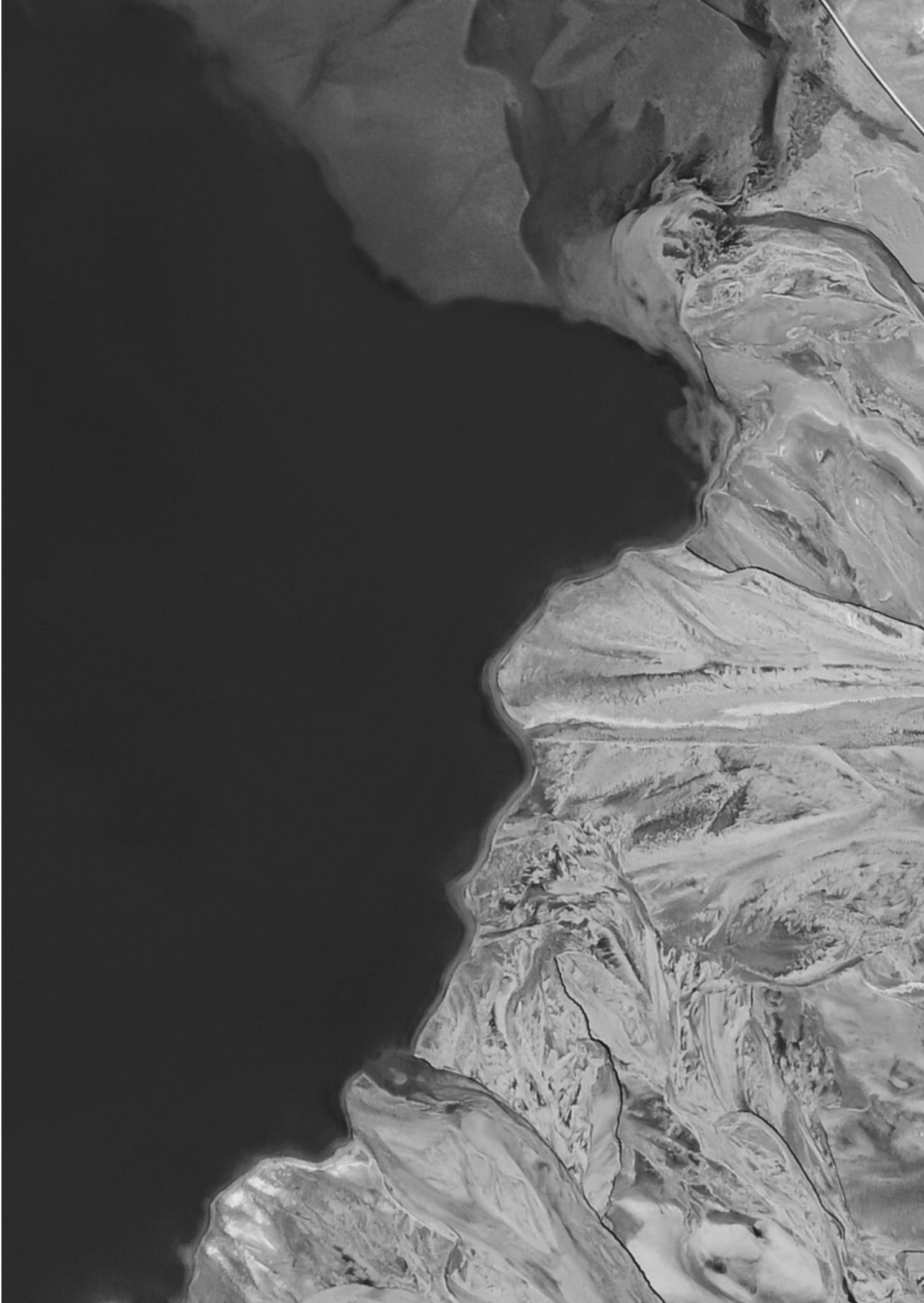
considerations could come into play in choosing what options are feasible and desirable. This combination is crucial because in a plural society multiple possible courses of action exist and preferences of actors differ accordingly, while it is "simultaneously necessary, inevitable, and desirable" to make a choice between them (Brown, 2015; Mouffe, 2000; Stirling, 2008, p. 284). A science-policy practice that employs this approach will activate the responsibility of policymakers in this process and spur them to play their part as co-producer of usable knowledge by co-articulating research questions and contributing their own expertise and that of their networks. Although it is unlikely that policymakers can play this part without allocating some additional capacity, our suggestion by no means implies a fully shared workload between all practitioners. Instead, we suggest to strive for equal levels of commitment, but seek differentiated responsibilities and tasks. For policymakers, the crucial shift lies in realising that they have a role as co-producer *throughout* the knowledge production process. For researchers, this shift will more clearly highlight that each knowledge practice has its limits, thereby leading to humility with regard to claims made and a continued curiosity for potential unanticipated negative effects of science and knowledge (Turnhout et al., 2019).

We contend that such an approach will not only benefit the legitimacy of science-policy practices but will indeed also boost their effectiveness. The downsides of current ways of working are clear. The consequence of the focus on depoliticised research continues to construct science as an obligatory passage point, from which a unified voice and stamp of approval is to be obtained before any action can proceed. This leads to an "over-dependence on fact-finding" (Jasanoff, 2007, p. 33) that slows down much needed change and action. Not only is this harmful for those hurt most by the status quo, but it also plays into the hands of those who have a vested interest in the status quo since these actors can use the reliance on science to forestall change by sowing doubt and by questioning the existence of consensus (Pearce et al., 2018). Alternative imaginaries of science-policy practices are needed to catalyse productive and generative discussions on how to move towards desirable futures. Specifically, an approach that foregrounds the political can embed an ethos of care in science-policy practices, which requires "knowledge and curiosity regarding the needs of an 'other'" (Puig de la Bellacasa, 2011, p. 98). Recognising that the transformations required to address contemporary socio-ecological challenges are inherently political (Scoones et al., 2020), such an ethos is much-needed in order to develop governance solutions that do justice to these various needs.

Conclusion

This chapter departed from the question of why linear science-policy practices remain lingering. We have analysed the PBL-MFA relationship, showing that even though improvements in this science-policy interface are aspired, this has not yet led to a significant shift towards a co-productive model. Rather, we highlight how the linear model is kept in place by neglecting to imagine possible improvements in science-policy practices in a symmetrical way that considers both scientific and policy actors. In other words, a broader institutional outlook on what democratic science-policy practices might look like is still missing. This results in an asymmetrical emphasis on the roles and activities of scientists which detracts from the potential legitimacy and effectiveness of science-policy relations. We have argued that the alignment of responsibilities can be improved if science-policy practices explicate the politics of knowledge. While ample literature discusses how such a politicising approach can benefit both the effectiveness and legitimacy of science-policy arrangements, it often remains unclear how this might be operationalised in practice. To this end, we think valuable insights could be gained from studies considering how established co-productive science-policy arrangements distribute responsibilities among their participants. Social practice theory provides a useful lens to analysing such arrangements symmetrically.

We close by briefly remarking on the relevance of our analysis for the broader public debate on science-policy-society relations. There, in response to the pressure of outright science denialism, we increasingly see naïve calls being made that reinforce the linear model, asking policymakers to 'listen to the science'. However, while such calls underline the important responsibility policymakers have, we feel they are asking the wrong question, because it gives policymakers an opportunity to hide behind science (Rovelli, 2021). This regressive development makes the task of developing alternatives all the more urgent; alternatives in which policymakers are both responsible and accountable for the choices they make in, and the political implications that result from, programming, funding, creating, and using knowledge and evidence for decision-making.



Chapter 3.
Effectively empowering: a different look at bolstering the effectiveness of global environmental assessments

Published as:

Maas, Timo Y., Jasper Montana, Sandra van der Hel, Martin Kowarsch, Willemijn Tuinstra, Machteld Schoolenberg, Martin Mahony, Paul L. Lucas, Marcel Kok, Jan Bakkes, and Esther Turnhout. 2021. "Effectively Empowering: A Different Look at Bolstering the Effectiveness of Global Environmental Assessments." *Environmental Science & Policy* 123:210–19. doi: 10.1016/j.envsci.2021.05.024.

Effectively empowering: a different look at bolstering the effectiveness of global environmental assessments

Introduction

Global Environmental Assessments (GEAs) play a prominent role in global environmental governance (Biermann, 2002; Cash et al., 2003; Rothman et al., 2009; van der Hel and Biermann, 2017). GEAs assemble and synthesise the state-of-the-art of fragmented scientific knowledge to provide insight and add meaning to policy-relevant questions (Jabbour and Flachsland, 2017; Mitchell et al., 2006). In this way, they ultimately aim to improve socio-environmental outcomes, even if their aim to be 'policy relevant, not prescriptive' means they ostensibly strive to be agnostic to exactly what the best socio-environmental outcome or the best way to achieve that outcome might be (Rothman et al., 2009; Turnhout et al., 2016; van der Hel, 2018). GEAs are commonly institutionalised processes with specific practices and governance structures, such as the Intergovernmental Panel on Climate Change (IPCC) or the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Such assessments are generally considered to have significantly contributed to environmental decision-making, e.g. the IPCC to the Paris Climate Agreement, the fifth Global Environment Outlook to the 2030 Agenda for Sustainable Development, and IPBES' Global Assessment to currently ongoing negotiations in the Convention on Biological Diversity (Carraro et al., 2015; Gustafsson, 2019; Kowarsch et al., 2017b; Kowarsch and Jabbour, 2017; Oppenheimer et al., 2019). Despite this wide acknowledgement of their importance, there is persistent debate on the 'effectiveness', 'impact', or 'influence' of GEAs (Alcamo, 2017; Borie et al., 2020; Farrell and Jäger, 2006; Livingston et al., 2018; Mitchell et al., 2006; Riousset et al., 2017; Sarkki et al., 2019). While this is often seen as a matter of uptake into policy (i.e. the implementation of a GEA's key messages into policy measures), commentators have also argued the effectiveness of GEAs is being limited because of a lack of acknowledgement of the political role of knowledge (Beck et al., 2014; Turnhout et al., 2016) and for seeking consensus outcomes that are proclaimed to be value-free (Scoones, 2009; van der Sluijs et al., 2010; Castree et al., 2020). These limitations are difficult to overcome because they are embedded

in the institutional structures of assessments, which reflect deeply held beliefs about what constitutes relevant knowledge and how science and policy should relate (Diaz-Reviriego et al., 2019; Montana, 2020; Lahsen and Turnhout, 2021).

These debates have played out in GEAs in various ways, ranging from the development of principles to guide assessment processes (IPBES, 2016a; Pintér et al., 2012), instituting a task force on the future of an assessment body (Thoni and Livingston, 2019; UNEP, 2019), to the way the design of IPBES builds on lessons learned in the IPCC (Montana, 2020). Much scholarship on the effectiveness of GEAs implicitly assumes their influence arises in well-defined settings of decision-making, such as in national legislatures or multilateral negotiations. However, scholarship has shown that the influence on decision-making of expertise from GEAs and other expert bodies can take different forms. A long-term study of the Royal Commission on Environmental Pollution in the UK, for example, found the influence of this national-level expert body ranged from rapid adoption of recommendations to diffuse 'atmospheric' influence that is impossible to tease out from other sources (Owens, 2012). This picture is further complicated when we consider that GEAs engage with a heterogeneous global audience, whose cultures and traditions of decision-making can vary widely (Miller, 2007). Indeed, a comparative study of GEAs found that their impact might be best understood as shaping policy discourse, whereby GEAs contribute to policy learning and scientific literacy (Riousset et al., 2017). It is therefore pertinent to look for alternative ways of considering effectiveness that go beyond direct transfer to policy objectives in familiar settings like international conventions or through so-called national focal points liaising between assessments and national governments, and to take account of the way that GEAs may also be contributing to a process of enabling diverse actors to enact their own forms of agency in the decision-making settings that matter most to them (following what Scoones et al. (2020) have dubbed "enabling approaches" to transformation).

This chapter provides such an alternative understanding of the effectiveness of GEAs, by considering GEAs as processes able to empower diverse actors – e.g. in national and local government, civil society, the private sector and indigenous communities – to act towards socio-environmental objectives. Consequently, this means that GEAs can increase their effectiveness by attending more explicitly to who they empower and how. At the same time, this understanding foregrounds normative and political questions about what effectiveness is desirable and which actors and whose actions GEAs support. We provide three examples of how such an understanding of the effectiveness of GEAs can be operationalised in different phases

of GEA production and use. We conclude by discussing the implications of fostering the empowerment function for the design and execution of assessments.

Efforts to improve effectiveness

Efforts to bolster GEA effectiveness can be characterised as following one of three strategies, both in GEA practice and in the literature on GEAs, which we label solution-orientation, participation, and contextualisation. Here, we discuss these three strategies, as well as how effectiveness stems from more than the assessment reports themselves.

Solution-orientation

In the first strategy to bolster effectiveness, there is a changing emphasis towards solution-oriented assessments (Kowarsch and Jabbour, 2017). Whereas past assessments often primarily focused on problem definitions and the 'status and trends' of environmental issues relative to potential goals, recent assessments complement this focus with significant attention to assessing and presenting different solution pathways and possible policies by which to meet globally agreed goals and targets (Kowarsch et al., 2017b; van Vuuren et al., 2012). This strategy can be seen as linked to an evolving environmental governance context moving from agenda- and target-setting towards policy formulation, implementation and evaluation (Jabbour and Flachsland, 2017). Yet, this strategy may be hindered by the way assessments commonly operationalise the concept of consensus. Consensus in a GEA can contribute to its effectiveness, particularly in relation to signalling environmental problems, or when approached in the form of 'meta-consensus', indicating recognition that different legitimate positions regarding values, beliefs, and policy options exist (Dryzek and Niemeyer, 2006). However, the approach to consensus in GEAs becomes more problematic when it comes to solutions since it is seemingly predicated on the idea that policy action follows from equivocal and objective scientific input on what range of solutions is available. This can be counterproductive because it results in GEAs steering clear of the normative dimensions these solutions entail (van der Sluijs et al., 2010; Edenhofer and Kowarsch, 2015; Castree et al., 2020). GEAs thereby risk closing down political debate prematurely, instead of contributing to moving that debate forward (Pearce et al., 2017; Turnhout et al., 2020).

Participation

In the second strategy to bolster effectiveness, many GEAs attempt to increase the diversity of experts included by focusing on participation. Attaining diversity in participating experts is

seen as important for the acceptance of the assessment by different states (Garard and Kowarsch, 2017) as well as for creating a 'balance of bias' that is seen to contribute to the assessment's objectivity (Oppenheimer et al., 2019). Furthermore, increased diversity is seen to contribute additional expertise required, which links to the strategy of solution-orientation. Yet, GEAs have historically struggled to include a diverse array of experts (Ho-Lem et al., 2011; Timpte et al., 2018; Yamineva, 2017). Shifting the emphasis towards solutions means that assessments increasingly discuss socio-economic and political dynamics, for which in turn they seek a greater contribution of social scientific expertise (e.g. Stenseke and Larigauderie, 2018). Moreover, there is growing acknowledgement of the possible contribution of indigenous and local knowledge to GEAs, for which IPBES is widely cited as a front-runner by having adopted specific procedures to this end (Montana and Borie, 2016). Nonetheless, the degree to which the strategy of participation has led to greater diversity is limited, including because of the powerful position of member states (Díaz-Reviriego et al., 2019), an instrumentalist operationalisation that employs strict rules to balance involvement of different experts (Garard and Kowarsch, 2017; Montana, 2017) and the persistence of principles of scientific autonomy and consensus (Esguerra and van der Hel, 2021). The inherently global orientation of the problem framing and preconceived indicator frameworks of GEAs do not necessarily match with e.g. indigenous and local knowledge frames. Adapting existing procedures to facilitate the integration of alternative forms of knowledge turns out to be a challenge in practice. This limits the extent to which a diversity of knowledge is actually reflected in GEAs and their messages.

Contextualisation

In the third strategy to bolster effectiveness, GEAs focus on contextualisation by attempting to connect to national and local contexts through regional reports (e.g. the *Global Environment Outlook*, *the IPBES Regional assessments*, *Millennium Ecosystem Assessment*) or through reports targeting specific types of policymakers, e.g. at the local and regional level (e.g. within *The Economics of Ecosystems and Biodiversity* and in a planned IPCC Special Report on Cities) or in business (in an upcoming IPBES report on Business and Biodiversity). These attempts can be seen to respond to earlier critiques pointing to the difficulty of making the globalised knowledge GEAs typically develop useful in local or specific policy contexts (Hulme, 2010; Jasanoff and Martello, 2004; Turnhout et al., 2016). Yet, in practice, the ability of this strategy to actually improve localised decision-making is often hampered by the fact that these attempts tend to remain either a method to obtain staggered input to a global synthesis report or a spin-off, rather than a fully-fledged assessment itself. Ultimately, GEAs tend to be poorly

connected to local and national ecosystems of science for policy which might otherwise be well-positioned to mobilise an assessment (Görg et al., 2016).

Effectiveness beyond assessment reports

These three strategies reflect a rising interest in the effectiveness of GEAs and an increasing recognition that this effectiveness is not just a matter of improving their end-products: the assessment reports. Even if the successful achievement of these strategies still faces limitations in practice, they highlight the equal importance of reflecting on and improving the practices, processes and institutions that shape assessments (Bakkes et al., 2019; Farrell et al., 2001; Jabbour and Flachsland, 2017). Going beyond assessment reports in thinking about the effectiveness of GEAs necessitates recognition that GEAs involve a swathe of actors that contribute to their work, from governmental representatives to chapter scientists. GEAs are typically large networks of actors, from both science and policy communities, which collectively constitute the 'macro-actor' of each GEA (cf. Callon and Latour, 1981). These complex networks are crucial to the authority of GEAs and the circulation of their outcomes (Castán Broto and Bulkeley, 2018; Montana, 2019).

This realisation holds the key for the further improvement of the effectiveness of GEAs and for letting the three strategies come to fruition. Rather than only focusing on enhancing the authority of assessments by strengthening the credibility and validity of the reports, improving the effectiveness of GEAs can also focus on the way in which assessment processes are able to catalyse the generation of meaning within the networks and actors involved (Dewulf et al., 2020; Montana, 2020). Here, meaning refers to the ability "to construct a comprehensive, grounded and deliberative understanding" of environmental issues (Montana, 2020, p. 245). With this emphasis on meaning, we intend to go beyond more established approaches to improving GEAs which have tended to end up being used to reduce the question of effectiveness to procedural 'checkboxes' to tick on criteria like relevance, credibility, and legitimacy (Cash et al., 2003; Farrell and Jäger, 2006; Owens, 2015; van der Hel and Biermann, 2017), neglecting the many different ways through which GEAs can contribute to socio-environmental outcomes. Such a perspective on effectiveness should put the questions of what effectiveness is desirable and whose actions GEAs support and catalyse centre stage. Indeed, both expertise itself and the organisational logics that guide expert bodies, including GEAs, reflect and are shaped by "beliefs and values about the world [they are] seeking to describe" (Mahony and Hulme, 2018, p. 16) while actively shaping that world in the process (Jasanoff, 2004). This

means expertise and expert bodies produce political effects and thus necessitates reflection on who is empowered by the production of this expertise (Turnhout et al., 2019).

Global environmental assessments as empowering processes

For GEAs to harness their potential to contribute towards socio-environmental objectives, they need to consider how they can empower actors and stakeholders in policy and society. We recognise that the concept of empowerment has a wide variety of uses and interpretations in different disciplines including development studies, feminist studies, or transition studies (Avelino and Wittmayer, 2016; Batliwala, 2007; Cornwall and Brock, 2005; Smith and Raven, 2012). These interpretations range between fairly instrumental conceptions of empowerment that tend to focus on the building of actors' capacities to achieve pre-defined outcomes and objectives, and more radical and explicitly political notions of empowerment that prioritise the redistribution of power and the creation of autonomy and self-determination. In this chapter, we take the latter approach out of a recognition of the political character of GEAs and their potential to catalyse diverse political actions. In this way, and building on other work in science and technology studies, we take empowerment to denote the political agency that arises when actors draw on the representative power of the GEA-network in interactions with other actors (Callon and Law, 2004; Latour, 2005). Because this definition centres on interactions, empowerment works bi-directionally, but also requires the opportunity of interaction to be present.

The way GEA processes are organised favours empowerment of certain actors rather than others. An obvious example concerns the way summaries for policymakers are negotiated: including government representatives but not civil society or industry organisations. More subtly, institutionalised problem frames may exclude certain actors from benefitting from the assessment by inhibiting them from perceiving the assessment as relevant to their own concerns and actions (Beck, 2019). For example, a framing of climate change as a global commons problem to be solved by global collective action limits the scope for possible solutions found at a more local or regional level (Hulme, 2015).

After all, it has long been recognised that environmental governance, that which GEAs are intended to inform and support, is not solely conducted through state-centric modes but rather is a polycentric and distributed affair (Ostrom, 2010). Numerous kinds of actors, including sub-national governments, cities, civil society, and private corporations, at all kinds of

levels (e.g. local, regional, transnational) are involved in environmental decision-making and are governing themselves through private governance arrangements (Bevir, 2010; Burch et al., 2019; Hajer et al., 2015). Their actions shape the same socio-environmental outcomes that GEAs also ultimately aim to affect. However, whereas we can get a general impression of the role GEAs play in the multilateral system, this is much more difficult – if not outright impossible – for the full spectrum of governance beyond the state. Nonetheless, it goes without saying that the multilateral orientation in the design of GEAs has consequences for empowerment in other parts of the environmental governance landscape.

To strengthen their effectiveness, GEAs need to empower and be relevant and actionable for a broader part of the environmental governance landscape than the multilateral system alone (Beck and Mahony, 2018). Rather than simply advancing a global longue-durée perspective on environmental issues (Jasanoff, 2010), they arguably need to more meaningfully connect with the scales and temporalities of existing social and political institutions. A recurrent issue here is the degree to which GEAs can be inclusive and accommodate different problem and solution frames as fundamental enablers of the empowerment of a wide variety of actors.

There can be good reasons to create more opportunities for certain forms of empowerment than for others. Since it is impossible to actively facilitate 'all' forms of empowerment, assessment procedures are inevitably compromises between how different actors in a GEA network expect them to help meet their goals successfully (Alcamo, 2017). The challenge GEAs face is thus not to empower all actors equally, but rather to consider who and what they empower, and with what legitimacy. We contend that explicit attention to these questions will yield opportunities to broaden empowerment and thereby lead to effectiveness beyond a mere focus on strengthening the authority of the reports. In this way, this approach fosters a reflexive attitude to effectiveness, i.e. one which defines effectiveness of the GEA in relation to which actors are being enabled "to take action on their own behalf" (Scoones et al., 2020).

Identifying empowerment in and through GEAs

Approaching GEA effectiveness through the lens of empowerment opens up a way of evaluating their performance by providing plausible narratives of empowerment which are able to accommodate 'atmospheric' influence rather than striving to causally link GEAs to specific impacts (cf. Owens, 2012; van Wessel, 2018). In this way, it is possible to illustrate how GEAs are already realising empowerment in different ways in practice. This section provides a

number of examples in which empowerment takes place, summarised in Table 3, for which we distinguish three phases of GEAs: the scoping phase, the production phase, and the use phase. We intend these phases to be a heuristic that is recognisable to GEA-practitioners, so as to highlight the potential for empowerment found throughout the GEA-process.

Phase	Examples of empowerment	Who is empowered	How does the GEA process empower?
Scoping phase	IPCC: 1.5°C and the small island developing states	Small-island development states	Supports scientific & political discursive shift to 1.5°C, instead of focus on 2°C
Production phase	IPBES: validation of indigenous and local knowledge (ILK), social sciences, and humanities (SSH)	Diverse knowledge holders and their contributions to environmental governance	Different types of knowledge are seen as relevant to protecting biodiversity
	IPCC: urban climate governance	Decision makers at urban scale	Developing knowledge that is meaningful at the urban scale supports climate action
Use phase	IPCC: Greta Thunberg and Dutch NGO Urgenda	Advocacy actors	Actors use an assessment report to build a case for their advocacy work
	Global Environment Outlook (GEO): local and regional spin-offs	Decision makers at local and regional scales	Building local and regional capacity by using GEO process as a model for local environmental assessments

***Table 3**. Examples of empowerment in different phases*

First, the **scoping phase**, which determines the questions a particular assessment process is asked to answer. In or at the conclusion of this phase, experts holding relevant knowledge to these questions are selected to contribute to the assessment process. This phase therefore also importantly involves considerations over which expertise is considered relevant. Furthermore, as part of the scoping phase of many GEA-bodies, draft tables of contents and outlines of the report are created, and particular requests may be made for certain sources of information to be included. An example of how empowerment can function through the scoping phase is the Paris Climate Agreement's request to the IPCC to produce a report on 1.5 degrees of warming. This request can be seen as part of wider and longer-term advocacy by small-island developing states (SIDS) and other actors to reframe the discussion on 'maximum acceptable global warming' away from the previously-dominant 2-degree target (Bjermeland, n.d.; Livingston and Rummukainen, 2020; Randalls, 2010). While SIDS are of course part of the multilateral system, they arguably have limited influence in it. As a result, the IPCC's acceptance to explicitly examine the difference between 1.5 and 2 degrees of warming has helped to empower SIDS and their position in the political discussion, by leveraging the network of

scientists and policymakers the IPCC is composed of to engage with the different target in political discussions, as well as increase scientific research engaging specifically with a 1.5-degree target (Livingston and Rummukainen, 2020). Empowerment thus works in two directions, by strengthening the position of a relatively marginal group of actors and by stimulating a shift in the knowledge base of the GEA.

