HBM4EU science and policy for a healthy future

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A (phased) plan for action: how structurered multi-actor dialogues on human biomonitoring results can facilitate targeted policy action

Generic canvas for HBM4EU (final version 2017)

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1 List of abbreviations

ALARA	As low as reasonably achievable
ANSES	French Agency for Food, Environmental and Occupational Health & Safety
DEMOCOPHES	Demonstration of a study to coordinate and perform human biomonitoring on a European scale
DH	Department of Health, United Kingdom
EEA	European Environment Agency
EU	European Union
FLEHS	Flemish Environment and Health Study
HBM	Human biomonitoring
HBM4EU	European Human Biomonitoring Initiative
IRGC	International Risk Governance Council
LNE	Flemish department for environment, Leefmilieu, Natuur en Energie, Belgium
MCA	Multi-criteria assessment
NGOs	Non-governmental organisations
PFOAs	Perfluorooctanoic acid
PM	Policy makers
POP	Persistent organic pollutants
RIVM	Rijksinsituut voor Volksgezondheid en Milieu, National Institute for Public Health and the Environment, the Netherlands
SIA	Social Impact Assessment
SH	Stakeholders
UAntwerpen	University of Antwerp, Belgium
UBA	UmweltBundesAmt, German Environmental Agency, Germany
UNCED	United Nations Conference on Environment and Development
VITO	Flemish Institute on Technological Research, Vlaamse Instelling voor Technologisch Onderzoek, Belgium
WP	Work package
WHO	World Health Organization

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3 Preface

The European Human Biomonitoring Initiative (HBM4EU) is not just about the production of targeted, timely and fit for purpose knowledge on chemicals of concern, exposure levels and health effects and the underlying harmonisation of monitoring practices, HBM4EU has the ambition to actively support policy making and protect the EU population from the harmful impacts of chemical exposures on health.

Work package 5 explicitly addresses the **translation of results for policy making**: it aims to establish a strategy to derive and adopt health-based HBM guidance values at European level. It also aims to improve chemical risk assessment through the use of HBM data. It will develop indicators, based on HBM data to evaluate spatial and time exposure trends of the EU population. And it will propose and experiment with collaborative or participatory processes to explore the wider relevance and use of HBM, mainly in terms of (policy) options for dealing with environmental health risks. This deliverable is produced in the context of this last task (Task 5.5).

The basic assumption in Task 5.5 is that it would be a misunderstanding to assume that data and metrics, the raw scientific results, can speak for themselves. Scientific findings need and deserve efforts to stimulate their further interpretation, evaluation and use in order to become evidence and robust knowledge for policy making. This uptake is of course incorporated in the objectives of different tasks.

Also other work packages, with solid tasks on setting priorities, mapping of policy needs, writing of scoping documents, the knowledge hub for knowledge dissemination, efforts for external communication and the involvement of policy makers and stakeholders in the management structure of the project, demonstrate that the uptake of results is considered essential in HBM4EU.

However, many of these tasks stay close to the scientific modus of operation or tend to mainly involve scientists, although also communicating and disseminating targeted information to stakeholders and policy makers. The leaders of WP5 and Task 5.5 are convinced that more can be done in this science-policy nexus by increasing interaction and collaboration between the different actors involved, from science, policy and society. This deliverable therefore aims to be a source of inspiration, but also a starting point for concrete action with regard to the organisation of **multi-actor dialogues** on human biomonitoring. As Task 5.5 aims to create openness and transparency in the translation of science into policy, this generic canvas hopes to **inspire concrete practices of interaction on HBM-data between science, policy and society**.

We purposely named this document '**generic canvas'** as it aims to lay a foundation of basic ideas and concepts for operational settings, just as a crafted linen or wooden substrate would do for a painting. We focus on identifying arguments and motivations for multi-actor dialogues on HBM-results, share 'building blocks' to take into account when organizing these dialogues and look forward to potential case study selection processes, with the partners in our task.

As this canvas is aimed to be pragmatic and inspirational, we chose not to write too academically, rather using 'fieldwork terminology'. Of course, where relevant, references to the social scientific literature are included, but as is clear from the previous, this manuscript is not conceived or intended as a state-of-the art literature overview.

Inspiration for this deliverable was found in the scientific literature on new knowledge- and policy arrangements, in consultation of the international group of partners of WP5 and in experience with explicit and systematic initiatives for policy uptake in the Flemish Environment and Health Study (FLEHS).

In fact, the idea to include this Task 5.5 in the HBM4EU project originated in Flanders (Belgium), where experience has been built up during the last decade with a '*phased plan for action*', a

protocol implemented after each cycle of HBM by the Flemish Environment and Health Study (FLEHS), to systematically evaluate HBM-results and develop targeted policy actions based on the needs that were implied from the HBM findings. This protocol was implemented collaboratively by scientists and policy makers involved in the FLEHS study, but also other interested and affected parties collaborated. This approach is presented in more detail in part 3 of this document.

Our experience with this kind of collaborative processes tells us that mutual ownership becomes tangible using this approach. Researchers being involved in risk assessment often have reasonable suggestions in mind for interventions and risk management and are able to mobilise additional insights for policy translation. Policy makers and stakeholders on the other hand, can add their interpretation from other contexts and perspectives, imagine futures and can set priorities to frame results, envision measures and judge their political feasibility.

We are convinced that we can profit from the good experiences we all share together and at least develop a common language in pursuit of science-policy translation. The aim is not to cross-nationally harmonise practices, but – of course – we hope that this general introduction may inspire national and EU-partners involved taking valuable additional initiatives for ‘science to policy’ translation, both at the domestic level and the European level.

4 Reader's guide

What lies in front of you? - This report is the 'generic canvas' University of Antwerp aims to develop as part of Task 5.5 of the HBM4EU project. The generic canvas is meant to be a source of inspiration, but also a starting point for concrete action with regard to the organisation of dialogues on human biomonitoring (HBM) between scientists, policy makers and other stakeholders, with the ultimate aim of stimulating or developing targeted policy actions.

For whom it is written? - The target group of this publication is composed diversely. On the one hand, we aim to find common ground within the consortium on principles and best practices to 'coproduce' targeted policy actions in response to HBM, with scientists, policy makers and societal actors. On the other hand, this document can also inspire policy makers at various governmental levels (the European level, the member state level, regional authorities) as well as scientists, (corporate) risk managers, NGOs, citizens and other actors interested in human biomonitoring to get involved in multi-actor dialogues on HBM topics.

Structure of the publication – In part 1, we identify reasons why organising multi-actor dialogues on HBM is interesting and relevant. We identify arguments from the side of policy makers, as well as from the side of scientists, stakeholders and citizens. In part 2, we list some requirements that should guide or inspire the organisation of dialogues on HBM, and 'building blocks' for the design of such structured, collaborative processes. In part 3, we offer some further guidance for Task 5.5., to stimulate our partners in Task 5.5 to identify potential case study topics with relevance for multi-actor dialogues on EU-level and national level. As an illustration, we also describe the protocol developed in Flanders that served as the inspiration for this Task 5.5.

5 Part 1 – Why organising multi-actor dialogues on HBM?

Human biomonitoring should not be a scientific endeavour alone. On the contrary, cooperating and even coproducing knowledge with policy makers, civil society and market players has many advantages and helps to meet some of the often-heard concerns. Hereafter, we describe some of the concerns of scientists, policy makers, stakeholders and citizens.[1]

5.1 Concerns of scientists

Scientists involved in human biomonitoring aim to gather objective data on environment and health risks, but are often confronted with challenges.

Not rarely, controversy rises on environmental health risks and the output of HBM research. Based on the best of their knowledge, scientists might for example conclude that the health risks of particular substances or activities are low, but NGOs or citizens protest against these conclusions because they perceive the risk differently. Or the other way round, scientists might conclude that the health risks of a specific substance are high, but no one is really listening. For scientists, this **gap between objective results and subjective perceptions** makes their work more difficult as the validity of the scientific work is questioned or the relevance of their work is not (sufficiently) valued in terms of drawing adequate conclusions.

Scientists often feel the **need of more dialogue**, for example with colleague-scientists from other disciplines. In order to better understand the complex interplay between environment and health problems, various disciplinary perspectives help to put the puzzle together. Interdisciplinary cooperation is often felt to be a necessary condition to overcome the inherent problems of complexity and uncertainty. Being confronted with the worries of concerned citizens, can also trigger the need for interdisciplinary cooperation.

Scientists tend to communicate carefully about scientific (HBM) results in contexts in which citizens, NGOs and policy makers expect to hear 'the' scientific answer to their question(s). Society expects scientists to give clear answers, while scientists feel the need to make nuances and point at the complexity. The other way round, complex circumstances trigger scientists to question conclusions from earlier research, leading to new research questions and requests for further research (in order to come to clarity). In both cases, scientists are pushed and pulled towards making clear statements on the one hand and making nuances on the other.

Further, scientists are confronted with alternative knowledge claims from other types of actors. Think of stakeholders that set-up research themselves (such as industry, civil society actors or citizens). These types of actors initiate research often for strategic reasons, for example to convince others of their viewpoint or to enforce their claims about environmental health risks. This practice illustrates that **scientific research and its results not automatically convinces others**. Some scientists respond to these situations with new or better attempts to convince the others. Other scientists underline the need for debate and deliberation.

[1] Characteristic for human biomonitoring is the large number of actors involved. Not only on the scientific side many actors play a role (think off academics with various disciplinary backgrounds, scientific personnel of government (research) institutes and risk assessment bodies and so on), also on the societal and policy side many actors are involved in the discussions on HBM. Without the ambition of being exhaustive, we can refer to NGOs, industry, (medical) professional organisations, policy makers at various governmental levels and policy domains, citizens, local stakeholder organisations etc. And even within each 'group', there is a large heterogeneity. In this publication, we often refer to 'scientists', 'policy makers' and 'societal actors' or 'stakeholders' in a general way, since it is not desirable to each time specify the large heterogeneity of relevant perspectives. Our main intention is, to indicate the importance of dialogue between different actors and perspectives, whoever it may be.

5.2 Concerns of policy makers

Governments are not rarely the commissioner of human biomonitoring programmes. Based on the results, policy makers want to draw policy relevant conclusions. However, translating science to policy often proves hard.

