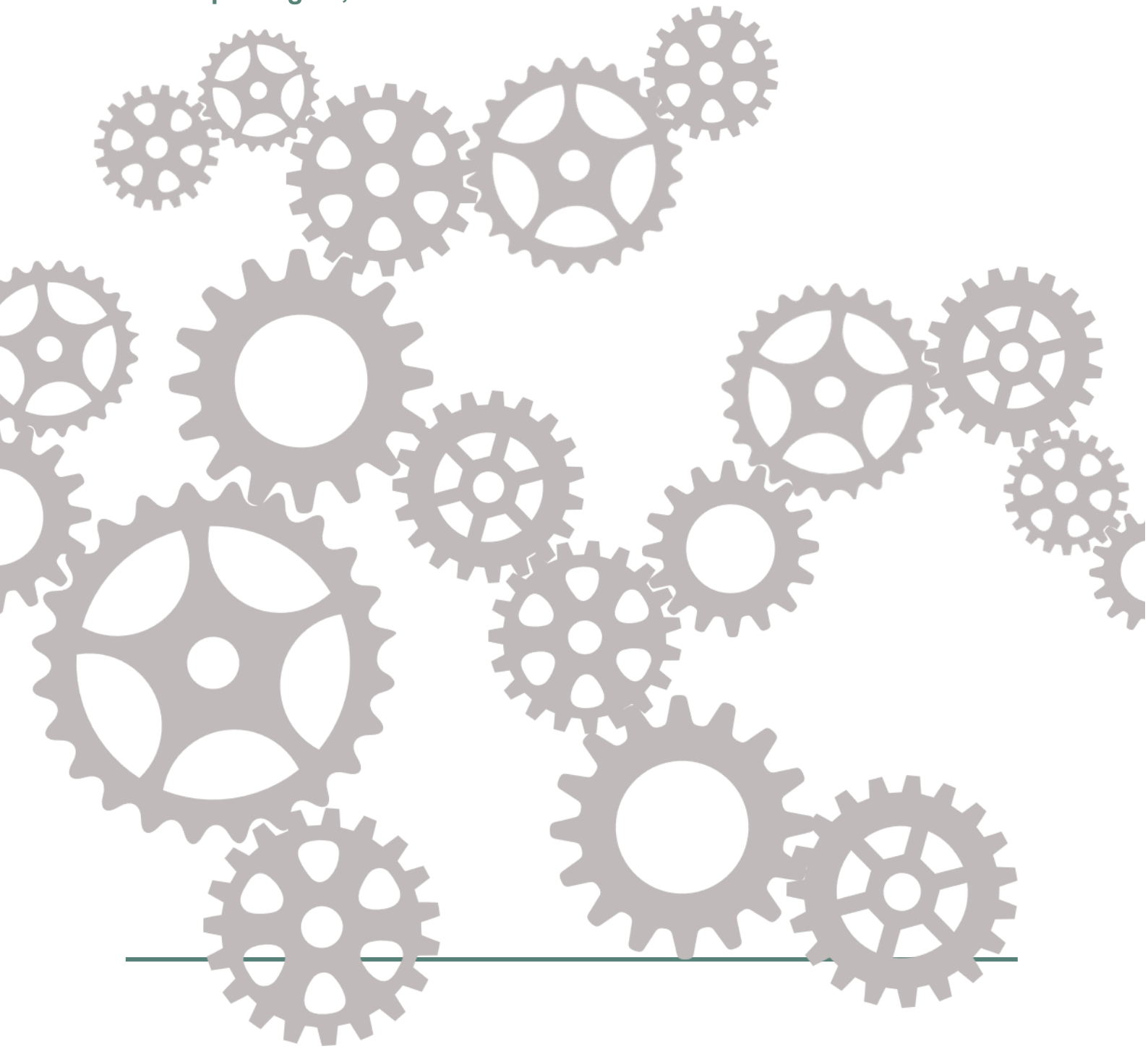
EEAB & SRG Recommendations

Project KNOWING

Work package 6, Deliverable D6.3



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Legal Disclaimer

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List of Acronyms

CIC	Climate Interaction Context
D	Deliverable
EEAB	External Expert Advisory Board
KER	Key Exploitable Result
IPCC	Intergovernmental Panel on Climate Change
SD	System Dynamics
SRG	Stakeholder Reference Group
T	Task
WP	Work Package