Second, during the **production phase**, the main assessment process takes place. Contributors to the assessment synthesise the materials relevant to answer the questions as defined in the scoping phase and a Summary for Policymakers is usually created, in some cases involving governments negotiating its contents with the authors of the underlying report. An example of empowerment in this phase is how the IPBES' conceptual framework validates different knowledge systems for legitimate use in its assessments (Borie and Hulme, 2015; Stenseke and Larigauderie, 2018). Recognising that indigenous and local knowledge, as well as the social sciences and humanities, have important contributions alongside the natural sciences can empower local and context-specific actions (Turnhout et al., 2012). Another example is the IPCC's decision to produce a Special Report on Climate Change and Cities in its 7th Assessment Cycle at the request of various city networks, potentially empowering urban decision-makers in climate change-related actions (IPCC, 2016; ISOCARP, 2016). In both these examples, diverse forms of knowledge and actors are acknowledged to be able to make a relevant contribution to environmental governance by interacting with GEA processes – including by actors being empowered to make the knowledge GEAs produce more relevant to themselves.

Third, the **use phase**. This includes the assessment report and its summary(s), as well as spin-off products and communication output like press releases. Whereas in the scoping and production phases the GEA process is crucial for empowerment, in this final phase the written output of the assessment can also play an important role in facilitating empowerment (cf. Weisser, 2014). To some extent, these examples echo the traditional approach to effectiveness as centring on a GEA's authority and also exemplify how it can matter that GEAs establish a form of consensus. The point here however is to illustrate how actors not involved with the GEA process are nonetheless able to enact agency by interacting with it. For instance, we can think of how Greta Thunberg arguably won her status as poster child for progressive climate politics in part through statements that the world should "listen to the scientists" at prominent forums such as the United Nations General Assembly and World Economic Forum, and submitting the IPCC Special Report on 1.5 degrees as her testimony in a United States congressional hearing (Milman and Smith, 2019). Also the Dutch NGO Urgenda can be seen to have been empowered by the IPCC's reports. In a landmark court case in the Netherlands, the

Supreme Court ruled in favour of Urgenda, ordering the Dutch government to increase climate action. In their ruling, the Court adopted part of the NGO's argumentation based on the IPCC's 4th and 5th assessment reports (Nollkaemper and Burgers, 2020). While neither Thunberg's status nor Urgenda's victory can be fully *attributed* to the IPCC, it should certainly be seen to have *contributed* to both cases, i.e. both examples would have been difficult to imagine *without* the IPCC. This highlights that empowerment is not reducible to a transfer of power but arises in the interaction. A third and rather different example of empowerment in the use phase, is how particularly during the late 1990s and early 2000s, UNEP's Global Environment Outlook is described to have inspired hundreds of local and regional 'spin-off' reports throughout the Global South (Bakkes et al., 2019), suggesting its system of environmental assessment empowered capacity building for environmental policy in many places and settings. This example reiterates that empowerment includes highly diffuse forms of influence, in which socio-environmental outcomes depend on the way diverse actors enact their own agency (cf. Callison, 2014).

The examples we include here are obviously not exhaustive but serve to clarify how empowerment by GEAs takes place when actors draw on the GEA-network in interactions with other actors. Certainly, empowerment can also occur across different phases and assessments. For example, through creating experts that can bring their experience with past assessments to bear in new ones or use it to engage in activities like advising governments or testifying in parliamentary hearings (Borie et al., 2020; Gustafsson, 2021). We hope examples like these stimulate reflection on the opportunities offered by taking an empowerment approach to GEA effectiveness. In this, we also identify a task for analysts of GEAs to go beyond what goes on inside the Panels and their processes, and also follow GEAs out into the world. In what places are assessments mobilised other than well-studied multilateral environmental negotiations? How do their insights become meaningful in these contexts? Can more be said about who they empower and how? And how does empowerment in one phase affect the potential for empowerment in another phase or element of a GEA?

As already noted in the previous section, the way an assessment process is organised can favour empowerment of certain actors rather than others. For instance, since national governments commonly hold formal decision-making power in many GEAs (Díaz-Reviriego et al., 2019; Esguerra et al., 2017; Thoni and Livingston, 2019; Yamineva, 2017), the ability of other actors to influence the assessment in directions that may empower themselves is limited. So while in the scoping phase example, the fact that small-island states are sovereign states can be seen to have helped the pursuit of a 1.5-degree report, the examples from the production

phase were already more dependent on 'benevolence' for potential contributions to be acknowledged. In the use phase, empowerment relates closely to the degree to which a diverse range of actors perceives the assessment as relevant to them and is able to draw on it. While GEA bodies may play a smaller role here, assessments can pro-actively facilitate such processes for non-traditional audiences through tailored communication outputs and by supporting meaningful contextualisation.

Crucially, the examples above illustrate that empowerment is never neutral. They stimulate reflection on the effectiveness of GEAs as relating to who is empowered. In this way, empowerment provides a way to think about opportunities to increase GEA effectiveness that go beyond simply strengthening their authority. This leads us to consider pluralism as an important quality of effective GEAs, since including different problem and solution frames enables the empowerment of a wide variety of actors. After all, each of the examples is characterised by a directionality that can be contested from certain angles. To highlight some of these: the inclusion of diverse forms of knowledge has been critiqued for being primarily about knowledges that can fit a single, integrated frame (Castree et al., 2014; Lövbrand et al., 2015); plenty of IPCC authors may frown on the way their work was mobilised in the Urgenda Court Case (based inter alia on IPCC reports, the Court found that consensus existed on the need for developed countries to achieve 25-40% emission reduction, see also Nollkaemper and Burgers, 2020); and while we certainly admire Greta Thunberg's zeal, we do so ambivalently, because her insistence on following a capital-S 'Science' is diametrically opposed to crucial tenets from science and technology studies which hold that political arguments cannot be linearly derived from scientific statements (cf. Fuller, 2017). In this respect, accommodating pluralism can be a way to improve the effectiveness of GEAs, because it embeds responsibility for the empowerment they facilitate. In the next section, we present three constructive and pragmatic ideas to improve effectiveness in this way.

Illustrative ideas for improving GEA effectiveness

Our argument that pluralism can improve the effectiveness of GEAs dovetails with pleas to transform global sustainability science in a way that allows it to facilitate more explicit political debates about how to respond to socio-ecological challenges (Castree et al., 2014; Lövbrand et al., 2015; Castree et al., 2020; Lahsen and Turnhout, 2021). Arguably, such pleas have so far left a gap between what change they envisage and how that change is to be

achieved. For instance, Castree et al. (2020) recently argued for far-reaching change in GEAs but subsequently limit their suggestions to several questions that future GEAs could answer. Because empowerment helps us to think of effectiveness throughout the GEA process, it provides a way to articulate the question of *how* change could be achieved more concretely. Here, we provide three illustrative ideas that can contribute to improving the effectiveness of GEAs. These ideas are the outcome of discussions held at a workshop on the role of GEAs at PBL Netherlands Environmental Assessment Agency in December 2019 and are rooted in the multidisciplinary academic literature on GEAs (see also Maas et al., 2020).

These ideas all aim to accommodate pluralism and thereby embed greater responsibility for empowerment within GEAs. Accommodating a diversity of problem and solution frames creates entry points for the exercise of political agency by enabling the broad range of actors playing a role in contemporary environmental governance to mobilise the GEA in their own actions. Moreover, accommodating pluralism in the GEA facilitates mutual learning processes about both governance problems and potential solutions, which can also empower actors of various stripes in the environmental governance arena (Kowarsch et al., 2016). In addition, mutual learning processes can create a shared knowledge that makes explicit not just the aspects on which consensus exist, but which also allows going beyond consensus towards multiple conditional perspectives, and towards empowering not only actors but also a broader range of knowledge systems themselves (Díaz-Reviriego et al., 2019; Kowarsch et al., 2017a; Stirling, 2010).

There is a risk in the empowerment approach to neglect structural constraints, thereby unduly burdening marginalised actors to spur their desired change (Scoones et al., 2020). We think embedding greater responsibility for empowerment within the GEA goes somewhat towards addressing that, because it makes these expert organisations responsible for creating the opportunties for empowerment that are an essential precondition for their effectiveness. It thereby also increases the ability for analysts and others to hold GEAs accountable for the empowerment that is facilitated in practice. This also depends on the degree to which changes like we propose can be adopted in GEA processes. This requires flexibility in GEAs to re-think their procedures, position and purpose, while recognising that the outcome will reflect the balance of power between actors with varying and sometimes contradicting needs. Although we feel that such a reflection is inevitable in the long term, we realise that in the short term and in the context of ongoing negotiation processes this might not always be feasible. The illustrative ideas below therefore have different levels of ambition in catering for alternative

problem and solution frames as well as in their required shift in institutionalised GEA-procedures.

Furthermore, some actors in GEAs may be deterred by the prospect of broader empowerment, which could reduce their claims to authority derived from asserted political independence and a consensus-based account of reality. Greater pluralism will likely affect this form of authority in GEAs, particularly in multilateral settings. This is not without its possible costs. GEAs largely rely on government financial contributions for their operations, and those with an intergovernmental structure rely upon the continued buy-in of governments and the volunteered time of the scientific community to realise their work. However, in this light, the dynamics of seeking authority as commonly understood arguably primarily empowers already-dominant actors in environmental governance (Esguerra and van der Hel, 2021). We contend that limiting empowerment to only these actors is insufficient to weather contemporary socio-environmental challenges. Instead, the empowerment approach we put forward indicates that strategies for authority need not be as tied to effectiveness as has been suggested elsewhere (e.g. van der Hel and Biermann, 2017). Arguably, what matters most in environmental governance is the ability of GEAs to contribute to socio-environmental outcomes. To achieve this, GEAs might consider working more towards empowerment, which will require a rethinking of what authority of expert organisations means (Esguerra and van der Hel, 2021) or indeed embracing multiple forms of authority to accommodate the diverse communities that they seek to serve (Montana, 2020).

Finally, before turning to the ideas, we stress that other options are certainly possible. Crucially, any further implementation of these ideas requires reflection on their operationalisation within the context of a particular GEA to avoid new procedural checkboxes arising (Chilvers and Kearnes, 2019). These ideas should thus be seen as pragmatic examples that can stimulate the reflexive attitude to effectiveness we have tried to expound amongst scholars and other GEA practitioners (see Table 4 for a summary overview).

Mapping diverse perspectives, values and ontologies

During the scoping phase, assessments could create a map of divergent perspectives relating to the subject of an assessment to facilitate diversity in problem and solution framings. This mapping identifies the range of different values and norms and their interpretation in particular contexts, as well as the different ways of knowing or ontologies in which these are embedded (Kenter et al., 2019). The objective is not to find the "right" or "most suitable"

perspective but merely to cover as much of the breadth as possible, which benefits from a wide variety of experts and stakeholders to be involved in this mapping. Subsequently, the mapping provides a targeted point of departure for efforts to ensure diversity in the assessment. During the assessment's production phase, this mapping can inform the assumptions, goals, constraints, and evaluation criteria used within GEA processes, such as within integrated assessment modelling. It would also allow for reflection on whether the assessment is representing the full breadth of previously identified perspectives, thereby functioning as a tool to help avoid particular perspectives from dominating the assessment. So, while in this option the onus to ensure the wide range of mapped perspectives is satisfactorily reflected in the assessment still lies largely with its authors, the mapping can empower authors from less dominant perspectives in the process to maintain a diversity of frames. In the use phase, this option allows policymakers and other actors to navigate an explicitly value-laden solution-space, because having the assessment's conclusions be positioned in relation to different perspectives facilitates their usefulness and applicability in different contexts. This approach reflects certain elements of the 'cartography of pathways' proposed by Edenhofer and Kowarsch (2015), in which researchers 'map' policy alternatives and their implications in light of diverse goals and values in order to illuminate the controversies and potential for policy overlap that decision-makers face. However, whereas the model they suggest develops a multi-stage iterative process that significantly departs from common GEA-practice, the approach we describe here could be a readily implementable way of diversifying and providing transparency on problem and solution framings. A practical example that resembles this approach is the ongoing IBPES Methodological Assessment on Values, which is assessing different conceptualisations of values of nature and its benefits, as well as methodologies by which to incorporate these into governance (see IPBES, 2018).

Envisioning desired futures and pathways

Another possible approach consists of developing a set of ways to envision the future and key pathways leading there from the current situation. Particularly in GEAs in which integrated assessment methods play a prominent role (van Beek et al., 2020), such a set could promote pluralism throughout an assessment's scoping and production phase. Each of these visions may reach goals such as the Sustainable Development Goals and other more long-term objectives, but provide a tangible expression of the fact that several ways to reach these objectives exist in terms of economic structure and reliance on existing and expected technologies (van Vuuren et al., 2015). The combination of visions with pathways that could lead to them brings to the fore how they embed different perspectives and dependencies on e.g. particular

technologies, institutions, policy instruments and behaviour. These visions and pathways can then provide a framework by which to structure the assessment. Whereas the previous idea functions by helping assessment authors work with different perspectives, this approach makes this diversity a visible and explicit part of the final product. Including the different visions and pathways in assessments levels the playing field among this diversity of perspectives while providing actors with a shared language. This creates improved possibilities for the political contestation of policy options and fosters learning about policy alternatives, leading to opportunities for the empowerment of a broad range of actors.

A concrete way to operationalise this option is to turn around the use of scenarios – an important element of many GEAs – so they can be explicitly used to explore desirable futures and possible ways to reach these (IPBES, 2016b). This approach resembles the work by the former expert group and current task force on scenarios and models of IPBES to develop a 'Nature Futures Framework' (NFF). The NFF means to allow the scientific community to develop new scenarios towards positive future trajectories for nature and nature's contributions to people to be used in future IPBES assessments, at multiple scales and both quantitatively and qualitatively. The NFF is a heuristic tool based on the diverse, positive relationships humans have with nature, building iteratively on a combination of systematic outreach to a diversity of stakeholders, modelling and analysis (Pereira et al., 2020). Not only the ongoing development of the NFF, but also the participatory process itself offers spaces and moments for different actors to exchange and voice a wide range of perspectives on what is desirable for nature in the future. Moreover, this IPBES scenarios and models work also brought together a large modelling community for the first time to undertake a biodiversity and ecosystem services scenario-based model intercomparison (BES-SIM) for the IPBES Global Assessment (IPBES, 2019a). The BES-SIM exercise strengthened ties between the biodiversity and climate communities by basing their input on the Shared Socio-economic Pathways and the Representative Concentration Pathways used for the climate scenarios in the IPCC (Rosa et al., 2020). The development of the NFF and the BES-SIM work thus not only adds to diversity of knowledge included in GEAs, but also offers opportunity for the empowerment of actors and their expertise in bringing together different stakeholders and different research communities.

Deliberative mini-publics

A further potential approach, and perhaps the most ambitious, is to set up deliberative mini-publics, consisting of randomly selected citizens from around the world (Setälä and Smith, 2018). These mini-publics would provide a deliberative process within GEAs to advise on the way different perspectives are reflected throughout the assessment's scoping, production and use phases. Most GEAs already allow anyone interested to submit review comments to their process, but this is a rather passive procedure, foremostly used by academics and specifically interested people. Instead, mini-publics could be a way to actively and purposefully bring in external perspectives, thereby avoiding prematurely closing down value-laden aspects of the assessment (cf. Kowarsch et al., 2017a). They have the potential to create space for various problem and solution frames and alternative forms of knowledge, facilitate deliberation and reflection, as well as to conduct more straightforward tasks like advising on communication strategies. At the same time, because they would not be a decision-making body within the GEA-process, the question of whether or not a majority opinion or consensus exists is irrelevant (cf. Bellamy et al., 2017): there is no need for mini-publics to achieve agreement, merely to force assessments to keep an open eye to different perspectives and positionalities. Implementing such an approach of global deliberation could usefully build on the experiences that will be gained from a current initiative for a global citizen assembly on the topic of genome editing, seeking to bring together at least 100 individuals from around the globe to deliberate on guiding principles for the regulation of genome editing (Dryzek et al., 2020).

	Mapping diverse perspectives, values and ontologies	**Envisioning desired futures and pathways**	**Mini-publics**
Scoping	Map breadth of different perspectives and problem framings of assessment subject	Develop a set of coherent visions of the future and pathways leading to them	Broaden range of perspectives asking questions
Production	Use mapping to include relevant knowledges, in assessment methods, and to keep diversity of frames	Structure the assessment using the visions and pathways	Reflection and deliberation from mini-public avoids closing down on issues that are contested
Use	Link the mapping to assessed solution-options	Provide actors with a shared 'language' for a political discussion on preferable courses of action	Set up regional/local mini-publics as citizen juries to translate findings towards recommendations to priorly specified actors

***Table 4**. Overview of the three illustrative ideas, describing their place within different GEA phases.*

Conclusion

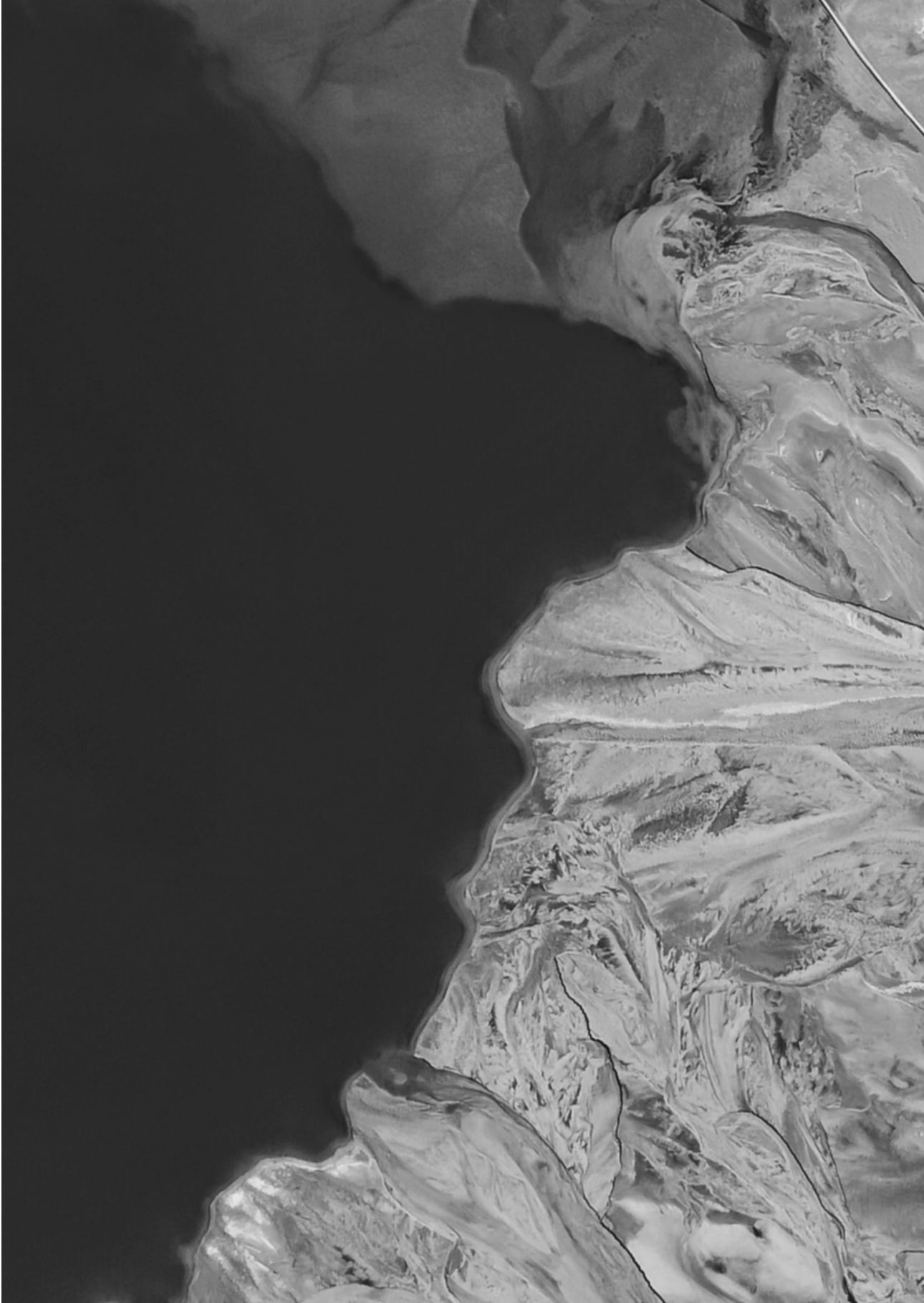
In this chapter we departed from highlighting how current efforts to improve the effectiveness of global environmental assessments reflect a growing sensitivity to the many different ways in which GEAs contribute to socio-environmental outcomes. We have argued this requires an understanding of GEA effectiveness that considers all elements that compose a GEA: i.e. not just their reports, but also their practices, processes and institutions, as well as the actors involved in these. Accordingly, we have put forward an approach to GEA effectiveness as depending on their ability to empower various kinds of actors. Acknowledging the polycentric and distributed character of contemporary environmental governance, GEA effectiveness therefore hinges on their ability to empower a broad range of actors in this landscape.

Furthermore, because organisational procedures as well as the problem and solution frames embedded in assessments provide more opportunity for some to be empowered than for others, GEAs have a political role as much as a scientific one. Hence, for GEAs to responsibly fulfil their empowering role requires them to adopt a reflexive attitude to their effectiveness and seek ways to include and accommodate a diverse range of actors, perspectives, and frames to enable broad empowerment. In our effort to provide constructive critique, we have provided three illustrative ideas in which this responsibility can be operationalised during the scoping, production and use phases of an assessment. Broadening empowerment in this way may have implications for the authority of assessments in traditional forums of environmental governance, but is in our view essential to reap the broader potential contribution of GEAs.

For science-policy scholars, the empowerment approach has implications for how GEAs are studied. Rather than just examining their internal workings or their uptake in formal decision-making settings, we urge a more open, grounded approach to empirically studying the multiple empowering effects that GEAs – as both products and processes – have in the world. We have provided a number of examples of how such empowerment may play out in different GEA-phases, but greater insight is necessary into the myriad of places and ways GEAs are mobilised. In this way, a wider view of the effectiveness of GEAs can be developed (see also Borie et al., 2021).

Finally, more fundamentally, our argument also asks GEAs and their commissioning bodies to engage in an ongoing discussion on their purpose and power in contributing to socio-environmental outcomes, rather than merely decide on the specific questions a future assessment should answer. In the end, accommodating broad empowerment successfully depends

on whether institutional structures can be changed accordingly. Concrete windows of opportunities for such discussions are approaching. For example, the IPCC's sixth Assessment Cycle ends in 2022, and early discussions on the 7th cycle have already started. The upcoming IPBES assessment reports may also benefit from the insights offered in this chapter. In the long term, we think recurring GEAs would do well to regularly reflect on their purpose, position, and the degree to which these are matched by their procedures. Such reflection involves negotiating between different stakeholders' interest and preferences, without ever being able to fully satisfy them all. We realise this can be a thankless task, but nonetheless see it as an important one for GEAs to continue their empowering work responsibly.



Chapter 4.
Politicizing expertise: Knowledge accountability dynamics in developing wellbeing concepts at the Dutch science-policy interface

Submitted as:

Maas, Timo Y., Annet Pauwelussen, and Esther Turnhout. "Politicizing expertise: Knowledge accountability dynamics in developing wellbeing concepts at the Dutch science-policy interface."

Politicizing expertise: Knowledge accountability dynamics in developing wellbeing concepts at the Dutch science-policy interface

Introduction

Despite increasing lamentations to the contrary, there can be little doubt that expertise plays an important role in contemporary democracies. Decision-makers draw on various forms of scientific and other knowledge, and a range of science-policy arrangements exists to develop knowledge that aims to enable more effective policymaking. Economic concepts are undisputedly chief instances of this influence of expertise on policymaking (Atkinson, 2009; Birch, 2017; Hirschman and Berman, 2014; Mügge, 2016). Because of this importance, it is perhaps no surprise that economic concepts have also been a long-time interest in a wider body of research on the role of expertise in contemporary democracies. In this context, work on performativity, i.e., the world-making effects of the natural and social sciences (Asdal and Marres, 2014; Blok, 2011; Callon, 1998; Law and Urry, 2004; MacKenzie et al., 2007; Mol, 1999), is particularly noteworthy for two reasons. First, these studies have shown how concepts have political effects through how they render some things visible and others invisible, some ideas reasonable and others unreasonable, and some actions possible while others remain considered unfeasible. Second, they point to the crucial role played by science-policy arrangements and highlight the co-constitution of modes of knowing and modes of policymaking (Bacevic, 2021a). Not only do science-policy arrangements perform concepts as modes of policymaking, but concepts also call particular science-policy arrangements into being (Callon, 2007; Halffman and Pastoors, 2019; MacKenzie, 2009; Pallett and Chilvers, 2015; Turnhout et al., 2014). These science-policy arrangements are institutionalized through expert organizations and their institutional epistemologies, or the practices through which they produce, combine, and negotiate knowledge (Borie et al., 2021). The success of a concept is thus closely linked to its ability to mobilize science-policy arrangements and expert organizations.