Translating science to policy is hard, not in the least because scientific results might be complex and disputed, stakes and interests of societal stakeholders might conflict and the effectiveness of potential measures remains uncertain.

Policy makers want to make policy, but they need the involvement of other actors (science, market, civil society) to do so. **Policy makers need multi-actor dialogue** on HBM issues to make policies that are supported (legitimate) and reach their goals (effective) in an efficient, coproduced way.

In organising participation on HBM results, policy makers are confronted with the question 'who should we invite to have relevant multi-actor dialogues on HBM results?'. **Organising participation is easier said than done**, as not all societal stakeholders are willing to participate (e.g. because they lack trust in government) and as policy makers need to take into account power imbalance between societal stakeholders (e.g. powerful market players versus relatively powerless citizens).

Which government should take action? In the context of **multi-level governance**, many governments have responsibilities in taking policy action, based on HBM results. Depending on the local and supra-local perspectives on what is relevant knowledge, policy solutions might differ. This insight should trigger an approach in which the principle of subsidiarity is applied: local and supra-local governments should try to develop complementary policy action, based on productive and constructive dialogues between them. A nice principle, but policy makers of various governmental layers experience that bringing about this multi-level dialogue is easier said than done.

Responsibilities in developing solutions for environment and health problems, are not solely concentrated with governments. Governments often stimulate other actors (market players, citizens, NGOs) to take action themselves. Sometimes stimulating them is even not necessary: driven by the conviction that a sustainability transition is desirable, we see corporate risk managers, citizens and NGOs set up 'bottom-up' initiatives themselves. This implies that **taking action is not the exclusive prerogative of governments**. On the contrary, actions of other types of actors is evenly important, even though not all actors might be willing to take this responsibility.

Making (new) regulations is often perceived as the ultimate action of policy makers, confronted with certain HBM results. However, it might be considered relevant to initiate or support other types of actions: **soft measures, besides 'hard' regulation**. Think of: initiating or supporting awareness campaigns on environmental health risks, initiating or stimulating more or different scientific research, facilitating constructive dialogues between scientific disciplines, stakeholders, governmental layers etc.

Obviously, policy makers underline the importance of the effectiveness of policy measures. In that respect, building insight in the **mechanisms of behavioural change**, necessary for environmental health improvement, is essential. Literature indicates that more knowledge does not automatically lead to the desired behavioural changes. Disseminating knowledge (by means of study results) is one thing; taking complementary action for steering behavioural change is another.

On top of that, policy makers experience that evaluating effectiveness of policy actions is not self-evident, due to problems with e.g. **(multi-)causality**. When the status of environmental health risks remains stable or changes, do we have to blame (or be grateful for) policy measures or did 'intervening variables' influence the results?

5.3 Concerns of stakeholders

Stakeholders are organisations standing up for the interests of their members, or a certain interest. In HBM topics, diverse types of stakeholders have a stake, for example industry federations, environmental movements, medical doctor's associations etc. Even though their interests may conflict, they still share some particular concerns with regard to HBM results and how to deal with them.

Regardless of the type of stakeholder, they appreciate to be consulted and have the **opportunity to explain their viewpoint and defend their stakes**, in particular in policy discussions that might lead to new or adapted government policies.

In some cases, stakeholders underline the importance of **working together** with policy makers, with scientists and with other stakeholders, as it is acknowledged that coproduction and coordinated actions are probably the most effective way of dealing with complex problems of environmental health risks.

In other cases, stakeholders will explicitly **refuse to cooperate**. In particular when the stakes of their members are high and when (policy) action might harm them, there will be little willingness to work together. On the contrary, stakeholder organisations will then be harsh in opposing any potentially harming initiative.

5.4 Concerns of citizens

HBM-results concern environmental health risks citizens are exposed to. Obviously, citizens are interested in the results and wonder how to make the right interpretation of these results. In their confrontation with HBM research, citizens and affected groups meet difficulties and have specific concerns. In this respect, we do not treat aspects of mere 'study participation' here, in which persons are study objects rather than subjects.

For citizens that have not been educated to judge the validity of scientific research results, it is **hard to make sense from the various knowledge claims of scientists**. In particular when scientists tell different stories, citizens might be left in doubt: who to believe?

Citizens often look at the government to take action to prevent environmental health risks, for example by developing and implementing new regulation. However, they also often feel the **need to be informed** on what they – as citizens – can do themselves to prevent environment & health problems. Citizens want to take responsibility, but are often unsure on what they can do.

Some citizens are concerned about specific, often local environmental health risks (e.g. installations or activities in their neighbourhood). In these cases, it is not always easy for citizens to **draw the attention of scientists and policy makers to their (local) concern**.

Citizens are not always confident that the government is taking appropriate measures in response to environmental health risks. In some cases, governmental measures are considered too weak and insufficient to deal with the risk. In other cases, governmental measures are seen as 'exaggerating'; in particular when citizens do not understand why certain measures are necessary. **Citizens sometimes lack confidence, both in policy and in science**. Indeed, sometimes even the competence to merely facilitate human biomonitoring is contested.

5.5 The idea of organising multi-actor dialogues

In order to meet these concerns of scientists, policy makers, stakeholders and citizens, organising multi-actor dialogues on HBM issues might be seen as a (part of the) solution. The idea is that all relevant persons or groups should be involved in the process of starting up HBM research, interpreting and evaluating potential risks and discussing policy consequences of HBM results. The basic idea behind multi-actor dialogues is that it is mutually profitable to cooperate and coordinate action with regard to environmental health problems.

5.6 Why are multi-actor dialogues in the science-policy-society nexus important? Some preliminary conclusions

Multi-actor dialogues on HBM are important because – when performed well – they can function as a decision-support method. As illustrated in the description of concerns of scientists, policy makers, stakeholders and citizens, there is a big challenge, not only **to do justice to the complexity of and remaining uncertainty in HBM results and processes**, but also **to come to relevant and supported conclusions for environment and health policies** and **to build trust** between the actors involved, including citizens. In literature, concepts as 'transdisciplinarity', 'mode-II-knowledge production' (Gibbons, 1994) and 'post-normal science' (Funtowicz, Ravetz, 1993), 'sustainability science', 'social or mutual learning for sustainability' and a 'new social contract for science' (Clark et al. 2016), are introduced with the ambition to complement mainstream science by other relevant forms of knowledge and expertise. In particular given the moderate trust of citizens in governments and science, well-organised multi-actor dialogues can be a suitable 'answer' to the complexity and uncertainty that is inherent to environment and health problems (SCU, 2014). Facilitated multi-actor dialogues are recommended, rather than classic participation tools governments have at their disposal (e.g. public inquiry).

We start off from the idea that collecting data does not automatically generate suitable scientific knowledge, nor do data automatically have policy relevance. Data need to be interpreted and in this interpretation and 'translation' to policy it is valuable to involve different experts and perspectives, as we support the idea that this will **increase the knowledge base,** in particular relevant for **complex issues** (Hage et al, 2010). This, is often called an "analytic-deliberative approach". It stresses the importance of combining analysis and deliberation, **potentially resulting in more acceptable decisions** to interested and affected parties (Stern, 2005; Renn, 1999; Stern & Fineberg, 1994).

Of course, we acknowledge that the way this collaborative analysis and deliberation is organised is also methodologically complex, as the question remains: how should these different (technical) expertises, public preferences and values be combined and judged? For example, merely putting different stakes at the negotiating table will not unambiguously solve problems when problem framing and the definition of problem solving strategies are characterised by differences of opinion. Nevertheless, diversity of viewpoints can be an important source of relevant information for **optimising policy or policy learning**.

Literature mentions various reasons in favour of participation of multiple actors in decision-making processes (see e.g. Bulkeley & Mol, 2003). These reasons are either instrumental or normative.

- The **instrumental arguments** refer to the fact that via participation multiple functional goals can be reached.

Firstly, *the knowledge base can be broadened and deepened*. Because of the complexity of HBM issues, knowledge input from different angles is important. A debate with multiple types of actors is a relevant form of knowledge, in particular in contexts of uncertainty, controversy and lack of

univocal appreciation of scientific knowledge. Dialogues with multiple actors can open up to the diversity of knowledge claims and opinions.

Secondly, *the involvement of relevant groups can stimulate support* for the process of knowledge production, knowledge interpretation and the translation of knowledge to policy. Because people are invited to think along, a feeling of co-ownership can arise. Because participants feel co-responsible for the decisions made during the process, chances that decisions are contested afterwards are reduced. By creating support, conflicts can be avoided. Recent initiatives of citizen science also demonstrate that co-ownership over knowledge and research can be promising.

Thirdly, organising dialogues with scientists, governments, stakeholders and citizens can help to *build trust and reduce scepticism* about the viewpoints of others. Often, lack of confidence in other actors is caused by lack of awareness about each others arguments and ignorance about problems these other actors are facing. Organising dialogues can help to overcome these drawbacks.

- The **normative arguments** relate to the idea that participation can enrich the democratic character of the judgments, deliberations and choices made.

Participation should be policy-oriented and can reduce the distance between governments at the one hand and citizens/interest groups on the other hand. Participation can also contribute to active citizenship: empowering people to get control over their environment, reach goals and build capacities to help others and improve life quality.

5.7 The challenges of Task 5.5

Hereafter, we focus on organising multi-actor dialogues between scientists, policy makers and society. However relevant and needed, we are not going to focus on stimulating dialogue for example between scientists alone, or between policy makers of different governmental levels.

In the HBM4EU-project, the aim is to develop an approach that allows to derive policy actions that are desirable to cope with environmental health risks. Organising multi-actor dialogues on HBM results is not a goal in itself, but a means to come to ‘targeted’ policy actions.

While in many countries, organising these multi-actor dialogues is not new, the HBM4EU project starts off from the idea that countries could learn from the good HBM practices of other countries and that it might be beneficial to offer inspiration and guidelines on how to organise these multi-actor dialogues in a productive, efficient and legitimate way.

This ‘generic canvas’, aims to contribute to that aim. However, we fully acknowledge that developing a generic protocol is a challenge on its own.

