



European joint programme HBM4EU - Bridging science and policy: experiences and lessons learned from the key partners in the scientific steering of the initiative^{*}

Alexandra Polcher^a, Maren Gadermann^a, Greet Schoeters^{b,c}, Argelia Castaño^d, Catherine Ganzleben^e, Joana Lobo Vicente^e, Roser Gasol^e, Marta Esteban-López^d, Jean-Philippe Antignac^f, Robert Barouki^g, Hanna Tolonen^h, Ovnair Sepaiⁱ, Mariana F. Fernandez^{j,k,l}, Lisa Melymuk^m, Normunds Kadikisⁿ, Paula Alvito^{o,p}, Maria João Silva^{q,r}, Andromachi Katsonouri^s, Susana Viegas^t, Helle Raun Andersen^u, Beatrice Bocca^v, Flavia Ruggieri^v, Maria Uhl^w, Christina Hartmann^w, Lijana Kononenko^x, Dragan Gjorgjev^y, Mirjana Dimovska^y, Siiri Latvala^z, Karin Norström^z, Rita Cavaleiro^{aa}, Thorhallur Ingi Halldorsson^{ab}, Cathrine Thomsen^{ac}, Maja Mampaey^{ad}, An Van Nieuwenhuysse^{ae,af}, Tamás Szigeti^{ag}, Nicole Probst Hensch^{ah}, Medea Imboden^{ai}, Tamar Berman^{aj}, Philipp Weise^{ak}, Kim Pack^{ak}, Rosa Lange^{ak}, Lena Reiber^{ak}, Nicole Kobosil^{ak}, Petra Apel^{ak}, Madlen David^{ak,*}, Marike Kolossa-Gehring^{al}

^a Ramboll Deutschland GmbH, Tölzer Str. 1, München, 81379, Germany

^b VITO Health, Flemish Institute for Technological Research (VITO), Boeretang 200, Mol, 2400, Belgium

^c University of Antwerp, Dept. Biomedical Sciences and Toxicological Centre, Universiteitsplein 1, Wilrijk, Antwerp, 2610, Belgium

^d National Centre for Environmental Health, Instituto de Salud Carlos III, Madrid, 28220, Spain

^e European Environment Agency (EEA), Kongens Nytorv 6, Copenhagen K, 1050, Denmark

^f Oniris, INRAE, LABERCA, Nantes, France

^g Université Paris Cité, Inserm T3S, Paris, France

^h Finnish Institute for Health and Welfare (THL), Helsinki, 00300, Finland

ⁱ UK Health Security Agency, Oxfordshire, UK

^j Biomedical Research Center (CIBM), University of Granada, Granada, 18016, Spain

^k Instituto de Investigación Biosanitaria de Granada (ibs.GRANADA), Granada, 18012, Spain

^l CIBER de Epidemiología y Salud Pública (CIBERESP), Spain

^m RECETOX, Faculty of Science, Masaryk University, Kotlarska 2, Brno, 611 37, Czech Republic

ⁿ Health Inspectorate of Latvia, Latvia

^o National Institute of Health Dr. Ricardo Jorge, Lisbon, 1649-016, Portugal

^p Centre for Environmental and Marine Studies (CESAM), University of Aveiro, Aveiro, 3810-193, Portugal

^q Department of Human Genetics, National Institute of Health Dr. Ricardo Jorge, Lisbon, 1649-016, Portugal

^r Comprehensive Health Research Center, CHRC, NOVA Medical School, NOVA University of Lisbon, Portugal

^s State General Laboratory, Ministry of Health, Nicosia, Cyprus

^t NOVA National School of Public Health, Public Health Research Centre, Comprehensive Health Research Center, CHRC, REAL, CCAL, NOVA University Lisbon, Lisbon, Portugal

^u Clinical Pharmacology, Pharmacy and Environmental Medicine, Department of Public Health, University of Southern Denmark, Odense, Denmark

^v Department of Environment and Health, Istituto Superiore di Sanità, Rome, Italy

^w Environment Agency Austria, Vienna, Austria

^x Chemicals Office of the Republic of Slovenia, Slovenia

^y National Institute of Public Health, North Macedonia

^z Environmental Protection Agency, Sweden

^{aa} Fundação para a Ciência e a Tecnologia, I.P., Portugal

^{ab} Faculty of Food Science and Nutrition, University of Iceland, Iceland

^{*} This article is part of a special issue entitled: "VSI:Special Issue: HBM4EU" published in International Journal of Hygiene and Environmental Health.

^{*} Corresponding author.

E-mail address: Madlen.David@uba.de (M. David).

<https://doi.org/10.1016/j.ijheh.2026.114907>

Received 27 April 2026; Received in revised form 11 September 2026; Accepted 15 September 2026

Available online 7 October 2026

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Open access funding enabled and organized by Projekt DEAL.

^{ac} Norwegian Institute of Public Health, Department of Food Safety, Norway^{ad} Environment & Health, Flemish Government, Department of Environment & Spatial Development, Brussels, Belgium^{ae} Department Health Protection, Laboratoire National de Santé (LNS), Dudelange, Luxembourg^{af} Centre for Environment and Health, Department of Public Health and Primary Care, KU Leuven (University of Leuven), Leuven, Belgium^{ag} National Center for Public Health and Pharmacy, Hungary^{ah} Swiss Tropical and Public Health Institute, Allschwil, Switzerland^{ai} University of Basel, Switzerland^{aj} Department of Environmental Health, Israel Ministry of Health, Israel^{ak} German Environment Agency (UBA), Corrensplatz 1, Berlin, 14195, Germany^{al} Ruhr University Bochum, Medical Faculty, Institute for Prevention and Occupational Medicine of the German Social Accident Insurance, Institute of the Ruhr University Bochum (IPA), Germany

ARTICLE INFO

Keywords:

Human biomonitoring

HBM

HBM4EU

HORIZON2020

Management

Project steering

Science-policy interface

ABSTRACT

The European Joint Programme HBM4EU was established to address politically relevant questions on chemical risks to public health through a targeted human biomonitoring research programme. Running from 2017 to 2022, it was co-financed by the EU's Horizon 2020 Research and Innovation Programme (grant agreement No. 733032) and national or institutional funds from participating partners. HBM4EU was the first large European initiative to establish a robust science-to-policy interface by systematically aligning research activities with concrete regulatory needs. The programme introduced a structured governance model that actively involved policy-makers at European and national levels, scientists from multiple disciplines, and other stakeholders. A transparent prioritisation process defined key chemical groups as scientific focus areas, each supported by dedicated topic leaders. These leaders formulated relevant policy questions and translated them into targeted scientific tasks implemented via annual work programmes. To support regulatory uptake, HBM4EU produced tailored, policy-oriented communication products for all priority chemicals. At the end of the project, a structured survey among project partners assessed collaboration between scientists and policy-makers, as well as coordination, management and knowledge transfer. The results highlighted factors enabling effective communication and mutual understanding at the science-policy interface. They showed that shared governance promoted transparency, fair distribution of effort and synergies, and underlined the importance of continuous dialogue to ensure lasting impact. Overall, the findings provide practical guidance for future EU-funded projects seeking strong scientific excellence and policy relevance.

1. Introduction

Human biomonitoring (HBM) provides direct evidence of human exposure to chemicals through the measurement of these substances and/or their metabolites in human tissues and fluids, offering a realistic assessment of the total internal burden from all exposure routes - air, water, food, consumer products, and occupational sources. This makes HBM an indispensable complement to traditional environmental monitoring (Angerer et al., 2007).

Effective science-to-policy support requires more than the generation of high-quality scientific data. Any scientific data used for policy making needs to be robust and need to be comparable across countries. In practise, however, such support was challenging because HBM programs have historically been organised at national level, with different study designs, sampling strategies, analytical methods, targeted populations and data interpretation. These differences limited the comparability of results in the past and reduced the extent to which HBM evidence could be used consistently at the European level (Den Hond et al., 2015).

Recognising these challenges, the European Commission co-funded a series of initiatives, including Expert Group to Support Biomonitoring in Europe (ESBIO), Consortium to Perform Human Biomonitoring on a European Scale (COPHES) and DEMOnstration of a study to COordinate and Perform Human Biomonitoring on a European Scale (DEMO-COPHES), to strengthen collaboration and progressively align HBM approaches across Europe. These efforts laid the foundation for the European Joint Programme HBM4EU (HBM4EU) (Kolossa-Gehring et al., 2023a), which sought to build a more coherent and policy-relevant European HBM framework.