A key example is Gross Domestic Product (GDP). Together with its associated international standard 'System of National Accounts', originally developed as a measure of national income, GDP has become largely equated with societal wellbeing: a high GDP is taken to mean a

society is doing well (Hoekstra, 2019). This equation of GDP with wellbeing can be taken to be part of a wider 'growth paradigm', in which the continued growth of GDP is considered to be simultaneously possible, necessary, and desirable (Schmelzer, 2015). Consequently, as GDP and its growth became the goal, policy processes became a matter of pursuing that goal (Coyle, 2014; Hoekstra, 2019). Moreover, the concept of GDP (growth) has become deeply embedded in expert organizations. For example, they use modelling to project the effects of policies on GDP or they advise policy makers on how to optimize GDP growth.

Of course, the presumed relationship between GDP (growth) and wellbeing has long been critiqued for creating various invisibilities. Inter alia, ecological critique highlights the disregard for the environmental cost of economic growth, feminist critique the disregard for non-monetary and household labour, and decolonial perspectives have focused on the extractive relations required for growth (Schmelzer, 2022). Moreover, the performativity of GDP exemplifies the concern articulated by a range of authors, who consider contemporary societies to be increasingly constrained through arguments of necessity rather than choice (Davidson and Iveson, 2015; Graeber and Wengrow, 2021; Kenis et al., 2016). Decisions are urged for being the necessary thing to do, not for being the right thing to do. Not least in the context of contemporary socio-ecological challenges, this 'post-political condition' is argued to lead to a managerial and technical approach to governing, side-lining and ignoring irresolvable conflict and dividing decisions (Mouffe, 2000, 2005; Swyngedouw, 2011). But arguably, and in light of the growing attention to the notion of transformative change, socio-ecological challenges call for decision-makers to confront different views, interests and incumbent powers (Machin, 2013; Scoones et al., 2020). Instead of pursuing policies that achieve taken for granted goals derived from existing paradigms, the pursuit of transformative change has to make space to deliberate about what changes can be considered desirable. Taking transformative change to mean "a fundamental, system-wide reorganization across technological, economic and social factors, including paradigms, goals and values" (IPBES, 2019b, p. 14), this raises the question of how transformative change can become about choosing change that is considered desirable.

Against this background, we take an interest in the proliferating attention to alternatives to GDP for policymaking. Such alternatives include non-Western concepts like Ecuador's Buen Vivir or Bhutan's Gross National Happiness as well as concepts developed on the fringes of modern economics, e.g. 'steady-state economics' (pioneered by Herman Daly) and more recently 'donut economics' (Raworth, 2017) and 'degrowth' (Hickel, 2020). Closer to mainstream economics, a major impetus to the development of alternative concepts and models

for the economy was given by the Commission Stiglitz-Sen-Fitoussi (2009), instated by then-French President Sarkozy. So far, many of these concepts have remained rather inconsequential for policymaking (Biermann et al., 2022; Masood, 2022; Turnhout et al., 2021). Nonetheless, more concrete operationalizations of alternative approaches to societal and economic wellbeing in policymaking are widely sought after, leading to various 'approaches-in-the-making'. In the Netherlands, this search is currently culminating around the concept of 'Broad Wellbeing',[12] which is currently applied to a series of partially related initiatives. These include the national statistics agency's Monitor of Wellbeing aimed to report on broad wellbeing 'here and now', 'later', and 'elsewhere' (Statistics Netherlands, 2022); the development of indicators for the governments' budgetary cycle (CPB et al., 2022); broad wellbeing as a part of a reflexive evaluation of a national-regional government program (PBL, 2022a); as well as various kinds of experiments run by individual ministries with integrating broad wellbeing in their way of working. In this search, we see that new economic concepts are developed together with particular science-policy arrangements as expert organizations are not just involved in developing these approaches, but are also allowing their practices to be reshaped by them – i.e., also for broad wellbeing, modes of knowing co-constitute modes of policymaking.

The way that modes of knowing and policymaking co-constitute each other reflects broader expectations of the role of formal expertise in policymaking in contemporary societies (Halffman, 2005; Weingart, 1999). In the Dutch case, the importance of formal expertise is particularly visible through the involvement of the three so-called Dutch 'planning bureaus': governmental knowledge institutes for policy assessment, tasked with economic, social, and environmental policy analysis.[13] The planning bureaus combine statutory tasks to report on given issues, research taken at their own initiative, and ad hoc tasks commissioned by government ministries. They have a unique position in the Dutch science-policy landscape due to their de facto role as political stabilizers (Halffman, 2009), meaning they structure what can be thought, said, and done in political discourse (cf. Hajer and Versteeg, 2005). This role is observable for instance in the analysis of election manifestoes performed by CPB and PBL, which are widely considered to 'discipline' politicians into avoiding to propose policies that are difficult to express in quantitative or monetary terms and that are, partly as a result of the previous, considered 'unrealistic' or 'unconventional' (Pesch et al., 2012, p. 499). The problematic potential implications of this disciplining are well-established. Government expenses

[12] We use the capitalized version of Broad Wellbeing to refer to operationalization for policymaking and lowercase broad wellbeing to refer to the, literally, broad set of aspects that matter for wellbeing.

[13] The CPB Netherlands Bureau for Economic Policy Analysis (CPB), SCP Netherlands Institute for Social Research (SCP) and PBL Netherlands Environmental Assessment Agency (PBL).

for education or healthcare are a well-known example in the Dutch context where the models' limitations come to be debated: because the model cannot translate such expenses into monetary benefits, a political party that allocates no budget to education or healthcare will perform very well in the analysis. Even though, luckily, this has not led parties to completely cancel funding for healthcare, political parties will anticipate these models and their shortcomings to try to be painted in an as positive as possible picture, which illustrates the performative effects of these expert organizations and their calculative tools. This means we should be mindful of the effects of the new approaches-in-the-making in terms of enabling alternative policymaking practices, and ask under which conditions these practices might help formulate adequate answers to the challenges faced by contemporary societies, including the limitations of GDP-growth-oriented economic and social policy?

As we emphasized earlier, neither new approaches nor the science-policy arrangement they involve are stabilized. This presents an opportunity for engaged STS analysis. The aforementioned work on performativity has pointed to the emancipatory potential of reflexively practicing these performative effects. Indeed, recognizing that changing the way we understand the world is a way of changing it, opens up the possibility to think about "what kind of world we want to participate in building" (Gibson-Graham, 2008, p. 615; Law and Urry, 2004). Put differently, acknowledging that expert organizations are involved in performing wellbeing approaches, which in turn, have political effects, should impel thinking about ways to learn and adjust these organizations' practices in anticipation of these effects (Pallett and Chilvers, 2015). This responds to calls for 'STS making and doing' and an ethos of care, so that expert organizations take greater responsibility for the effects of concepts they are implicated in (Downey and Zuiderent-Jerak, 2016; Puig de la Bellacasa, 2011). We are further instructed by Chilvers and Kearnes' (2020) call to move from effective expert practices to reflexive and responsible ones, in order to reconfigure the contribution of expertise to democracy. Here, we reflect on the importance of pluralist democratic politics for transformative change (Scoones et al., 2020). We suggest that the key contribution expert organizations can and should make is to develop and perform wellbeing approaches that make these politics visible.

In the remainder of this chapter, we introduce the concept of knowledge accountability to refer to the expectations held regarding how expertise is to be used in governing. We consider these expectations to be fundamentally implicated in the performativity of wellbeing approaches and especially important in shaping the practices of the expert organizations involved. Using this concept of knowledge accountability, we analyse the potential to make pluralist democratic politics visible using new wellbeing approaches. We focus on the case of

Dutch Broad Wellbeing, but point out that a wide variety of initiatives exist through which wellbeing is being operationalized in policymaking processes around the globe (Berger, 2022; Truijens and Georgieva, 2021).

Knowledge accountability

We use Dutch Broad Wellbeing as a case study to analyse the potential of expert organizations to contribute to democratic politics. The unstable character of Dutch Broad Wellbeing allows us to learn in detail about its multiple possibilities and potentialities (cf. Flyvbjerg, 2006; Hitchings and Latham, 2021). For the case study, we held 23 interviews with policymakers and researchers involved in different Dutch wellbeing initiatives, in addition to examining relevant reports and policy documents (interviews are lettered and dated, documents referenced where relevant). We analysed the interviews in concurrence with developing our broader theoretical argument. Broadly speaking, we distil two approaches taken by Broad Wellbeing initiatives. In the first approach, Broad Wellbeing is an *instrument for optimization,* while in the second, it is an *instrument for discussion*. The starting point of Broad Wellbeing as *instrument for optimization* is to develop an approach which can measure wellbeing beyond GDP. The key challenge associated with this approach is to integrate the different themes and dimensions that broad wellbeing intends to cover (succinctly: economic, social and environmental themes, across the dimensions 'here and now', 'later' and 'elsewhere'). In an example applying this approach, national policy analysis institutes define the wellbeing framework using predominantly quantitative indicators and models, which can be applied to policy processes like the annual budget cycle (to assess the 'broad wellbeing effects' of the government budget) (CPB et al., 2022). This focus on indicators sets up Broad Wellbeing to function as a yardstick for the actual or expected performance of policy. In the second approach, Broad Wellbeing is seen as an *instrument for discussion*. Here, Broad Wellbeing is seen as a relatively open-ended framework which can help elicit different visions, interests and perspectives in policy processes. An example applying this approach is a set of guiding questions one ministry has developed that civil servants can use in discussions and workshops (Ministry of Infrastructure and Water Management, 2022). This way of working is meant to ensure that a broad diversity of dimensions to a policy issue are brought to the table. In this approach, Broad Wellbeing is a tool to make policy choices transparent instead of a measurement framework to assess wellbeing outcomes.

Taking the 'performativity thesis' as a starting point, it is evident that any new wellbeing approach will bring particular policymaking practices into being, while foreclosing others. This

directs attention to the question of what they are likely to in- and exclude. What will a new wellbeing approach bring into focus, and what will it enable policymaking practices to remain ignorant of? To explain this point further, we draw on ignorance studies, which have emphasized that the production of knowledge and ignorance are complexly intertwined (Gross and McGoey, 2015). This means that rather than considering ignorance simply as a 'precursor' or 'impediment' to knowledge, we should appreciate ignorance itself as a source of power (McGoey, 2012). Recognizing ignorance as a potential source of power draws attention to how it might be deployed strategically, creating "situations where people create or magnify unknowns in an offensive rather than a defensive way, to generate support for future political initiatives rather than to simply avoid liability for a past mistake" (McGoey, 2019, p. 3). This point challenges dominant norms of ostensible neutrality and allows for critical reflection on who is enabling what knowledge production to remain undone (Bacevic, 2021a; Frickel et al., 2010; McGoey, 2020; Turnhout and Lahsen, 2022). Such reflection is needed to avoid reproducing the pitfalls of expertise for GDP in Broad Wellbeing. This involves asking what particular knowledge and ignorance are produced by the science-policy arrangements that wellbeing approaches bring into being; that is, what kinds of knowledge are expected to be seen as useful or useless, how are knowledge and ignorance used to justify decisions, and what are the effects and implications of knowledge produced for wellbeing?

Here, we introduce the notion of knowledge accountability as a means to analyse these justifications and the possible subsequent exclusions and effects. Bovens (2007) defines accountability as "a relationship between an actor and a forum in which the actor has an obligation to explain and to justify his or her conduct, the forum can pose questions and pass judgment, and the actor may face consequences" (p. 107). Accountability is often associated with effectiveness and transparency, but there are many ways through which such explanations and justifications can be given (Behagel, 2012). Notably, knowledge accountability differs from the accountability of science itself, i.e. the need for scientific practices to explain their 'decisions, selections and values' (Turnhout et al., 2019). By contrast, knowledge accountability refers to the way in which decision-makers are expected to explain and justify how and what knowledge influenced their decision. In other words, if accountability is about explanations, knowledge accountability is about the role accorded to knowledge in these explanations. By asking an account of *how* knowledge influenced decision-making rather than merely *if* knowledge influenced decision-making, knowledge accountability opens up the potential for a more meaningful relationship between science, policy and society. In this way, knowledge accountability extends existing reflections on the science-policy-society interface and on

expert accountability logics (e.g. Bandola-Gill, 2021), in which key concepts like legitimacy, effectiveness or authority are still commonly considered to be unilaterally constructed by experts and the organizations they work in, i.e. in the science sphere of this interface (Mahony, 2020). Instead, the concept of knowledge accountability helps us think through these concepts themselves as performative, with the involvement of a wide range of policy and societal actors.

We suggest that there are at least two potential logics of knowledge accountability, technocratic and political, which we discuss in more detail below. These logics refer to rationales about the purpose and application of knowledge accountability (following Barry et al., 2008). While in abstract terms, both logics will claim to favour 'more use of knowledge' and 'a more effective relationship' between knowledge and policymaking, we suggest they do so through different logics. Both logics of accountability are visible in the two approaches taken by Dutch wellbeing initiatives. Amongst adherents of Broad Wellbeing as an *instrument for optimization*, the question of how to measure broad wellbeing is seen as a purely technical exercise, which can – and should – be placed within technical expert organizations (interview U, 22 July 2022*;* see also e.g. Hoekstra, 2019). This means indicator sets are developed to form a framework for broad wellbeing. In this framework, neither the indicators themselves nor their direction ('is more/less better?') are considered to be contestable, solely their relative priority with respect to each other. This framework is envisioned to be used to assess the effects of policy decisions, *ex ante* and/or *ex post*. Herein, this approach echoes dominant economic thinking on projections. For instance, one informant suggested two scenarios were possible were this framework to be applied (interview J, 30 June 2022). In the first, the projections are "perfect, thus everyone is happy". The second scenario includes uncertainty, in which case "one can make periodic adjustments". Prompted with the question of whether a third scenario is thinkable, in which there is also ambiguity about indicators, the informant quickly reverted to discussing methodological challenges, comparing a broad wellbeing framework to projections of GDP on which we are 'sufficiently *certain*' (our emphasis). According to the informant, what is needed is making sure that indicators are 'methodologically sound'. By extension of this discussion, another informant notes how in this framework of broad wellbeing, potential indicators may be deliberately kept out of the framework precisely because there is too much dissensus on them. Mentioning livestock density as an example, for which it would be overstepping her organization's mandate to make the implicit political choice of assigning a direction (interview A, 21 January 2022). This approach can then be seen to follow what we call a technocratic logic of knowledge accountability. This logic assumes that the more knowledge available to policymakers, the better, i.e. the more 'integrated', their decisions will

be. Here, Broad Wellbeing can provide a – literally – broader assessment of these costs and benefits, which is assumed to lead to 'better' policy.

Importantly, technocratic knowledge accountability does not necessarily mean that science can provide the right course of action. This is a significant difference with arguments for outsourcing certain decision-making powers to scientific experts (Brennan, 2016; for critiques see e.g. McGoey, 2019; Reiss, 2019; Van Bouwel, 2022). For instance, in a policy brief on Broad Wellbeing, the Economic Planning Bureau emphasizes that "weighing the consequences of policy for different domains of wellbeing remains a task for politics" (CPB, 2022, p. 5). At the same time, technocratic knowledge accountability contains a disciplining effect that is well-documented in the literature on performativity and indicators, which highlights the invisible normative choices involved in constructing ostensibly objective indicators (Mügge, 2017; Porter, 2020). One informant explicitly recognizes this potential disciplining effect, by being there to "call bullshit" if broad wellbeing is used as a political 'excuse' for policy intentions (interview J, 30 June 2022). Also acknowledging this disciplining effect, another informant senses a latent desire – also amongst policy actors – for broad wellbeing analyses to yield unequivocal results in terms of 'positive' or 'negative', despite all the talk of leaving prioritizing to politics (interview H, 23 June 2022). This means that broad wellbeing as instrument for optimization contains a paradoxical combination of political freedom and constraint. One the one hand, politicians are free to weigh and decide autonomously. On the other hand, their ability to explain these decisions is constrained by the affordances of a fixed and predetermined framework, constructed by specific science-policy organizations.

This paradox also comes to the fore in one informant's statement on supposedly problematic volatile political desires:

> "The framework is developed independently of politics, but politics uses it to prioritize and develop policy. That might seem like outsourcing at first, and instinctively undesirable, however, if politics would develop the framework, a new cabinet would just create an entirely new framework." (interview D, 6 May 2022).

Along these lines, several informants support the setting of broad wellbeing goals, but they disagree on what the purpose of such goals should be. Should they span long timeframes to discourage all-too-drastic changes when a new government is formed after elections, or should they be part of the declaration made by new government at their instalment, and thus change every four years (or faster) (interviews B, 21 January 2022; D, 6 May 2022; K, 30 June 2022; R, 19 July 2022)? Here, some informants also note that the attractiveness of broad

wellbeing itself depends on one's position on the political spectrum, with some political parties being more enamoured by it than others (interview D, 6 May 2022). Another informant, recognizing this dependency on political colour, contends it is unwarranted, arguing every political movement has some sort of vision of the future which could become visible through broad wellbeing. Yet, referring to the scientific basis of broad wellbeing, this same informant reduces this kind of disagreement back to scientific (un)certainty, contending that 'science does have the task to narrow down possible opinions. To point out right and wrong views of the future' (interview U, 22 July 2022).

Conversely, informants describing broad wellbeing as an *instrument for discussion* emphasize its potential to enable transparent and *ex ante* justifications of policy decisions towards society and parliament, including normative choices related to trade-offs associated with those decisions (interview H, 23 June 2022). As one informant puts it, "broad wellbeing gives you a handle to clarify that choosing for one option, is also a choice against other options" (interview G, 23 June 2022). Informants contend that in this way, broad wellbeing could help to make visible what normativity is embedded in the choice for one policy instrument over another, abandoning the illusion that there is the possibility for an entirely neutral, value-free, position (interviews G, 23 June 2022; K, 30 June 2022). As one informant stated: "I attach much more importance to the political dimension of the discussion than people who keep looking for some kind of analysis that is alternative to political decision-making" (interview H, 23 June 2022). Another summarized this approach to broad wellbeing as informing the ongoing formulation of "what … we consider important", as opposed to "if we calculate this accurately, it will tell us what to do" (interview Q, 14 July 2022). This approach can then be seen to follow what we call a political logic of knowledge accountability, which assumes that expertise can make the normative dimensions to the choices policymakers face explicit, and that it can enable the articulation of explanations that make this normativity visible. In this logic, knowledge accountability goes beyond merely offering insight into effects of policy decisions. It also explicitly opens up the possibility to deliberate about the norms and values against which effectiveness is assessed.

Broad Wellbeing as instrument for discussion puts less emphasis on capturing wellbeing outcomes in indicators, even if indicators can still help "show how you are doing" (interview O, 11 July 2022) and thereby play a role in articulating problems and putting these on political and societal agendas. To another informant, the complexity of societal transitions implies that a tight coupling between broad wellbeing and indicators is to be avoided. She argues that relying on highly detailed indicators and modelled versions of real-life complexity is risky,

because a lot of nuance remains invisible and thereby easily skipped over in policy processes. Instead, using broad wellbeing as a tool to facilitate a transdisciplinary discussion on a concrete issue presents an opportunity to identify different options and an assessment of what their most important effects might be (interview G, 23 June 2022). Moreover, as another informant argues, the idea that this assessment has to be highly detailed may well be misguided for such a discussion, as information on the direction of a relationship and perhaps a rough idea on its strength might well suffice (interview K, 30 June 2022). This shows an appreciation of the expertise held by policymakers themselves, with expert organizations focusing on how interrelations affect normative choices available to decision-makers.

Accounting for transformative change

In order to understand the difference between the two logics of knowledge accountability, it is helpful to turn to their respective conceptions of politics and the role of knowledge therein. Technocratic knowledge accountability operates from a decision-making logic of consequentiality, which sees policymakers as facing well-structured problems for which expert organizations can assess the costs and benefits of different policy choices (Dewulf et al., 2020; Hisschemöller and Hoppe, 1995; Maas et al., 2022a, see **Chapter 2**). It holds that because politicians may have different views on how to value those costs and benefits relative to each other, the question of how to prioritize those is up to them. However, what counts as cost or benefit – is a cost actually a loss, a benefit truly beneficial? – is not up for discussion. Conversely, political knowledge accountability reflects an understanding of decision-making as following a logic of meaning, in which policymakers need to make sense of complexity and ambiguity (Dewulf et al., 2020; Montana, 2020). As such, it does not attribute insufficiently 'integrated' decision-making to a lack of information on interrelations, but to a lack of explicit deliberation ahead of a policy choice. Not only are the costs and benefits of different policy choices something to prioritize relative to each other, the question of what counts as a cost or benefit itself is open to discussion.

Political knowledge accountability is thus about decision-making in which different, visibly political, options can be expressly and consciously reflected on and chosen between (Graeber and Wengrow, 2021; Kenis et al., 2016; Stirling, 2008). This logic favours a co-productive approach to science-policy relations in which science and politics are visibly interconnected rather than kept separate (Maas et al., 2022a, see **Chapter 2**). Thus, the two logics of knowledge accountability ask for subtly but crucially different explanations of the role of politics. Technocratic knowledge accountability asks 'are we doing things right?', where political knowledge

accountability *also* asks 'are we doing the right things?'. Technocratic knowledge accountability works well if the ambition is to improve performance on current development trajectories, but it has relatively little to offer to change these trajectories. In contrast, political knowledge accountability aims to continuously questions these trajectories and can, therefore, support fundamentally shifting or transforming them.

For this reason, notwithstanding the importance and usefulness of technocratic knowledge accountability, we believe current times ask for a deeper appreciation of political knowledge accountability. Specifically, we suggest that this logic can contribute to equipping science-policy-society relations with the capacity to support transformative change (Brouwers et al., 2022; Fisher et al., 2022) because it can capitalize on what McGoey (2019) refers to the 'epistemological superiority' of democracy to other forms of governance. As she notes, this superiority stems from a "perpetual check on the knowledge of the powerful", which "[thwarts] entrenchment of power monopolies by people with an incentive *not* to learn about the weaknesses or errors of their own decision-making" (McGoey, 2019, p. 297). In other words, a well-functioning democracy is able to change course if it finds – and is willing to find – that its current course is undesirable. Of course, this ability and willingness are central when it comes to transformative change. In such cases, the aforementioned question of 'are we doing the right things' is of utmost importance, because it foregrounds the question of "what is, or ought, to be sustained" (Yunita et al., 2022, p. 93). Moreover, this question requires 'taking politics seriously' (Scoones et al., 2020), because of the inherently political character of transformative change (Patterson et al., 2017; Visseren-Hamakers et al., 2021). For this reason, the inadequacy of technocratic knowledge accountability to politicize issues – to keep 'uncomfortable knowledge' about politics invisible (cf. Rayner, 2012) – translates into a democratic deficit. Since hiding politics does not mean they cease to exist but rather transposes politics to other sites, technocratic knowledge accountability hinders transformative change by the subpolitics it creates. The effects of such subpolitics are described by MacKenzie (2009) in the context of carbon markets. Here, the site of subpolitics involves preserving the boundary between science and politics to ensure that political action can be seen as based upon 'sound science' (MacKenzie, 2009, p. 453). However, this focus on whether action is 'sound' crowds out discussion on what action is *desirable,* thereby stifling transformative action.

Political knowledge accountability can facilitate deliberation about what actions are desirable by expecting that knowledge politicizes issues, i.e. creates space for politics. As Castree et al. (2020) highlight, politicizing can help to 'reveal the real but very different decision-spaces that are defined by competing, though sometimes complimentary, political worldviews'. Choosing

not to explicitly politicize issues serves vested interests. It implies a particular kind of strategic ignorance, which McGoey (2020) refers to as 'rarefied ignorance', in which the dominance of vested interests rests on their ability to maintain a state of unknowability. In this sense, our distinction between political and technocratic knowledge accountability highlights that neither knowing nor finding out about politics – about what *could be* considered desirable action – is a choice in and of itself. Now, we realize that in the current global political landscape, many may feel that 'the public has had enough of politicization' (to paraphrase the infamous remark by UK politician Michael Gove). Indeed, it seems that politics has become a derogatory term. While we recognize a feeling of despair induced by contemporary practices in politics, we think it is crucial to defy an outright dismissal of politics and reclaim its meaning from their association with petty party politics and general retrogression. For this, we turn to the work of John Dewey and Chantal Mouffe. Their thinking supports an understanding of politics that helps us consider its productive potential for transformative change.