Glossary

Adaptation	The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects (IPCC, 2014). This can be specific for climate change (United Nations Framework Convention on Climate Change, UNFCCC), but also apply for other challenges such as soil erosion, migration and structural economic changes. Adaptation can occur in autonomous fashion, for example through market changes, or as a result of intentional adaptation policies and plans at International, National or local scale (UNISDR, 2009).
Adaptation measures	Adaptation measures are technologies, processes, and activities directed at enhancing our capacity to adapt (building adaptive capacity) and at minimizing, adjusting to and taking advantage of the consequences of climatic change (delivering adaptation) (Climate–ADAPT). Can be separated in: Hard and source-oriented measures, Hard and receptor-oriented measures and Soft measures (Glossary of the Clarity Proposal). In the context of EU-GL, the term generally refers to the Actions reducing vulnerability to climate change

	and climate variability by preventing negative effects or by enhancing resilience to climate change (ClimWatAdapt, 2012) (EU-GL, 2011).
Climate impacts	The consequences of realized risks on natural and human systems, where risks result from the interactions of climate-related hazards (including extreme weather and climate events), exposure, and vulnerability. Impacts generally refer to effects on lives; livelihoods; health and well-being; ecosystems and species; economic, social and cultural assets; services (including ecosystem services); and infrastructure (based on IPCC, 2018)
Climate Impact Contexts (CIC)	Within KNOWING three CICs (Heat & Health, Soil fertility & Agriculture, Flooding & Infrastructure) are investigated, representing emerging risks for the Demonstrators due to climate change.
Climate Mitigation Pathways	Timeline (or Pathways) that depict the timing of mitigation and possible adaptation measures, with respect to specific climate impacts, that need to be implemented to reach climate neutrality by a certain point in time (e.g. 2050).
Domain Model (DM)	A detailed computational model of a domain that covers its relevant structure and interfaces with other domains. A Domain Model incorporates both behaviour and data. In KNOWING, the used Domain Models can be classified into three main groups: Sector models, Climate models and climate Impact assessment models. The term "Domain" refers to a specific discipline or field. This is more generic than using the term "Sector" which is sometimes used as a synonym for "Domain" in the literature. In this Deliverable, however, the term "Sector" is only used for the main economic sectors relevant in the KNOWING context (e.g., Energy, Transport, and Land Use & Agriculture).
Impact	The probable spatial/temporal damage distribution according to a predefined scale of damage expected on the element at risk under consideration. The impact scenario therefore represents the probabilistic distribution, in a given geographical area, of the damage caused by a single hazardous event with an assigned probability of occurrence (assumed as the reference hazard scenario) (Zuccaro et al. 2018). The impact can be measured in several ways: physical, economic, social, functional etc. and it can be evaluated as direct and/or indirect consequence of the event at a given time (snapshot) or projected in the future. In literature impact is defined as "consequences of a hazardous event, on natural and human systems, once it materializes, i.e. actually affects a societal system. The term impacts is used primarily to refer to the effects on natural and human systems of extreme weather and climate events and of climate change. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. The impacts of climate change on geophysical systems, including floods, droughts, and sea level rise, are a subset of impacts called physical impacts (IPCC, 2014).
Measures Inventory	Comprehensive list of mitigation and adaptation measures, as well as their response risks and opportunities compiled within WP1 (see D1.1 and D1.2).
Mitigation	In the context of climate change, and in this document, the term is used to indicate "a human intervention to reduce the sources or enhance the sinks of greenhouse gases (GHGs)" (IPCC, 2014), that are the source of climate change. It is also used to indicate the lessening or minimizing of the adverse impacts of a hazardous event (UNISDR, 2017), through actions that reduce hazard, exposure, and vulnerability (IPCC, 2014). However, this is not the meaning that is used in this document. Annotation: The adverse impacts of hazards, especially natural hazards, cannot be completely prevented, but their scale or severity can be substantially reduced by various strategies and actions. Mitigation measures include engineering techniques as well as improved environmental and social policies and public awareness.
Mitigation Measures	In climate policy, mitigation measures are technologies, processes or practices that contribute to mitigation, for example renewable energy technologies, waste minimisation processes and public transport commuting practices (IPCC, AR6).
Response opportunities	Potential for positive side-effects of responses. This can be on the sector associated with the response, or in other sectors, or on other societal objectives, such as the Sustainable Development Goals (SDGs) (IPCC, AR6).