Over time, these initiatives have steadily advanced, with HBM being increasingly recognised as a valuable tool for supporting policy development in the field of risk assessment, chemical regulation and transparent information on exposure burden for the general public. In 2017, alongside the European Union (EU)'s Strategy for a Non-Toxic Environment, HBM4EU was launched under the Horizon 2020 Framework

Programme (Ganzleben et al., 2017). Unlike many other research projects, HBM4EU uniquely emphasised the science-policy interface as a key element of its design, making it distinctive among projects of its kind and creating a new and innovative type of policy-focussed EU research project. HBM4EU brought together institutions from 24 European Union Member States as well as Norway, Iceland, Israel, United Kingdom, Northern Macedonia and Switzerland and the European Environment Agency (EEA), which led to an overall number of over 110 partner institutions being involved in the project work.

To be able to coordinate and steer such a project successfully, a governance structure was set up before the start. The governance structure of HBM4EU is shown in Fig. 1.

As shown in Fig. 1, the HBM4EU governance structure comprised several interconnected bodies: the Governing Board, the Scientific and Administrative Management, the Management Board (MB), the National Hubs, the Stakeholder Forum, the Advisory Board and the Ethics Board.

The Governing Board was made up of HBM program owners, those institutions which were responsible for running the national programmes and their financing, primarily Ministries, from participating countries, national policy leads and representatives from the European Chemicals Agency (ECHA), the EEA, and the European Food Safety Authority (EFSA). The Governing Board took decisions as the ultimate decision-making body of HBM4EU.

Scientific and administrative coordination was ensured by the Project Coordinator, supported by the Co-Coordinator and the Secretariat. The MB brought together the Project Coordinator, the Co-Coordinator, the Pillar Leaders, the Work Package Leaders (WPLs) and the National Hub Coordinators, reflecting the structure presented in Fig. 1.

In addition to these formal governance bodies, Chemical Group Leaders (CGLs) played an important cross-cutting role in the scientific steering of HBM4EU. For each prioritised substance or substance group, a CGL coordinated the substance-specific work, supported the translation of policy questions into research tasks and helped to ensure that results were scientifically robust and relevant for policy use. Their role is

introduced here as part of the project's scientific coordination.

The National Hubs established and maintained the link between HBM4EU and national HBM activities. Through their National Hub Contact Points (NHCPs), they provided information on national needs into the European project and supported the flow of information back to national contexts (Ubong et al., 2023).

The Stakeholder Forum included representatives from outside the project and provided strategic input to enhance HBM4EU's accountability and credibility. Its members represented non-governmental organisations, trade unions, industry, and environmental, health and consumer organisations, ensuring that a broad range of societal interests could be considered.

The Advisory Board was composed of internationally recognised HBM experts who provided scientific advice and brought external knowledge and experience to HBM4EU.

Finally, the Ethics Board provided guidance on ethical considerations during the project. It consisted of five members: the ethics coordinator, representatives of the project coordination team, the health studies work package (WP), the National Hub coordinator, the data management team, and a specialist in social sciences (Knudsen et al., 2023).

Several European studies and project-based reports have examined the governance, coordination, evaluation, and policy relevance of large, multi-partner research consortia, including European research and innovation partnerships, national science-for-policy ecosystems, and large-scale initiatives such as HBM4EU. Although these projects differ in scope, disciplinary focus, and institutional setting, they report several recurring lessons. Effective consortia require clearly defined roles,

transparent decision-making structures, adequate resources for coordination, and sustained communication and trust among partners (Jansen et al., 2014). Early and continuous engagement with policy makers and other knowledge users is essential to ensure that research questions and outputs remain relevant and useable (Dotti, 2024; Krieger and Melchor, 2022; Pedersen, 2023). Moreover, evaluation should extend beyond scientific outputs and assess learning, network integration, institutional capacity, knowledge transfer, and longer-term policy or societal impacts. Finally, data harmonization, conflict-resolution mechanisms, and arrangements for sustainability beyond the funding period should be addressed from the outset. This literature provided a useful background for HBM4EU, but it has not systematically documented the perspectives of the partners responsible for scientific steering.

The present article addressed this gap by analysing feedback of three individual surveys from the key partners of the scientific steering, a) the WPLs, b) the CGLs and c) the NHCPs and reflects on aspects that could be beneficial for similar research projects. By bringing together the feedback the manuscript adds a practical perspective that complements earlier publications on HBM4EU and helps to define which organisational features contributed to the programme's scientific and policy relevance. It further aims to systematically reflect on the experiences of key HBM4EU partners involved in scientific steering and to contribute practical knowledge on how large, multi-partner environment and health projects can organise effective governance, coordination and science-policy interaction.

Additional lessons learned from HBM4EU – focusing on the coordinators' perspective, have been published by Kolossa-Gehring et al. (2023b). The present article complements the coordinators perspective

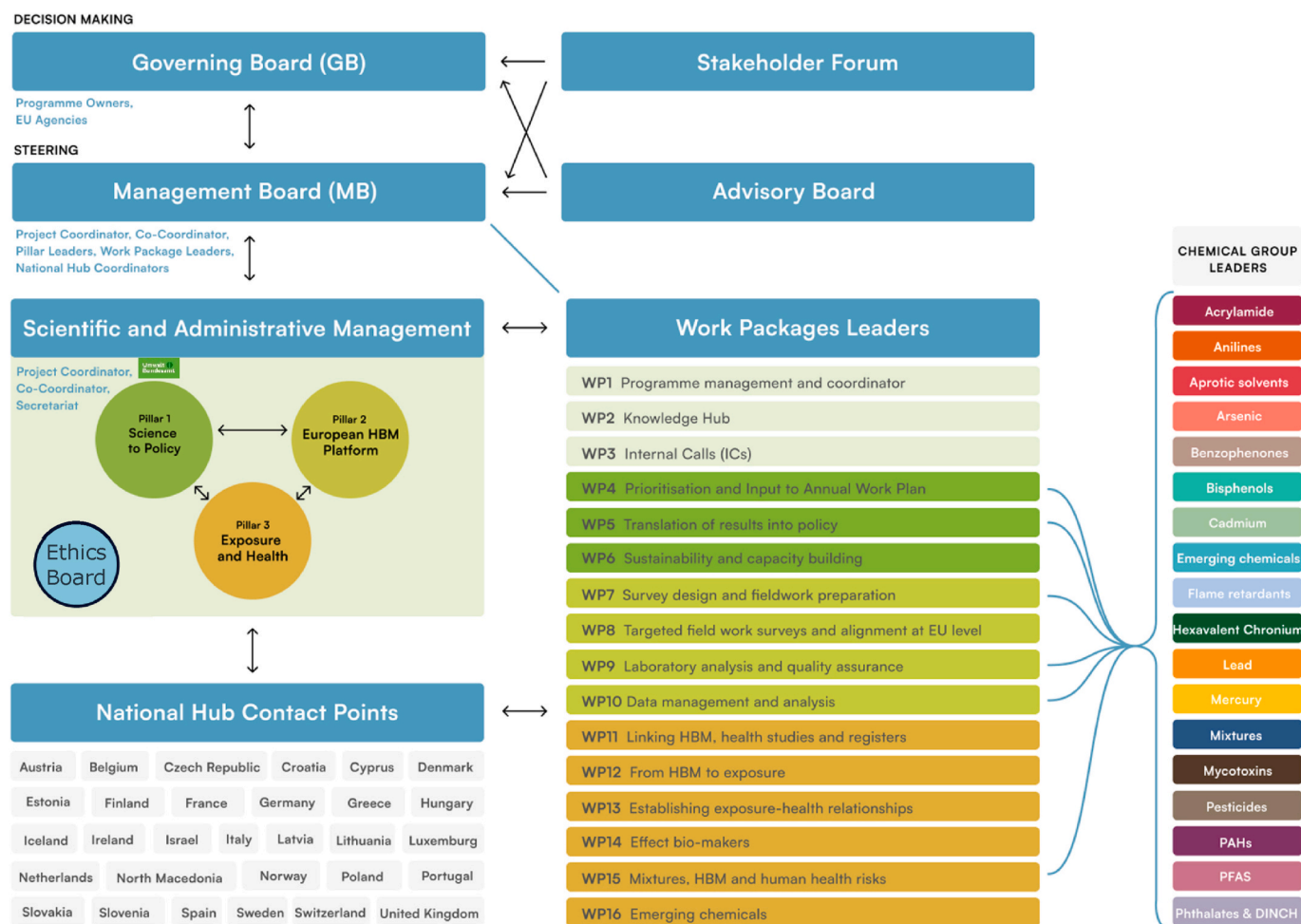


Fig. 1. The governance structure of HBM4EU.

by bringing in the perspective of the key project partners.