In his seminal work *The Public and its Problems* (2016 [1927]), Dewey provides an ontology of democratic politics as revolving around a practice of issue formation (see also Marres, 2007). Central to his work are the two concepts 'publics' and 'issues'. Dewey defines the public through a co-constitution with issues:

> "The public consists of all those who are affected by the indirect consequences of transactions to such an extent that it is deemed necessary to have those consequences systematically cared for (…) Since those who are indirectly affected are not direct participants in the transactions in question, it is necessary that certain persons be set apart to present them, and see to it that their interests are conserved and protected." (Dewey, 2016, p. 69).

In other words, neither publics nor issues exists independently. Rather, they bring each other into being (Marres, 2005). In approaching democracy in this way, Dewey deconstructs the state as being some kind of intrinsic entity itself. Rather, the state is a collection of individuals who are "doing the business of others in securing and obviating consequences that concern them" (Dewey, 2016, p. 71). Particular arrangements institutionalize these, but these arrangements do not exist for the sake of the state, but are a means to an end: to enable care for the public's problems. At the same time, Dewey recognizes that such arrangements have a tendency to persist and hinder change. As a result, Dewey argues that the continuous remaking of these arrangements is a key quality in a democracy: "almost as soon as [a state's] form is stabilized, it needs to be re-made" (Dewey, 2016, p. 81).

Although Dewey talks about 'the public', this should neither be seen as a singular collective, nor an equation with an overarching societal good. Dewey notes a plurality of social groupings exist, which pursue state arrangements that we may think of as good or bad (Dewey, 2016, p. 114). As such, we might think of the public as a 'space of pluralism' (Rogers, 2016). It is through this notion of pluralism that we connect Dewey's pragmatism to Chantal Mouffe's thinking (see Mouffe, 2000, 2005), which draws attention to political conflict. She defines the 'political' through the antagonisms inherent in human relations. In other words, fundamentally different worldviews exist, the actualization of which comes with winners and losers. Politics, by turn, refers to an "ensemble of practices, discourses and institutions which seek to establish a certain order and organize human coexistence in conditions that are always potentially conflictual because they are affected by the dimension of 'the political'" (Mouffe, 2000, p. 101). The purpose of democratic politics is to transform antagonism into agonism. In a state of agonism, conflict and dissent remain present without a need to subsume all voices into an overall consensus. This does not mean consensus is entirely impossible, undesirable, or even unnecessary. Rather, it highlights that consensus is always the outcome of power relations and always involves a degree of exclusion – not all divergent worldviews can be equally accommodated. Similar to Dewey's views on the need to continuously re-make the state, Mouffe notes that consensus offers at most "temporary respites in an ongoing confrontation" (Mouffe, 2000, p. 102). This means Mouffe's thinking implies a 'double commitment' (Marres, 2012): it considers conflict as both foundational to politics as well as productive to democracy as an enabler of change.

Taken together, Dewey and Mouffe help us understand how democratic politics, transformative change, and knowledge accountability interrelate. The socio-ecological roots of the notion of transformative change highlight – in Dewey's words – a search for 'systematic care for indirect consequences'. In other words, we can conceptualize transformative change as an issue in the process of being articulated, as something around which the state is to be re-made. At the same time, a great deal of pluralism exists regarding what this re-making means. Different worldviews struggle for their take to be accommodated on what ought to be changed, and what to be sustained. Rather than seeking to overcome these differences, they can be used productively to establish a remade state. The question foregrounded by knowledge accountability is how expertise can equip democracies with a way to use pluralism productively towards supporting a process of issue articulation (cf. Dijstelbloem, 2007). Technocratic knowledge accountability cannot answer this question satisfactorily. Even more so, it prevents the question from even being considered. Even if it can point to the ineffectiveness of policy

choices – that 'we are *not* doing things right' – its strategic ignorance of politics means it cannot support a process of issue articulation that could lead to radical alternative policy choices. Some small patches may mend the worst consequences of ineffective policy choices, but remaking arrangements in order to do the right things, and do them right, is beyond this logic's capacity. Conversely, the answer of political knowledge accountability is to reveal the 'hidden moralities' of potential choices (cf. Prettner et al., 2021), thereby striving to productively channel conflict towards issue articulation.

Experimentalizing Dutch Broad Wellbeing

Having established the potential for political knowledge accountability to spur transformative change, we turn back to the role of expert organizations. If we take seriously their co-constitutive role with regard to new wellbeing approaches, this implies that the knowledge they produce will enact the logics of knowledge accountability unevenly. Our interviews show that individuals recognize the affordances of (and need for) political knowledge accountability, but we also see that expert organizations are dominantly predisposed to technocratic knowledge accountability. Nonetheless, we stress that the degree to which expert organizations produce knowledge/ignorance about politics is a choice they can make – at least partially – on their own accord. At this stage, it will be hardly surprising that we think *if* expert organizations want to position themselves more actively as an enabler of transformative change, this means they should emphasize political over technocratic knowledge accountability. We think an ethos of STS making and doing can guide expert organizations to institutionalize political knowledge accountability. We return to the case of Dutch Broad Wellbeing to explore how this could work. Following Marres' (2013, p. 423) call to examine "how politics and democracy are accomplished through the deployment of devices, objects and settings", we ask: how can expert organizations enact Broad Wellbeing in such a way that it functions as a device that can establish political knowledge accountability?

To some degree, our earlier characterization of Broad Wellbeing as an *instrument for discussion* already contains several hints. At the same time, as our interviews also showed, it is much harder for people to imagine what this means concretely. This parallels the absence of an alternative imaginary for science-policy arrangements described in **Chapter 2**. In an attempt to make such an alternative more tangible, we aim to develop a kind of 'speculative design', in the spirit of Haraway's (2016) call to 'stay with the trouble' and her emphasis, in reference to Marilyn Strathern, on the importance of "what thoughts think thoughts" (p.12). In other

words, by speculating on what a politicizing approach to Broad Wellbeing *could* be, we invite you – the reader – to imagine it *can* be (cf. Oomen et al., 2022).

This speculative design can start from the different treatment of diverse ways of knowing we have described for the two approaches to Broad Wellbeing. Broad Wellbeing as *instrument for optimization* seeks to integrate knowledge from different scientific disciplines into a single framework, which in turn is able to answer the question what broad wellbeing *is*. Conversely, Broad Wellbeing as an *instrument for discussion* seeks to open up a transdisciplinary dialogue about what broad wellbeing *could be*. Broad Wellbeing thereby functions as a policymaking tool through which to realize what Aarts (2018) refers to as dialogue; a way to deal with conflict in a productive sense and create sufficiently widely shared options without requiring the elimination of diverging norms. At the same time, a Broad Wellbeing that politicizes is more than a procedural intervention. It operates on the fine line between opening up to multiple reasonable policy options and the realization that it is "simultaneously necessary, inevitable, and desirable" to make a choice between them (Stirling, 2008, p. 284). This means Broad Wellbeing is more than just an instrument to facilitate a dialogue about alternative worlds, but also contains a substantive commitment to the ever-going practice of democratic politics, namely to ensure such a dialogue is always ongoing and never completed. Expert organizations can contribute to this dialogue through analyses of the various 'experimental facts' it contains – unstable and contested claims. Rather than seeing these claims as in need of adjudication, they should be considered to indicate attempts at issue articulation (Marres, 2018). Consequently, the analysis does not focus on whether the claim is true, but on what it would imply for the conditions under which a claim can be true. Such analyses offer an opportunity to use these claims to think through possible alternative worlds (Puig de la Bellacasa, 2011).

As a consequence, a politicizing approach to Broad Wellbeing means that expert organizations will be much more visibly entangled in political decision-making processes. We anticipate that this role will be opposed by many for violating conditions of independence and neutrality. Yet, crucially, expert organizations are not there to make 'political judgments'. Rather, they can facilitate the discussion by balancing between exploring potential options, questioning dominant options, empowering marginalized options, and navigating conflicts between options (Chambers et al., 2021, 2022). To this end, their unique value may lie in what Castree et al. (2020) dub 'political expertise', namely "to present the most elaborated versions of various worldviews, while also noting areas of complementarity, ambiguity, contradiction or confusion within them" (p.19). Adding political expertise to a policymaking process using Broad Wellbeing helps the actors involved in the process to understand their respective positions,

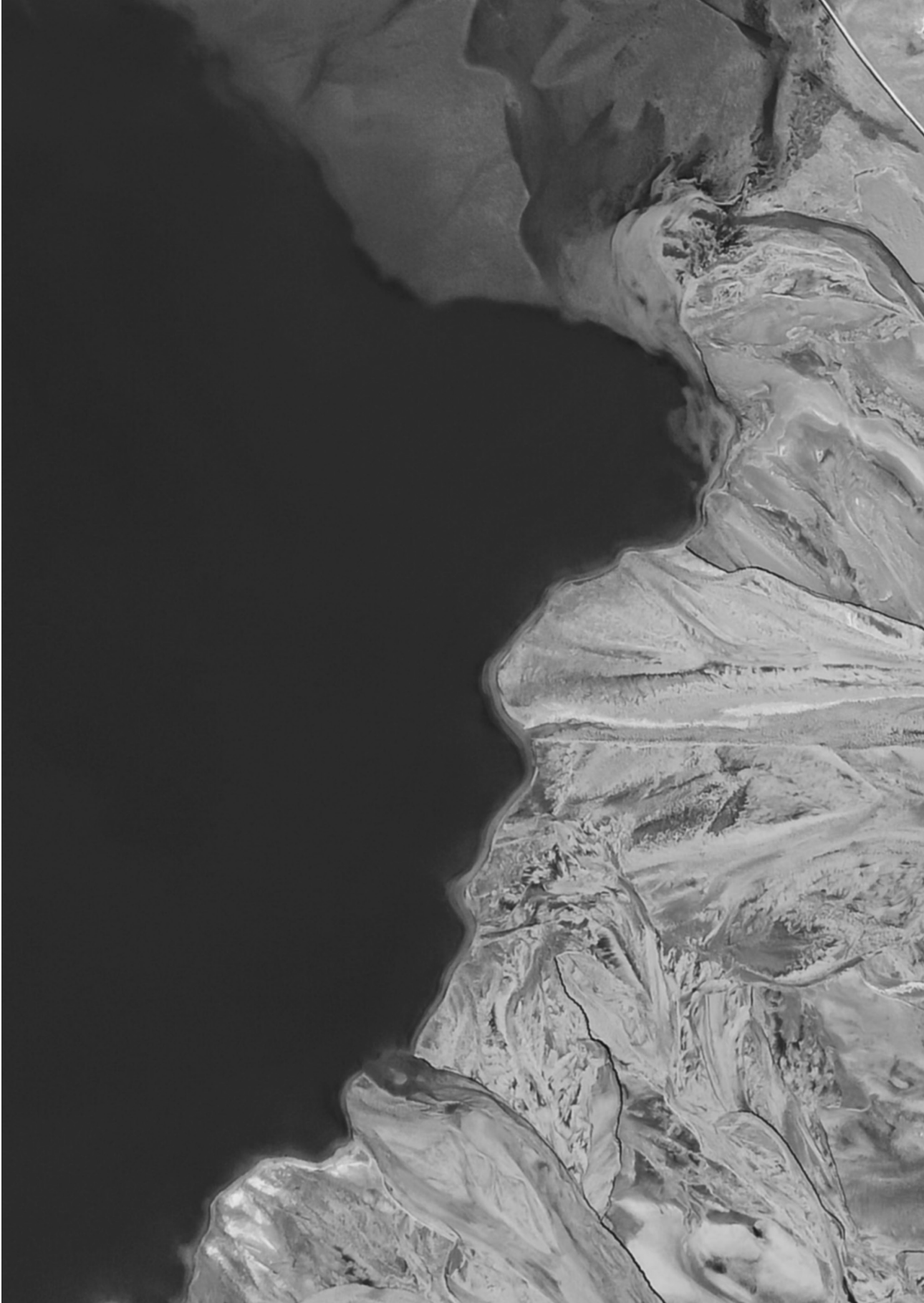
including their own, echoing the decision-making logic of meaning (Aarts, 2018; Dewulf et al., 2020). A tentative example of what adding political expertise to Broad Wellbeing could mean is found in a recent study by PBL Netherlands Environmental Assessment Agency on mobility policy (PBL, 2021). Discussing what broad wellbeing-based mobility policy could mean, the study shows how a choice between different theories of distributive justice – utilitarianism, egalitarianism, and sufficientarianism – leads to different kinds of policy measures appearing as the 'logical choice'. Such political expertise extends the contribution of expert organizations beyond bringing complex interrelations between different domains of life, in space, and in time to the fore (Lidskog et al., 2022; Lidskog and Sundqvist, 2018), but also actively empowers diverse actors to articulate these interrelations as political issues worthy of collective care (Maas et al., 2021, see **Chapter 3**; Marres, 2007). It may well be that the resulting contribution made by expert organizations is no longer recognizable as 'scientific' by conventional standards – something highlighted by one of our informants, who wondered whether her discussion-oriented perspective on Broad Wellbeing would "still be concrete, still be seen as scientific" (interview K, 30 June 2022). This hesitation shows that something significant is perceived to be at stake. A politicizing approach will change the science-policy-society contract, including norms of what is considered good science and of how science and society should relate. This will likely face opposition from those experts and policymakers who have built their careers and reputation on these norms (Turnhout and Lahsen 2022). Yet, it has become abundantly clear that continuing on the same path dictated by technocratic logics is not a viable option. The role of expert organizations must be reinvented for them to no longer be part of the problem and support democracy.

Rethinking relations between science, policy and society

We close this chapter by reflecting on how the argument we have set out can actually materialize and what alternative practices it may be able to engender within expert organizations. In these reflections, modesty befits us. We have not aimed to provide a blueprint for such alternative practices. The speculative design we set out in the previous section is our way to stimulate thinking on alternatives, which, in and of itself provides a kind of experimental fact. In this way, we hope to contribute to a wider discussion on how to improve relations between science, policy and society.

Foremost, it would be naïve to expect changes in these practices to arise endogenously in expert organizations. Relations between science, policy and society are a collective responsibility, and by direct extension, so is enacting political knowledge accountability. Change, thus, depends on policymakers and politicians explaining their decisions in normative terms, rather than deferring this responsibility to some transcendent authority of science (Stirling, 2010). The same goes for the various interlocutors referring to expertise in public debates, including the media and activists, who have a responsibility to interrogate decision-making and the role of expertise in a way that promotes discussion on what is *desirable* rather than what is necessary. In this collective responsibility, laments about a changing authority of science are misguided, since a changed authority of science might just be the revolution we need to break through the dominance of established actors (Esguerra and van der Hel, 2021).

At the same time, it is pertinent to point out two important changes in the institutional epistemologies of expert organizations that are prerequisites to alternative practices (Borie et al., 2021). First of all, it is crucial that expert organizations take an interest in questions that are still commonly perceived as 'non-scientific'. As put by Stengers (2018), rather than seeing 'non-scientific' or 'non-objective' questions as not of their concern, as "trespassing on matters to be decided in terms of political or ethical values (…) [they] have to be willing and able to participate in a collective assessment of consequences" (p.103). Second, it requires expert organizations to 'resist the urge to be relevant', at least for as long as the effectiveness of their work continues to be defined in terms of a fluid connection between a shared and singular frame for both knowledge and action (Turnhout, 2022; Turnhout et al., 2014). Dealing with strategic ignorance requires a critical reflexivity to recognize those questions whose answers will remain politically inconsequential. These political consequences should be at the front of our expectations of what expertise can contribute to decision-making. Ultimately, we think this is where the added value of expertise in navigating contemporary challenges lies.



Chapter 5.
Do we need a new science-policy interface for food systems?

Published as:

Turnhout, Esther, Jessica Duncan, Jeroen Candel, **Timo Y. Maas**, Anna M. Roodhof, Fabrice DeClerck, and Robert T. Watson. 2021. "Do We Need a New Science-Policy Interface for Food Systems?" *Science* 373(6559):1093–95. doi: 10.1126/science.abj5263.

Do we need a new science-policy interface for food systems?

Credibility, legitimacy, and diversity of knowledge are critical

Introduction

Food systems require urgent transformations to meet multiple demands of food and nutrition security, justice, livelihoods, biodiversity conservation, and climate change mitigation and adaptation. These transformations require knowledge on the multiple dimensions of food systems (e.g., production, trade, consumption, culture, human and animal health, livelihoods and employment, food waste, and environmental sustainability), as well as a mechanism to translate these insights and analyses into governance processes. Drawing on the role of the Intergovernmental Panel on Climate Change (IPCC) in global climate policy, an equivalent platform has been proposed to support food system transformations (Von Braun and Kalkuhl, 2015). These calls have gained momentum in the context of the upcoming United Nations Food Systems Summit (FSS) (Fresco, 2020). We reflect on the science-policy landscape for food systems and discuss requirements for and challenges of a science-policy platform, focused on addressing social, cultural, and political dimensions of food and challenges in food systems governance.

Our analysis is relevant for the current processes around the FSS, where critical voices have pointed to risks of undue corporate influence of the Summit and a dominance of techno-optimist approaches and solutions (Canfield et al., 2021; Burlingame et al., 2021). These concerns demonstrate the need to ensure equity and justice in the inclusion of scientific, local, and Indigenous knowledge systems and in the participation of actors from civil society, the private sector, and governments.

The Global Food Systems Science-Policy Landscape

There is no shortage of organizations and initiatives dedicated to the synthesis and assessment of knowledge around food systems for policy purposes. These include applied research organizations such as the reformed One CGIAR, assessment processes such as the International

Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD), the EAT-Lancet Commission, and the High-Level Panel of Experts (HLPE) to the UN Committee on World Food Security (CFS). Moreover, aspects of food systems are covered by the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), the IPCC, and the expert bodies of the Codex Alimentarius Commission.

A recent report commissioned by the European Commission reviewed the global food systems landscape and concluded that current organizations and initiatives provide valuable contributions to bridging gaps between knowledge and policy-making (European Commission, 2021). Nonetheless, it identified a need for integration and coordination, in addition to filling gaps in knowledge related to, for example, the political economy and sustainability dimensions of food, as well as options for transforming food systems (5). By underscoring the importance of global knowledge synthesis for food systems transformations, the report illustrates a mode of reasoning identified in other policy domains where the science-policy interface is put forward as a solution to improve governance (Turnhout et al., 2014). Although this reasoning can be intuitively appealing, we raise two critical questions to consider as part of any decision-making process about whether and how to improve the food systems science-policy interface: How can a food systems platform ensure legitimate and credible knowledge?; and how will it be able to support actual improvements in food systems governance?

Ensuring Credible and Legitimate Knowledge

There is increasing consensus that inclusive and participatory approaches to knowledge production can support the credibility and legitimacy of knowledge. This is particularly important for the case of food systems science and knowledge. Although science can provide clarity on global guardrails to guide policy on health, climate, and environment, the IAASTD has made evident that food systems science and knowledge involve tensions and contestations, among others, about the potential contributions and risks of technologies like genetically modified organisms, pesticides, trade agreements, agroecology, and organic farming to desired food system outcomes (IAASTD, 2008). It is important to recognize that these contestations are characterized by competing understandings not only of what policy options are effective and legitimate but also of what knowledge is seen as relevant and credible. That is, they are not simply controversies over competing values or interests; they are knowledge controversies (Turnhout et al., 2019).

Although there is no doubt about the value of science, the persistence of knowledge controversies underscores the importance of including plural forms of knowledge from natural science, social science, and humanities disciplines, as well as from Indigenous and local knowledge systems. A key task of global platforms lies in organizing the rigorous, independent, and expert-led synthesis and assessment of this knowledge without a priori privileging science. Put differently: We need a knowledge-policy interface, not just a science-policy interface.

However, ensuring pluralism is not an easy task in view of current inequities between knowledge holders, particularly geographical differences in scientific capacities, access, and resources, and differences between industry-funded versus civil society–oriented research efforts. In this regard, IPBES is often seen as an example of a mechanism that has taken explicit steps to ensure this inclusion and diverse participation (Diaz-Reviriego et al. 2019), and this has been of key importance to the authority and relevance of its assessments. The HLPE, which develops evidence-based analyses and advice at the request of the CFS, similarly calls for the representation of diverse knowledges (Duncan et al., 2018). Notably, the HLPE pays explicit attention to controversies to explore how diverse knowledges can enrich understanding of problems, solutions, tensions, and trade-offs (Duncan et al., 2018). The HLPE's Global Narratives report offers an example that explicitly discusses controversial areas, such as sustainable intensification and Climate Smart Agriculture, and identifies and assesses diverse knowledge claims from plural knowledge systems (HLPE, 2020).

Supporting Improved Food Systems Governance

Improving the knowledge-policy interface only makes sense if it can actually contribute to the needed transformations in food systems. This is an urgent issue in view of the challenges of global food governance, which include a lack of coordination, conflicting interests between stakeholders and member states, and a general failure to ensure equitable access to sufficient and healthy diets, improve livelihood opportunities for food producers and processors, and contribute to sustainability (Candel, 2014).

Experiences from IPBES and IPCC show that political buy-in and uptake are facilitated by the joint negotiation by governments of the assessments' summaries for policy-makers. The 2019 IPBES Global Assessment made global headlines, and the IPCC's repeated messages over many years have contributed to raising awareness and changing discourse and policy.

However, challenges remain in informing and supporting concrete actions by public and private decision-makers across levels and scales (Maas et al., 2021, see **Chapter 3**). The pluralist approach suggested in the previous section is key to securing relevance for and uptake by a diversity of actors in government, civil society, and the private sector, all of whom play vital roles in food systems governance (Pearce et al., 2018). In other words, and expanding further on the notion of the knowledge-policy interface, what is needed might be better called a knowledge-governance interface.

The CFS and the HLPE offer an example with procedures comparable to those of IPBES and the IPCC in the sense that HLPE reports form the basis for the joint negotiation of policy recommendations. Notably, the CFS has offered participation rights to relevant stakeholder groups, including from civil society and the private sector. This means that member states and participants are active in negotiations, including those concerning knowledge and assessment, and, with varying degrees of influence, in the contextualization of policy outcomes (HLPE, 2020). Analysis of the ongoing national food system dialogues of the FSS could illuminate whether this other model can effectively engage diverse actors and enhance the credibility, legitimacy, and actionability of options and pathways.

Moreover, the IPCC and IPBES inform specific multilateral conventions and also address specific requests from these conventions. This adds weight to the assessments that are produced and pushes the scientific community to produce "demand-driven" research that has specific value to decision-making. Apart from binding regulations related to the trade of food mediated through the World Trade Organization (WTO), there is no dedicated global convention for food systems.

Improving the knowledge-governance interface requires not just improving science and knowledge, but also improved coordination of governance. This can involve coordination between international organizations such as the CFS and WTO, as well as the development of dedicated international food systems regulations (Vos, 2015). For example, the UN Framework Convention on Climate Change and the Convention on Biological Diversity could include targets and actions to promote food systems sustainability. The fragmentation of food systems governance means that it is currently unclear what governance processes a food systems platform will inform and how governments and other intended policy and societal audiences will be engaged. If there is no real perspective on improved governance, this will ultimately undermine the utility and effectiveness of a food systems platform.

An IPCC For Food?

As we have discussed so far, efforts to strengthen the food systems knowledge-governance interface require improved coordination of knowledge as well as governance, and a participatory and pluralist approach to both.

Creating a new food systems platform following the models of the IPCC and IPBES is a potential option to meet these objectives. However, this model involves considerable challenges. For one, it will likely take several years of intergovernmental negotiations before assessment work could start, and the costs of such a platform are also substantial: an estimated USD 5 to 8 million per year. Second, close engagement with governments and stakeholders will be needed to ensure that the platform is demand-driven; supports the interaction between knowledge, policy, and action; and maintains independence, legitimacy, and credibility.

Despite the tremendous efforts of IPCC and IPBES in accomplishing these goals, there is also a potential limitation pertaining to pluralism and legitimacy. The experience of IPCC and IPBES shows that governments have been restrictive in allowing the participation of stakeholders from science, the private sector, or civil society in decision-making roles in the platform, including decisions about what assessments will be undertaken and other components of the program of work, or the negotiation of platform products. Governments thus have a deciding role in what and whose knowledge needs will be met and how. If repeated in a new food systems platform, this may affect the credibility and legitimacy of assessments, as well as their relevance for and uptake in governance processes.

In this respect, the participatory mechanisms of the CFS and the HLPE provide alternative models to enhance pluralism in the production of assessments, as well as in their use and uptake (Burlingame et al., 2021). Both are not without challenges and limitations of their own. Intergovernmental negotiations are often frustrating and lengthy, and the open and participatory approach of the CFS can contribute to this. Recent policy negotiations have left many actors questioning its effectiveness. Moreover, the HLPE relies on a much smaller number of scientists than IPBES or IPCC and needs increased funding and capacity to integrate available knowledge.

Another option, and a potential way to make progress on this issue, is the organization of a food systems assessment. This would contribute to the coordination and synthesis of knowledge without the high costs and lengthy negotiations involved in creating a new platform. To ensure relevance and uptake, the assessment could be called for and overseen by an

existing intergovernmental body such as the UN General Assembly or the FAO Council and could create organizational roles for the CFS and HLPE. In this option, care must be taken to ensure participation and inclusion of diverse stakeholders and forms of knowledge. Throughout the process, a clearer picture could emerge on what further institutional steps can be taken, whether to create a new platform, strengthen the HLPE and the CFS, or take some other approach.