Response (in climate adaptation and mitigation)	Actions or behaviours (including inaction) by individuals, groups, organisations, companies, institutions or governments related to climate adaptation and mitigation. This includes actions meant directly to reduce the impacts of climate change and or emissions (see 'adaptation measures' and 'mitigation measures') as well as actions or behaviours to reduce/capitalize on the intended and unintended consequences of such actions (see 'response risks').
Response risk	Potential for trade-offs or negative side-effects from responses. This can be on the sector associated with the response, or in other sectors, or on other societal objectives, such as the Sustainable Development Goals (SDGs) (IPCC, AR6). Note: response risks may occur in the same sector or in other sectors.
Strategies	Sets of measures, of either mitigation or adaptation. Strategies are commonly generated in advanced (climate-related) planning, at national, regional or local level.

Executive summary

KNOWING activities are supported by two external bodies:

1) the **External Expert Advisory Board (EEAB)** is composed of experts from a range of scientific backgrounds, including for example climate sciences, social sciences and humanities. The disciplines represented by the EEAB Members shall complement the scientific competences and expertise of the scientific and technical partners of the KNOWING Consortium. The EEAB supports the scientific and technical development of the project and shall provide advice, feedback to project results as well as strategic guidance to ensure scientific completeness, integrity, soundness of applied methods and transparency at specific points throughout the duration of the project.

2) The **Stakeholder Reference Group (SRG)** assembles representatives selected from a larger pool of stakeholder representatives from the Demonstrator and Follower Regions as well as representatives of relevant stakeholder representatives involved during the strategic outreach activities. Throughout the duration of the project the SRG shall provide advice, feedback to project results as well as active engagement in the co-creation process of tools and practical guidance for the widespread implementation of Climate Mitigation Pathways.

After the first period, a substantial step to implement and work with the boards has been done. Therefore, this Deliverable contains the description of:

- the appointed members, their roles and expertise
- the description of the first interactive workshops to present KNOWING as well as the measures of climate mitigation and climate adaptation compiled within WP1
- the boards' recommendations and feedback on the presented content and their integration within KNOWING

As an update at the end of the second reporting period, this Deliverable summarizes the EEAB consultation within WP2 for task T2.2 (Sector model coupling to quantitative SD model) and how the received feedback is considered in the further development of the KNOWING Modelling Framework.

1 KNOWING summary

Climate change has been globally recognised as an existential threat requiring urgent action to avoid catastrophic consequences. Hence, the EU's Green Deal has been proposed "to make Europe the first climate neutral continent in the world". This includes not only the elimination of net emissions of greenhouse gases by 2050; this is to be achieved while decoupling economic growth from resource use and striving for a fair implementation, leaving no person and no place behind. This ambitious goal is additionally challenged by the need to adapt to unavoidable impacts.

According to the EU's Climate Adaptation Strategy (COM(2021) 82), "improving knowledge and managing uncertainty" is key for realising the vision of a climate neutral and climate-resilient Union, as "Climate change is having such a pervasive impact that our response to it must be systemic". Thus, there is an **urgent need for an integrated approach for enhanced understanding of the interaction, complementarity and trade-offs** between adaptation and mitigation measures, especially regarding the expected increase in regional mean temperature, changing precipitation pattern and soil moisture (IPCC AR6 WG I). Furthermore, this **understanding and knowledge needs to be provided to a broad audience to support local authorities** in EU countries for developing regional programmes.

KNOWING aims to develop a **modelling framework to help understand and quantify the interactions** between impacts and risks of climate change, mitigation pathways and adaptation strategies. The framework will be used to assess the **interrelations between public and private adaptation and mitigation strategies** in order to **identify mitigation pathways along optimised combinations of interventions** in different sectors (e.g. energy, mobility, land use, construction, agriculture). The framework will focus on **three main Climate Impact Contexts** (CICs): (1) Heat waves & health, (2) Soil fertility & agriculture, and (3) Flooding & infrastructure (including river and coastal flooding). It be applied **in four Demonstrator and five Follower Regions by involving authorities, stakeholders and citizens** to develop **enhanced activation and empowerment services, providing target-group-specific awareness, education and decision support tools** to improve the comprehensibility of complex interrelations and support strategic planning of combined adaptation and mitigation measures.