2. Methodology

2.1. Collecting feedback from HBM4EU key partners

Three different online surveys were prepared in March 2023 – 9 months after the finalisation of HBM4EU, which are available in the [supplementary information \(SI\)](#). Most of the questions were open-ended, allowing respondents to elaborate on their feedback in their own words.

The questionnaires were designed by an independent consultant with a professional background in the development, coordination and evaluation of European HBM activities and a long-term record of following the development of HBM networks in Europe. The consultant was not part of the HBM4EU project consortium or its governance bodies and was therefore independent of the project structures assessed in the surveys. The questionnaire design was based on the project structure, the roles of the different respondent groups and the aspects to be reflected after completion of HBM4EU. The questions were reviewed and validated in close coordination with an expert from the HBM4EU management team to ensure that they were understandable, relevant to the project context and suitable for capturing feedback from the key partners addressed.

The three questionnaires differed in length and format according to the role of the respondent group. The WPL questionnaire included 11 main questions, almost all of which were open-ended, with one question using simple rating options. It was expected to take around 30 to 45 min to complete. The CGL questionnaire included five main questions, combining closed yes/no/partly questions with optional comment fields and open-ended follow-up questions, and was estimated to take around 20 to 30 min. The NHCP questionnaire included six main questions, two of which used closed response options with space for clarification and four of which were open-ended; it was expected to take around 20 to 30 min to complete.

The three questionnaire surveys aimed to gain insights into the different perspectives on success factors and barriers of the project partners and information if the ambitions of HBM4EU could be met. This should allow the derivation of recommendations for optimising project steering and coordination. All responsible experts were contacted via email explaining the scope of the survey and the questions addressed, non-respondents received up to two reminders. In total survey participants had up to two months to respond to the surveys.

The survey was developed and analysed using a framework-based approach. The questionnaire items were derived from a conceptual framework covering key dimensions of HBM4EU, including the policy context, the development and structure of the consortium, financial planning and implementation, and processes and working methods. This framework provided the predefined topic structure for the surveys and the initial basis for organising and comparing the responses across respondent groups. At the same time, the open-ended format of most questions allowed participants to raise additional issues in their own words. The raw survey data responses were only accessible to the consultant. Two experts from the consultant first assessed the raw responses individually and prepared structured summaries for each respondent group to identify recurring observations, shared experiences and points of divergence. These summaries were then compared, and combined, solving possible interpretation biases and inconsistencies. Additional to derive the final results presented in this manuscript, a verification step was introduced, in which all respondents had the opportunity to review the resulting summaries. The final results presented in this manuscript were derived from this combined assessment and respondent review process. The findings should therefore be understood as a structured synthesis of survey feedback based on a framework-informed analysis, rather than as the outcome of a formal qualitative research design. Overarching conclusions presented in the Discussion were developed by synthesising recurring patterns across the survey

responses and, where appropriate, by interpreting these findings in light of broader organisational considerations relevant to future multi-partner projects.

2.1.1. Survey of the WPLs

Within HBM4EU a science-to-policy interface had been set up as a unique process to ensure policy relevance of the research. Especially the first online questionnaire focused on this specific science-to-policy interface but covered also questions related to the general structure of the project, financial planning and the involvement of partners in the WPs. 11 of 14 approached WPLs answered the survey. The detailed participation is shown in [Table 4 \(SI\)](#).

2.1.2. Survey of the CGLs

Within HBM4EU priority substances were identified. Those were defined as chemicals most important to monitor in humans across Europe, due to their potential risk to health, public concern, and their relevance for current or emerging EU policies on chemicals. The selection took place following a structured and participatory approach as described in ([Ougier et al., 2021](#)), that involved EU Member States, the EU policy board comprising members from the European Commission and European agencies as well as the established Stakeholder Forum.

For each priority substance a set of policy questions has been elaborated, which should be answered by HBM4EU. Those policy questions basically defined what policy makers need to know about chemical exposures and its health impacts in order to design, evaluate, or improve regulations and they can be regarded as the driving force behind all work carried out under HBM4EU. Once the questions were set, the necessary work plan to answer the questions could be established accordingly. A dedicated CGL was selected, to answer the policy questions for the substances prioritised within HBM4EU. For the first list of priority substances, the CGLs were appointed during the proposal-preparation phase by a steering committee composed of national representatives. For the second list covering 2019–2021, the process was more formal and based on nominations by national representatives and selection by the MB ([Ougier et al., 2018](#)).

Policy questions to be addressed within HBM4EU comprised different research areas like a) current exposure burden of the general public, b) information on sources and pathways, c) health effects, d) effectiveness of policy measures. For each priority substance group a dedicated policy brief¹ was elaborated, which also included the original policy questions.

The 18 leaders of the HBM4EU chemical substance or substance groups were approached with the request to complete a questionnaire particularly focused on the policy interface and ten of them responded to the survey. The detailed participation is shown in [Table 5 \(SI\)](#).

2.1.3. Survey of the NHCPs

A dedicated online questionnaire was also sent to the 30 NHCPs to gain a better understanding of the national situations and how far the information flow from the work in HBM4EU reached them. 18 NHCPs answered the survey. The detailed participation is shown in [Table 6 \(SI\)](#).

3. Results

The response rate of the different key partners of the project was 79% for WPLs, 56% for CGLs and 60% for the NHCPs. The results presented below have been summarised based on the three conducted surveys. It is important to note that not all respondents shared the same views, and therefore, the summaries represent general trends and common themes rather than unanimous consensus. As such, the findings should not be interpreted as reflecting the opinions of all respondents but should be considered as a valuable source of individual experiences useful for further research projects.

Where views differed clearly between respondent groups or individual respondents, these differences are reflected in the relevant results

sections, either through explicit wording, examples or the presentation of group-specific responses. In several cases, diverging views were linked to the specific role of the respondent in HBM4EU, the national context or the extent to which the respondent had been involved in the respective activity. For this reason, the results do not quantify support for each statement across all respondents but highlight common patterns while noting relevant deviations where they were apparent from the survey responses.

The results are structured around the two main areas addressed in the survey feedback. First, the HBM4EU policy interface, which refers to the structures and processes through which policy needs were identified, translated into scientific tasks and communicated back to policy actors. This included the involvement of policy makers and agencies in defining priorities and policy questions, the work of the EU Policy Board and National Hubs, the role of CGLs in linking substance-specific research to policy questions, and the preparation of policy-oriented outputs such as policy briefs and tailored communication products.

As a second aspect the results address HBM4EU project steering, which needs to be understood here as the organisational and managerial arrangements used to coordinate the large multi-partner programme. This includes the distribution of responsibilities across pillars, WPs and cross-cutting roles, the functioning of National Hubs, staff engagement and continuity, and financial management.

The result section is limited to reported survey findings, response patterns, direct quotations and illustrative examples from respondents. Broader interpretation, implications for future projects and lessons formulated by the authors are presented separately in the Discussion and Conclusion.

3.1. The HBM4EU policy interface

The survey items on the HBM4EU policy interface asked respondents to reflect on how policy needs were identified, how policy questions influenced research planning, how interaction with policy makers worked in practice, and which outputs supported regulatory or policy uptake.

Across the responses, direct coordination with policy makers was described as taking place through workshops, expert meetings and input into regulatory processes. The value of quality-controlled and quality-assured data on human exposure to chemicals were also identified in the responses as an important project output supporting the policy interface.

For the survey items addressing the practical functioning of the science-to-policy interface, feedback from the WPLs repeatedly highlighted trust and close cooperation with policy makers as important features of HBM4EU. The role of policy agencies as project partners was also emphasised. In HBM4EU, representatives of the EEA were responsible for running the WP on prioritisation. Experts from the EEA stated in the survey: *“As lead of [one WP], EEA benefits significantly from being an EU institution in terms of our access to the members of the EU Policy Board, as we departed from a position of trust. This enabled us to secure engagement in the prioritisation process”*. A WPL further stated: *“The science policy interface worked well for WP5, we had regular contacts (structured and ad hoc) with policy makers mainly at EU level. Different workshops were organised with active input and co-ordination of policy makers both during the project and when the results became available.”*

Responses further indicated that the relevance and intensity of the science-policy interface differed across WPs. WP2 and WP4 were reported as having central roles in cooperation with policy makers, with WP4 contributing to the prioritisation process and WP2 focusing on the translation of research results into policy-relevant messages. WP5 was described as having regular and structured communication with policy makers, mainly at EU level, including workshops organised with active input and coordination by policy actors. WP6 was reported to provide a link to policy makers through work on sustainability and National Hubs, including ongoing exchanges with the Directorate General for the

Environment of the European Commission (DG ENV) on data and data generation. By contrast, WPs with a stronger methodological or technical focus, such as WP7, WP9, WP11 and WP16, were described as having a less prominent or more indirect science-policy interface, although respondents noted positive feedback from policy makers where interaction occurred and interest in selected outputs, including new screening methods.