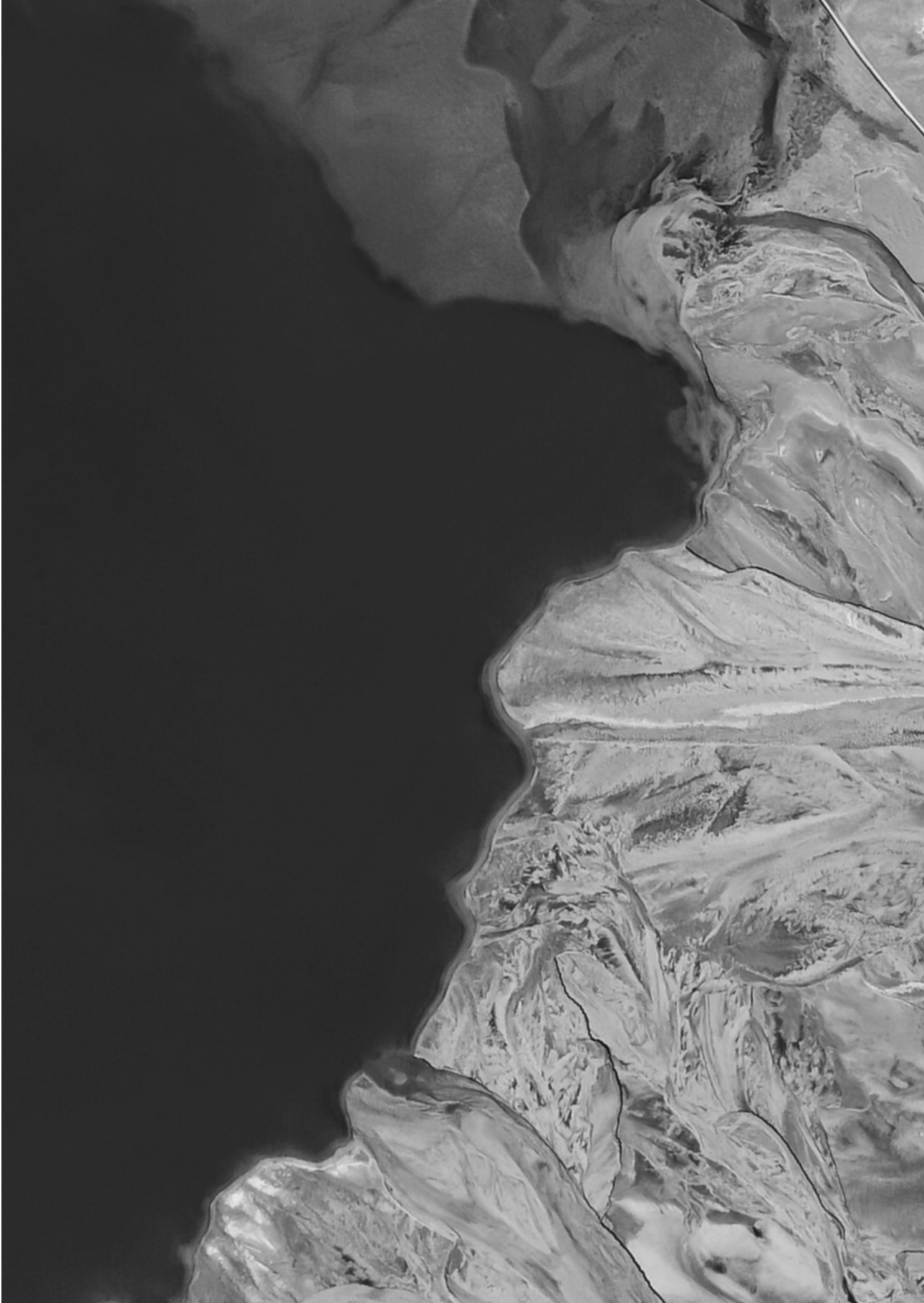
No Silver Bullet

There is no silver-bullet solution that will be able to address current challenges in food systems knowledge and governance. Efforts to coordinate knowledge can be valuable, but only if these efforts ensure the legitimacy and credibility of knowledge, and when they can contribute to urgently needed improved global food governance. Although creating a new platform can be appealing, we offer three issues for careful consideration.

First, we have to consider what is already in place. In many ways, the CFS and the HLPE are well positioned to fulfil the role of a food systems knowledge-governance interface. We need to consider what challenges they face and why, and how these challenges can be overcome. Without such reflection, a new platform or assessment will likely reproduce these same challenges.

Second, if pluralism, equitable participation, and inclusion of diverse forms of knowledge cannot be ensured, a new platform could do more harm than good. In this scenario, a new platform would risk promoting a narrow and regressive understanding of food systems issues and knowledge and risk acting as an obstacle for the needed transformations.

Third, we must recognize that effective governance cannot be reduced to scientific input. Fostering a just and sustainable global food system requires commitment, political will, and the participation of governments and stakeholders. The implicit suggestion in many science-policy interface initiatives that the synthesis, assessment, and communication of knowledge will strengthen governance in and of itself is misguided and overly simplistic, and it risks detracting attention away from actual policy action. Any existing or new science-policy platform will have to carefully navigate these political dimensions by putting inclusion, justice, and equity centre stage.



Chapter 6.
General conclusion and discussion

General conclusion and discussion

I opened this thesis by expressing my concern about contemporary sustainability issues and my interest in the potential held by the emerging discourse of transformative change to address these issues (Feola, 2015; Scoones et al., 2020; Visseren-Hamakers et al., 2021; Fisher et al., 2022). More specifically, I am interested in the question whether relations between science, policy and society need to be transformed in order to contribute to such transformative change. The potential I consider transformative change to hold lies in its apparent openness to question, rethink, and change current structures and societal practices. I also think it is promising that the scientific community as whole, so no longer just social scientists, is starting to recognize that sustainability issues are inseparable from ethical, political, and socio-economic concerns (see e.g. Biermann, 2021).

I do not know what a transformatively *changed* world will look like, just that some kind of transformation is increasingly likely. After all, *not* addressing sustainability issues will also result in something akin to transformative change – major climate disruption and an unravelling of the 'fabric of life' (Diaz, 2022). In this final chapter I will argue that accepting this indeterminacy – the not-precisely-knowing of transformative change – plays a key role in the potential of transformative change. Crucially, this potential is not going to actualize itself. We, therefore, need to cultivate our ability to influence *what* transforms and *how,* and find new ways of inhabiting Earth (Latour, 2018). In this respect, I am interested in calls to repurpose science-policy arrangements to facilitate and enable transformative change. Can transforming science-policy arrangements help grasp the potential I consider transformative change to hold? As a result, I formulated the following objective of this thesis: **to articulate an effort to repurpose science-policy arrangements for transformative change for sustainability.**

Chapter 1 demonstrated that it is neither self-evident that science-policy arrangements can make this contribution, nor that we should be overly confident that they are currently being sufficiently shaped to do so. I argued that a persistence of three problematic modernist assumptions about knowledge, politics and policy limits the ability to shape science-policy arrangements in desirable directions. To repeat these assumptions, which are strongly interrelated, here: (1) the assumption that knowledge is neutral and value-free, (2) the assumption that knowledge is separate and prior to action, and (3) the assumption that action depends on the exercise of a singular, concentrated agency that is driven by deliberate intentionality. Together, these assumptions leave the fundamental question about desirability unasked and

unanswered – 'what are the science-policy arrangements we want for transformative change'. I highlighted that putting these modernist assumptions aside can be helped by mobilizing insights on enactment, pluralism, power and democratic politics. Alternative analyses of science-policy arrangements that engage with these insights can help constitute more desirable alternatives; alternatives in which science-policy arrangements are fit to facilitate transformative change. Consequently, the discussions in **Chapter 1** resulted in the following three research questions central to this thesis:

1. ***Through what division of roles and responsibilities are science-policy arrangements enacted?*** (**RQ1**). With this question I aimed to understand the obduracy of the linear model in practice, while (re)introducing a symmetrical understanding of actors in science-policy arrangements.

2. ***What does the diversity of actors involved in transformative change mean for how to conceptualize the effectiveness of science-policy arrangements?*** (**RQ2**). With this question I sought to contribute to understanding how science-policy arrangements might come to terms with the shift from government to governance.

3. ***What does the political dimension of transformative change mean for how science-policy arrangements are to be enacted?*** (**RQ3**). This final question consciously took a prescriptive angle, and sought to explicate the consequences of repurposing science-policy arrangements for transformative change through explicitly engaging with the interrelations between democratic politics and transformative change.

In this thesis I have addressed these questions through a set of analyses of different cases, each presenting a different science-policy arrangement. In the process, I have been in the relatively unique position of doing my research while also working within a prominent Dutch science-policy organization (PBL). In this final chapter, I answer my research questions, reflect on the positionality of studying the science-policy interface from within, and discuss my thesis' contributions and implications for studying and shaping relations between science, policy, and society. To illustrate how these contributions and implications can be put to work, I conclude by reflecting on what they might mean for PBL.

Answering the research questions

In this section, I answer the individual research questions across the chapters in this thesis.

A lopsided distribution of responsibilities risks enacting science-policy arrangements as obligatory passage points towards action, which stifles potential for change

To start with my first research question, *through what division of roles and responsibilities are science-policy arrangements enacted?* I addressed this question foremostly in **Chapter 2**, which focused on the framework agreement between PBL and the Dutch Ministry of Foreign Affairs. I used the concept of social practice to analyse how my colleagues, both those within PBL and those on the 'policy side', enacted this science-policy arrangement. Social practice theory allowed me to approach science-policy arrangements symmetrically, without *a priori* privileging researchers or policy actors. To guide the analysis, I presented a heuristic separation between linear and co-productive models of science-policy arrangements, each of which are characterized by particular repertoires, competencies, and context (see **Tables 5 and 6** adapted from **Chapter 2** below). Through this, I was able to show that by and large, the linear model is able to persist through a continuing division of labour between science and policy in the way the arrangement is enacted. Although among both researchers and policymakers there is some recognition of points of entry for more co-productive science-policy arrangements, change is constrained by the lack of alternative imaginaries of what this would look like in practice. Moreover, discussions tended to focus one-sidedly on roles and responsibilities of the researchers involved, while the question of what might be appropriate roles and responsibilities for other actors was largely overlooked. As a result, researchers tended to be casted as the sole knowledge-producing actor in science-policy arrangements. To the extent that the role of other actors was given consideration, it was primarily as a rather passive recipient of knowledge, and secondarily as potential source of questions for researchers to answer. The enactment of science-policy arrangements in this case thus created a division of labour in which responsibility for knowledge production comes to lie almost entirely with the 'science' side of science-policy arrangements.

		Linear	Co-productive
Repertoire *How is one expected to operate in the science-policy arrangement?*	*Knowledge brokering*	Supplying, Bridging	Facilitating
	Logics of decision-making	Consequentiality and appropriateness	Meaning
Competencies *What makes actors able to perform well in the arrangement?*		Boundary work & stage management	Co-productive agility
Context *In what ways do context factors stabilise the arrangement?*		Expert-driven policy context in which institutional and spatial configuration promotes separate domains of science and politics	Normatively-driven policy context in which institutional and spatial configuration promote conjunction of science and politics

***Table 5**. Summary overview of the characteristics of the linear and co-productive models of science-policy arrangements.*

	Supplying	**Bridging**	**Facilitating**
Knowledge brokering repertoire	The science-policy arrangement aims to provide policymakers with knowledge produced by experts	The science-policy arrangement aims to answer questions policymakers have with relevant knowledge produced by experts	The science-policy arrangement enables policymakers and experts to collaborate to co-produce more-than-knowledge
Logic of decision-making	Logic of consequentiality: decisions are based on their expected consequences	Logic of appropriateness: decisions are based on rules prescribing what to do in what situation	Logic of meaning: decisions are based on what is meaningful to decision-makers

***Table 6**. Summary of the three repertoires, based on Turnhout et al. (2013) and Dewulf et al. (2020).*

Such a lopsided distribution of responsibilities creates important problematic consequences. First of all, it narrows down what is viewed as relevant knowledge to the knowledge that is held and produced by scientific actors. It thus prevents knowledge to be taken into account that is less formal and less likely to be codified or to hold a scientific stamp of approval, even if such knowledge might hold important insights. Moreover, as **Chapter 5** highlighted in the context of discussions about improving food systems science-policy arrangements, disputes about policy choices often embed controversies about what knowledge is seen as relevant and credible. Such disputes have more to gain from an inclusive and plural approach to knowledge. Hence, our reframing of science-policy arrangements as *knowledge*-policy arrangements. Such a reframing helps to see how a more symmetrical approach to roles and responsibilities also enables new strategies to be found for improving science-policy arrangements. As **Chapter 3** highlighted for global environmental assessments, a myriad of actors is directly and indirectly involved in their scoping, production and use and this means that the effectiveness of these assessments hinges not just on the ability of scientists to produce more authoritative

assessment reports, but also on finding new ways by which assessment processes can accommodate the knowledge held by the wider diversity of actors involved.

Secondly, a one-sided distribution of responsibilities towards science comes with particular expectations about what knowledge can do. In **Chapter 4**, and building on insights from the sociology of ignorance, I introduced the concept of knowledge accountability to refer to the way in which decision-makers are expected to explain and justify what knowledge influenced their decision and how. In this respect, to allocate responsibility for science-policy arrangements with scientists reflects a technocratic logic of knowledge accountability. This logic focuses primarily on estimating the (expected) effects of (potential) policy decisions without opening up explicit discussion around the question of what might be desirable effects. It asks them to explain and substantiate what the expected effects of their choices *are*, not what effects they *want* to achieve. Crucially, because even estimates of ostensibly objective effects contain invisible normative choices, this logic creates a paradoxical combination of political freedom and constraint. On the one hand, policymakers are considered to be free to decide independently, but on the other hand they are expected to explain these decisions within the constraints of a fixed and predetermined framework. This means that technocratic knowledge accountability is primarily suitable for improving performance within current structures, but has relatively little to offer to changing those structures.

The narrowing down of relevant knowledge to technocratic expectations about what knowledge is and can do, positions science-policy arrangements as obligatory passage points towards action. It reinforces the assumption that knowing is separate from and prior to doing; the assumption that we need to 'first know, then act'. The corollary of this assumption is that it feeds into the thought that science-policy arrangements can in and of themselves form a solution to governance problems. That if we get the science right, the policy will undoubtedly and inevitably follow. However, this one-sided search for solutions through science in the end only reproduces this assumption and continues to prioritize effectiveness as the goal of science-policy arrangements instead of questioning what they *do* and *could do*. So let me turn to answering my other two research questions and discuss how these answers help decentre science-policy arrangements and articulate their potential to contribute to transformative change.

Recognizing the diversity of actors involved in governance allows for a decentring of science-policy arrangements

My second research question asked *what does the diversity of actors involved in transformative change mean for how to conceptualize the effectiveness of science-policy arrangements?* In formulating this question, I highlighted in **Chapter 1** how the governance of sustainability issues is now generally taken to have become a polycentric affair. If we take this polycentricity seriously, the assumptions that knowledge is separate from and prior to action and that the domains of science and policy can be clearly demarcated become untenable. This, in turn means that attempts to retain the status of science-policy arrangements as obligatory passage points is detrimental to the potential for transformative change, because it results in depoliticization that forecloses possibilities for change. In this respect, I see an understanding of the effectiveness of science-policy arrangements in relation to this wide variety of governance actors as one way to decentre these arrangements, and as a stepping stone to re-allocating roles and responsibilities in ways that are more conducive to change.

As a first step in this direction, **Chapter 3** reconceptualized effectiveness as empowerment: the ability of science-policy arrangements to enable diverse actors to enact agency towards their own socio-environmental objectives. Crucially, this empowerment arises from interactions between science-policy arrangements and other actors, and it works bi-directionally. The chapter's empirical focus on global environmental assessments (GEAs) situated it at the epitome of the polycentricity of contemporary environmental governance. After all, GEAs may be used across different levels of government, and by actors in academia, the private sector, as well as civil society. Foregrounding this diversity of actors highlighted that improving the effectiveness of GEAs must go beyond enhancing the authority of reports, and it puts questions of what effectiveness is desirable and whose actions GEAs should support and catalyse front and centre. While it is impossible to empower all actors equally, science-policy arrangements can improve their ability to empower a broad range of actors. Yet, the ability to empower broadly depends on the degree to which science-policy arrangements manage to ensure pluralism and accommodate a diversity of knowledges, perspectives and frames of problems and solutions. The extent to which pluralism can be accommodated shapes the opportunities for other actors to meaningfully engage with science-policy arrangements and whether agency can arise from these engagements. This openness to action by a broad range of actors is also what the notion of knowledge-*governance* arrangement introduced in **Chapter 5** seeks to convey.

Improving effectiveness through broader empowerment extends the earlier point on how policy discussions often embed knowledge controversies. These controversies cannot be resolved by 'better' knowledge but revolve around *what* and *whose* knowledge is 'good enough' for acting in one way or another. A pluralist approach to knowledge is then not simply a matter of improving the 'quality' of knowledge, by making it more complete or integrated, but explicitly links knowing and acting. This link between knowing and acting is also found in **Chapter 3**'s understanding of empowerment as arising in interactions, and therefore being symmetrical and bi-directional. This symmetry can be seen to extend to the link between knowing and acting. In that way, it becomes clear that empowerment does not privilege either one over the other, nor does it assume that acting is necessarily sequential to knowing. Approaching effectiveness in this way thus points to the need to eliminate the position of science-policy arrangements as obligatory passage points for action, but retains and explains their potential to *contribute* to (transformative) change. By repositioning them from obligatory passage point to potential contributor, it also becomes clear that science-policy arrangements are not in and of themselves solutions for governance problems. This means the importance of science-policy arrangements can no longer be taken for granted, but rather must be formulated based on an explicit articulation of what their potential contribution could be: what empowerments, what kind of interactions, do they make possible? My third research question explores this in the context of the politics of transformative change.

Science-policy arrangements should contribute to pluralizing and politicizing transformative change

My third research question asked the question of *what does the political dimension of transformative change mean for how science-policy arrangements are to be enacted?* I formulated this question taking as a starting point that it is considered desirable for science-policy arrangements to facilitate transformative change, and that transformative change is a political process. For this, I suggested in **Chapter 1** that articulating the contribution of science-policy arrangements would benefit from a more explicit understanding of the interrelations between democratic politics and transformative change. In **Chapter 4** I provided such an understanding based on the political philosophies of John Dewey and Chantal Mouffe. In my interpretation, their thinking shares a commitment to the possibility for change that is not just procedural but also substantive. From Dewey, I took that addressing public problems – issues – requires a continuous re-making of governance, and from Mouffe that consensus is always an outcome of power relations and should therefore always be temporary. Their thinking thus contains a

fundamental openness to questioning the desirability and legitimacy of current trajectories; to ask, are we (still) doing the right things? This question highlights why they both consider pluralism an important virtue. Pluralism carries most possibility of contesting the desirability and legitimacy of current trajectories, of contesting the temporarily-established consensus, thereby creating a potential for change. This foregrounding of pluralism as a productive force provides an understanding of democratic politics as an enabler of change. In this perspective, the meaning and direction of transformative change not only are, but also should remain unstable, allowing for different views on what ought (not) to be sustained or transformed to arise. In other words, pluralist politics are not obstructive to change, but are a vital means of articulating and enacting change in desired directions, while simultaneously making sure that this change has a permanently tentative and provisional character.

In this way, I posited that transformative change requires knowledge about what action could be *desirable,* and for whom, rather than what action is 'sound', 'necessary', or 'possible'.[14] This focus on what is desirable connects the politics of transformative change to science-policy arrangements through the logic of political knowledge accountability (**Chapter 4**). This logic, I argue, enables formulating the potential contribution of science-policy arrangements as stimulating pluralism and providing expertise that politicizes; that empowers actors to politicize issues. In other words, to facilitate transformative change, science-policy arrangements should not seek to adjudicate in political conflict, but rather empower actors to articulate a plurality of perspectives on desirable change. To this end, science-policy arrangements should make visible what norms and values these perspectives embed – what worlds do they imply? Such visibly political discussions also allow for a more explicit attention to justice and equity in transformative change, even if this does not guarantee transformative change to be just and equitable. An emphasis on pluralism and politics pairs well with the aforementioned need to aspire to broad empowerment, as it acknowledges and invites a diversity of actors as co-producers of knowledge and action.

Finally, this commitment to maintaining the plural and political potential of transformative change also brings me back to the distribution of roles and responsibilities in science-policy arrangements (**RQ1**) and the re-framing of effectiveness (**RQ2**). My combined understanding of democratic politics and transformative change can be seen as a starting point for the alternative imaginary **Chapter 2** called for; an imaginary in which political choices cannot be

[14] This differs from, but is sometimes caricatured as, the extreme relativist position that 'everything is possible'. Usually, such caricatures serve to foreclose discussion and act as a kind of prohibition on thinking through the question of what it would mean for something to be true.

deferred to science-policy arrangements. Such an imaginary is critical to articulate how science-policy arrangements might constructively contribute to – rather than constrain – transformative change. Such a constructive contribution is also what I have aspired to achieve in my own plural positionality as a PhD-researcher *and* PBL-employee. I now turn to reflecting on the consequences of my positionality for this thesis, before discussing this thesis' contributions and implications for studying and shaping relations between science, policy, and society.

Reflections on studying the science-policy interface from within

I have been in a relatively unique and fortunate position while writing this thesis, being able to combine it with working in a prominent science-policy organization. I already reflected on some of the consequences for my positionality in **Chapter 1**, describing it as multiple due to the combination of roles. Not only could I conduct the in-depth analysis and reflection on science-policy arrangements that a doctoral thesis entails, but in my PBL-role I was also concurrently coordinating the PBL-MFA collaboration (**Chapter 2**), doing 'substantive' work on PBL reports and policy briefs (e.g. Maas et al., 2020; Lucas et al., 2020; Maas et al., 2022b; Maas and Lucas, 2021, 2023; Arts et al., 2023), and engaged in methodological and reflective work on the way PBL approaches impact assessment. This combination of PhD and PBL roles raises the question of how this multiple positionality has affected that research and what this means for the criticality and validity of this thesis.

I begin with the potentially conflicting situation that the cases presented in which I was directly reflecting on the work of myself and my direct colleagues. Especially **Chapter 2**, and to a lesser degree **Chapter 4**, lie at the heart of my PBL-position and critically reflect on PBL practices. However, it is not self-evident what 'critical reflection' means for a situation that is so intertwined with one's daily working environment, since interpersonal and collegial relations affected the kind of questions I asked and the interpretations I gave. For instance, in this thesis I do not address questions around motives, agendas and potential conflicts of interests at the level of individual researchers or the organizations they work for. In part, this may be due to the deep level of discomfort I would likely have felt personally to explicitly discuss such questions with the same people I also review the weekend with. But I also think such questions practice a different kind of ethics than I sought to do in this thesis. As Thrift (2003) explains by invoking Spinoza, such questions of motives, agendas and conflicts of interest might be

more about 'praise or blame' than about gaining a better understanding of ourselves. My objective was the latter. I intended to reflect on our practices so that we could improve them, and with this objective in mind I also presented my work at various moments *to* my colleagues. This objective also relates to a difference I discussed in **Chapter 1** on my research design, namely that my interest is not so much in what is 'true' but rather what the effects are of what we take to be true, and whether these effects are desirable and helpful in light of ambitions around transformative change, or whether they obstruct desirable change. I certainly see my chapters as taking a critical stance towards those effects while avoiding 'blaming' individuals, and thereby remaining able to promote a reflexive discussion about whether our way of working is still fit for purpose.

Moreover, my own sense of actually 'having something to contribute' to discussions about possible change in science-policy arrangements also grew significantly over the course of this PhD. Especially in the first two years or so, I found it hard to judge to what extent my 'critical stance' towards our own science-policy relations at PBL – are *we* doing the right things? – was valued by others in the organization. I frequently questioned how direct I could be, and to what extent I might have to walk on eggshells to remain seen as a legitimate – loyal, committed – member of the organization. It was never easy – and probably still isn't – to assess whether I was right to be hesitant. On the one hand, instances such as colleagues responding dismissively to my use of the term 'politicizing' in a presentation would suggest so, but on the other hand I also received support and was given much freedom to develop my ideas. Nonetheless, I did experience being a precarious researcher (on a fixed-term contract) as a barrier to fully discuss these ideas beyond my immediate colleagues (PBL has about 250 employees). Without formal certainty about my employment position there was an ever-present, but never articulated, feeling that I might be seen as 'difficult' and not worth keeping on a permanent contract. I started to become more self-assured in my sense of having something to contribute after the publication of my first papers, as well as after receiving positive and interested responses to my work from people both within and outside of the organization. Such assurances acted as encouragement to become more 'entrepreneurial' towards the end of my PhD-trajectory, taking up opportunities to articulate my views on desirable change in the organization. Undoubtedly, eventually obtaining a permanent contract helped too.