- Firstly, we have to create a vocabulary that the project partners can share. This implies that the canvas needs to ‘set the scene’, aiming to build a common ground for organising multi-actor dialogues on HBM. Part 2 hereafter offers ‘building blocks’ that are meant to contribute to that aim.
- Secondly, the canvas aims to smooth the way towards selecting suitable cases to experiment further with multi-actor dialogues, both at the national level of our partners in Task 5.5 (by UAntwerpen/VITO, DH, ANSES, RIVM) and at the European level (by EEA and UAntwerpen). ‘Case studies’ will be executed from the end of 2017 onwards. The selection criteria and guidelines in part 3 are aimed to prepare and inspire these case studies. The case studies will – on their turn – be a source of inspiration to fine-tune this generic canvas later on in the project.

6 Part 2 – 'Building blocs' for multi-actor dialogues on HBM?

What we do not aim for - To be perfectly clear on our ambition: we do not aim for the presentation of a fixed script or a manual that fits all solutions, since the organisation of collaborative dialogues on HBM should ideally be contextual and tailor-made. Although ample literature is reported on normative (meta-)principles for participatory governance (Hage et al, 2005), the essence remains *learning by doing and doing by learning* (Kates, Clark et al. 2001, Wals, 2009). One should always take into account the specific topic, the specific concerns of actors involved in a praxis and the specific aims of the initiator. Furthermore, we do not aim to reproduce the already existing (and often qualitative) frameworks. Our ambition is thus not to make yet another participation handbook.[2]

What we do aim for - In this part we describe some 'basic ingredients' or 'building blocks' for the organisation of multi-actor dialogues on HBM. In combining these building blocks wisely, there is a key to success in 'translating' adequately HBM-results into targeted policy action. In some cases, the initiator of multi-actor dialogue on HBM will chose to adhere more attention to one building block over another, while in another case the balance between the building blocks will be put differently. One approach is not necessarily better than the other: tailor-made approaches are key.

What do we refer to, when talking about 'building blocks'? - In what follows we distinguish eight building blocks that ideally should be part of considerations when organising multi-actor dialogues on HBM-results. A good multi-actor dialogue on HBM results should…

1. Take into account the various stages and activities in the science-policy nexus[3]
2. Be iterative and oriented towards learning
3. Open up to various perspectives from multiple actors
4. Be guided by a well-considered process architecture
5. Have eye for hidden stakes and passive stakeholders
6. Create transparency
7. Be action-oriented, ideally resulting in targeted policy action
8. Be focused on developing a fair and competent process

6.1 Take into account the various stages and activities in the science-policy nexus

In the nexus between science and policy many different activities or practices unfold intended to facilitate the uptake of research findings for policy making. From reviewing and assessing the best-available scientific information, which can be seen as a form of second-order knowledge production (Beck et al., 2014), to scenario building, cost-benefit analysis, etc. to evaluate and discuss potential policy options and strategies. Some of these activities stay close to the scientific work, while others evolve more towards policy formulation and decision-making. Figure 1 illustrates these different stages in the science-policy nexus.

Although the process from science to policy is not necessarily linear and goal-oriented, this representation is helpful to situate the sequence of goals in the science-policy nexus, in relation to activities and processes in between science and policy.

[2] We do not intend to give an overview of participatory methods and tools in this document. For this purpose, we can refer to other guidebooks, such as the '*Stakeholder Participation Guidance*' developed in the Netherlands for the Environmental Assessment Agency (MNP, 2008 and Hage et al., 2010).

[3] By science-policy nexus we mean the boundary area where science and policy meet and in which diverse stages and activities can be discerned, ranging from activities of knowledge production to policy development.

Figure 1: Science and policy interaction and feedback stages

Feedback loop(s): input for research priorities and design

The main reason why we present the scheme in Figure 1, is to illustrate that each activity and stage in the science-policy nexus is important and often even indispensable for coming to targeted policy action. HBM results do not speak for themselves. 'Translating' scientific research into policy options, involves a staged process. For example, in the Flemish phased plan for action, all steps are actively given attention (see Part 3). In Table 1 below, we illustrate activities in the science-policy nexus to give the reader an idea of the types of activities belonging to each stage.

Table 1: Activities in the science-policy nexus

This table includes some examples of activities/practices in the different stages of the science-policy nexus. Some of these activities are explicitly taken up in the work program of HBM4EU (indicated in **bold**). This non-exhaustive overview reveals that within HBM4EU especially the stage of formulating policy options (cf. 4th column) might deserve more attention. This can be an opportunity for Task 5.5, to develop structured processes that address this challenge (see also Part 3 of this report).

Scientific research	Interpretation of research findings	Evaluation of research findings	Formulation of policy options	Decision making and implementation
Data collection and analysis **Scientific reporting and publishing** **Peer review** **Scientific conferences** …	**Assessing the quality of our knowledge base** Uncertainty mapping **Framing results according to different policy areas** Assessing the potential of scientific innovation **Executive summary** …	Risk assessment and **procedures for optimising risk assessment** **Prioritisation/ ranking** **Developing health based guidance values** **Developing indicators** Environment and health scenarios …	**Developing solutions** Health impact assessment Which policy areas to address? Which policy instruments preferable? Developing policy-scenario's Cost-benefit analysis (CBA) …	Political decision-making Resource allocation Implementation Monitoring Evaluation … **Mapping policy needs**

For HBM4EU, it is considered a valuable suggestion to (1) critically assess which activities are already well-developed in the national and/or EU context and (2) identify the 'gaps': in which stages of the science-policy nexus additional initiatives could be valuable to translate science to policy? Or whether it is valuable to develop more comprehensive processes that actively addresses each stage, such as the 'phased plan for action' in Flanders? The choice on how the close the 'gap' will be context and case dependent.

6.2 Be iterative and oriented towards learning

An important addition to a merely linear, goal-oriented representation of the science-policy nexus in Figure 1 is that both evidence and policy are often a result of iterative learning processes.

New research data or the use of new research techniques such as human biomonitoring, can result in a better understanding of environmental health risks. However, uncertainties usually remain and new questions may arise, leading to new research needs. Also the interpretation and evaluation of research data from different perspectives can reveal assumptions underlying the HBM data analysis, leading to new challenges for research design.

The same applies to policy strategies and interventions, whose effectiveness is rarely guaranteed in advance and is often a result of learning-by-doing. Also other context factors such as (political) beliefs and path dependency can have a decisive influence on policy, causing the need for continuous evaluation and modification.

A linear representation therefore lacks the nuance of iterative learning cycles within the nexus as well as feedback loops to previous steps. We should therefore keep in mind the temporary nature of conclusions in (each stage of) the science-policy nexus, reflecting the knowledge and beliefs at that particular time.

An arrow was added to Figure 1, to minimally illustrate the feedback loops from the different stages in the nexus back to scientific research. This also illustrates the fact that scientific research is increasingly steered by policy needs and the call for policy relevance, influencing research priorities and design. Leaving enough room for such loops is also framed as (timely) 'upstream public engagement in science' (Van Est, 2011). Also within the HBM4EU project, serious efforts are made to map policy needs and to decide collaboratively on the research agenda.

When considering or implementing a process, it is essential that the initiator(s) take into account and make explicit what happened before, what can be learned from the past and whether new insights or evaluations should question previously reached conclusions. The ambition should be to build upon and improve available evidence and existing policy initiatives.

6.3 Open up to various perspectives from multiple actors

In translating HBM-results into targeted policy action, an important challenge is to combine perspectives of the various actors involved and (even an ambition level higher) to enrich the conclusion from the translation process by wisely integrating scientific knowledge, policy experience, lay knowledge and interests of the multiple stakeholders in well-balanced conclusions.

In each stage of the nexus presented in Figure 1, opportunities arise for the involvement of a diversity of actors and perspectives. Although the ultimate responsibility for risk assessment and management remains with the responsible authorities or risk managers and accountability for scientific knowledge production remains with scientists, the need for collaboration is persistent. Policymakers need scientists to cope with complex problems and to meet the ambition of

evidence-based policymaking. Scientists on the other hand are challenged to produce policy-relevant knowledge, for which they need to interact with policymakers and stakeholders to learn what their needs are and how to accommodate these needs.

Apart from interactions between scientists and policymakers, there is also a need to open up towards other societal perspectives to guarantee social robustness of and support for evidence claims and policy action (see also Part 1, for arguments in favour of involving stakeholders as well as other interested and affected groups). While stakeholder participation and public involvement is probably most common in policy development and decision-making (see e.g. Renn, 2004), also knowledge production is increasingly opening up towards stakeholders (Hage et al., 2010) and citizens (cf. citizen science). Other examples can also be found in the interface between science and policy, e.g. in the field of health impact assessment, with increasing attention for more integrated and participatory assessments (Briggs, 2008; Elliott & James, 2008; Nieuwenhuijsen et al., 2017).

These participatory/dialogical approaches have in common the recognition that to increase the effectiveness and legitimacy of risk assessments and management, there is a need for collaboration (cf. risk governance), transparency on research and policy activities and mutual learning. Opening-up towards a diversity of perspectives also leads to a more holistic approach, in which risks and policy options are discussed acknowledging the wider social and policy context, and not in isolation.

For the reasons mentioned above, it is important – in HBM4EU – to critically assess the potential for 'opening up' to other perspectives from multiple actors. This openness could/should be created both at the side of science and at the side of policy-making.

6.4 Guided by a well-considered process architecture

6.4.1 The analytic-deliberative approach

Integrating public input and preferences in decision-making does not reduce the importance of sound scientific analysis. On the contrary, analytical thinking and deliberative exchange of arguments should be seen as complementary and mutually reinforcing. While analysis enhances the competence in the decision-making process, deliberation among experts, stakeholders, policy makers and the public at large improves the relevance, acknowledgment and acceptance of risk characterisation and management and attributes a fair share of responsibility of managing risks to those who are or will be affected by the potential consequences (Stern, 2005; Renn, 1999).