The same set of questions also captured challenges in translating technical research outputs into accessible, policy-relevant information. One WPL noted that researchers had difficulties identifying which findings were most relevant to policy makers and communicating these in a non-technical way.

There is also the aspect of tailoring communication products for different needs as emerged in HBM4EU. Policy makers at various levels and sectors (from EU to national level) may have different priorities and information needs. This was reflected in the answer of the leader of WP2: *“EEA brought experience in translating research results into policy relevant messages for policy makers. [...] with researchers, who [...] were not skilled at identifying those results relevant for policy makers and communicating them in a non-technical way. Important to recognise the different actors in the policy domain - including scientists working with regulatory science at EFSA and ECHA, as well as desk officers at DG ENV and SANTE and high-level policy makers [...] - they need different communication products targeted to their specific information needs.”*

At national level, the survey responses indicated that translation of materials into national languages was sometimes necessary to engage national policy makers. The reported interaction with policy makers at European and national level included feedback loops, adjustments during the project and structured exchanges with policy actors. Two WPLs described these interactions as recurring rather than limited to individual dissemination events.

WPLs, particularly those involved in sustainability and data-related work, also referred to data generation, infrastructure development and governance as areas relevant to the longer-term use of HBM4EU outputs. Those WPL comments mentioned the importance of data management and the need to ensure compliance with the General Data Protection Regulation (GDPR) while enabling the use of HBM, environmental and health data.

WPLs also mentioned the development of governance frameworks, stakeholder networks and sustainability discussions as relevant elements for the continued use of project outputs.

WPL responses also stressed the importance of collaboration across WPs and pillars. Two WPLs mentioned the input provided by HBM4EU during the public consultation for the universal PFAS restriction proposal as one example of joint work across different parts of the project. WP5 contributed considerations on risk assessment and mixture assessment, WP8 and WP9 contributed information from aligned studies, WP10 addressed available PFAS data, WP14 worked on suitable biomarkers of exposure, WP15 contributed to work on biomarkers of effect, and WP13 added information on adverse outcome pathways.

3.1.1. The influence of the policy component on project work

As a next aspect, WPLs and CGLs were asked how the policy component influenced the design and implementation of project work, including the formulation of policy questions, their translation into research activities and the extent to which they could be addressed within the project.

The majority of CGLs referred to the need for early involvement of policy makers in the development of HBM4EU research questions and priorities. According to the survey feedback, policy makers were involved from the planning phase onwards and contributed to shaping the research agenda and policy questions addressed in the project. Scoping documents, annual work programmes and review through project governance bodies were mentioned as mechanisms used to align scientific activities with policy needs.

Especially the CGLs also described challenges in balancing scientific

exploration and longer-term research goals with shorter-term expectations linked to policy needs.

The answers from the WPLs, but in particular from the CGLs, indicated further that respondents considered it essential to align the expectations of policy makers with the practical possibilities and limitations faced by scientific research. Taking into account the necessary personnel capacities at the start of the project planning and enabling knowledge transfer through appropriate training were also mentioned in the responses. Respondents noted that while policy makers may seek timely decisions, researchers face data availability and methodological constraints that must be acknowledged from the outset.

All responding CGLs stated that policy questions should be well specified and achievable within the project timeframe. Three CGL responses described policy questions as very general and difficult to address comprehensively within the scope and duration of HBM4EU. One response stated: *“Policy questions were too broad to be covered within HBM4EU merely and the time span available.”* Another response stated: *“the policy questions [...] were formulated more at the strategic level. It was already known from the start that we would only partially answer the questions.”* One CGL also commented: *“... In retrospect, it might have been beneficial to discuss and adapt them [the policy questions] together with the EU Policy Board at mid-term.”* Fig. 2 shows responses from ten CGLs. For the question whether policy questions were clearly formulated and remained valid during the project, eight CGLs answered “Yes”, one answered “Partly” and one answered “No”. For the question whether coordination with policy makers was ensured during the setting-up of the questions, seven CGLs answered “Yes”, one answered “Partly” and two answered “No”. For one group, the response was: *“We received some comments from the EU Commission and the EU agencies, (review of the annual work plan) but there was no opportunity (at least for the CGLs who were not part of the Management Board) to discuss them with the policy board and refine the questions accordingly. Furthermore, it was also difficult to propose additional activities to be able to answer the questions or rather to get the commitment to carry these activities out.”*

Two WPLs and several NHCPs referred to the need for policy makers to recognise the added value of HBM data for risk assessment, policy development and the monitoring of policy effectiveness. These responses also noted that the inclusion of HBM studies at national or European level is not yet a legal requirement.

A key aspect for use in future projects mentioned by WPLs was continued policy and regulatory development monitoring. Where HBM4EU identified the requirement for research to keep pace with policy needs, proactive scanning of the policy horizon was considered important to allow projects to identify and respond to emerging legislative opportunities and consultations.

When asked whether it was possible to provide answers to the respective policy questions and whether the financial planning was sufficient, responses showed that some selected questions could not be answered fully, while financial planning was generally not identified as the limiting factor (Fig. 3).

The reasons provided by responding CGLs for not answering some policy questions fully related mainly to the broad scope of some questions and to limitations in data availability. For one group, the CGL response indicated that questions on occupational exposure could not be answered fully because very few previous studies on occupational exposure levels for the prioritised substances were available and no new data were generated.

Overall, the survey data showed that many WPLs, CGLs and NHCPs recognised the value of coordination and reported successful outcomes of the HBM4EU policy interface. At the same time, CGL responses in particular highlighted limitations, including insufficient or late interaction with policy makers, limited involvement of some CGLs in decision-making, and policy questions that were sometimes too broad, insufficiently adaptable or beyond the available data and project scope. These responses indicate that the positive assessment of the policy interface was not uniform across all respondent groups and that several

practical constraints were reported alongside the successful examples.

3.1.2. The national perspective of the policy interface

Of the 18 NHCPs having answered to the respective survey questionnaire, 14 confirmed that the policy questions addressed by the project reflected a national policy need. Three NHCPs stated that the policy questions were not documented in such a way as to form a qualified opinion. Two of these three respondents stated that, due to this absence of information, they could not confirm whether the policy questions addressed by the project reflected priorities at the national level. One NHCP mentioned that information on the policy context could only be gained due to other roles in the project (Fig. 4).

The Cyprus NHCP stated that the concept was important for establishing a functional linkage between the European and national levels. The same response referred to comparable structures at EU level in other domains, including national focal points for EFSA in the area of food safety, the EIONET network for environmental information, and the ECHA Forum for enforcement. The respondent listed the main obstacles as: (a) *creating a clear value for national actors, so that they would engage substantially*, (b) *lack of substantial resources and support to have more national hub activities*, (c) *unlike the official frame related to European authorities, the partnership offered an ad hoc frame*.

3.2. The HBM4EU project steering

In this article, project steering refers to the practical coordination of HBM4EU as a large, multi-partner programme, including how responsibilities were distributed, how partners and cross-cutting roles were coordinated, how national structures were linked to the European project, how staff continuity was maintained and how financial aspects were handled. HBM4EU involved partners from 30 countries, substantial EU and national or institutional co-funding, and a three-pillar framework. The survey feedback presented in this subsection therefore focuses on respondents' reported experiences with these organisational and managerial aspects of the project.

3.2.1. Distributing project responsibilities

The HBM4EU project was organised around three supporting pillars: Pillar 1, Science to policy; Pillar 2, The European HBM platform; and Pillar 3, Exposure and health. Each pillar had a responsible leader. The survey responses from WPLs addressed both advantages and challenges of this structure.

Two WPLs explicitly described the three-pillar structure as an advantage for project management, while another WPL highlighted the value of shared scientific management across coordinators and pillar leaders. One respondent described this as follows: *“Good to have three pillar representatives providing strategic direction to the research in their pillars. Good also to balance the authority of UBA, the project lead, with a second tier of authority in the project management.”* According to the responses, the three-pillar approach also supported collaboration within individual pillars. One response stated: *“From the perspective from inside a pillar - working in the pillar gave a feeling of belonging together, strengthening the pillar.”*

WPL feedback also referred to challenges in communication and coordination across the pillars. Three respondents noted that collaboration was easier within individual pillars than across pillars, and two referred to a risk of silo working. One response stated: *“The benefits are a way to manage the workflow and to ensure the leadership is shared over many shoulders. Of course, this can lead to some silo working - where one pillar does not see the work of the other pillars as often or as necessary. This was reduced by having all Pillar leads and WP leads in the management board.”* Some WPLs also noted retrospectively that more interaction and transparency between the pillars could have taken place.