Before going into the opportunities I encountered to contribute to change in science-policy arrangements, it is worth emphasizing that these cannot be reduced to knowledge and expertise in the traditional, codified, sense. Sure, written material in some cases prompted such opportunities to arise, as well as providing a means to structure my arguments and thinking.

In that way, written materials made it easier for me to offer a coherent and meaningful contribution when an opportunity presented itself. But I think the role of written materials cannot be separated from more invisible interactions, and I think the opportunities I did encounter illustrate this. For instance, PBL was asked to participate in a UNEP Steering Committee on the future of the Global Environmental Outlook, for which the senior colleague sitting on this committee and I regularly drew on our thinking for **Chapter 3** and the related PBL-report on global environmental assessments. A presentation of this report to Dutch policymakers also provoked the trajectory that would lead to **Chapter 5**. I think it is easy to forget about the role of such a presentation and the subsequent contact I had with these policymakers, now that the resulting reflections are published as a Policy Forum in *Science* (which means that they are certainly recognizable as a written contribution to a debate). Even more invisible are the ways I have sought to institutionalize insights from this thesis in the new framework agreement between PBL and the Ministry of Foreign Affairs (2022-2027), for which I wrote the proposal in consultation with my MFA counterpart. Finally, (other) opportunities for change within PBL exist in numerous settings. For instance, by writing a letter to the incoming director-general of PBL, as I did with two colleagues. We saw the fact that PBL would be getting a new director-general as a good opportunity to highlight his unique responsibility to position PBL both internally and externally. Finally, I foresee discussions about our own way of working to carry on long past this PhD. After all, such discussions are not conducted on the pages of this thesis, but in a range of everyday practices and internal strategic discussions and decisions. Further below I summarize what I think this thesis could contribute specifically to PBL's practices, but first I turn to the contributions and implications of this thesis to studying and shaping relations between science, policy and society.

(Re)thinking and (re)making science-policy arrangements

Following on from my answers to the research questions and reflections on working 'within' a science-policy arrangement, I formulate three ways in which I consider my thesis to contribute to studying and shaping science-policy arrangements. To emphasize the need to avoid reductive solutionism – i.e. to retain a sense of not-precisely-knowing – these contributions are formulated as questions. The first question is: *what are the science-policy arrangements we want*? It seeks to open up the ability to decentre science-policy arrangements, in order to enable an explicit discussion on what might be a normatively desirable function of science-policy arrangements. The second question is: *what makes science-policy arrangements able to*

facilitate transformative change? In discussing this question, I present my own – provisional – view on this desirability. While this second question addresses science-policy arrangements *for* transformative change, my third question is about transformative change *in* science-policy arrangements: *how to create and seize opportunities for transformative change in science-policy arrangements?*

What are the science-policy arrangements we want?

The first contribution I consider my thesis to make is a call to foreground *desirability* in the study and practice of science-policy arrangements. I think it is of paramount importance that we are able to discuss science-policy arrangements in terms of what we *want* them to do. This may not seem like a difficult question: few would argue against the generic idea that science-policy arrangements can and should contribute to policymaking. But as I show in this thesis, and what is also evident from literature on science-policy arrangements and research impact (Halffman, 2005; Pregernig, 2014; Boswell and Smith, 2017; Smit and Hessels, 2021), there are many different ways to position and achieve such a generic contribution in practice. In other words, there is a multiplicity to enacting science-policy arrangements.

Chapter 2 showed that the linear model may be dominant, but it coexists with entry points for more co-productive arrangements. Also, the various examples of empowerment highlighted in **Chapter 3** pointed to the multiple ways global environmental assessments contribute to socio-environmental outcomes. Nonetheless, even though science-policy arrangements are enacted in multiplicity, we still need to ask about the effects, appropriateness and desirability of the enactments we encounter. These are normative and essentially contestable questions, and they are, thus, also political questions. This is the reason STS literature on enactment speaks of ontological *politics* (Mol, 1999).

Efforts to improve science-policy arrangements by taking these political questions into account are thwarted by a wider dynamic of depoliticization identified in global politics and Western democracies, which has arguably led to a 'post-political condition' (Mair, 2006; Mouffe, 2005; Swyngedouw, 2011). In this condition, political decision-making is characterized by arguments of necessity and inevitability, arguments which constrain choices by invoking the Thatcherian notion that 'there is no alternative' (Davidson and Iveson, 2015). While Thatcher's words are emblematic for the association between depoliticization and neoliberalism, I suggest that depoliticization is equally present in some contemporary progressive pleas

for sustainability – 'follow the science' (or else…?).[15] Indeed, depoliticization pairs well with the modernist idea about science as being the value-free pursuit of truth about a single, putatively knowable world. This idea is problematic for several reasons: it ignores the large body of literature showing facts and values to be intertwined, it marginalizes other ways of knowing and being (Escobar, 2020), it is susceptible to sabotage by doubt-mongering and other 'discourses of delay' (Oreskes and Conway, 2010; Lamb et al., 2020), and ultimately, it leaves many controversies without a means to settle them. As Sarewitz (2004) explains, "for a given value-based position […], a supporting set of scientifically legitimated facts" can often be found (p. 389). The presence of epistemic uncertainty and normative ambiguity in facts means that decision-making cannot defer responsibility to a transcendent authority of science (Stirling, 2010; Jasanoff and Simmet, 2017). Depoliticizing issues by continuing to pretend such a mode of settling them is possible arguably leaves us with what Schinkel (2012) has called a lack of fact-free politics. Modernistic depoliticization thereby leads to inaction and unaccountable decision-making. In recent years, little has made what Jasanoff (2007, p. 33) has dubbed an "overdependence on fact-finding" more plainly visible than Covid-19. As several publications point out, many approaches to the use of expert advice in Covid-19 decision-making were characterized by a focus on reducing factual uncertainty, but avoided attention to the normative-political choices made in the process (Bacevic, 2020; Prettner et al., 2021; Hulme et al., 2021; Jasanoff et al., 2021; Evans, 2022).

As **Chapter 4** of this thesis argued, depoliticization merely hides politics; stifling potential for change. Depoliticization does not remove politics – as if normative questions suddenly stopped mattering – but narrows these questions down to arguments of necessity rather than choice. This forecloses possibility for political and democratic deliberation on what change, if any, is desirable. In this way, a reluctance to take a normative position creates a game of make-believe, pretending another world, another choice, is impossible. It is this reluctance to take a normative position that I see as problematic also for efforts to improve science-policy arrangements, and is at the core of the 'more is better'-view of science-policy arrangements I set out in **Chapter 1**. After all, in a climate of depoliticization, the idea that value-free knowledge can inform deterministic governance is akin to a siren call – if only we can *discover* how best to arrange science-policy arrangements, we can *necessarily do* them optimally (Stirling, 2016; Sokolova, 2023). Indeed, how irresistible is it to be able to present an improvement of science-policy arrangements in a way that transforms them into an ostensible objective account, to 'fit

[15] And in the Netherlands, a political culture of 'pacification' has been likened to a belief in the need to depoliticize that is ideological in itself (Lijphart, 1968; Mellink and Oudenampsen, 2022).

and conform' improvements by aligning them with dominant modernist norms (cf. Smith and Raven, 2012; Kunseler, 2017; Verwoerd et al., 2022). But by depoliticizing the role of science-policy arrangements, we also lose the ability to ask what role we *want* science-policy arrangements to play.

This thesis contributes to restoring that ability by offering a symmetrical and broad approach to understanding the multiple ways in which science-policy arrangements are enacted by different actors. This contribution starts from my application of social practice theory to science-policy arrangements, which helps to see them as enacted through a combination of repertoires, competencies and context – i.e. intersubjective, individual, and institutional factors. It is further developed through the notion of knowledge accountability that **Chapter 4** introduced. Different logics of knowledge accountability can be seen to encourage different repertoires and be part of different science-policy practices. After all, responsibility and accountability are linked notions (in Dutch, there is even an etymological relation: *verantwoordelijkheid* and *verantwoording*). Another component to this ability to articulate desirable science-policy arrangements is presented by re-conceptualizing the effectiveness of science-policy arrangements as empowerment. Approaching effectiveness in this way makes clear that science-policy arrangements are not in the game to be authoritative, but to serve a wide diversity of actors with potentially conflicting knowledges, perspectives and frames of problems and solutions. Empowerment is never neutral, authority never uncontestably legitimate. This realization should spark humility about sometimes still surprisingly self-congratulatory views in science-policy arrangements on their ostensible all-round neutral benevolence. To paraphrase the infamous (mis)quote that "what is good for General Motors, is good for America"[16]: the idea that what is good for science, is good for science-policy arrangements, is good for society. Together, my insights help future research and praxis to be less one-sidedly 'science-focused', and instead explicitly address the simultaneously empirical, practical, and normative question of how responsibilities, accountabilities and opportunities for empowerment are to be distributed across a diversity of knowledges and science-policy practitioners.

To put the desirability of science-policy arrangements front and centre also broadens the view on where to find potential agents of change from those directly involved in science-policy arrangements to diverse actors. As illustrated through the discussion of knowledge accountability (**Chapter 4**), such a role could be played by interlocutors of expertise in public debates

[16] The actual quote is: "… for years I thought what was good for our country was good for General Motors, and vice versa. The difference did not exist.", which still equates the wellbeing of a corporation with that of a country (see Terrell, 2016).

and decision-making such as the media and activists. This can inspire action-oriented studies that seek to actively contribute to changing undesirable science-policy arrangements (Mahony, 2020) in ways that employ notions of reciprocity. Along this line of thinking, I see my view on decentring the science-policy arrangement as paralleling Wall Kimmerer's (2013) reciprocal definition of leadership as "rooted not in power and authority, but in service and wisdom" (p. 122). And Bijker et al.'s definition of wisdom as "a well-argued reflection on the state of knowledge in relation to the state of the world" (2009, p.142) privileges neither expertise nor the current state of the world but assumes their entanglement. By foregrounding reciprocity and entanglement in relation to the decentring of science-policy arrangements, I think ways of repositioning arrangements can open up that do not take knowing and doing as separate and sequential.

After all, what a desirable science-policy arrangement is cannot be appraised prior to and separate from its enactment in practice. This means we have to consider the question of institutional reflexivity (cf. Pallet and Chilvers, 2013; Borie et al., 2021) and ask how to systematically organize a kind of symmetrical opening up and closing down of science-policy arrangements which enables them to respond to potential changes in what is considered to be desirable (cf. Stirling, 2008)? Under certain conditions it may be acceptable for science-policy arrangements to be technocratic; not all problems have to be addressed as wicked problems after all (Hoppe and Hisschemöller, 1995). At the same time, though, it is key to acknowledge that the potential of such technocratic arrangements is largely limited to maintaining the status quo as efficiently and effectively as possible. Consequently, when changing the status quo becomes a concern it is crucial that there remains a reflexive ability on the part of science-policy arrangements to open up for possible repositioning away from technocratic logics. Yet, the question is how to organize such reflexive ability. To place this responsibility entirely within science-policy arrangements seems risky because it would require powerful actors, within science as well as policy, who benefit from the status quo to not only identify when such a repositioning is needed but also to make room and take a step back to allow this repositioning to happen (cf. Turnhout and Lahsen, 2022). In other words, the question is whether and how relatively technocratic arrangements can simultaneously be reflexive. Further research along this line could analyse 'successfully reflexive' science-policy arrangements; arrangements which have been able to reposition themselves. At the present juncture, I concur with the kind of repositioning Stengers (2018, p.141) argues we need: "a different, positive, definition […] to regain relevance and become capable of weaving relations with different peoples and natures".

Foregrounding the necessity of being able to explicitly discuss the desired purpose of science-policy arrangements itself is not enough to *repurpose* them to be able to facilitate transformative change. Consequently, in the next section I explain how this thesis contributes to finding a positive definition of what might make science-policy arrangements fit for this purpose.

What makes science-policy arrangements able to facilitate transformative change?

To repurpose science-policy arrangements for transformative change is by no means a straightforward feat because it requires that the politics of science-policy arrangements are visibly discussed. After all, as long as depoliticization is the norm, a visibly normative argument on the desirability of changing science-policy arrangements necessarily fails to live up to current expectations of effectiveness. There is no best or optimal science-policy arrangement, merely variously and contestably desirable variants. Based on the insights in this thesis, I articulate one such variant in this section, namely what it could mean for science-policy arrangements to contribute to facilitating transformative change. Before explaining what I think this contribution could consist of, it is helpful to position such a contribution as dovetailing with recent arguments that science-policy arrangements can be fruitfully studied as governance actors in their own right (Jagannathan et al., 2023). Approaching science-policy arrangements as actors in transformations also points to possible connections with a growing literature around notions of transformative governance, which has suggested that the governance of transformations requires the transformation of governance (Termeer et al., 2017) and has explored how and under what conditions, governments can perform 'transition tasks' (Braams et al., 2021, 2022) or facilitate transformative change (see also Wolfram, 2016; Kok, 2022; Nabeliek et al., 2023). Here, I will discuss how science-policy arrangements can be part of transformative governance systems and ask what makes science-policy arrangements able to facilitate transformative change. My brief answer to this question is that this potential contribution depends on the ability of science-policy arrangements to *politicize* a *distributed* and *pluralist* governance landscape. I will now explain each of these elements in turn: distributed, pluralist, and politicizing.

Characterizing policy as distributed stems from my view of transformative change as an emergent and indeterminate process. Following Stirling (2016) and others (Bulkeley, 2015, 2023; Lidskog et al., 2022), we ought to understand transformative change as arising from a plurality of distributed agencies and knowledges. This perspective on how change arises can be further explained through the contrast between what Kwa (2002) has called 'romantic' and 'baroque'

complexity. Romantic complexity assumes that reality is complex but consistent, founded on a functional and integrated whole, whereas for baroque complexity such a unity is absent; in baroque complexity, though things are related, but they do not necessarily 'add up' (Law and Mol, 2002). In this way, baroque complexity points to a deep and unresolvable uncertainty (Pauwelussen, 2017), an indeterminacy which I have suggested to require the acceptance of not-precisely-knowing. Highlighting the difference between these two views of complexity helps to understand my view of governance as distributed – governance to be complex in the baroque sense. This approach to complexity accepts there exists a fundamental incommensurability in the values, interests and perspectives of governance actors. As a result, seeing transformative change as arising from baroquely distributed governance does not need to assume knowledge to be able to align or integrate this incommensurability, i.e. it helps to transcend the problematic modernist assumptions I discussed in **Chapter 1**. Approaching change and governance in this way also reiterates why my understanding of effectiveness as empowerment is particularly appropriate to science-policy arrangements for transformative change (**Chapter 3**). Empowerment allows us to let go of the impetus of integration and consensus and to also accept disintegrated knowledges, and it puts the ability of science-policy arrangements to empower broadly central to assessing their (potential) effectiveness in facilitating transformative change. My concern lies not with the question of whether science-policy arrangements are able to prove 'how much' impact they have, but with their ability to explain why their practices open up the potential for broad empowerment. As I have explained above, this foregrounds the importance of pluralism.

Crucially, pluralism is not only about different perspectives of *what* needs to be governed, but also of *how* and *to what ends* (Pascual et al., 2021). Accepting pluralism and not-precisely-knowing helps to avoid falling for a simplistic form of solutionism that risks undesirable and unjust consequences. If we attach our hopes for a better and more sustainable future to transformative change, it is therefore essential that transformative change itself remains plural and not-precisely-known (**Chapters 4, 5**). After all, transformative change is by definition about alternative imaginaries of the future. Recent years have seen increased academic attention to the 'politics of the future' (Oomen et al., 2021), which asks through what 'techniques of futuring' and modes of anticipatory governance alternative futures are imagined, and what the effects of these futures are in the present (Borup et al., 2006; Bai et al., 2016; Hajer and Pelzer, 2018; Vervoort and Gupta, 2018; Burch et al., 2019). The transformative potential of such anticipatory governance is arguably highest when it takes a plural approach (Braun, 2015; Muiderman et al., 2020, 2022, 2023; Mangnus et al., 2021), which accepts baroque complexity and

its implications of indeterminacy and knowing-doing-governing as co-constituted (Stirling, 2016; Bulkeley, 2023). However, it is far from self-evident that such plural approaches are adopted in practice. For instance, the famous planetary boundary framework has been the subject of fierce critique for its top-down and depoliticized character, by "presenting human values as facts of nature" (see Rayner and Heyward, 2013 p.142; Stirling, 2016; Biermann and Kim, 2020). Van Beek et al.'s (2022) analysis of the legitimation of the 1.5 °C climate goal by integrated assessment models points to a similar tension between exploring radically other futures and aligning with dominant policy and scientific discourses. In his history of socio-economic planning in the Netherlands, Kayzel (2021) goes even further, by asserting that Dutch planning has become a technique to maintain the status quo. A final example illustrating that plural approaches are far from self-evident is found in critical discussions in transition studies literature, which is particularly relevant to point out given the popularity of this field in Dutch policy circles (Faber, 2021). These discussions highlight the problematic tendency to speak of 'the transition' as a singular concept (e.g. Meadowcroft, 2009, Shove and Walker, 2007; Hendriks, 2009, Geels, 2011; Lawhon and Murphy, 2012; Avelino et al., 2016; van Steenbergen and Schipper, 2017; de Geus et al., 2022). To overcome this tendency, it has been argued that transition governance stands to gain from a more explicit understanding of democracy (Tschersich and Kok, 2022).

A more explicit understanding of democracy in relation to change is also what I have sought to articulate by putting forward the notion of politicizing expertise, as a contribution of expertise that seizes the productive potential of pluralism. I have done so by interpreting the political dimension to transformative change through the joint political philosophies of Dewey and Mouffe (**Chapter 4**), which helps to see transformative change as an issue in the process of being articulated and enacted. The productive potential of pluralism is described by this interpretation by highlighting that different views on what ought (not) to be sustained are opportunities for change. The presence of such opportunities are what McGoey (2019, p. 297) calls an 'epistemic superiority' of democracy, because it prevents those with an interests in the status quo "not to learn about the weaknesses or errors" – and undesirabilities, I would add – of decision-making. In other words, pluralism, dissent and conflict are valuable rather than obstructive for change (Cuppen et al., 2019). They are part of how we might come to terms with the need to enduringly re-solve sustainability issues (Bulkeley, 2015). In my view, the contribution science-policy arrangements can make here is to make visible what norms and values are embedded in these different views – what worlds do they imply? Science-policy arrangements thus provide expertise that empowers actors to politicize issues. Or, put

differently, science-policy arrangements that are equipped to provide expertise for the productive channelling of political conflict can facilitate the issue articulation process of transformative change.

Distributedness, pluralism, and politicization are by no means a blueprint for desirable science-policy arrangements. I do not want to suggest that we can simply design arrangements that reflect these elements and that transformative change would follow automatically. Such an expectation would mean falling for the aforementioned siren call that if only we can *know* how to arrange science-policy arrangements for transformative change, we can *necessarily* do them accordingly. That being said, it bears highlighting that my view of desirable science-policy arrangements carries important implications around power and privilege.

To explain these implications, it is helpful to start by discussing the limits, risks and potential of empowerment. Its widespread use may turn it into a buzzword, stripped of its emancipatory potential (Cornwall and Brock, 2005; McLauglin, 2016). Also, even if this potential is upheld, a focus on empowerment carries the risk of placing the onus for change with marginalized actors, thereby limiting the potential for structural and systemic change (Scoones et al., 2020). In my view, the potential of the term lies in opening up a symmetry to agency: empowerment couples with disempowerment. There are two sides to this symmetry. One is that it shifts the focus to relative empowerment, i.e. the absence of empowerment is also a form of relative disempowerment, perhaps unintended. To highlight the potential of unintended disempowerment, Avelino (2017) speaks of (dis)empowerment in her framework for power in transitions. The second is that this symmetrical approach to agency opens up to intentional disempowerment. Indeed, keeping work on de-stabilization and unmaking in mind (e.g. Geels and Turnheim, 2012; Feola et al., 2021): could, no, should, science-policy arrangements that seek to facilitate transformative change also focus on *dis*empowerment, i.e. contribute to an active process of disenfranchising (dominant) actors? As my argument so far has valued symmetry, consistency should draw me to say science-policy arrangements certainly should seek to disempower actively as well. In fact, the impossibility of neutrality combined with the persistent assumption that it can be achieved nonetheless simultaneously empowers dominant actors and disempowers marginalized ones. In other words, disempowerment is inevitable; again, the relevant question is who is to be (dis)empowered? Nonetheless, I feel some hesitancy to hear myself propound that science-policy arrangements can contribute to active disenfranchisement. Perhaps that hesitancy is simply a discourse of delay, justifying inaction or inadequate efforts (cf. Lamb et al., 2020), perhaps it is the hostility in putting it so bluntly. In the latter respect, maybe less negative connotations to symmetrical (dis)empowerment are also

possible. As someone fond of strange metaphors, I cannot help but think of Marie Kondo's guru status in tidying up. She teaches not only to keep objects that 'spark joy', but also to 'thank' objects you are about to discard for their past service. Surely transformative change requires us to discard much of which the joy-sparking days are long gone. Unfortunately, there is a rather large difference between discarding old birthday presents and disempowering actors in order to facilitate transformative change. I foresee huge problems if science-policy arrangements are to establish what to disempower. Nonetheless, while we need to be mindful of positioning science-policy arrangements as a one-stop shop yet again, surely there must be ways to identify and stop the obviously problematic empowerments? Either way, (dis)empowerment underlines that science-policy arrangements can no longer ignore the thorny issue of their own power by assuming their own all-round benevolence.

As a result, my view of desirable science-policy arrangements highlights something significant is at stake for arrangements themselves. Dominant depoliticized issue frames and solutions stand to lose their self-evident status, and the experts and policymakers that benefit from them stand to lose privilege and power. But from Stengers' (2018) thinking of cosmopolitics I take that the possibility of successful change lies in the 'full and vivid awareness' of potential consequences. An initial consequence of my view is that it may become much less straightforward to assess the effectiveness of science-policy arrangements, especially compared to what common references to societal and policy impact may suppose. After all, to assess effectiveness is to ask whether something is conducted well. When that 'something' can no longer be seen as politically neutral, any assessment of it will also be contentious and political. To some extent, I think this means we have to give up on the possibility of assessing the effectiveness of science-policy arrangements, and replace it with operating norms for scientists and organizations active in science-policy arrangements (Turnhout et al., 2019). But I think the symmetrical approach I have taken in this thesis also shows that science-policy arrangements should be a collective responsibility, in which such norms cannot be individualized but have to be approached relationally. The potential consequences of this are arguably much more far-reaching than simply rethinking the assessment of science-policy arrangements. Put concisely, my view of science-policy arrangements for transformative change ultimately asks for a fundamentally different view of what 'science' and science-policy arrangements can deliver. It requires letting go of a detrimental focus on facts and truth. I agree with Shapin (2019) who, in an essay on the 'truth crisis', contends that public culture contains too much, not too little, science. Rather than concerning ourselves with whether people know facts and truth, we should be concerned about how an overreliance on truth pairs with neglect for the question

who benefits from these truths. This question, which recognizes that fact and value, power and truth, are intimately intertwined, is necessary to acknowledge that the needs of "civic institutions […] do not match with dedication to Truth" (Shapin, 2019). To pretend otherwise parallels the 'golden goose' image of science described by Stengers (2018), in which experts have sole authority to determine what questions are worth asking, but simultaneously veer back from value-laden questions seen as non-scientific. Focusing on these questions would mean that we risk being left with learning "all about how it works and nothing of what it mean[s]" (Wall Kimmerer, 2013, p. 221). It risks that we are left with all kinds of truths that remain entirely politically inconsequential, i.e. void of any potential to spur change.

As a first step in the right direction, we need to acknowledge that both our analytical *and* vernacular usage of common concepts for science-policy arrangements may be falling short of enabling the kinds of change we want. If we continue to associate *authority* with self-obsessed status rather than empowering potential, *impact* with "more" rather than "better", and *independence* with a self-deceiving separation of science and politics, we will continue to position science-policy arrangements as an obligatory passage point towards transformative change. Because this position continues to place *knowing* separate from and before *doing*, the contribution of science-policy arrangements to transformative change will remain a distant ideal. I consciously highlight that common concepts like authority, impact, and independence are both analytical and vernacular in order to draw attention to the fact that many of these terms are in everyday usage by people who are not necessarily trained, interested, or well-versed in the intricacies laid bare by their in-depth theoretical understanding. Moreover, we cannot expect change to depend upon such an understanding; the ability to practice alternatives does not hinge on one's thorough explicit theoretical understanding of it. So, how instead do we go from science-policy arrangements *for* transformative change, to enacting transformative change *in* science-policy arrangements? This leads me to the next and final part of this discussion.

How to create and seize opportunities for transformative change *in* science-policy arrangements?