To put this ambition into practice, an analytic-deliberative approach in which analysis and deliberation alternate, is recommendable. Although analysis and deliberation should not be isolated from each other, a sequential involvement of experts, stakeholders and the general public has proven to be a productive way of ensuring competence, fairness and efficiency (Renn, 1999). When implemented in different cycles, deliberation can frame analysis, analysis informs deliberation and the process benefits from feedback between the two (Stern & Fineberg, 1994). Part 3 offers a concrete illustration of how such an analytic-deliberative approach can be implemented in practice.

For HBM4EU, our recommendation is to explore the opportunities to base the translation from science to policy on an analytic-deliberative approach, with the sequential involvement of experts, policy makers, stakeholders (and potentially also the general public).

6.4.2 When (not) to invest in participation?

An often-voiced question, is whether an extensive and time-consuming participatory process is really needed. After all, standardised procedures for risk assessment and management are in place and are often even legally binding. In some cases, routine management might indeed suffice and even guarantee an equal treatment for each case. However, for cases with higher levels of complexity, uncertainty and/or societal debate, the need for a transparent and participatory process becomes more urgent. These risk characteristics also determine the aspects and considerations that should be made the main focus of the process as well as the (type of) actors that should be involved.

In this regard, a first screening of the case for which a process is considered should minimally reflect on:

i) the available evidence;
ii) the complexity of the case, and accordingly the scientific disciplines, knowledge sources and perspectives that should be taken into account;
iii) the quality of the evidence base and remaining uncertainties, e.g. with regard to sources of exposure, variability, exposure-effect relationships, etc., informing the need for precautionary policy initiatives;
iv) interested and affected groups, their perceptions, potential controversy and (in)ability to protect or represent their stakes, and
v) the policy context, i.e. current policy strategies, support or contestation for these strategies by key stakeholders and opportunities for (additional) policy development.

A basic screening of these aspects should constitute the basis for the design of the process.

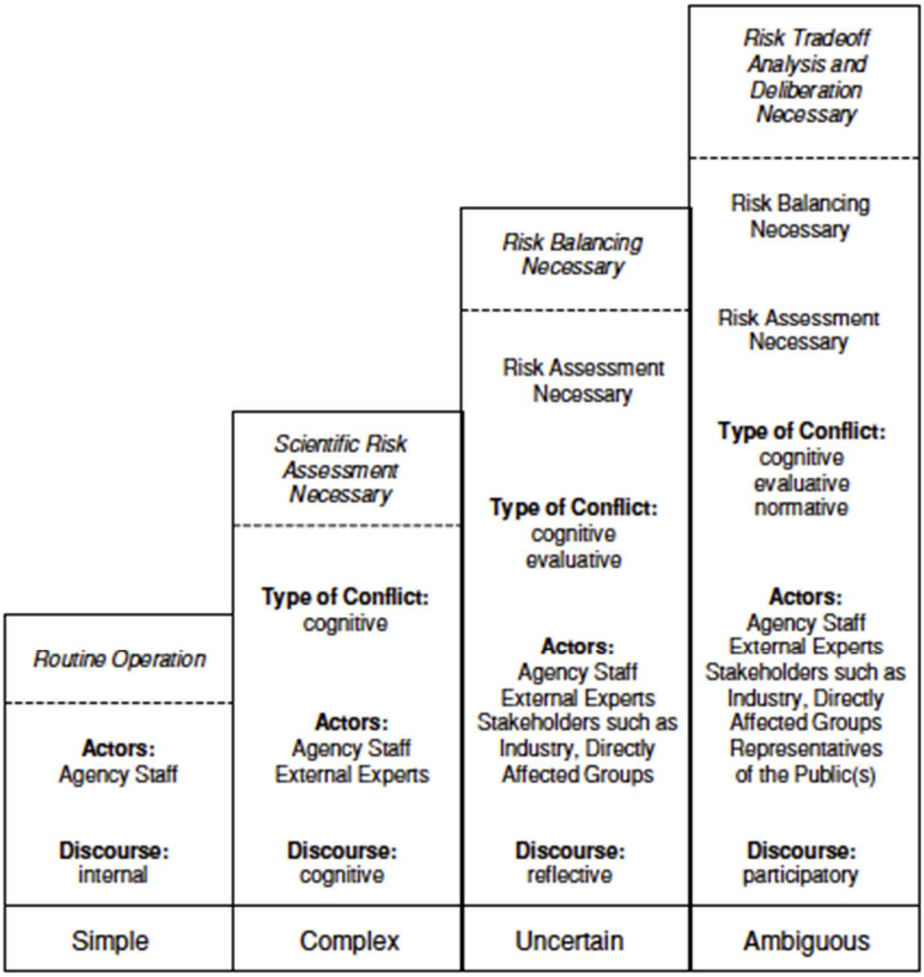
Illustration: The risk management escalator (Klinke & Renn, 2002)

In the context of the International Risk Governance Council (IRGC) a framework has been developed to improve and promote risk governance strategies at a global scale. The IRGC also stresses the importance of a structured and inclusive, participatory approach and the need to integrate scientific, economic and socio-cultural aspects in the assessment and management of complex risks (Renn, 2005). The IRGC framework proposes different management strategies and instruments depending on risk characteristics, i.e. the degree of ‘complexity’, ‘uncertainty’ and ‘controversy’ related to a specific risk problem. The risk management escalator (Figure 2 below), that already appeared in earlier publications (Klinke & Renn, 2002), is a good illustration of this approach.

Depending on the characteristics of a certain risk, related to the knowledge base (complexity and/or uncertainty) as well as the societal context (ambiguity), other management strategies become apparent as well as the need to expand the scope of actors involved.

Based on this approach, routine management by agency staff, i.e. technocratic procedures, is only recommended if complexity, uncertainty and controversy is negligible. In all other cases, a more extensive process would be required.

Figure 2: Risk management escalator



Source: Klinke & Renn, 2002

6.4.3 Who to involve?

A very tricky question is that of 'representation': who to invite? And how to guarantee representativeness? Some stakeholders might impose themselves, while other stakes are hard(er) to reach. A more pragmatic approach is to focus on a diversity of perspectives rather than representativeness. Although this also depends on the topic under discussion and the intended level of participation (see section 4.4), e.g. for co-decision or delegation of power on ethical issues, democratic representation is more important.

Relevance should be determined by how the most involved/concerned/affected/interested and most responsible actors assess the situation. The types of concerned parties are grouped following the major spheres in society: state, market, science and civil society. Generally spoken, these correspond with the actors as policy makers, business & industry (or market parties), the research community and civil society organisations (and citizens). Based on document review on the HBM theme and based on networking, it should be possible to identify relevant perspectives and groups.

For each case a first and preliminary mapping should be prepared, that can be verified and adjusted during the process. In these concrete cases, more specific stakeholders will appear with relevance for the topic. The risk classification scheme of the IRGC (see 4.2.) can furthermore help to identify the type of actors (e.g. agency staff, experts, stakeholders or the general public) that ideally should be involved.

For the HBM4EU cases, it is recommended to involve a balanced representation of relevant stakeholders in combination with desk research for hidden stakes or affected groups that are not represented nor organised.

6.4.4 How much participation?

It is useful to think about and make explicit the level of participation that is most suitable in a certain case (inform > consult > co-decide > cooperate > delegate), as this affects and will determine the roles, power relations and expectations of the actors involved. The distinction between different levels of participation goes back to Arnstein (1969), but many authors formulated variations. See Table 2 for one of them.

Higher levels of participation, with ultimately shared decision-making power ('co-decide') or delegation of power, is certainly not always the most appropriate strategy. Especially with regard to controversial topics, it is better for the responsible government to hold the final power to decide. Even though consensus or compromise would be the ultimate goal, in some cases a referee is needed to balance stakes and finally make a verdict.

In HBM4EU and particularly when we develop case-studies exploring new participatory approaches to translate science to policy, we need reflection on and consideration of the level of participation that is appropriate, given the characteristics of the case at hand.

Table 2: Levels of participation

	Aspired level of communication	Direction of communication	Forms of participation	Advantages	Disadvantages/pitfalls
Interactive	Co-decide	PM <-> SH	• Not very common in practice • Examples: joint management of nature databases and participation in IPCC working groups • The main target group is fellow-scientists	• Optimize use of participants' resources • Fulfils democratic motives	• In extreme cases the stakeholders determine the content of policy reports • Policy makers risk losing control
	Co-produce	PM <-> SH	• Interactive scenario-development • Alternation of research and participation; research-led participation process • Use of participatory methods	• Increases commitment of participants • Reflective approach to co-production can make a major contribution to the production of knowledge • Ideally, generates support and produces knowledge	• Demands open-mindedness from the policy makers • Policy makers have to commit to results to some extent, which is only possible if everyone is open to this • Intensive process • Participants' choice and quality of the facilitator are key factors for success
	Take advice consult	PM <- SH	• Interactive workshops for: o Defining the problem o Research design o Conclusions • Bilateral sessions • Review of project design and conclusions o Written reports o Workshops • Themed workshops for knowledge production	• Can result in new perspectives • Highly goal-oriented approach. Can be put into action at key moments in a project	• Less easy for the policy-maker to steer the process; process can produce unintended results • Stakeholders may disagree with the framing; can lead to unrest • Difficult to guarantee transparency
Non-interactive	Listen	PM <- SH	• Set up feedback channels • Keep an eye on the media • Receive complaints, protest and criticism	• Policy-maker gets answers to questions it did not ask; prevents tunnel vision • Policy-maker is able to draw attention to problems at early stage	• Difficult to draw a line between where listening brings benefits an where it does not • Can be very time-consuming
	Study	PM <- SH	• Surveys • Interviews • Focus groups	• Large numbers of stakeholders can be reached with relatively little effort • Information can be collected in a very targeted way	• A strong framing effect may occur: other factors which were not asked about may be relevant
	Inform	PM -> SH	• Presentations	• Takes relatively little time and effort	• Can cause dissatisfaction among stakeholders • No opportunity to make a contribution ; no 'real' participation
	No participation	PM SH	• None	• Project receives little attention. Under certain circumstances, this may be desirable	• No feedback • No utilisation of external sources of information • No legitimisation

Note: PM = policy makers; SH = stakeholders. *Source*: Hage et al., 2008

6.4.5 Participation, not only for developing policy, also in producing knowledge

Multi-actor dialogues and deliberation are most often targeted towards risk management and political decision-making. However, also with regard to knowledge production and the evaluation of evidence, dialogue and deliberation are valuable. In first instance between scientific fields of study, since the complexity inherent to many environmental health risks urges for the integration of knowledge across different scientific disciplines (cf. interdisciplinarity, in contrast with multidisciplinarity that only looks at a topic from different scientific disciplines, without really trying to integrate issue-framing, methodology evidence and solutions (Strang, 2009)).