At WP level, WPLs were asked how well partners in their WP fulfilled their roles. Overall, respondents described WP members as reachable, timely and providing good to very good quality contributions.

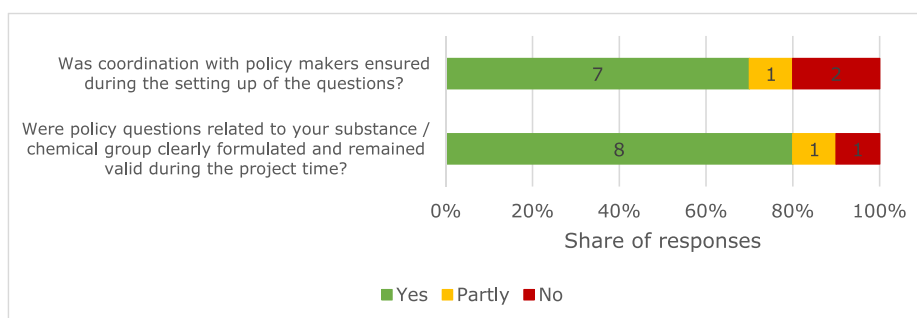


Fig. 2. CGL responses to policy questions.

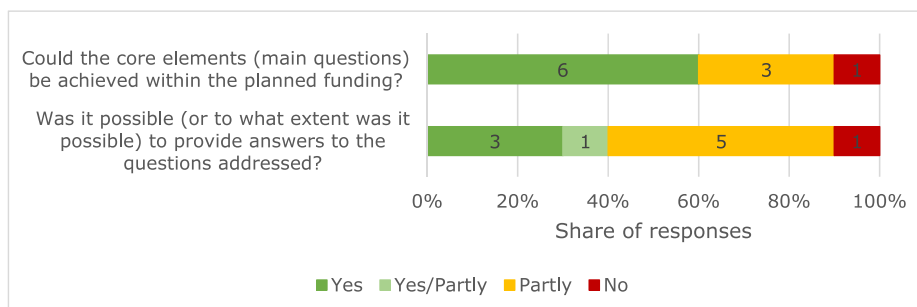


Fig. 3. CGL responses to policy answers.

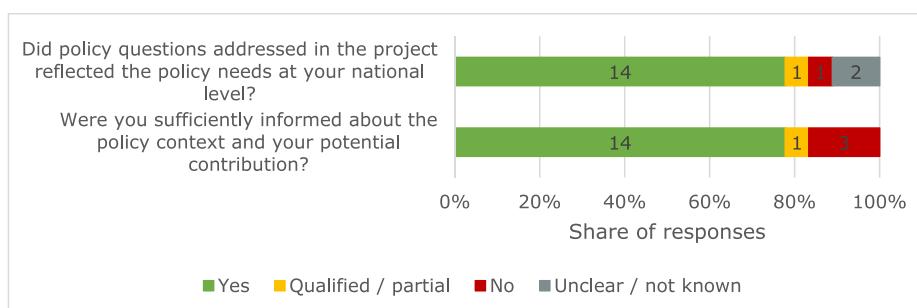


Fig. 4. NHCPs and policy questions.

During the final reflections collection of the WPLs, it clearly came forward that within HBM4EU, performance and collaboration of the partners differed: whereas some partners were quite active and communicative, others did not cooperate much or were difficult to contact. General satisfaction with project partners nevertheless stood at a high level, six of eight responding WPLs gave the highest rating for response to emails, and five of eight gave the highest rating for both on-time delivery and quality of contributions.

The survey feedback also addressed the role of CGLs. Respondents described CGLs as responsible for guiding substance-specific work and linking scientific activities to policy questions. Three CGLs reported differences in information flow and engagement opportunities depending on whether they were also members of the MB. CGLs who were members of the MB reported more direct access to project updates and decision-making processes, whereas CGLs who were not members of the MB reported more limited insight into project developments.

3.2.2. Reflecting on national needs by setting up national hubs

NHCP responses showed considerable variation in the implementation and functioning of National Hubs across participating countries. Respondents linked these differences to pre-existing national conditions, including available infrastructure, stakeholder cooperation, funding

availability and political support. Countries with established infrastructures or stakeholder cooperation, such as Germany, Austria and Belgium, reported that National Hubs functioned well and supported policy involvement and stakeholder contributions. In Belgium, inter-agency communication was described as functioning well, while Austria was reported to have benefited from an already well-founded basis. By contrast, two countries reported challenges linked to low political support and/or limited previous HBM experience. One country reported joining late in the project, with the National Hub not finalised by the end of HBM4EU. Spain reported that HBM4EU promoted the creation of a national HBM structure within the framework of the National Environment and Health Action Plan¹.

Although NHCP responses were generally supportive of HBM4EU and the National Hub approach, eight NHCPs highlighted limitations that were closely linked to different national starting points. These included weak political engagement, limited recognition of HBM by national policy makers, difficulties in maintaining policy interest, and uneven implementation of the National Hub concept where roles and expectations were not always clearly defined.

¹ <https://www.boe.es/eli/es/o/2022/11/01/pcm1049>

Four NHCPs reported that National Hubs were embedded in broader health or environmental programmes where National Hub management was strong. NHCPs also described remaining challenges, including long-term financing and fragmented analytical capacities across universities, research centres and governmental laboratories. One NHCP highlighted sustaining interest in HBM among different parties and stakeholders within the country as a main obstacle.

NHCPs also commented on materials provided by HBM4EU for aligning studies. These materials were considered supportive and helpful for national initiatives, with two countries having highlighted this aspect.

An overview of materials provided to National Hubs is presented in Pack et al. (2023).

The NHCP responses also differed in relation to policy maker knowledge and engagement at national level. NHCPs from Germany, Austria, Belgium, Spain and Sweden reported high, recognised or active engagement by policy makers, including through reports, policy briefs and close collaboration. NHCPs also mentioned policy briefs, indicator leaflets and national reports as strategies used to facilitate policy maker understanding and engagement. Other NHCPs reported obstacles in accessing or disseminating information to policy makers, partly linked to limited recognition of the added value of HBM programmes and partly to a lack of dedicated funding. Five NHCPs also referred to COVID-19 as an obstacle to engagement, particularly for events and outreach communication.

For Cyprus, Norway, Slovakia, Spain and Sweden, NHCPs referred to regular reporting, workshops and close collaboration with agencies as effective ways to disseminate information and involve policy makers. The Portuguese NHCP reported several dissemination strategies, including pioneer workshops on HBM at national level, which promoted exchange of knowledge and networking among attendees, mostly scientists, and to a lesser extent students, representatives from industry, trade unions, regulatory organisations, governmental organisations and international organisations. However, one NHCP also reported that policy makers were not reached despite attempts made. Another NHCP mentioned regular engagement with policy makers and stakeholders via newsletters.

3.2.3. Staff engagement and continuity

WPL feedback on staff engagement and continuity referred to the importance of personnel stability during HBM4EU. One WPL stated: *"It was fortuitous that most of the key task leaders were committed to the project for all the 5 - 5.5 years and beyond."* WPLs linked the continued presence of key task leaders with stability and the completion of essential tasks throughout the project.

One WPL also reported that personnel changes occurred during the project and stated: *"As far as I experienced (Pillar 1 and WP5), most activities and responsibilities have been carried out as planned, although sometimes personnel changed. Most partners took responsibility for their tasks. It became clear after a while which partners were eager to work at science-to-policy interface, while others had a more academic behaviour and it took some while before they appreciated the close connection between science and policy."* According to this feedback, staff changes did not generally prevent planned activities from being carried out, although engagement with the science-to-policy interface differed among partners.

Three WPLs commented on the importance of matching competencies to tasks. Feedback indicated that where specific expertise was needed, tasks were sometimes easier to implement when assigned to partners or individuals with the relevant skills. One respondent stated: *"Overall, it is easier and more efficient to deliver a task with a limited number of skilled partners, than with a large number of partners with very few person months."* Some respondents, however, also referred to capacity building as an important project objective.

The survey feedback also mentioned flexibility in resource allocation. Respondents reported that, during HBM4EU, several partners

reallocated resources and contributions to prioritise certain work areas while continuing to work towards the project's overall goals.