The third contribution of this thesis reflects on the question of how to bring about change in science-policy arrangements. This contribution is informed by the research as well as by my vantage point of working 'within' science-policy arrangements. As a starting point I take my previous argument that we should explicitly discuss *desirable* science-policy arrangements, as well as my view that decentring, pluralism, and politicization have a role to play in these

desirable arrangements in light of current sustainability challenges. At the same time, in the spirit of not-precisely-knowing, this contribution is necessarily unfinished. To this end, I take inspiration from literature on experimental governance, from an ethos of care, and from feminist and antiracist insights on inconvenience and institutional change.

The past decade has seen literature on experimental governance proliferate (e.g. Bulkeley and Castan-Broto, 2013; Evans et al., 2016; Turnheim et al., 2018; Fuenfschilling et al., 2019; Bulkeley, 2023). This literature documents and analyses a large growth of experimentation, suggesting experimentation holds a potential to open up space for doing things radically otherwise. Experimentation can promote practice-based learning and change in uncertain and ambiguous conditions (Sengers et al., 2016), with evaluation accorded an important role in such learning (Luederitz et al., 2017). The relevance of this literature lies in using science-policy arrangements as subjects of experimentation in themselves, instead of as instruments for experimentation – detached observers performing evaluation that spurs learning. As Bulkeley (2023, p. 3) suggests, the turn to experimentation is a "significant and potentially paradigm-shifting break with established norms and practices" concerning who governs, science-policy relations, and the plurality of desirable futures. I see the potential of experimentation for science-policy arrangements as simultaneously clear and indeterminate, simultaneously incremental and transformative. After all, if transformations are emergent, experiments can *contribute* to them, without it being possible to *attribute* transformations to concrete experiments. This means that on the one hand, experimentation can be a way to do things radically otherwise, while on the other hand, and at the same time, it can also provide a means to render harmless whatever radical potential an 'experiment' contains. This is a somewhat self-contradictory combination, and it is rarely evident on which side the coin has fallen. The risk that transformative initiatives become partly co-opted into dominant modes of working, and thus, get partly stripped of their transformative potential is illustrated in Verwoerd's (2022) in-depth study of the normalization of 'reflexive evaluation' at PBL.[17] Verwoerd's work not only shows how reflexive evaluation has become an acceptable policy evaluation repertoire within the institute, but also points out how this repertoire has been adjusted throughout in order to align it more neatly with dominant norms (see also Verwoerd et al., 2022), i.e. the aforementioned problematic modernist assumptions. Without knowing whether and how further change may happen on a longer timescale, this raises the difficult question of whether the adjusted repertoire sufficiently transcends the problematics of these assumptions – is it

[17] Kunseler and Vasileiadou (2016) contrast modernist and reflexive evaluation logics, with modernist evaluation being a mechanism for accountability and reflexive evaluation geared to policy learning.

enough to settle for? If experimentation results in modernism by other means, we stand little to gain from reproducing a 'condition of permanent experimentation' in science-policy arrangements (Karvonen, 2018; Bulkeley, 2023). In that sense, for permanent experimentation to overcome knowing and doing as separate and sequential, and for it to deliver on the promising potential of 'simultaneously suspending and sustaining' indeterminacy (Bulkeley, 2023, p. 10), requires a particular ethos amongst those conducting the experiments.

I think the notion of care provides ingredients for this ethos. Care is a much-discussed notion in recent work in STS. Care foregrounds the importance of the political and normative implications of our work, the resulting potential for change, and the role of the analyst to actively engage with this potential (Puig de la Bellacasa, 2011; Tironi and Rodríguez-Giralt, 2017). Care reflects a similar attitude as reflexivity, i.e. the ability to combine attention to what effects one's practices have with a willingness to examine how these practices contribute to these effects (Smith and Stirling, 2007; Pallet and Chilvers, 2013; Borie et al., 2020). But whereas reflexivity is often a relatively individualistic trait, care is more of a collective ethos. Care reflects an openness to engage with the potential of experiments to do things radically otherwise, including the political and normative implications of such other doings. It is this openness that lies at the heart of the potential of careful experimentation. The appropriateness of care to grasping the promising potential of experimentation is expressed by Martin et al. (2015, p. 630), who highlight that care "does not offer closed and teleological solutions; an attention to 'matters of care' remains open-ended and responsive: one does not know in advance where this attention will lead". This is the not-precisely-knowing that I think is necessary to uphold the indeterminate potential of experimentation. Upholding this indeterminacy through care requires rearranging responsibilities and coming to terms with 'contaminated diversity' (Tsing, 2015; Haraway, 2016). To speak with Puig de la Bellacasa (2011, p.90), it asks for a "practical responsibility to take care of the fragile gathering[s]" that possible re-arrangements of science, policy and society constitute. In this thesis I hope to have enacted such a responsibility – if only a little – by actively fostering alternative imaginaries for science-policy arrangements, like the illustrative ideas for broader empowerment in GEAs (**Chapter 3**), a speculative design for experimentalizing broad wellbeing (**Chapter 4**), and the different options for global food knowledge-governance interfaces (**Chapter 5**).

The question is whether, and how, enactments of care can become common practice. According to Martin et al. (2015), who articulate care through the feminist notion of 'response-ability', such institutionalization or standardization is impossible. Martin et al. point out that response-ability refers not just to the ethical responsibility of researchers, but also to their

"willingness and capacity to be moved", both emotionally and physically; to both consider something to *matter* and be available to respond in yet-unknown ways. In other words, response-ability foregrounds that responding is at stake, but also points out that not everyone is equally *able* to respond (Haraway, 2016). This unequal ability, including the potential legitimacy of non-response is why Martin et al. (2015) claim that care cannot be institutionalized or standardized. I agree that when institutionalization involves a homogeneous standardization of this ability across individual science-policy practitioners, such a move seems antithetical to the meaning of response-ability. However, I think locating care in a collective ethos does make some form of institutionalization possible. I take this possibility from Haraway's (2016) distinction between *autopoiesis* versus *sympoiesis* as referring to autonomous and collective achievements, respectively. Response-ability and care are not *autopoietic* achievements, no matter by how many, but are *sympoietic*. This point is further explained from the way Haraway draws on Stengers' cosmopolitics, as requiring the presence of those affected in decisions and their consequences to be exposed as fully as possible (Stengers, 2018). In other words, decisions are always meant to be a *sympoietic* achievement, and *require* care for consequences to become visible. Crucially, cosmopolitics is not about peace and harmony, it has little to do with 'being polite', nor with tolerance or inclusiveness; at best, it is inconvenient, at worst it foregrounds existential conflict (Latour, 2004b, 2018; Stengers, 2018). This connection between cosmopolitics and care also further explains my argument that an ethos of care can contribute to reaping the potential benefits of experimentation, precisely (or paradoxically?) because it, as Stengers points out, 'introduces hesitation' (Stengers, 2018, p. 151). As such, I locate the possibility of institutionalizing an ethos of care in our willingness to hesitate, to be inconvenienced. I think this willingness is likely to be resisted in many science-policy arrangements, because it is so strongly at odds with modernistic mantras of certainty, effectiveness, neutrality, and 'getting the science right'. As a consequence, the possibility of institutionalizing this willingness comes with a particular everyday politics. To further describe these everyday politics, I take inspiration from feminist and antiracist thinking on inconvenience and institutional change.

Necessarily, I take this inspiration with the appropriate humility, lest inspiration become appropriation.[18] After all, the emancipatory struggle in feminist and antiracist thinking-doing is far from identical to my aspiration to effect change in science-policy arrangements. But where depoliticization has made it hard to see the everyday politics of science-policy arrangements,

[18] It bears pointing out here that gender matters also in knowledge production. I doubt I would have included these passages – written them at all – had my supervisors been male.

antiracist and feminist writing can help to make them visible. Here, I limit myself to discussing two particular notions that can be instructive to science-policy arrangements, hoping to further thinking and reflection about their improvement. I start by discussion DiAngelo's (2018) notion of 'white fragility' as a descriptor of a power dynamic at play in attempts to address institutionalized racism, followed by Ahmed's (2023) reclaiming of 'killjoy feminism' as a commitment to inconvenience. White fragility is the term DiAngelo uses to describe the dominant response of white people when confronted with racial inequality and its effects. A defensive reflex that may be "triggered by discomfort and anxiety, [but is] born of superiority and entitlement" (DiAngelo, 2018, p. 2). Under the pretence of discomfort and taking offense, it functions as a powerful mechanism to silence critique and avoid reflection on one own's responsibility. For science-policy arrangements, I think the foregrounding of 'fragility' as a power dynamic, could help further draw out the politics implied in a *lack of* care and reflexivity. In this way, fragility as a power dynamic helps to avoid narrowing down the challenge of change from transforming an ethos to the more straightforward fostering of competencies, taking the difference between ethos and competencies to lie in the fact that competencies can be trained individually and incrementally, while changing an ethos is a collective transformation. This could for instance constructively extend the concept of co-productive agility and rigidity introduced by Chambers et al. (2022), and which I used to describe science-policy competencies in **Chapter 2**. Considering agility (and rigidity) as an ethos rather than competency, enables us to ask not just how to foster agility, but also who benefits from enduring rigidity.

This is where I think we can take further inspiration from Ahmed's notion of 'killjoy feminism' (Ahmed, 2023). With the motto "we have to keep saying it because they keep doing it" (p. 40), Ahmed uses this notion to describe how one is seen to spoil the mood when one exposes sexism in someone's speech or acts; to describe how one can be dismissed for not simply 'going with the flow', even if the flow one obstructs is highly problematic. Ahmed seeks to reclaim the negative and dismissive meaning of killjoy by considering it a commitment to inconvenience, to *be* inconvenient, and thereby be a source of change. If fragility is a response enacted by those being inconvenienced, *to killjoy* is to do the hard work of being the source of that inconvenience. It is an attempt to force reflection (not reflexivity) upon those for whom 'the flow' is most enjoyable. To some extent, I cannot help but feel ambiguous. To explain, let me take co-productionism as a shorthand for a response to the limitations of modernist assumptions about science; a perspective that considers fact and value, knowing-doing-governing as intertwined, rather than separate and sequential. In that case, will being 'killjoy

coproductionists' not simply keep modernist science-policy arrangements alive; provide the constitutive outside for the linear model to persist? This is a real risk. After all, it highlights what is stake not just for those that see co-productionism as desirable, but also for those who feel they have something to lose, personally or professionally, by discarding modernism. In her important work on epistemic positioning, Bacevic (2021b) points to the different ways in which knowledge claims are devalued based on their knowers' identities. It is not difficult to imagine such devaluation in the case of killjoy coproductionists. Conveniently positioned as subjective and normative in a context that values objectivity and neutrality above all, killjoy coproductionists are easily positioned as the 'bad expert', a term introduced by Sweet and Giffort (2020) to describe how antithesis performances of expertise are constitutive of the inside of that expert culture. In this case, my view of 'transformed' science-policy arrangements may well be positioned as 'bad' and 'activist', and thus not worthy of the term expertise. But then again, Ahmed also fittingly refers to Audre Lorde's words that "the master's tools will never dismantle the master's house" (see Ahmed, 2023; Lorde, 1984). Those most supported by current structures stand the least to gain from change. This means that anyone wishing to truly commit to co-productionism must also accept being inconvenienced themselves; as Ahmed points out, what is required on everyone's part is a commitment to be "willing to be inconvenienced" (Ahmed, 2023, p. 244). It is a commitment to solidarity from a shared sense that in a world where objective and neutral transformations are impossible, there is also no objective, neutral way to transform science-policy arrangements.

Taking my discussion of experimentation, care, and inconvenience together, it is clear that the question of '*how to create and seize opportunities for transformative change in science-policy arrangements?*' has no clear-cut answers. Nonetheless, the direction these literatures point to can be summarized as a willingness and insistence on doing things differently, even when this is difficult and uncomfortable, while remaining open to different perspectives on *how* to do them differently. If nothing else, I think this direction is at least congruent with the other contributions I have described this thesis to make.

Transforming relations between science, policy and society for sustainable futures?

Here, I briefly summarize this thesis' contributions to its aim to articulate an effort to repurpose science-policy arrangements for transformative change for sustainability. I take the discussions of the previous subsections to highlight that such a repurposing must be conjunctive: it requires the ability to explicitly discuss the desired purpose of science-policy arrangements,

a view of what makes them fit for this purpose, and some kind of strategy to achieving change in arrangements. I have argued that being able to discuss the desirability of science-policy arrangements is crucial because it avoids efforts to one-sidedly focus on the role of scientific expertise and scientific actors. Furthermore, I have explicated my view of science-policy arrangements that are fit for facilitating transformative change as requiring them to be able to politicize a distributed and pluralist governance landscape. In other words, I think what is desirable is that science-policy arrangements make a plurality of potential futures visible, explicate their political-normative differences, and empower a wide range of actors involved in contemporary sustainability governance to engage in a democratic political process of articulating and enacting such futures. Finally, I have suggested that to change science-policy arrangements in this direction, requires scientists, policymakers, and other societal actors to be both willing to and insistent on doing things differently, and to endure the inconveniences different doings invariably cause.

Together, these contributions are reflected in the title to this thesis: *'Transforming relations between science, policy and society for sustainable futures?'*. Inevitably, to explain a title is to short-change it, but I will do so anyway. Importantly, I emphasize that the *transforming* in the title should be taken in both its possible grammatical meanings: it points both to the need for change *in* science-policy arrangements, and to the potential for science-policy arrangements to contribute to transformations. In other words, it means that only by *transforming* science-policy arrangements, can science-policy arrangements become *transformative*. Finally, to emphasize the necessity of accepting the indeterminacy, the not-precisely-knowing, and to highlight the plural and political character required of transformative change, is there a better way to punctuate this title than a question mark?

Transforming PBL?

I conclude this thesis by reflecting on how my findings and contributions might be of use for PBL itself. As the foremost government research institute for environmental policy, PBL is a key actor in Dutch science-policy arrangements for sustainability. Consequently, I think the expression *noblesse oblige* is particularly fitting. Even though it is a collective responsibility to answer the question of what PBL we want, i.e. a question that is not up to me or even the institute to answer independently, it makes a difference in what way PBL positions itself. In other words, in what ways does PBL co-produce the science-policy arrangements it participates in? In this respect, there are two points I think are worth highlighting and explaining, the first referring to PBL's purpose, the second to its institutional inertia.

First, with regard to PBL's purpose, its mission is to "contribute to the quality of political-administrative decision-making". There is little doubt in the institute that this is a rather vague mission. And certainly, many different interpretations exist within PBL as to what 'high quality' decision-making consists of. Some see it as signified by use of PBL's work as evidence in decision-making, an interpretation contested by others who see it to interfere with politicians always having the final say. Others again argue that considering PBL's focus on environmental issues, high-quality decision-making is indicated by a high quality of the living environment. Of course, this thesis provides no way of settling that discussion. Instead, it contains the more modest and perhaps rather obvious appeal to discuss more explicitly what PBL's 'contribution' can and should be, and when decision making can be considered to have 'quality'. Not just within PBL, but also with other actors in science, policy and society. In other words, to discuss and articulate the specific role of PBL in the projects and programs it undertakes, beyond the specific 'substantive' questions that drive them. To be sure, these discussions already take place, but they mostly tend to focus them especially on 'what' we want to know (the 'substance'). Instead, we need to also ensure a collective understanding exists of '*why*' and *'how*' we want to know. I think such collective understandings can lead to more awareness of what different roles entail, and of what PBL can and cannot do by adopting them. Moreover, they are a way to not just explicate the roles and responsibilities of PBL, but also articulate expectations on the roles and responsibilities of other actors. This would be a concrete way to jointly reject the problematic assumptions that I have discussed in this thesis. The result may still well be a similar plurality of roles and repertories as is currently the case, but it will at least help in assessing PBL's role in concrete instances in terms of desirability instead of necessity.

Second, as in many places, there is a certain inertia and path-dependency to PBL's way of working. This inertia exists in at least two forms: in PBL's staff and in its projects. As a consequence, this inertia is also partially inevitable. Flexibility in one's way of working is dependent on the expertise, networks, experience, and competencies of those doing the work, in addition to other constraints of low staff mobility and finite budgets. And existing projects contain external commitments on which it is not always easy, possible, or desirable to backtrack. What then to do to (re)introduce some more flexibility to our projects and staff? I certainly would not want to plea for precarious working conditions and a further normalization of temporary contracts. On the contrary, I think these contracts only lead to the pigeonholing of researchers as competent only or primarily on the specific topics they are already working on. This pigeonholing reproduces the 'first know, then act' assumption at the level of individual researchers, as if they would be unable to 'act' on other topics without first 'knowing' them. I think it

could be relatively easy to stimulate more internal mobility, complementarity and fit-for-purpose project teams. Furthermore, my impression is that when colleagues retire or change jobs, there exists a reflex to find near-identical replacements. I think this reflex hampers PBL's ability to use such openings as an opportunity to consider what expertise, networks and competencies would benefit and complement the institute in a broader sense. Furthermore, with regard to projects, I think a modest intervention could be made by reducing the current asymmetry between projects that already exist and projects that are being proposed. To not just ask new projects to articulate "why is this project desirable", but also ask existing projects to (re)articulate "why is this project *still* desirable". To reduce the high work pressure, there is rightly a lot of attention to the need to say "no" and prioritization within PBL. It is my conviction that such prioritization can never succeed when it is focused on reducing the influx of new work, without tidying up existing work.

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English summary

Can improving relations between science, policy and society get us out of the mess that we are in? That is, in a nutshell, the question this thesis seeks to answer. There is increasingly widespread recognition that we – Earthlings – are in a mess, owing to pressing sustainability issues like climate change and biodiversity loss. The urgency to address these issues has given rise to the notion that major changes are desirable, a notion that is now commonly referred to as 'transformative change'. Moreover, it is frequently suggested that an important role for facilitating such change can be played by what I call 'science-policy arrangements'. With the term science-policy arrangement, I refer to the manifold ways in which relations between science, policy and society can be organized. The ways, in other words, in which expert knowledge plays a role in societal and political decision-making. At the same time, it is far from self-explanatory what such a role means in the context of facilitating transformative change. Nonetheless, I think it is a role worth exploring, because I consider the notion of transformative change to hold a promising potential. In particular, I think that the challenges we face make clear that some kind of major change is now inevitable – major climate disruption will *also* facilitate transformatively changed societies, though they may not be particularly pleasant or desirable. As a result, I think we need to cultivate our ability to influence *what* transforms and *how,* while also accepting that transformative change requires a permanent condition of not-precisely-knowing. To me, this is at stake in calls to repurpose science-policy arrangements, and as such the objective of this thesis is to **articulate an effort to repurpose science-policy arrangements for transformative change for sustainability**.

In **Chapter 1** of this thesis, I argue it is not self-evident that science-policy arrangements can make a contribution to transformative change. Moreover, I suggest we should not be overly confident that current attempts to reshape science-policy arrangements is making them sufficiently fit-for-purpose. This leads me to formulate three interrelated research questions. Together, I think these can help to formulate alternatives in which science-policy arrangements *are* potentially fit to facilitate desirable transformative change:

1. ***Through what division of roles and responsibilities are science-policy arrangements enacted?***
   With this question I seek a better understanding of the ways in which different actors are involved in science-policy arrangements. By focusing on the division of roles and responsibilities, I aspire to go beyond the contribution of researchers and

scientists, to also make visible how actors outside of science might contribute.

2. ***What does the diversity of actors involved in transformative change mean for how to conceptualize the effectiveness of science-policy arrangements?***
   Both in academic literature and practice there is increasing recognition of what is commonly referred to as a shift from 'government to governance', meaning that addressing sustainability challenges requires action by a wide diversity of actors, not just governments. For science-policy arrangements, this shift means that traditional views in which policymakers base their decisions upon the best available science are no longer tenable. However, if science-policy arrangements are not always central to action, different ways of assessing their effectiveness are required.

3. ***What does the political dimension of transformative change mean for how science-policy arrangements are to be enacted?***
   Much of the literature on transformative change suggests that it is an inherently political and normative process. At the same time, traditional views hold that science-policy arrangements should be neutral and apolitical. With this research question, I explore the interrelations between democratic politics and transformative change. This allows me to formulate a potential contribution of science-policy arrangements to transformative change, and to highlight what is at stake if we want this contribution to come to fruition.

I answer these research questions across four qualitative case studies, each of which I describe in a separate chapter (**Chapters 2 to 5**). These case studies developed as part of my work as a researcher at PBL Netherlands Environmental Assessment Agency (PBL), the Dutch national institute for policy analysis on sustainability issues. As such, I was wearing two hats throughout this study: (1) that of a PBL employee tasked with conducting policy studies and coordinating the relationship between PBL and the Dutch Ministry of Foreign Affairs, and (2) that of a PhD researcher interested in analysing and reflecting on the practices of his direct and indirect colleagues and institute. Simultaneously working within a prominent science-policy organization and conducting thesis research is a rather unique position. I see this position as multiple, with different versions of myself being active. This multiple position brings both challenges and opportunities. I tried to find ways to organize synergies between this PhD and my work at PBL, both in a practical sense – to avoid *de facto* working two different jobs – and at a more strategic level. After all, my position in PBL also offered unique opportunities to put

my reflections and analysis into practice. To think beyond current practices and make room for alternatives. At the same time, it is impossible to fully capture this multiple position in the case studies through which I answer my research questions. For this reason, I conclude **Chapter 6** of this thesis – and this summary – by answering the question of what my thesis could mean for PBL.

In **Chapter 2**, I studied my most direct working context, the evolving collaboration between PBL and the Dutch Ministry of Foreign Affairs (MFA). Studying this collaboration enabled me to develop an in-depth analysis of the distribution of roles and responsibilities in science-policy arrangements. The chapter describes two different heuristic models of understanding science-policy arrangements from the literature, linear and co-productive. The linear model assumes that science and politics can be neatly separated and is often considered to be dominant but inadequate. Conversely, the co-productive model assumes that science and politics are best seen as intertwined and has gained currency as a promising alternative to the linear model among science-policy scholars. Conceptually, I suggest we can analyse science-policy arrangements as social practices. Social practices are routinised patterns of behaviour, and adopting this perspective allows me to describe how the different actors involved – researchers and policymakers – make sense of their involvement in the PBL-MFA collaboration. The chapter confirms the relative dominance of the linear model, explaining it as persisting through a particular division of labour between researchers and policymakers. Although among both researchers and policymakers there is some recognition of the potential of co-productive science-policy arrangements, change is constrained by the lack of alternative imaginaries of what this would look like in practice. Discussions of roles and responsibilities one-sidedly focus on what they are for researchers involved, while the question of what might be appropriate roles and responsibilities for other actors involved goes largely overlooked. I argue this lopsided distribution of responsibilities risks offloading democratic responsibilities from policymakers to researchers. To avoid this, alternative imaginaries could depart from common, but differentiated responsibilities. Improving the alignment of responsibilities also stands to gain from greater emphasis on the politics of expertise, something on which I expand in **Chapter 4**.

For **Chapter 3**, I focused on global environmental assessments – such as the Intergovernmental Panel on Climate Change (IPCC) or the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Global environmental assessments are a process as well as a report, and especially that process makes them a particular type of science-policy arrangement. Global environmental assessments are used by a wide variety of actors,

from different levels of government to academics, the private sector and civil society. This places them at the forefront of the shift from government to governance, and thus, the need for an alternative understanding of their effectiveness, in which they are not necessarily central to action. To this end, **Chapter 3** develops an understanding of effectiveness as empowerment: the potential for science-policy arrangements to contribute to the ability of other actors to take action. This alternative understanding of effectiveness foregrounds the question of what empowerment is desirable: whose actions do science-policy arrangements support? I argue that while it is impossible to empower all actors equally, science-policy arrangements can nonetheless aspire to empower a broad range of actors. To do so, they have to be inclusive of a diversity of perspectives on problems and solutions, without having to integrate or adjudicate between these. Such pluralism can thus improve the effectiveness of science-policy arrangements, and the chapter provides three illustrative ideas of how GEAs might operationalize this.

Chapter 4 stems from an interest in *expectations* about what knowledge can do. In particular, I seek to understand how expertise may be used to justify decisions. Building on insights from the sociology of ignorance, I introduce the concept of *knowledge accountability*, to refer to the way in which decision-makers are expected to explain and justify how and what knowledge influenced their decision. Accountability and responsibility are closely related. This means that different ways in which expectations of knowledge accountability exist – different 'logics' of knowledge accountability – stimulate different models of science-policy arrangements described in **Chapter 2**. Empirically, **Chapter 4** studies the ongoing development of Dutch Broad Wellbeing (*Brede Welvaart*) as an alternative to Gross Domestic Product (GDP). This case study leads me to suggest at least two different logics to knowledge accountability exist, technocratic and political. Technocratic knowledge accountability focuses on assessing the effects of policy decisions. Political knowledge accountability focuses on deliberating the norms and values against which effectiveness is assessed. Subsequently, I use the political philosophies of John Dewey and Chantal Mouffe to theorize that the political logic is most able to effect (transformative) change, because transformative change asks for knowledge about what action could be *desirable.* For science-policy arrangements, I argue this means their potential contribution to change lies in providing expertise that politicizes – expertise that empowers actors to deliberate potential futures in terms of their normative desirability. In other words, science-policy arrangements do not have to know what 'good' transformative change is, but should help other actors formulate their desired transformative change.