However, also other (non-scientific) knowledge sources and perspectives need to be taken into account to fully appraise the complexity and scope of environmental health risks, its societal dimensions and the best possible management strategies. A concept to describe this need is 'transdisciplinarity'. A transdisciplinary approach intends to integrate scientific and non-scientific perspectives in the identification, formulation and resolution of problems (Gibbons & Nowotny, 2001). This concept originated from the increasing demand for relevance, legitimacy and applicability of academic research to societal challenges in a policy context (Pereira & Funtowicz, 2006). To put the transdisciplinary ambition in practice, the idea of an 'extended peer community' was successfully proposed (Ravetz, 2006; Funtowicz & Ravetz, 1992), aiming to complement the scientific peer community with non-scientific peers, such as policy makers, stakeholders and lay people.

For HBM4EU, the value of discussing risks with 'non-experts' is not so much to discuss the quality of scientific data and the validity of risk assessments, or to convince the non-experts of the expert view. Interaction with policy makers, stakeholders and lay people is especially valuable to understand differences in perception, conceptualisation and argumentation. And trigger the integration and contextualisation of evidence in function of real world problems.

6.5 Have eye for hidden stakes and passive stakeholders

Sometimes participants to a multi-actor dialogue on HBM-results will spontaneously introduce or invite themselves. In other situations, it is key to identify **'passive' actors** that have a specific stake but are not (yet) involved actively. One might think of citizens with low socio-economic status. It is well-known that their level of participation to (policy-related) deliberation processes is lower, compared to citizens with higher socio-economic status, while the chance that they live in areas with environmental health issues is – in comparison - higher. So, notwithstanding the stake they might have in the development of environment & health measures, it can be expected that people with lower socio-economic status participate less in multi-actor dialogues on HBM. In order to involve them actively, special and perhaps additional initiatives should be taken.

Evenly important, is to take into account 'hidden stakes': stakes that are often not defended by specific stakeholder organisations. One might think of: the stakes of unborn children and next generations. An often implemented solution to give them a voice, is to involve social scientists. Social scientists are also often invited to bring in arguments into the discussion about the impacts of social exclusion, increasing inequalities in society and reproduction of environmental injustice.

Summarising: to create broad societal engagement in the discussion on the HBM theme, it is important to make tailor-made choices on who to invite and how to involve passive stakeholders and hidden stakes.

6.6 Create transparency

Creating transparency contributes to accountability and helps to build trust with the public. Transparency implies that openness is created: (1) on the whole of the process, including documentation of each step of the process, and (2) on who is responsible for what (distribution of tasks and responsibilities). In order to guarantee true transparency, the information should be tailored to the needs of the public, so that the information makes sense to them.

The need for transparency applies both for the production of scientific knowledge as for the production of policy.

* In order to guarantee transparency in knowledge production, researchers, commissioners and ideally also the 'consumers' of the knowledge should commit to some 'procedural rules'. The rules refer to: 1) the whole process and its documentation, so that interested parties are able to follow up; (2) the tasks and roles in the research, its interpretation and translation (see Figure 1), and (3) the content, such as assumptions behind the research design and plan of analysis, on remaining uncertainty, on societal and political relevance. These rules clearly go beyond the rules that are common within the scientific community (research integrity, research ethics and open science).
* In order to guarantee transparency in the process of policy-making, transparency is also needed: on the process, distribution of tasks and responsibilities and on the content. Examples of initiatives contributing to transparency in deliberation processes on HBM are, (1) a procedure for the participation process, discussed beforehand with the parties involved, (2) a communication strategy, defining what, why, when, to whom (and on behalf of who) and how things will be communicated about the HBM-results; (3) how the input of each stakeholder must be described and how decisions are motivated, given that input.

There are many advantages, associated with creating transparency. When transparency on the scientific evidence is created, it can be better evaluated and improved upon. Further, the public will be better able to understand and engage with the reasoning for policy interventions, when the policy-making process is transparent. And on top of that, further government initiatives and policy evaluations can build on the transparency that was created earlier.

6.7 Be action-oriented, ideally resulting in targeted policy action

6.7.1 Keeping in mind a broad diversity of (policy) options

Governmental policies have a key role in influencing and improving the state of our health and environment. Environmental policies have developed significantly since the late 1960s and the early 1970s. Since no single policy instrument can provide solutions to all problems, the spectrum of policies has broadened gradually to address increasingly complex environmental and health related problems. Today, many environmental policy interventions combine i) traditional regulatory approaches, sometimes labelled 'command-and-control measures' (for example emission standards, bans of toxic substances, and land planning instruments); ii) market based instruments (such as environmental taxes, greenhouse gas emission trading, granting subsidies for 'healthy' insulation of houses) and iii) persuasion: information campaigns and awareness raising (including for example energy efficiency labels and communication campaigns).

Besides instruments that aim to steer the behaviour of citizens and other actors, governments can also decide to introduce 'internal measures' that focus on changing the way governments themselves (re)act on environment & health problems. For example, creating a legal basis for regular state-of-the environment reporting (including environment & health) is helpful to institutionalise policy makers' attention for environment & health problems. Another example, is

making formal agreements between (on the one hand) the ministry for the environment and (on the other hand) the ministry for public health, to co-finance human biomonitoring.

Often, a distinction is made between “hard” legally binding rules and “soft” regulation. “Hard” legally binding rules are used to provide clarity as to the behaviour which is required from organisations or individuals, making it relatively straightforward to identify non-compliant behaviour. It fits best with the command-and-control measures mentioned before. “Soft” regulation is used when an analysis of subsidiarity and proportionality demonstrates that traditional law instruments are not necessary or apt. In the framework of soft regulation, a range of policy instruments is available, including recommendations, governmental plans and policy briefs, technical standards, voluntary bottom-up initiatives and legislation-induced co-regulatory actions.

6.7.2 Multi-criteria decision-making

When it comes to making decisions in the science-policy nexus, e.g. on priorities for policy-making, appropriateness of policy actions as well as decisions for study design (e.g. on research questions, substances to include or geographical focus), health impact is usually not the only decisive criterion. Other scientific as well as societal and political considerations come into play.

Making these criteria visible and transparent, as well as the way they are weighed against each other in function of a decision or priority ranking, can improve the credibility of the decision-making process and support for the outcome. Stakeholders can be invited in the process for input and critical reflection, while the power to decide can remain with the government or risk manager to finally make a well-informed and transparent decision. Multi-criteria decision-support can be valuable for making (socially robust) decisions in both the research design and policy making. Stakeholders or other interested and affected groups can be invited not only to inform certain criteria, but also to reflect and agree on the selection of criteria, the weight criteria should receive and eventually also to perform a ranking or judgement.

Multi-criteria assessment (MCA) should be understood mainly as decision support tool. Very often, documenting criteria in-depth could involve detailed analysis for each criterion. E.g. a ‘social-impact assessment’ (SIA) could be performed to document social impacts of different options. However, MCA can also be used in a more pragmatic way, e.g. by asking experts/actors with relevant expertise to make an (argumented) judgement on the basis of their knowledge.

6.7.3 Uncertainty and the precautionary principle

Environmental health risks are very often confronted with a degree of uncertainty, which complicates the process of risk assessment and management. As stated in the previous section, transparency and deliberation on uncertainty and how to deal with that, becomes unavoidable. Several approaches have been proposed to describe or characterise uncertainty, both in quantitative and qualitative ways (see e.g. van der Sluijs, 2008). Different types of uncertainty can be distinguished, such as measurement errors or biases, variability, indeterminacy and lack of knowledge (Van Asselt, 2000) and these uncertainties may relate to different aspects of the risk, e.g. the relative importance of different causes of exposure, exposure-effect relationships, lack of data in certain environmental compartments or from HBM studies, etc. We refer to Petersen (2013) for a guide on uncertainty assessment that comprises a mini-checklist and quickscan questionnaire.

When uncertainty is judged to be significant and cannot be overcome in the near future, precautionary policy initiatives should be considered as an option. The precautionary principle states that “*the lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation*” (UNCED, 1992). This principle has already caused a lot of debate, often between proponents and opponents of banning certain activities, chemical substances or technologies. However, between these two extremes many other

policy options are imaginable, e.g. limiting the use to a minimum or define conditions (see e.g. the ALARA principle, 'as low as reasonably possible'), containment in time and geographical dispersion, stimulating (the development of) alternatives (e.g. BAT, 'best available technology'), monitoring and research, improving resilience (e.g. by awareness raising and information campaigns, reducing vulnerability), protecting vulnerable groups, etc. In terms of chemical exposure, it seems especially relevant to pay attention to persistency, highly vulnerable groups and inequalities.

6.7.4 Multi-level governance

Over the last three decades, initiated by the Declaration of the United Nations Conference on the Human Environment in 1972 and followed by the European Conferences on Environment and Health of the World Health Organisation (WHO), environmental health issues have come to be explicitly present on the political agenda in Europe and its member states. These agreements on environmental health stimulated initiatives at the national policy level to deal with environmental health issues. The other way round, national practices influence European research and decision-making on environmental health issues by 'uploading' national ideas and practices. All this illustrates the importance of **multi-level governance** in environmental health issues: the idea that domestic and supranational levels of authority are entangled.

Recent research has illustrated that **changing discourses on environmental health on the European level reproduce and transform institution on the national level, and vice versa** (Stassen 2009). Illustrated for public health policy arrangements in Flanders (Belgium) and the United Kingdom, research has for example come to the conclusion that – although both countries are (at least still for some time) part of the EU and therefore responding to the same general charters and governance initiatives - the uploading and downloading of environmental health policies differs. In the Belgium/Flanders case a top-down approach is dominant whereas in the UK has developed a more inward facing approach to policy development on environmental health. These differences can be explained by the impact of activities of various national institutions, regional environmental health realities, and the interplay between formal and national and international institutions.