3.2.4. Handling financial aspects

Survey feedback on financial aspects referred to the management of a large multi-partner project with EU and national or institutional co-funding. Respondents reported that the project reached its main goals regarding management, communication and analysis within the planned funding, supported by tight resource planning and efficient use of the co-funding model.

Two WPLs described challenges linked to the complexity and rigidity of EU rules governing fund transfers, while another WPL referred more broadly to financial planning and administrative complexity as a major issue. These challenges were reported in particular for specific payments such as analysis costs and for cases where samples from one country had to be analysed by laboratories in another country. Four WPLs also referred to administrative burden linked to personnel-month-based payments and to perceived unequal distribution among partners.

The survey feedback further indicated that administrative procedures needed to be transparent and effective. For many key partners, the EU Horizon research funding rules were manageable; for others, they were perceived as too rigid and administratively heavy. Some respondents suggested that internal reporting procedures could have been simplified because reporting was required at different levels.

Two WPLs also reported that several project partners had over-estimated their resource needs during the planning phase, which later required reallocation of funds. The feedback referred to the need to keep financial management informed about potential redistribution needs and to maintain alignment among partners during such reallocations.

All partners recognised that managing a project of this scale posed several challenges, particularly concerning financial planning and capacity building. One key area of feedback centred on the desire for greater financial flexibility, allowing partners to reallocate resources between personnel and other direct costs or among different team members.

4. Discussion

The survey findings show that the main HBM4EU contributors played complementary roles in connecting scientific work with policy needs. Policy makers supported relevance, stakeholders helped legitimise priorities and scientific advisors contributed technical rigour. Together, these structures made the project responsive to a complex policy landscape, but the feedback also shows that such interfaces need structured flexibility, including opportunities to revisit policy questions during implementation.

The feedback also indicates a possible tension between responding to urgent policy issues and maintaining space for broader scientific and public health priorities. While attention to topics already high on the policy agenda, such as PFAS, can be valuable, it may also risk giving less attention to other relevant issues. Several responses therefore point to the value of clearer feedback loops between policy leadership and scientific work areas. Regular dialogue with WPLs and sufficient resources on the authorities' side would help refine policy questions, address new challenges and keep expectations realistic.

The results further underline the need to define clearly what "policy" means within a science-policy interface. Future projects should distinguish between immediate regulatory needs and longer-term strategic goals so that research activities can be aligned with both.

Although HBM4EU had many structures in place, the feedback suggests that these require continued supervision, clear communication and a shared understanding of roles and responsibilities. Tools and processes alone are not sufficient if partners are not fully aware of how their contributions support the wider project objectives.

The lessons discussed here are most transferable to large, multi-partner environment and public health projects that combine policy

involvement, national perspectives and dedicated roles for translating findings into useable outputs. They may be less directly applicable to smaller or purely academic projects, but the broader principles of early engagement, clear responsibilities, realistic expectations and sustained coordination are relevant for other policy-oriented research initiatives.

HBM4EU can also be seen in relation to established biomonitoring initiatives outside Europe, such as the National Health and Nutrition Examination Survey in the United States, the Canadian Health Measures Survey and the Korean National Environmental Health Survey, which demonstrate the value of repeated population-based biomonitoring for exposure assessment and public health action (Calafat, 2012; Haines et al., 2017; Hong et al., 2024). However, these programmes mainly provide comparators for the scientific and public health function of HBM, whereas HBM4EU is particularly relevant for its multi-country governance model and explicit science-policy interface.

This makes HBM4EU relevant not only for future HBM initiatives, but also for other large research programmes that need to combine scientific harmonization, policy relevance, stakeholder engagement, data governance and sustainable capacity building. However, the mentioned programmes provide comparators mainly for the scientific and public health function of HBM, rather than for the governance of a large multi-partner research consortium. To assess the organisational contribution of HBM4EU, it is therefore more appropriate to situate it within the broader literature on the governance and evaluation of European research partnerships, large framework-programme projects and science-for-policy ecosystems.

4.1. The HBM4EU policy interface

Taken together, the survey findings indicate that an effective science-to-policy interface depends on more than the availability of scientific data. One of the takeaways from the HBM4EU experience based on feedback from the WPLs is the fact that trust and close cooperation with policy makers are very important in an early phase of the process. In HBM4EU, trust-based cooperation, the involvement of policy agencies, structured communication channels and tailored communication products were repeatedly identified as factors that supported the uptake of scientific outputs by policy actors.

In our interpretation, time and resources invested in monitoring policy and regulatory developments can help large research consortia identify emerging legislative opportunities, contribute timely science-based recommendations and reduce the risk that relevant project outputs are not aligned with the current and future policy landscape.

The feedback also suggests that communication across the science-policy interface requires dedicated effort and resources. Scientific outputs need to be translated into clear, non-technical and audience-specific messages, and in some national contexts also into national languages. Several responses showed that researchers sometimes found it difficult to identify which findings were most relevant to policy makers and how to communicate them in an actionable way. This underlines that communication and translation activities should be planned as integral parts of large environment and health projects, supported where needed by mutual learning between scientists and policy actors.

HBM4EU further established a rapid response mechanism for NHCPs and EU Policy Board members to send an urgent policy question to the HBM4EU consortium. A request related to copper was the first request addressed. DG SANTE submitted the request in October 2018 in connection with the renewal of approval of copper compounds as active substances in plant protection products (PPP). The question was whether available HBM data could help clarify absorption and excretion, whether PPP-related copper contributed more to body burden than other sources, and whether cumulative exposure assessment would add value for risk assessment. HBM4EU gathered 35 HBM data collections from 13 countries across Europe. The data were mostly aggregated blood copper results, with urinary data available in only part of the dataset, and the consortium also adapted a generic PBTK model to represent

copper's complex lifelong toxicokinetics and homeostasis. The process confirmed a functioning of the science – policy interface.

As further examples of this successful interface HBM4EU outputs supporting regulatory discussions to address bisphenols and PFAS as groups, rather than as single substances can be mentioned. HBM4EU generated human biomonitoring data that contributed to the European evidence base on exposure to chlorpyrifos and supported science-policy discussions relevant to the regulatory assessment of the substance. In January 2020, the European Commission decided not to renew the approval of chlorpyrifos in the EU under Regulation (EU) 2020/18. Subsequently, in 2021, the European Union submitted a proposal to list chlorpyrifos under the Stockholm Convention, and chlorpyrifos was listed in Annex A by Decision SC-12/9 in 2025. HBM data provided evidence relevant to the decision to ban chlorpyrifos under the Stockholm Convention in 2020, showing that children's exposures were too high (UNEP, 2023). While the environmental burden of disease from lead in Europe remains considerable (Plass et al., 2024), HBM could demonstrate that the decreasing time trend of blood lead levels is levelling off at around 10 µg/L (Lermen et al., 2021). Evidence from HBM time trends also indicated that legislative measures to reduce acrylamide in food (introduced in 2017) are associated with declining biomarker levels (Poteser et al., 2022). Mercury biomonitoring of pregnant women in five countries lead to the validation of dietary advice for fish consumption and inputs to the UN Minamata Convention on Mercury (Katsonouri et al., 2023). Finally, HBM data consistently revealed that children show higher biomarker concentrations than other age groups for several chemicals, including aprotic solvents, mycotoxins, pyrethroids, and chlorpyrifos, highlighting their vulnerability and the need for targeted protective measures (Govarts et al., 2023).

Another important lesson learned from HBM4EU was the consistent and systematic interaction throughout the duration of the initiative with policy makers at European and national level. The frequent interaction allowed for dynamic adjustments and firmly establishing the utility of the research for policy purposes, and it exemplified once more the importance of embedding interactive processes between science and policy at the beginning. Detailed lessons learned were reported based on a case study (Coertjens et al., 2022).

The survey feedback highlighted data generation, infrastructure development and governance as important for the longer-term use of HBM4EU outputs. The following point moves beyond the survey evidence and draws on related HBM4EU background literature to contextualise this feedback. In large environment and health consortia, sustainable use of data depends on governance arrangements that protect personal data while enabling scientific analysis and policy use. HBM4EU experience shows that GDPR-compliant data governance, harmonised data structures and interoperable approaches are important conditions for re-using HBM, environmental and health data beyond the project period (Govarts et al., 2022).

Investment in the development of governance frameworks within a project, stakeholder networks and early sustainability discussions was mentioned as important for the continued use of project outputs. It could be noted that addressing these aspects early in the project lifecycle, in close collaboration with policy makers, can support the longevity and applicability of the outputs.