Chapter 5 is a commentary on a potential new science-policy body for food systems. The chapter illustrates key points in this thesis in the context of global discussions about such a new science-policy arrangement. The commentary highlights that policy disputes in food systems often embed knowledge controversies. Consequently, such disputes have more to gain from charting the different perspectives than from attempts to determine who is right. This reiterates the need to include plural forms of knowledge from natural science, social science and humanities, as well as from Indigenous and local knowledge systems. Moreover, a large variety of actors is involved in the governance of food systems. This means action requires much more than governmental policy. The combination of plural knowledge and action beyond government is conveyed by suggesting to replace the term science-policy arrangement with knowledge-governance arrangement. Finally, the commentary highlights that even an improved knowledge-governance arrangement is no silver bullet solution.

In the **final chapter**, I discuss my thesis' contributions and implications for studying and shaping relations between science, policy, and society. I do so by means of three questions that my work foregrounds. The first question is '*What are the science-policy arrangements we want?*'. I think it is of paramount importance that we are able to discuss science-policy arrangements in terms of what we *want* them to do. I highlight how much contemporary societal and academic discourse is characterized by arguments of necessity. I argue this reluctance to take a normative position also hinders efforts to improve science-policy arrangements.

The second question I discuss is '*What makes science-policy arrangements able to facilitate transformative change?*'. This is my answer to the question of what science-policy arrangements are desirable. Based on the chapters in this thesis, I argue their contribution to transformative change depends on their ability to *politicize* a *distributed* and *pluralist* governance landscape. *Distributed*, to highlight the shift from government to governance. *Pluralist*, to highlight the inclusivity of different forms of knowledge and the importance of not-precisely-knowing. And *politicizing*, to emphasize that expertise can help to formulate desirable transformative change.

If this second question is about science-policy arrangements *for* transformative change, my third question is about transformative change *in* science-policy arrangements. It asks *'How to create and seize opportunities for transformative change in science-policy arrangements?'*. In the spirit of not-precisely-knowing, I take inspiration from different sources. I suggest experimentation can also be a powerful tool for science-policy arrangements to learn how to do things otherwise. At the same time, I think successfully tapping into the potential of

experimentation requires an ethos of care. Care means an openness to engage with the potential for change, including the political and normative implications of such change. Though it might not sound like it, care-*full* experiments can be quite confrontational. This requires a willingness to be inconvenienced for people working in science-policy arrangements. I suggest that feminist and antiracist thinking has important lessons in this regard.

Together, these three questions explain the title of this thesis, '*Transforming relations between science, policy and society for sustainable futures?'*. Only by *transforming* science-policy arrangements, can science-policy arrangements become *transformative*.

Finally, I am of course interested in what my thesis could mean for PBL. Foremostly, as a public research institute, I think the question of what PBL we want cannot be answered by me alone, or even within the institute. It is a collective responsibility for science, policy and society. In this respect, our mission to "contribute to the quality of political-administrative decision-making" is rather vague, and could be more concretely articulated in projects, programs, or for the institute. This may well result in a similar plurality of roles as is currently the case, but should also lead to more collective consciousness on what different roles entail, and of what PBL can and cannot do by adopting them. Furthermore, as in many places, there is a certain inertia and path-dependency to PBL's way of working. At the level of PBL's staff, this inertia could be addressed both through more internal flexibility, as well as in new hires. For the latter, we would do well to avoid the reflex to find near-identical replacements, but use the opportunity to reconsider what expertise, networks and competencies would benefit the institute. Finally, we could not just ask new projects to articulate "why is this project desirable", but also ask of existing projects to re-articulate "why is this project *still* desirable". Articulating the desirability of all projects can help to prioritize and reduce work pressure, and to contribute to better positioning the institute.

Nederlandse samenvatting

Kan het verbeteren van de relaties tussen wetenschap, beleid en maatschappij ons uit de penibele situatie halen waarin we ons bevinden? Dat is in een notendop de vraag waar deze dissertatie om draait. De urgentie om duurzaamheidsproblemen zoals klimaatverandering en het verlies van biodiversiteit aan te pakken wordt inmiddels breed onderkend. Vanuit deze urgentie is het idee ontstaan dat grote veranderingen wenselijk zijn; dat 'duurzaamheidstransformaties' nodig zijn om het tij te keren. Daarbij wordt vaak gesteld dat een belangrijke rol in het bereiken van zulke veranderingen is weggelegd voor 'wetenschaps-beleidsarrangementen'. Met deze term verwijs ik naar de vele manieren waarop relaties tussen wetenschap, beleid en maatschappij kunnen worden georganiseerd. De manieren, met andere woorden, waarop expertise een rol speelt in maatschappelijke en politieke besluitvorming. Het is echter verre van vanzelfsprekend wat expertise kan betekenen in de context van besluitvorming voor duurzaamheidstransformaties. Volgens mij is het belangrijk om deze rol te onderzoeken, vanwege de belofte die achter de aandacht voor duurzaamheidstransformaties schuilt. Of, anders gezegd, maken de uitdagingen waar we voor staan duidelijk dat grootschalige verandering onvermijdelijk is? Klimaatdisruptie zal immers óók transformatief veranderende samenlevingen opleveren, zij het waarschijnlijk niet bijzonder aangename of wenselijke. We moeten dus ons vermogen stimuleren om te beïnvloeden *wat* er transformeert en *hoe*. Daarbij zullen we ook moeten accepteren dat transformaties altijd een staat van 'niet-precies-weten' met zich meebrengen. Dit is wat er volgens mij op het spel staat bij suggesties dat wetenschaps-beleidsarrangementen een belangrijke rol te spelen hebben in duurzaamheidstransformaties. Het doel van deze dissertatie is daarmee om te onderzoeken **hoe wetenschaps-beleidsarrangementen kunnen bijdragen aan duurzaamheidstransformaties**.

In **Hoofdstuk 1** leg ik uit waarom het niet vanzelfsprekend is dat wetenschaps-beleidsarrangementen een bijdrage kunnen leveren aan duurzaamheidstransformaties. Bovendien stel ik dat we er niet al te zeker van moeten zijn dat huidige pogingen om ze te verbeteren ze voldoende geschikt maken voor dat doel. Te vaak blijven pogingen gestoeld op tekortschietende veronderstellingen over kennis, beleid, en hun onderlinge relatie. Op basis van deze tekortkomingen formuleer ik drie onderzoeksvragen. Gezamenlijk kunnen deze helpen bij het formuleren van alternatieve aanpakken, waarbij wetenschaps-beleidsarrangementen de potentie hebben om bij te dragen aan wenselijke duurzaamheidstransformaties:

1. ***Vanuit welke verdeling van rollen en verantwoordelijkheden worden wetenschaps-beleidsarrangementen in praktijk gebracht?***
   Met deze vraag zoek ik naar een beter begrip van de manieren waarop verschillende actoren betrokken zijn bij wetenschaps-beleidsarrangementen. Door te focussen op de verdeling van rollen en verantwoordelijkheden wil ik verder gaan dan alleen de rol van onderzoekers en wetenschappers, en ook zichtbaar maken hoe actoren van buiten de wetenschap deelnemer kunnen zijn in deze arrangementen.

2. ***Wat betekent de diversiteit van actoren die betrokken zijn bij duurzaamheidstransformaties voor het conceptualiseren van effectieve wetenschaps-beleidsarrangementen?***
   Zowel in de academische literatuur als in de praktijk wordt in toenemende mate erkend dat er een verschuiving heeft plaatsgevonden van '*government to governance'*. Deze verschuiving betekent dat het aanpakken van duurzaamheidsproblemen actie vereist van een grote verscheidenheid aan actoren, niet alleen overheden. Voor wetenschaps-beleidsarrangementen betekent deze verschuiving dat traditionele opvattingen van effectiviteit, waarin beleidsmakers hun beslissingen en actie baseren op de beste beschikbare wetenschap, niet langer houdbaar zijn. En als wetenschaps-beleidsarrangementen niet altijd centraal staan bij actie, zijn er andere manieren nodig om hun effectiviteit te beschouwen.

3. ***Wat betekent de politieke dimensie van duurzaamheidstransformaties voor de manier waarop wetenschaps-beleidsarrangementen in praktijk zouden moeten worden gebracht?***
   Veel van de literatuur over transformatieve verandering stelt dat het een inherent politiek en normatief proces is. Tegelijkertijd houden traditionele opvattingen in dat wetenschaps-beleidsarrangementen apolitiek en neutraal zouden moeten zijn. Met deze onderzoeksvraag reflecteer ik op de onderlinge relaties tussen democratische politiek en transformatieve verandering. Op basis hiervan kan ik een potentiele bijdrage van wetenschaps-beleidsarrangementen aan duurzaamheidstransformaties formuleren, en kan ik laten zien wat er op het spel staat als we willen dat deze bijdrage gerealiseerd wordt.

Ik beantwoord deze onderzoeksvragen aan de hand van vier kwalitatieve casestudies, die ik elk in een apart hoofdstuk beschrijf (**Hoofdstukken 2 tot en met 5**). Deze casestudies zijn

ontwikkeld als onderdeel van mijn werk als onderzoeker bij het Planbureau voor de Leefomgeving (PBL), het Nederlandse nationale instituut voor beleidsanalyse op het gebied van duurzaamheid. In die functie had ik gedurende mijn onderzoek twee petten op: (1) die van PBL-medewerker belast met het uitvoeren van beleidsstudies en het coördineren van de relatie tussen PBL en het Nederlandse Ministerie van Buitenlandse Zaken, en (2) die van promovendus geïnteresseerd in het analyseren van, en reflecteren op, het werk van zijn directe en indirecte collega's en van het instituut. Gelijktijdig werken binnen een vooraanstaande publieke kennisorganisatie én promotieonderzoek doen is een tamelijk unieke positie. Ik zie deze positie dan ook als meervoudig, waarbij er verschillende versies van mezelf actief zijn. Deze meervoudige positie brengt zowel uitdagingen als kansen met zich mee. Ik heb geprobeerd manieren te vinden om synergieën te organiseren tussen dit proefschrift en mijn werk bij het PBL, zowel in praktische zin – om te voorkomen dat ik *de facto* twee verschillende banen zou hebben - als op een meer strategisch niveau. Mijn positie bij PBL bood immers ook unieke mogelijkheden om mijn reflecties en analyses in de praktijk te brengen. Om verder te denken dan de huidige praktijken en ruimte te maken voor alternatieven. Tegelijkertijd is het onmogelijk om deze meervoudige positie volledig te vatten in de casestudies waarmee ik mijn onderzoeksvragen beantwoord. Daarom sluit ik **Hoofdstuk 6** van dit – en deze samenvatting – af met de vraag wat mijn onderzoek zou kunnen betekenen voor het PBL.

In **Hoofdstuk 2** bestudeer ik mijn meest directe werkcontext: de samenwerking tussen het PBL en het Nederlandse Ministerie van Buitenlandse Zaken (MinBuZa). Door deze samenwerking te beschrijven ontwikkel ik een diepgaande analyse van de verdeling van rollen en verantwoordelijkheden in wetenschaps-beleidsarrangementen. Het hoofdstuk beschrijft twee verschillende heuristische modellen voor het begrijpen van wetenschaps-beleidsarrangementen uit de literatuur: lineair en co-productief. Het lineaire model gaat ervan uit dat wetenschap en politiek netjes gescheiden kunnen worden, en wordt vaak als dominant maar ontoereikend beschouwd. Het co-productieve model daarentegen gaat ervan uit dat wetenschap en politiek met elkaar verweven zijn, en wordt door wetenschaps-beleidswetenschappers als veelbelovend alternatief voor het lineaire model gezien. Conceptueel stel ik voor om wetenschaps-beleidsarrangementen te analyseren als sociale praktijken. Sociale praktijken zijn routinematige handelingspatronen. Met dit perspectief beschrijf ik hoe de verschillende actoren – onderzoekers en beleidsmakers – hun betrokkenheid bij de PBL-MinBuZa samenwerking begrijpen. Het hoofdstuk bevestigt de relatieve dominantie van het lineaire model en verklaart het voortbestaan van dit model vanuit een bepaalde taakverdeling tussen onderzoekers en beleidsmakers. Hoewel er zowel onder onderzoekers als onder beleidsmakers enige erkenning

is van het potentieel van co-productieve wetenschaps-beleidsarrangementen, worden veranderingen beperkt door het gebrek aan alternatieve denkbeelden van hoe co-productieve arrangementen er in de praktijk uit zou zien. Discussies over rollen en verantwoordelijkheden richten zich eenzijdig op wat deze zouden moeten zijn voor de betrokken onderzoekers, terwijl de vraag wat passende rollen en verantwoordelijkheden zouden kunnen zijn voor andere betrokken actoren grotendeels over het hoofd wordt gezien. Deze scheve verdeling van verantwoordelijkheden brengt het risico met zich mee dat democratische taken van beleidsmakers op onderzoekers worden afgeschoven. Om dit te voorkomen zouden alternatieve denkbeelden kunnen uitgaan van gemeenschappelijke, maar gedifferentieerde verantwoordelijkheden. Verbetering van de afstemming van verantwoordelijkheden is ook gebaat bij meer nadruk op de politiek van expertise, iets waar ik in **Hoofdstuk 4** op inga.

Hoofdstuk 3 richt zich op mondiale milieurapportages, zoals het *Intergovernmental Panel on Climate Change* (IPCC) of het *Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services* (IPBES). Mondiale milieurapportages zijn niet alleen een rapportage, maar belichamen ook een proces, en vooral dat proces maakt ze tot een bijzonder soort wetenschaps-beleidsarrangement. Mondiale milieurapportages worden gebruikt door een grote verscheidenheid aan actoren, van verschillende overheidsniveaus tot academici, de particuliere sector en maatschappelijke organisaties. Hierdoor staan ze vooraan wat betreft de gevolgen van de verschuiving van *government* naar *governance*, en daarmee in de behoefte aan een alternatief begrip van hun effectiviteit waarin ze niet noodzakelijkerwijs centraal staan bij actie. Hiertoe ontwikkelt **Hoofdstuk 3** een begrip van effectiviteit als *empowerment*: het potentieel van wetenschaps-beleidsarrangementen om bij te dragen aan het handelingsvermogen van andere actoren. Dit alternatieve begrip van effectiviteit benadrukt welke bijdragen wenselijk zijn: wiens handelingsvermogen dienen wetenschaps-beleidsarrangementen (vooral) te ondersteunen? Ik beargumenteer dat, hoewel het onmogelijk is om in gelijke mate aan het handelingsvermogen van alle actoren bij te dragen, wetenschaps-beleidsarrangementen niettemin kunnen streven naar verhoogd handelingsvermogen bij een breed scala aan actoren. Om dat te kunnen doen, moeten ze rekening houden met een verscheidenheid aan perspectieven op problemen en oplossingen, zonder deze te hoeven integreren of de verschillen te beslechten. Op die manier kan pluralisme de effectiviteit van wetenschaps-beleidsarrangementen verbeteren. Het hoofdstuk geeft drie illustratieve ideeën over hoe mondiale milieurapportages dit zouden kunnen operationaliseren.

Hoofdstuk 4 komt voort uit een interesse in maatschappelijke *verwachtingen* over wat expertise kan doen. In het bijzonder probeer ik te begrijpen hoe expertise kan worden gebruikt om

beslissingen te rechtvaardigen. Voortbouwend op inzichten uit de sociologie van onwetendheid, introduceer ik het concept *kennisverantwoording*, om te verwijzen naar de manier waarop van besluitvormers wordt verwacht dat ze uitleggen en rechtvaardigen hoe en welke kennis hun beslissing heeft beïnvloed. Verantwoorden en verantwoordelijkheid zijn nauw met elkaar verbonden. Dit betekent dat er verschillende manieren bestaan waarop verwachtingen van kennisverantwoording – verschillende 'logica's' van kennisverantwoording – verschillende modellen van wetenschaps-beleidsarrangementen stimuleren (zoals besproken in **Hoofdstuk 2**). Empirisch richt **Hoofdstuk 4** zich op de lopende ontwikkeling van Brede Welvaart als alternatief voor het Bruto Nationaal Product (BNP). Op basis van deze casestudie suggereer ik dat er ten minste twee verschillende logica's voor kennisverantwoording bestaan: technocratische en politieke. Technocratische kennisverantwoording richt zich op het beoordelen van de effecten van beleidsbeslissingen. Politieke kennisverantwoording richt zich op het afwegen van de normen en waarden waaraan de effectiviteit wordt getoetst. Vervolgens gebruik ik de politieke filosofieën van John Dewey en Chantal Mouffe om te verdedigen dat de politieke logica het best in staat is om (transformatieve) verandering te bewerkstelligen, omdat transformatieve verandering vraagt om kennis over welke actie *wenselijk* zou kunnen zijn. Voor wetenschaps-beleidsarrangementen betekent dit dat hun potentiële bijdrage aan (duurzaamheids)transformaties ligt in het leveren van expertise die politiseert – expertise die actoren in staat stelt om mogelijke toekomsten te overwegen in termen van hun normatieve wenselijkheid. Met andere woorden, wetenschaps-beleidsarrangementen hoeven niet te weten wat 'goede' transformatieve verandering is, maar moeten andere actoren helpen bij het formuleren van de door hen gewenste transformatieve verandering.

Hoofdstuk 5 is een commentaar op voorstellen voor een nieuwe internationale wetenschap-beleidsorganisatie gericht op voedselsystemen. Het hoofdstuk illustreert belangrijke punten uit dit proefschrift in de context van wereldwijde discussies over zo'n nieuwe wetenschaps-beleidsorganisatie. Het commentaar benadrukt dat beleidsdiscussies over voedselsystemen geregeld kenniscontroverses met zich meebrengen. Dergelijke discussies hebben meer te winnen bij het in kaart brengen van de verschillende perspectieven dan bij pogingen om te bepalen wie er gelijk heeft. Dit herhaalt de noodzaak om meervoudige vormen van kennis uit de natuurwetenschappen, sociale wetenschappen en geesteswetenschappen, én uit inheemse en lokale kennissystemen, op te nemen. Bovendien bestaat de *governance* van voedselsystemen uit een enorm aantal en grote verscheidenheid aan actoren. Verandering vereist dus veel meer dan overheidsbeleid alleen. De combinatie van meervoudige kennis en actie buiten de overheid betekent dat de term wetenschaps-beleidsarrangementen tekortschiet, en beter als

kennis-governance arrangement gezien kan worden. Tot slot benadrukt het hoofdstuk dat zelfs een verbeterd kennis-governance arrangement geen wondermiddel is voor het oplossen van hardnekkige problemen.

In het **laatste hoofdstuk** bespreek ik de bijdragen en implicaties van mijn proefschrift voor het bestuderen en vormgeven van relaties tussen wetenschap, beleid en maatschappij. Ik doe dit aan de hand van drie vragen die in mijn werk centraal staan. Eerst bespreek ik de vraag '*Wat zijn de wetenschaps-beleidsarrangementen die we willen?*'. Ik denk dat het van groot belang is dat we wetenschaps-beleidsarrangementen kunnen bespreken in termen van wat we *willen* dat ze doen. Vaak worden het hedendaagse maatschappelijke en academische discours gekenmerkt door argumenten van noodzaak. Ik beargumenteer dat de onwil om een normatieve positie in te nemen ook inspanningen belemmert om wetenschaps-beleidsarrangementen te verbeteren.

De tweede vraag die ik bespreek is: '*Wat maakt dat wetenschaps-beleidsarrangementen kunnen bijdragen aan transformatieve verandering?*'. Op basis van de hoofdstukken in deze dissertatie stel ik dat hun bijdrage aan duurzaamheidstransformaties afhangt van hun vermogen om een *gedistribueerd* en *pluralistisch* governance-landschap te *politiseren*. *Gedistribueerd*, om de verschuiving van *government* naar *governance* te benadrukken. *Pluralistisch*, om de inclusiviteit naar verschillende vormen van kennis en het belang van niet-precies-weten te benadrukken. En *politiserend*, om te benadrukken dat expertise kan helpen bij het formuleren van wenselijke transformatieve verandering.

Waar deze tweede vraag zich richt op wetenschaps-beleidsarrangementen *voor* transformatieve verandering, gaat mijn derde vraag over transformatieve verandering *in* wetenschaps-beleidsarrangementen. Ik vraag '*Hoe kunnen we kansen voor transformatieve verandering in wetenschaps-beleidsarrangementen creëren en benutten?*'. In de geest van niet-precies-weten haal ik inspiratie uit verschillende bronnen. Ik stel voor dat experimenten een krachtig hulpmiddel kunnen zijn voor wetenschaps-beleidsarrangementen om te leren hoe het anders zou kunnen. Tegelijkertijd denk ik dat het succesvol benutten van het potentieel van experimenten een ethos van zorgzaamheid vereist. Zorgzaamheid betekent openstaan voor het potentieel voor verandering, inclusief de politieke en normatieve implicaties van zo'n verandering. Hoewel het misschien niet zo klinkt, kunnen zorgzame experimenten behoorlijk confronterend zijn. Dit vereist een bereidheid om ongemak te ondergaan voor mensen die werken in wetenschaps-beleidsarrangementen. In dit opzicht zijn er belangrijke lessen te leren uit feministisch en antiracistisch denken.

Samen verklaren deze drie vragen de titel van dit proefschrift, *'Transforming relations between science, policy and society for sustainable futures?'*. Alleen door wetenschaps-beleidsarrangementen te *transformeren*, kunnen wetenschaps-beleidsarrangementen *transformatief* worden.

Tot slot ben ik natuurlijk geïnteresseerd in de betekenis van mijn proefschrift voor het PBL. In de eerste plaats denk ik dat de vraag wat voor PBL wenselijk is niet door mij alleen beantwoord kan worden, noch binnen het instituut zelf. Het bepalen van welk PBL wenselijk is, is een collectieve verantwoordelijkheid voor wetenschap, beleid en maatschappij. In dit opzicht is de missie van het PBL om 'bij te dragen aan de kwaliteit van politiek-bestuurlijke afweging' nogal vaag. Deze zou concreter kunnen worden geformuleerd in projecten, programma's of voor het instituut als geheel. Het is heel goed mogelijk dat de huidige verscheidenheid van rollen van het PBL ook dan zou blijven bestaan, maar het zou ook moeten leiden tot een groter collectief bewustzijn van wat de verschillende rollen inhouden, en van wat het PBL wel en niet kan doen vanuit elk van deze rollen. Bovendien is er, zoals op veel plaatsen, een zekere traagheid en padafhankelijkheid in de manier van werken van PBL. Op het niveau van het personeel van het PBL zou dit geadresseerd kunnen worden door meer interne flexibiliteit van medewerkers en in het vacaturebeleid. Wat het laatste betreft zou het PBL er goed aan doen om niet reflexmatig vrijwel identieke vervangers van vertrekkende collega's te zoeken, maar om de gelegenheid te benutten om opnieuw te bekijken welke expertise, netwerken en competenties het instituut ten goede zouden komen. Tot slot zou het PBL niet alleen nieuwe projecten kunnen vragen om te beargumenteren 'waarom dit project wenselijk is', maar ook bestaande projecten kunnen vragen om opnieuw te beargumenteren 'waarom dit project *nog steeds* wenselijk is'. Het regelmatig articuleren van de wenselijkheid van alle projecten kan helpen om prioriteiten te stellen, de werkdruk te verlagen en bij te dragen aan een betere positionering van het instituut.

Timo Y. Maas

Wageningen School of Social Sciences (WASS)

Completed Training and Supervision Plan

Wageningen School of Social Sciences

Name of the learning activity	Department/Institute	Year	ECTS*
A) Project related competences			
A1 Managing a research project			
WASS Introduction Course	WASS	2020	1
Research proposal	WUR	2019-2020	6
Peer reviews	*Environmental Science & Policy*	2020-2022	3
Efficient Writing Strategies	*Wageningen in'to Languages*	2021	1.3
'Co-producing the science-policy interface: symmetry at last?'	Interpretive Policy Analysis Conference, 2021, *virtual*	2021	1
'Knowledge impact assessment at the science-policy interface'	INGSA Conference 2021, *virtual digital innovation session*	2021	1
A2 Integrating research in the corresponding discipline			
Infrastructures	WTMC Summer school	2018	5
Transformative and Participative Research Methods	WASS	2021	4
Epistemic Corruption	WTMC Summer school	2021	5
B) General research related competences			
B1 Placing research in a broader scientific context			
Analysing Discourse: Theories, Methods and Techniques, CPT 56303	WUR	2020	6
B2 Placing research in a societal context			
Invited presentation at the Institute of Environmental Sciences	The IES	2020	1
Organizing joint PBL-TIAS seminar on integrated assessment in a post-truth society	PBL	2022	1
C) Career related competences/personal development			
C1 Employing transferable skills in different domains/careers			
Training facilitation	Mischief Makers	2019	1
Total			**36.3**

*One credit according to ECTS is on average equivalent to 28 hours of study load

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Financial support from Wageningen University for printing this thesis is gratefully acknowledged.

Cover design by Ron Zijlmans

Printed by Proefschriftmaken.nl on FSC-certified paper