Others, like Renn (2005) have underlined the **impact of political culture** (i.e. regulatory regimes or governmental styles) on the way countries deal with risk. Distinct cultural differences among nations and the variations with respect to i) educational systems, ii) research organisations and structures of scientific institutions, iii) assessment and management of risks, all have their influence on the way countries deal with risk. However, Renn also nuances this. Risk management styles are becoming increasingly homogenous as the world becomes more globalised (Löfstedt and Vogel, 2001). From this perspective, nationality, cultural background or institutional setting only play a minor role.

This leaves unanswered the question why one can see divergent policy practices with regard to environmental health. Precedent to Stassen (2009), Weale (2000) researched why European Member States differ in the output and outcome of their environmental policies, despite the fact that they have comparable and shared environmental problems, scientific terminology and political agendas. He concluded that coming to more 'convergence' between Member States may be desirable (due to the need of policy coordination), but far from evident due to the political dynamics behind national environmental policies. In particular in countries where responsibilities for environmental policy is dispersed over many actors (such as Spain, Greece, UK), convergence with European policies is less evident than in countries where responsibilities are more concentrated in (large) administrative entities (such as Germany and the Netherlands). A 'persistent divergence' of governmental politics and policies and national policy styles is thus normal and not necessary a problem (Weale, 2000).

6.8 Be focussed on developing a fair and competent process

Both fairness and competence can be seen as two major quality requirements for a multi-actor dialogue, especially with regard to an analytic-deliberative approach. Fairness refers to the opportunity for all interested and affected parties to act meaningfully, while *competence* refers to the construction of the best possible understandings and agreements given what is reasonably knowable to the participants (Webler 1995). Table 3 lists some conditions for a fair and competent process.

Table 3: Conditions for fairness and competence

FAIRNESS	*Anyone may:* » Participate » Assert validity claims » Challenge validity claims » Influence final determinations of validity
COMPETENCE	» Minimal standards for cognitive and lingual competence » Access to the knowledge » Consensually-approved translation scheme » Most reliable methodological techniques available

Fairness is key to producing a forum where equality and popular sovereignty can emerge and personal competence can develop. When participation is fair, everyone takes part on an equal footing. Political equality and popular sovereignty also make an argument for efficiency and competence. To ensure efficient deliberation, the persons in a deliberative process need to be competent. Namely, all participants should be capable of protecting their own interests while also being capable of contributing to the definition of the collective will. Competence, in this sense, relates to the use of the best available knowledge and listening and communication skills, as well as the ability to articulate, evaluate, and refute arguments about an issue (Renn, 1999).

7 Part 3 – Guidelines for Task 5.5

In the previous parts of this canvas, we described the main arguments and ingredients for organising multi-actor dialogues on HBM. We also emphasised that there is no 'one-size-fits-all' solution and that multi-actor dialogues on HBM should be tailor-made.

To illustrate how one can design and implement tailor-made dialogues, the aim of Task 5.5 is to develop and implement a number of case studies. These case studies should be seen as experiments, to find out what works and what doesn't in different contexts. The cases will maximally focus on good procedures and practices at national levels and EU level, to share with others for inspiration and feedback. Executing the case studies and documenting the practices in case study reports, makes the currently available 'best practices' with regard to multi-actor dialogues on HBM-results to all interested parties public and transparent. By documenting and communicating on current best practices, we aim to contribute to capacity building within the European HBM community.

The idea to include this Task 5.5 in the HBM4EU project, originated in Flanders, where experience has been built up during the last decade with a '*phased plan for action*', a protocol implemented after each cycle of the Flemish Environment and Health Study (FLEHS), to systematically evaluate HBM-results and develop targeted policy actions in response. This approach is implemented collaboratively by scientists and policy makers involved in the FLEHS study, but also other interested and affected parties are invited to collaborate. The Flemish 'phased plan for action' will be described further down in this part as an illustration.

Please note that we do not ask for 'copy-paste' reproduction, nor do we claim the potential to universally implement the Flemish approach. Different countries, as well as cross-national and supranational governmental levels, such as the EU level, have varying institutional, cultural, political and social contexts. Also the scientific context can be different, e.g. with regard to the stock and familiarity of HBM-data and political support for nation-wide HBM programmes. These context variables need to be taken into account when developing a multi-actor dialogue on HBM.

In the following section, we try to position our Task 5.5 within the HBM4EU project that already includes several initiatives in the science-policy-society nexus. After that, the Flemish approach for a '*phased plan for action*' is described in detail as an illustration. We will explain how this approach (tries to) accommodate the 'building blocks' as presented in Part 2. Finally, a call for cases is launched, to start thinking about relevant cases for a multi-actor dialogue, on EU-level as well as in a selection of EU countries.

7.1 Positioning Task 5.5 within HBM4EU

The HBM4EU project is in itself is a nice example of interaction and cooperation between science and policy with regard to HBM, and more generally in dealing with environmental health risks. Also a strategy for interaction with stakeholders is being developed within the project (both on EU-level and on national levels). However, there seem to be opportunities left in three ways:

- A first opportunity might be to take initiative to discuss and develop risk management (risk mitigation) options in response to environmental health risks (in general) and HBM research findings (in particular), cooperatively by policy makers, scientists and societal actors and keeping in mind the diversity of policy-instruments that can be deployed. As illustrated in part 2, several activities that relate to stages in the science-policy nexus are already taken up in other tasks and work packages of HBM4EU. However, the stage of developing and discussing (a diversity of) policy options on the basis of HBM evidence, and doing this in cooperation, seems less explored. Nevertheless, HBM research has definitely advantages in this regard because it

sheds light on integral, real life exposures, determinants of exposure and health, spatial-, social- and intergenerational distribution, etc. These insights can be relevant to develop targeted policy action.

- A second opportunity might be to intensify interaction with stakeholders and other societal actors with regard to environmental health topic(s) related to chemicals exposure. Apart from discussing policy options (see first point), also the evaluation of environmental health risks as well as the (potential) role of HBM research with regard to specific topics can be discussed. Within HBM4EU, a stakeholder forum is established for the follow-up of the project, also a strategy for wider stakeholder and public involvement is being developed. However, apart from follow-up of the project, it might become relevant to put on the agenda more in-depth discussions on specific environmental health topics, related to HBM.
- A third opportunity might be to more explicitly open-up discussions on environmental health risks related to environmental chemicals towards a wider range of perspectives, including citizens and different publics/target groups (whether or not represented by interest groups). This third option can shed light on differences in perception and conceptualisation, opportunities for awareness raising as well as empowering less-involved groups to take action themselves (to prevent exposure or represent their stakes). Initiatives in this field can be valuable in itself, but are also complementary and supportive for the broader science-to-policy debate.

What to choose? - We suggest to strive for synergies and to design and implement processes that build further on the valuable work that is already programmed in other tasks and work packages. Task 5.5 should look for opportunities to complement and not duplicate.

7.2 A ‘phased plan for action’ in Flanders (Belgium) – From human biomonitoring to targeted policy action

As stated before, we will not impose a fixed script, but propose to design a customised process for each case during the next years, in cooperation with the partners involved in Task 5.5 and preferably also discussed with other actors involved. The approach in Flanders might serve as an illustration. Therefore, we hereafter describe the Flemish ‘phased plan for action’.

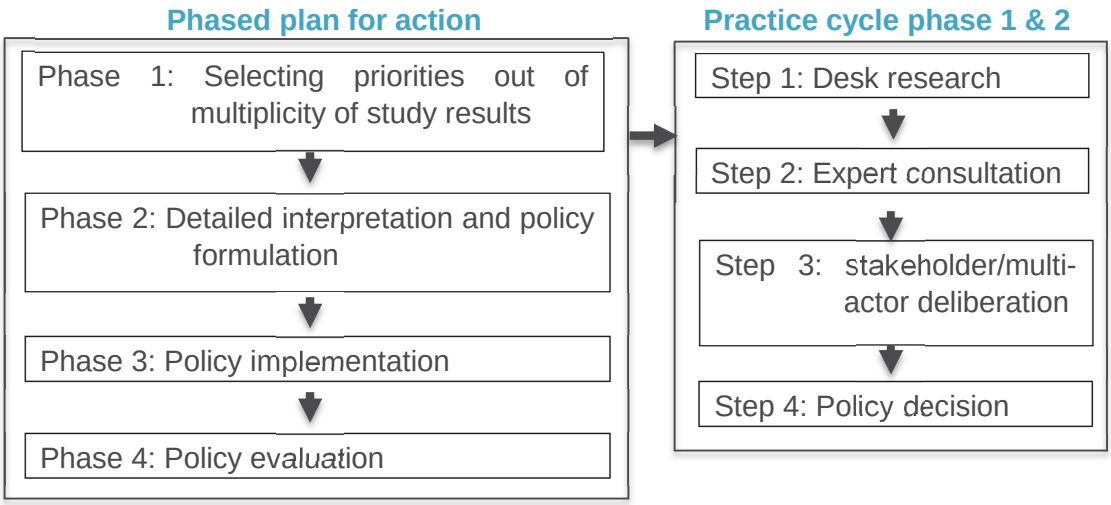
7.2.1 Background and generic approach

Since 2001 the Flemish Center of Expertise on Environment and Health conducts HBM studies in different age groups and in hotspot areas. Both classic pollutants and new emerging substances are monitored over time (Schoeters et al., 2016). To facilitate the uptake of research findings by policymakers and other stakeholders, a ‘phased plan for action’ has been developed collaboratively by scientists of the Centre and policy makers (Keune et al., 2009).

The action plan consists of four consecutive phases and incorporates the main elements of the ‘analytic–deliberative’ approach by involving experts, policymakers and stakeholders in each phase (in a structured practice cycle). See Figure 3.

By offering a structured and collaborative approach, the ‘phased plan for action’ has the ambition to increase transparency, support and partnership for environmental health policy, based on the best available knowledge. After each cycle of the Flemish Environment and Health Study (FLEHS), a phased plan for action has been implemented. Up to now three FLEHS cycles were conducted and a fourth study is ongoing. A ‘phased plan for action’ has been implemented for all three completed FLEHS studies, leading to five action plans. All have been inspired by the following protocol of steps and substeps (Figure 3).