Finally, the success of the science-policy interface depended on collaboration across the diverse work areas of HBM4EU. The input provided during the public consultation for the universal PFAS restriction proposal provides one example of such joint work, bringing together contributions on risk assessment, mixture assessment, aligned studies, aggregated and individual PFAS data, biomarkers of exposure and effect, and adverse outcome pathways. Overall, this shows that policy-relevant outputs required coordinated input across all three pillars and could not be developed effectively in retrospect only.

At the same time, these positive examples should be read together with the limitations reported in the survey results. The science-policy interface did not work equally smoothly across all project areas and

roles. Some respondents described policy questions as too broad or only partly answerable within the project timeframe, and others referred to insufficient or late interaction with policy makers or more limited involvement of CGLs who were not part of the Management Board. These findings suggest that the HBM4EU policy interface was valuable, but that its effectiveness depended on timely interaction, realistic and adaptable policy questions, and inclusive access to relevant information and decision-making processes.

4.1.1. The influence of the policy component on project work

The results demonstrate that the policy component shaped HBM4EU research from the planning phase onwards by helping to define policy-relevant questions and priorities. This illustrates how early and structured engagement with policy makers can orient research towards current regulatory and public health needs while maintaining a link to scientific work planning.

At the same time, the feedback points to the need for realistic expectation-setting at the start of science-policy initiatives. Policy questions need to be sufficiently specific and achievable within the project timeframe, and where broader questions are unavoidable, limitations should be communicated clearly while recognising the value that partial answers may have for later policy development. A clear and shared understanding between scientists and policy makers can therefore support realistic goal-setting. It helps clarify which questions can be answered within the available data, methods, resources and timeframe, and where partial answers should be communicated as such.

The CGL feedback also suggests that policy questions should not remain static throughout long projects. Regular opportunities to revisit and refine policy questions together with the EU Policy Board could help projects respond to emerging evidence, data limitations and changing policy priorities, especially for broad or rapidly evolving topics.

The comments on the longer-term sustainability of HBM4EU outputs further underline the importance of recognising the added value of HBM data for risk assessment and policy development. HBM data provide real-world evidence on internal exposure from multiple sources and can complement environmental monitoring, which usually measures chemicals in the external environment. Within HBM4EU, methodological aspects of using HBM in chemical risk assessment were elaborated in detail by [Santonen et al. \(2023a\)](#), although the inclusion of HBM studies at national or European level is not yet a legal requirement.

The survey feedback also pointed to the importance of translating HBM4EU outputs into policy-relevant products. The following examples are used as background context rather than as additional survey findings. HBM4EU generated substance-specific outputs, including exposure assessments and HBM guidance values, that illustrate how project results can support risk assessment, policy evaluation and regulatory discussion. Examples include work on cadmium, PFAS, chromates, mycotoxins, phthalates and aprotic solvents ([Alvito et al., 2022](#); [Gerofke et al., 2024](#); [Santonen et al., 2023b](#); [Snoj Tratnik et al., 2022](#); [Uhl et al., 2023](#)), as well as the overview of HBM guidance values derived under the initiative ([David et al., 2021](#); [Ghisi et al., 2019](#); [Lamkarkach et al., 2021](#); [Lange et al., 2021](#); [Mengelers et al., 2024](#)). An overview of the derived HBM-GVs is available in ([Apel et al., 2023](#)).

The project also emphasised tailored communication approaches ([Ganzleben et al., 2021](#)) when communicating to the policy makers. Numerous examples of various types of communication products such as policy briefs (see [HBM4EU, 2022](#)) are accessible for use on subsequent projects. WPLs stressed that the study findings needed to be converted into clear, comprehensible messages regarding policy debates.

4.1.2. The national perspective of the policy interface

The NHCP feedback shows that the national policy interface depended strongly on whether information on policy questions and policy context reached the National Hubs. Although most respondents considered the policy questions relevant to national needs, four NHCP responses also showed that this assessment was difficult where

documentation or direct policy contact was limited.

This points to the importance of comprehensive and regular communication between National Hubs and policy makers. Such communication is needed to understand national policy needs, clarify how European-level policy questions relate to national priorities and support more active national engagement with HBM outputs.

National Hubs can help link European and national structures, but their effectiveness depends on whether national actors see a clear value in engagement and whether resources and institutional support are available. They should therefore be supported not only as communication channels, but as structures with recognised responsibilities and sustained links to national policy actors.

4.2. The HBM4EU project steering

4.2.1. Distributing project responsibilities

The survey feedback suggest that the three-pillar structure helped distribute responsibility and provided a clear organisational framework for a large and complex project. A second tier of leadership supported strategic direction and reduced overreliance on the overall coordinator, while specialised oversight within thematic areas remained possible. At the same time, the results point to the need for deliberate mechanisms to prevent silo working. Regular interaction between pillar leaders, WPLs and other cross-cutting roles appears important to maintain a shared overview of progress, identify synergies and avoid parallel work streams becoming disconnected.

The differing experiences of CGLs further underline that roles outside formal decision-making bodies need structured access to information and engagement opportunities. Regular updates and defined opportunities for input could help ensure that all CGLs remain aligned with project governance, even where they are not members of the MB.

4.2.2. Reflecting on national needs by setting up national hubs

The survey responses indicate that National Hubs can play an important role in linking European project activities to national policy and stakeholder contexts, but that their effectiveness depends strongly on the national starting point. Existing HBM infrastructure, established stakeholder networks, available funding and political support appear to be key conditions for National Hubs to function effectively.

The differing experiences also suggest that National Hubs should not be treated only as communication channels. They require recognised responsibilities, sufficient resources and sustained institutional support if they are expected to mobilise national actors, maintain policy engagement and contribute to the uptake of HBM outputs.

The feedback further underlines that structured and continuous communication is central to the National Hub function. Regular reporting, workshops, newsletters and tailored national materials can support engagement, but the responses also show that these approaches may not be sufficient where policy makers are difficult to reach or where the added value of HBM is not yet recognised.

For future multinational environment and health projects, these findings point to the importance of assessing national capacities early, supporting less established national structures and planning dedicated resources for national engagement. The materials developed by HBM4EU for aligning studies ([Pack et al., 2023](#)) appear to provide a useful basis for such work, but their practical effect depends on the institutional and policy context in which they are used.

4.2.3. Staff engagement and continuity

The survey findings indicate that continuity among key task leaders was an important stabilising factor for HBM4EU, helping to maintain institutional memory, project momentum and completion of essential tasks. At the same time, personnel changes are difficult to avoid in long-running projects. This underlines the need for structured onboarding, clear documentation and knowledge transfer so that new staff can integrate without major disruption. The comments on partner

engagement suggest that tasks close to the science-to-policy interface benefit from both technical competence and willingness to engage with policy-oriented work, while capacity building remains an important project objective.

4.2.4. Handling financial aspects

The feedback related to finances indicates that large EU co-funded projects require clear financial control while retaining enough flexibility to respond to practical implementation needs. In HBM4EU, the co-funding model and tight planning supported delivery within the available budget, but rigid procedures were challenging where activities involved cross-border sample analysis, external laboratories or changing task requirements. For future projects, financial rules and contract-level expectations should therefore be clarified early and communicated consistently. Experienced financial management staff can help partners interpret EU funding requirements, apply procedures correctly and identify bottlenecks before they affect implementation. Overall, financial flexibility seems important for projects of this scale, but only when balanced with clear accountability.

5. Recommendations

Based on the experience of HBM4EU and the survey feedback, future large, multi-partner environment and health projects should give particular attention to the following areas when establishing a science-policy interface. The following recommendations summarise the practical and policy-relevant implications derived from the survey feedback and the discussion above. They are presented separately to keep the Discussion focused on interpretation of the findings.

- **Strengthen the science-policy interface from the outset.**

Policy makers should be involved early enough to help define policy questions that are clear, specific and feasible within the project scope. At the same time, long-running projects need opportunities to revisit these questions during implementation, so that they can be adjusted where evidence gaps, data limitations or changing policy priorities become apparent. Trust, regular interaction and clear communication channels between policy actors and project contributors should therefore be maintained throughout the project period.

- **Improve communication and translation of scientific results.**

Scientific findings should be translated into accessible, non-technical and audience-specific messages that can be used in policy discussions. This includes practical communication products such as information on laboratory networks, HBM reference values, HBM guidance values and other clear end-products. Where national uptake is important, materials may also need to be provided in national languages. Dedicated resources and training can help scientists communicate findings more effectively and support policy makers in interpreting and using project outputs correctly.

- **Establish clear and integrated governance.**

Future projects should define roles, responsibilities and decision-making processes transparently from the start. A shared vision, regular coordination between leadership levels and continuous interaction across WPs, pillars and cross-cutting roles are needed to maintain coherence and reduce the risk of silo working. Roles that are not fully represented in formal decision-making bodies, such as CGLs, should still receive timely information and structured opportunities to contribute.