Figure 3: The four phases and practice cycle of the "Phased Plan for Action"



A *first phase* focusses on the selection of priorities for policy action from the vast amount of HBM research data available in Flanders, each time after new HBM-results are published. In addition to scientific criteria (characteristics of the health risks) also social criteria (e.g. societal concern and social inequalities) and policy criteria (e.g. opportunities and political support for – additional – policy initiatives) are taken into account. To inform and review the different criteria, minimally environmental health scientists, the competent authorities (as policy experts) and social scientists are involved. Phase 1 ends with a (political) decision on priority topic(s). And more substantially, it also informs on risk characteristics and the socio-political context, as a first screening of problem definition and how to proceed.

In a *second phase* the priority topic(s) are studied and discussed in more detail, e.g. by more detailed analysis of the HBM-data and exploring other data sources on health and on the environment (by experts and the competent agencies) and organising multi- and transdisciplinary dialogue. The final aim of phase II is to explore and decide on policy options, considering a diversity of suggested policy instruments. The aim of this phase is to reach consensus on available evidence, uncertainties and appropriate policy action, in deliberation between experts, policy makers and interested and affected parties. It is however also important to map minority views or dissensus, in case differences in opinion cannot be bridged. For guiding these discussions, competent facilitators are essential.

A *third and fourth phase*, to implement and evaluate targeted (policy) actions, in addition to existing policy, is explicitly included in the 'phased plan for action', indicating the willingness of the responsible government to take action to prevent environmental health risks from occurring. (Policy) action in this respect is perceived broadly. Also other actors involved can take initiative and this is actively supported.

For the *first and second phase*, an **analytic-deliberative practice cycle** has been developed including five steps:

- deciding and planning *how to operate* and *which actors* to involve during the process, by steering group involving research team (environmental health and social scientists) and policy makers;
- *desk research* by research team;
- multidisciplinary expert consultation;
- *deliberation* with experts, policymakers, stakeholders (and if relevant also lay people) on the basis of a synthesis of the desk research and expert consultation;

- presentation of well-informed and documented conclusions to the responsible government(s) for *approval*.

This practice cycle is however implemented with a certain degree of ***flexibility***, tailored to the particular context and also evaluated and adapted during implementation. The proposed approach is preferably also discussed with the actors involved and external ***communication*** about the process as well as providing summaries and ***documenting intermediate conclusions*** is considered a continuous point of attention.

7.2.2 A practical example: the case(s) of POP's

To illustrate the '*phased plan for action*' in practice, we will describe how this approach has been applied to the exposure to persistent organic pollutants (POPs) in Flanders (2007-2008) and in a local industrial hotspot (2012-2013). Both cases involve a different multi-level context. In this description, we will mainly focus on the procedural aspects. For a more substantive description of analyses that have been performed and the policy actions that have been implemented for this case, we can refer to Reynders et al., 2016.

7.2.2.1 The first 'phased plan for action' in Flanders (2007-2008)

Phase 1: Selecting priorities for policy action

Exposure to POPs was selected as a priority for policy action in 2007, after the first FLEHS cycle (2001-2006). This FLEHS study was the first HBM study that produced representative data for Flanders. Especially in rural areas the exposure to POPs appeared to be higher than average, a quite unexpected result at that time, because the rural areas were originally expected to represent background levels for environmental exposure in Flanders and many of the POPs were already legally banned for many years.

The decision to select POPs as a priority was based on an extensive **multi-criteria assessment**, and following the analytic-deliberative practice cycle. A general overview of the different steps is given below. For a more detailed description, see Keune et al., 2009.

A first pre-selection of relevant topics for policy development was made by researchers of the Flemish Center of Expertise on Environment and Health, from the vast amount of HBM-data from FLEHS I and mainly based on scientific criteria (i.e. health risk), see Table 4. In total 6 topics were selected.

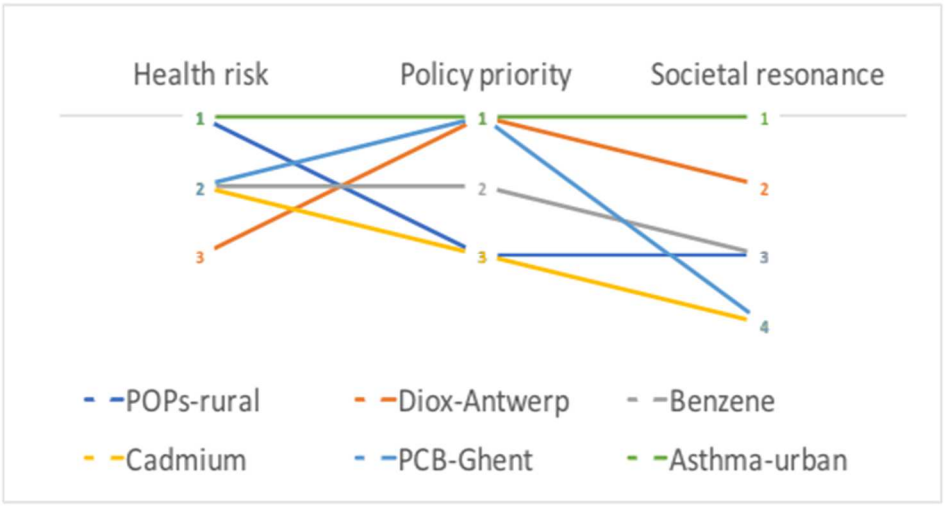
Desk research: These six topics were further documented by a research team comprising both natural and social scientists. Both available evidence on the health risks as well as information on the social and policy context was summarised.

Expert consultation: On the basis of the information presented from the desk research, an expert consultation was organised to rank the six cases on three main criteria (health risk, policy priority and feasibility, and societal resonance), see Figure 4. For each criterion, a different group of relevant experts was contacted with special attention for an adequate diversity of expertise. Experts were asked to individually rank the cases according to several sub-criteria and to argue their judgement (including quality of the evidence base, remaining uncertainties, etc.).

Table 4: Sub-criteria for prioritising biomoniotring results

1. Health risks	2. Policy feasibility	3. Social aspects
1.1 Necessity of additional biomonitoring?	2.1 Policy to suppress pollution source?	3.1 Risk perception factors from literature
1.2 Short term health effects?	2.2 Policy to prevent exposure?	3.2 Local concerns
1.3 Long term health effects?	2.3 Policy to prevent health effects?	3.3 Media attention
1.4 Necessity of tackling the problem?	2.4 Policy to treat health effects?	3.4 Risk perceptions from biomonitoring study?
	2.5 Congruence with current policy ambitions?	

Figure 4: Summary of the expert ranking (for the three main criteria)



The output of this multi-criteria assessment was not just taken for granted, i.e. the topic with the highest overall score was not automatically selected, but the expert ranking was used as input for stakeholder consultation and a final decision was made by the responsible ministers (see next steps).

Stakeholder consultation: as a next step, a group of stakeholders was invited to a workshop for an overall judgement and discussion. The group was composed quite diversely with representatives from different market and civil society organisations (e.g. industry, labour unions, environmental- and agricultural organisations, patient groups, consumer organisations). Also scientists from the FLEHS study and responsible policy makers were present. A summary of the desk research and expert consultation was made available beforehand and presented gradually during the workshop. Although the workshop resulted in a valuable discussion to learn from each other's perspectives on the different topics and HBM in general, the stakeholders did not feel the need and competence to make an overall judgement on priorities.

Conclusions and decision-making: based on all the collected information, a synthesis report was made by the research team and together with the responsible administrations a well-informed decision was prepared and presented to the responsible minister for approval. Finally, two topics were selected for phase 2: POPs exposure in rural areas, as well as the prevalence of asthma in urban areas.

Phase 2: Detailed interpretation and policy formulation
A more detailed analysis of the HBM data by the research team found significant associations between higher POP exposures and consumption of locally grown food (e.g. eggs), use of stoves and burning of waste. Furthermore a comparison with environmental monitoring data did not result in the identification of a clear environmental source. However, the basic interpretation of the HBM data already showed higher exposure levels in rural areas.

Following an evaluation of existing policy measures by the responsible authorities, and taking into account the associations found in the HBM data, several opportunities were identified collaboratively by the scientists and policy makers involved, to both modify regulation and develop additional policy initiatives to support the phasing out of POPs exposure, including:

- a sales ban for private waste incinerators and optimisation of legislation on open fires,
- continuing efforts to stimulate industry to apply best available technologies,
- optimisation and expansion of the environmental monitoring network and a HBM study to monitor POPs in mother milk,
- a campaign to collect remaining stock of banned pesticides and extra inspections by the environmental inspectorate and
- awareness raising campaigns on pesticides and outdoor and indoor waste/wood burning.

In this phase, scientists and policy makers from different responsible departments and agencies worked closely together. However, no active interaction with stakeholders or other actors was organised.

For an extensive participatory evaluation of the first two phases of this 'phased plan for action', see *Keune et al.,* 2014.

Phase 3 and 4: implementation and evaluation of policy actions
All the actions mentioned in the previous paragraph were consequently implemented and successfully evaluated by the responsible departments and agencies. More recent HBM data shows significant decreasing time trends for POP exposure in Flanders. It is however difficult to assign these trends to specific policy initiatives. See also further below.

7.2.2.2 A 'phased plan for action' in a local industrial hotspot (2012-2015)

In 2012, exposure to POPs (i.e. PCB's and dioxins) was again selected as a priority topic in a phased plan for action, this time after a local HBM study in an industrial hotspot (in the region of Menen, a municipality close to the French border).

Although the HBM study showed that levels of POP-exposure were decreasing in that region over time (compared to a previous HBM study) and even dropped below the average exposure levels in Flanders, the concern of the local community remained. They argued that the decreasing levels of exposure could possibly be attributed for a large part to individual preventive action by citizens, since the local government had decided to launch several health promotion recommendations for their inhabitants some years ago, after the first HBM study, e.g. discouraging the consumption of local eggs and locally grown food.