- **Support National Hubs and sustained national engagement.**

National Hubs can help connect European project activities with

national policy and stakeholder contexts, but they require recognised responsibilities, access to relevant information, sufficient resources and stable links to national policy actors. Future projects should account for differences between countries in existing infrastructure, stakeholder cooperation, funding and political support, and should provide targeted support where national structures are still developing.

- **Plan for continuity, skills and resource flexibility.**

The continuity of key task leaders should be supported through early commitment, clear documentation, structured onboarding and knowledge transfer when personnel changes occur. Tasks should be assigned to partners with suitable expertise and, where relevant, experience in policy-oriented work, while still allowing for capacity building. Financial and administrative procedures should be transparent, proportionate and consistently communicated. Experienced financial management staff can support partners in applying EU funding rules, and transparent mechanisms should allow resources to be reallocated when project needs change, without weakening accountability or fairness across the consortium.

5.1. Limitations

Several limitations should be kept in mind when interpreting the findings of this study. First, the analysis is based on survey responses from selected key partners involved in HBM4EU. It therefore reflects the experiences and views of those who chose to participate rather than the full range of perspectives across the project. A degree of non-response bias cannot be ruled out, particularly because some respondent groups and chemical groups were less well represented. This was the case, for example, for several CGLs and for chemical groups from which no response was received. A formal non-response bias analysis comparing responders and non-responders by country, institution type or level of project involvement was not conducted, as comparable information was not available for all non-respondents. The views presented may therefore over-represent partners who remained more actively engaged with HBM4EU until or after the end of the project.

The comparatively lower response rate among CGLs may partly reflect the nature of this role. In contrast to WPLs and NHCPs, CGLs were often involved in substance-specific tasks that varied in intensity over the project period and may not always have been closely connected to the overall project governance. In addition, the survey was conducted after the formal end of HBM4EU, which may have reduced availability or motivation to respond, particularly among experts whose main project tasks had already been completed. The CGL responses should therefore be interpreted as reflecting the views of responding CGLs rather than the full group of CGLs.

Those who were more closely involved in HBM4EU, or who had particularly positive or negative experiences, may also have been more inclined to provide detailed feedback. In addition, all respondents had themselves participated in the project. Their answers may therefore have been influenced by professional or social desirability, leading them to place greater emphasis on successful cooperation, constructive lessons and project achievements. Participants who did not respond might have presented a different, and potentially less positive, view, especially where they had been less engaged, lacked the resources to complete the survey or had encountered more substantial difficulties in the collaboration. Nevertheless, the responses did not provide an exclusively positive account. They also included critical observations, differences between national experiences and practical challenges, such as limited access to policy makers in some countries and difficulties in coordinating policy questions. These reflections helped to provide a more balanced picture.

A further limitation relates to the exploratory character of the analysis. The survey responses were reviewed and synthesised to identify common themes, but the work was not designed as a formal

qualitative study. The findings should therefore be regarded as a structured reflection on experiences gained during the project rather than as a representative qualitative evaluation.

When applying the lessons beyond HBM4EU, it should be considered that their relevance may be more limited for projects that differ substantially in size, funding arrangements, governance or level of policy involvement. HBM4EU was a large, EU co-funded initiative with dedicated WPs, national hubs and formal policy bodies. Lessons drawn from this setting may not transfer directly to smaller research projects, projects without established policy structures or initiatives with fewer resources for coordination and communication.

The findings must also be considered in light of the considerable differences in expertise and institutional maturity between participating countries. Some countries entered HBM4EU with established HBM programmes, experienced national networks and regular contact with policy makers. Others were still developing these structures or had relatively little national experience in HBM. Countries with existing programmes and strong stakeholder networks could build on structures that were already in place. By contrast, countries with less experience, limited funding or weaker political support often faced greater difficulties in establishing effective national hubs and engaging policy makers. These differences shaped the feedback received and mean that individual observations cannot necessarily be applied to all participating countries.

Finally, both the survey and the manuscript were prepared after HBM4EU had ended, rather than during its active implementation. This timing may have encouraged respondents to reflect more openly, as their comments could no longer directly affect ongoing working relationships. At the same time, the time elapsed since the project may have influenced which experiences respondents remembered and considered most important. In particular, they may have placed greater emphasis on outcomes and structures that remained visible after the project had been completed.

6. Conclusion

The present article is based on an evaluation of HBM4EU, which included three surveys among project partners. The feedback gathered highlights key messages for establishing an effective science-policy interface, illustrating how such an interface can shape research projects and influence national perspectives. Valuable insights are also provided for steering large-scale initiatives, particularly regarding the distribution of responsibilities, the role of national hubs, staff continuity, and financial management.

The partners of HBM4EU provided critical insights that strengthen the science-policy interface, offering a solid foundation for future research initiatives. Some of the key learning points include the importance of investing time in building trust with policy makers; adopting strategies for effective and flexible communication; tailoring outputs to different stakeholder needs; and involving policy stakeholders from the very beginning to the final stage of projects. By embedding these elements, future projects can better align their research with policy objectives, enabling informed decision-making across all levels of governance. Embracing these key messages will enable future initiatives to tackle the evolving policy demands, ensuring that science and policy coordination is further strengthened and delivers more effective environmental and public health policies across Europe.

On national level, the survey feedback suggests that HBM4EU supported the development or strengthening of HBM national networks in several countries and contributed to raising awareness of environmental health. We conclude that such national effects depend greatly on existing infrastructure, stakeholder cooperation, funding availability and political support.

For project steering, we interpret the survey feedback as showing the value of a clear multi-pillar structure, distributed responsibility, continuity among key staff, appropriate matching of expertise to tasks and

financial flexibility within accountable procedures. It has been recognised in five replies to the surveys that the continuous work of the coordination team helped to overcome problematic situations and, simultaneously, ensure successful project outcomes.

Acknowledgement

The work has been funded by the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection and the German Environment Agency in its role as coordinator of HBM4EU as project number FKZ 3720612020, parts of the grant not related to this specific survey are considered as subcontract within HBM4EU. HBM4EU has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 733032.

CRediT authorship contribution statement

Alexandra Polcher: Writing – original draft. **Maren Gadermann:** Writing – original draft. **Greet Schoeters:** Writing – review & editing. **Argelia Castaño:** Writing – review & editing. **Catherine Ganzleben:** Writing – review & editing. **Joana Lobo Vicente:** Writing – review & editing. **Roser Gasol:** Writing – review & editing. **Marta Esteban-López:** Writing – review & editing. **Jean-Philippe Antignac:** Writing – review & editing. **Robert Barouki:** Writing – review & editing. **Hanna Tolonen:** Writing – review & editing. **Ovnair Sepai:** Writing – review & editing. **Mariana F. Fernandez:** Writing – review & editing. **Lisa Melymuk:** Writing – review & editing. **Normunds Kadikis:** Writing – review & editing. **Paula Alvito:** Writing – review & editing. **Maria João Silva:** Writing – review & editing. **Andromachi Katsonouri:** Writing – review & editing. **Susana Viegas:** Writing – review & editing. **Helle Raun Andersen:** Writing – review & editing. **Beatrice Bocca:** Writing – review & editing. **Flavia Ruggieri:** Writing – review & editing. **Maria Uhl:** Writing – review & editing. **Christina Hartmann:** Writing – review & editing. **Lijana Kononenko:** Writing – review & editing. **Dragan Gjorgjev:** Writing – review & editing. **Mirjana Dimovska:** Writing – review & editing. **Siiri Latvala:** Writing – review & editing. **Karin Norström:** Writing – review & editing. **Rita Cavaleiro:** Writing – review & editing. **Thorhallur Ingi Halldorsson:** Writing – review & editing. **Cathrine Thomsen:** Writing – review & editing. **Maja Mampaey:** Writing – review & editing. **An Van Nieuwenhuysse:** Writing – review & editing. **Tamás Szigeti:** Writing – review & editing. **Nicole Probst Hensch:** Writing – review & editing. **Medea Imboden:** Writing – review & editing. **Tamar Berman:** Writing – review & editing. **Philipp Weise:** Writing – review & editing. **Kim Pack:** Writing – review & editing. **Rosa Lange:** Writing – review & editing. **Lena Reiber:** Writing – review & editing. **Nicole Kobosil:** Writing – review & editing. **Petra Apel:** Writing – review & editing. **Madlen David:** Writing – review & editing. **Marika Kolossa-Gehring:** Writing – review & editing.

Competing interests

No competing interests were disclosed.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijheh.2026.114907>.

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