Phase 1: Selecting priorities for policy action
For this 'phased plan for action', in the context of a local community, we decided to avoid the complexity of an extensive multi-criteria assessment to select priorities for policy action. Inspired by the 'community-based participatory research' approach (see e.g. O'Fallon & Dearry, 2002 and Cacari-Stone et al., 2014), a local advisory board that always met plenary, with representatives of – among others – local governments, community groups, local health workers (e.g. general practitioners) and industry was already established from the start of the

HBM study in 2010. With the support of the Flemish government it was decided to also assign a fair share of responsibility for policy development to this group and try to support them in this cause. The scientists of the FLEHS study tried to inform the local community on the HBM results in several meetings during and after the research period, in an understandable way and with opportunities for interaction.

As already illustrated in the previous paragraph, the local community had a considerable impact on the selection of priorities. The decision to select POP exposure for policy action, would not have been decided without involvement of the local community, because of the relatively favourable results of the HBM study.*

**Apart from the POPs, also exposure to PAHs and some heavy metals (Cd, Tl) were selected because of higher exposures in the region compared to average levels in Flanders. For this illustration we will however stick to the POPs-example.*

Phase 2: Detailed interpretation and policy formulation
Desk research: A comparison with available environmental monitoring data of the region showed that, despite largely decreasing industrial POP exposure, locally elevated levels could still be observed, occasionally exceeding the legal norms. The spatial impact of these emissions was however limited to the close surrounding of a specific company, impacting only one particular neighbourhood.

Expert consultation: In this case, experts mainly had an instrumental role to inform the local community about scientifically complex information.

Local advisory group: The main question of the local community was however, whether it was now safe again to consume locally grown food and local eggs. Moreover, the HBM study raised the attention of an adjacent municipality, because several participants to the HBM study living in that municipality had higher individual exposure levels for POPs, while the health recommendations with regard to locally grown food were not in force in their municipality. To come to a better understanding of the perceptions of the local community, also a focus group was organised with participants of the HBM study (adolescents and their parents).

Deliberation and decision making: Already early in the process, the local and Flemish governments decided together with the local advisory group to start an additional research project to monitor POPs in soil and locally produced eggs, to evaluate the existing health recommendations. Also in the neighbouring municipalities some measurements were carried out. Later on in the process, additional policy actions were decided, such as developing a ‘good practice guide’ for healthy gardening, a contact point at the municipality for local environmental information (both digitally and physically) as well as appointing a general practitioner/specialist in the region for medical questions related to environmental topics, and intensifying communication and interaction within the local community, also involving the local industry.

Phase 3 and 4: implementation and evaluation of policy actions
The policy actions as described in the previous paragraph are carried out in partnership between the local and Flemish governments and the local community. The good practice guide for healthy gardening was developed in collaboration with stakeholders (i.e. agricultural and environmental organisations) and was disseminated in many other regions in Flanders.

7.2.2.3 General evaluation of POPs exposure in Flanders

In 2015, a third cycle of the FLEHS study clearly showed significant decreasing levels of POP exposure in Flanders (Schoeters et al., 2016), similar to international trends and

environmental monitoring data, and undoubtedly for a large extent due to strict (international) regulation. However, because of the highly persistent nature of these substances, POP exposure only decreases slowly over time and can remain urgent in local 'hotspots' and for vulnerable groups in the population, even long after being regulated. HBM and the 'phased plan for action' in Flanders proved to be highly sensitive towards these nuances, leading to targeted policy actions, accurate surveillance, awareness raising of different actors and the public along the way, as well as better scientific insight, in addition to regulation and supporting – possibly also accelerating – the decreasing levels of exposure over time.

7.2.3 How does the approach of the 'phased plan for action' accommodate the requirements as presented in part 2 of this canvas?

Take into account the various stages and activities in the science-policy nexus: the phased plan for action focusses both on analysis (an appraisal of evidence on exposure to POP's and overview of remaining questions), interpretation (identifying the relevance of the findings on the basis of 3 types of criteria) and evaluation (qualifying, ranking, deliberating) of research findings, as well as discussing and developing policy options (anticipating possible measures). Even the phase of implementation and evaluation of policy actions is included in a third and fourth phase. This approach thus captures the whole nexus from science to policy, with separate attention for each step in between.

Be iterative and oriented towards learning: the step-by-step approach of the practice cycle (the substeps of desk research > expert consultation > deliberation > decision making in phases 1 and 2) can be seen as iteration and learning within the phased plan for action. Each step builds further on the previous step, thereby constructing a rich evidence base. On the other hand, iteration and learning can also be seen across one or more applications of the approach. The phased plan for action tries to take into account and build further on previous conclusions and assumptions. And when looking at the future: work is almost never done. Conclusions reached along the way should never be taken for granted.

Open up to various perspectives from multiple actors: for each phase of the phased plan for action, an evaluation was made of relevant perspectives and who should be involved at what stage. In principle, the input of all relevant perspectives is welcomed, although the practice cycle is implemented in a flexible way, not always involving the full variety of actors. For the mapping of relevant perspectives, we consulted networks we were familiar with already (such as the network of environmental health professionals) and applied a snowball-method of making further acquaintances.

Be guided by a well-considered process architecture: The phased plan for action has a transparent process architecture with fixed phases and clear goals. This procedure is a result of cooperation between scientist and policy makers and agreement on the necessary steps that generally should be taken. The sequence of steps within each phase, based on the analytic-deliberative approach, is implemented in a flexible way, but always well-considered and preferably also discussed with the actors involved. Also during implementation, the process can flexibly be adjusted if needed.

Have eye for hidden stakes and passive stakeholders: the desk research is conceived broadly, also exploring e.g. (social) inequalities, geographical and intergenerational distribution, etc. For stakes that could not be (easily) represented directly, e.g. the stakes of future generations, of newborns and adolescents or socially vulnerable groups, experts were asked to also consider these stakes. Moreover, stakeholders – especially when lay people are involved, e.g. from a local community – are supported/empowered by the (interdisciplinary composed) HBM-research team in the best way possible to enable them to participate in a competent manner.

Create transparency on who is involved and how: creating transparency on the process structure, who is involved and why, which conclusions are reached, etc. is a continuous point of attention. In first instance towards the actors involved, but also publically. Both the process steps, intermediate and final conclusion and argumentation were documented in intermediate reports.

Be action-oriented, ideally resulting in targeted policy action: the ultimate aim of the phased plan for action is to decide and implement policy actions for a better environment and health. In this respect a broad diversity of policy instruments is being considered, as illustrated in de case descriptions on POPs. Although already a lot of policy measures existed, the Phased plan for action identified additional opportunities for policy making.

Be a fair and competent process: in the process of the phased plan for action, fairness is being pursued mainly by inviting a broad range of perspectives and creating openness to discuss not only policy options, but also the evidence base as well as the process design and the agenda of meetings. Competence is being pursued by trying to get the best available evidence on the table and support all actors involved to play their role (e.g. by trying to explain complex scientific topics in an understandable and interactive way). The fairness was secured by inviting an adequate diversity of perspectives, providing reports of every meeting of the advisory group and feedback of authorities on the decisions made.

7.3 Call for cases

For the case studies that we plan to develop from Autumn 2017 onwards in Task 5.5 of HBM4EU, we are looking for cases/topics – both on EU-level and national level – that are qualified to serve as an experiment for a multi-actor dialogue, with regard to (one of) the opportunities as described in section 1 of this part.

7.3.1 Criteria for case selection

To select an adequate case, it might be useful to keep some additional criteria in mind:

- We are looking for cases in which the technique of HBM has/can have an added value for the societal and policy debate.
- Dialogue between different perspectives (from science, policy and society) is (expected to be) valuable and does not contain (too much) the risk of duplication of previous initiatives.
- Cases should not be too controversial, to avoid being caught in a deadlock in an early stage. Nor too scientifically complex, to guarantee that also non-experts can master a dialogue, at least for the parts that are relevant to them.

  [… Suggestions for additional criteria are welcome]

We would like to initiate one case at EU-level and several cases in different national contexts (e.g. in FL (BE), NL, FR, UK, i.e. the countries of the respective partners of Task 5.5). The different cases can focus either on the same topic, or on diverging topics, and can focus on one particular stage of the science-policy nexus as well as on multiple stages. The case in Flanders (BE) is already in implementation phase (2016-2018) and may serve as a source of inspiration.

7.3.2 First screening of potential cases

In addition to suggesting a potential topic for a case on EU-level and/or national level, it might be interesting to map some basic characteristics and background information on each proposed case:

- A basic sketch of available evidence
- Remaining complexity and uncertainty
- Affected and interested groups/actors/stakeholders
- Current policy (strategies, regulation, soft policy measures)

- Initiatives that already have been taken in the past to organise multi-actor dialogue

7.3.3 First ideas

As a result of (bilateral) skype meetings organised by UAntwerp with the other partners involved in Task 5.5 (EEA, DH, ANSES, RIVM, VITO) some first – preliminary – ideas emerged for potential cases, mainly focussing on the EU-level (the first case programmed in the multi-annual program):

- The issue of **mixtures** transcends different substances and (policy) domains, so important questions are: how will we judge the impact of mixtures? When will be decided to act (even if substance-specific norms are not exceeded)? Who will act? And which interventions are considered effective and efficient?
- Multiple countries face problems with **PFOA's**. E.g. the Netherlands with the Dupont-plant in Dordrecht, Sweden, Italy and Spain. And various governments use different norms. On the other hand it seems difficult to take effective measures to reduce the emissions.
- With regard to **endocrine disrupting chemicals**, opinions differ between scientists: some state that the endocrine system is incredibly vulnerable, particularly during early childhood. Others say that it is incredibly robust to cope with fluctuations in endocrine levels. It is an interesting case because it relates to the daily lives of people and high interest of stakeholders, which is positive to communicate externally on our case results, later on in the project. On the other hand, this case might be too controversial and already many initiatives have been taken.
- Organising a dialogue on HBM **results of DEMOCOPHES** might be useful because representative and comparable data is already available for different EU countries. This can be useful both on EU-level and potentially also for the national level. How were these results picked up by policy? And what additional opportunities might be open to explore? What can policy makers at the EU-level do with these kind of HBM results? And what do we count for as the responsibility of the countries themselves?
- [Other 'first ideas' are welcome]

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