To achieve this goal, KNOWING will produce the following **key exploitable results (KERs)**:

KER1	an **Impact Interaction Knowledge Base** comprising causal relations of climate and intervention impacts, rebound effects, coping strategies, etc. to inform Climate-ADAPT and IPCC Working Groups I, II & III
KER2	an **Impact Interaction Model Framework** consisting of a system dynamics model, climate and sector models for integrated assessment of impacts (direct and indirect) of climate change and countermeasures
KER3	a Typology of transferable **Climate Mitigation Pathways** including optimised bundles of adaptation and mitigation measures for different typical Climate Impact Contexts (heat waves, soil fertility, flooding)
KER4	**Climate Activation and Empowerment Services** addressing different target groups (citizens, businesses, authorities) to enhance climate literacy, provide playful trainings and support decision making

These results, developed with the support of an External Expert Advisory Board (EEAB) and a Stakeholder Reference Group (SRG), will **accelerate the transition to a climate-neutral and resilient society and economy** enabled through advanced climate science, mitigation and adaptation pathways and behavioural transformations.

This Deliverable is part of WP6 [Project Management] and represents the EEAB & SRG Recommendations, coordinated under task T6.1 and updated at the end of every reporting period.

2 Object of the Deliverable

This Deliverable, as part of WP6 (Project Management), coordinated under task T6.1 refers to the establishment of the External Expert Advisory Board (EEAB) and Stakeholder Reference Group (SRG) (MS15/MS16) as the main milestones in WP6, after having defined the Terms of Reference for these boards (see D.6.2). This report summarises the process of setting up the boards, the first interactive workshops, the recommendations and the feedback provided by both advisory bodies during the first and second Reporting Period. It will be further updated at the end of each Reporting Period.

According to the Grant Agreement, Task 6.1 (Overall Coordination and Organisation of Meetings) includes, in addition to the Project Manual (D6.1) and the EEAB & SRG Terms of Reference (D6.2) the EEAB & SRG Recommendations (D.6.3), updated every Reporting Period.

D6.3 presents the members, the content and set-up of the workshops, as well as the recommendations and feedback provided by:

- the EEAB: a group of scientific advisors who are chosen according to their expertise and to ensure that the methods applied within KNOWING are scientifically sound
- the SRG: represents high-level representatives from different (political) institutions that are highly involved in the implementation of adaptation and mitigation measures

Recommendations and feedback relate to:

- D1.2 (CIC-related Measures Inventory), a report comprising the categorised demonstrator specific adaptation/mitigation measures and interactions (as depicted in this deliverable).
- Key Exploitable Results (KER) that will additionally be reviewed by members of the EEAB or SRG (over the next months)
- D2.1 - Qualitative interrelations between sectors (qualification and evaluation by the EEAB) relevant for KNOWING mitigation pathways
- D2.2 - Quantitative SD sub-models, supporting the process of mapping the relevance of the proposed “flows” and “influences” by means of KNOWING domain models, and recognising missing quantitative parameters and/or highlighting significant uncertainties that may require further analysis to improve the robustness of the model and the reliability/usability of the results for decision-makers. (Note: This feedback has been collected during the second reporting period.)

3 Introduction

As described in D6.2 “EEAB & SRG Terms of References” KNOWING is supported by two external boards to support and ensure (i) the scientific quality of the methodologies applied (EEAB) and (ii) the awareness and consideration of implementation barriers and opportunities (SRG) of the resulting mitigation pathways. To ensure the above-mentioned goals, the boards need to fulfill the following description:

3) the **External Expert Advisory Board (EEAB)** is composed of experts from a range of scientific backgrounds, including for example climate sciences, social sciences and humanities. The disciplines represented by the EEAB Members shall complement the scientific competences and expertise of the scientific and technical partners of the KNOWING Consortium. The EEAB supports the scientific and technical development of the project and shall provide advice, feedback to project results as well as strategic guidance to ensure scientific completeness, integrity, soundness of applied methods and transparency at specific points throughout the duration of the project.

4) The **Stakeholder Reference Group (SRG)** assembles representatives selected from a larger pool of stakeholder representatives from the Demonstrator and Follower Regions as well as representatives of relevant stakeholder representatives involved during the strategic outreach activities. Throughout the duration of the project the SRG shall provide advice, feedback to project results as well as active engagement in the co-creation process of tools and practical guidance for the widespread implementation of Climate Mitigation Pathways.

Within the presented document, the members of the boards, their roles and expertise, as well as the reasons for appointing them to KNOWING, are depicted. Further, the content and approach of the first workshop to gather their feedback on the measures inventory list compiled within WP1 with respect to climate mitigation and adaptation is presented. After the workshop, the boards’ feedback and recommendations on the presented content was gathered and integrated within WP1 (refer also to sections 6.1 and 6.2) 6.2.2.

As an update at the end of the second reporting period, this Deliverable summarizes the EEAB consultation within WP2 for task T2.2 (Sector model coupling to quantitative SD model) and how the received feedback is considered in the further development of the KNOWING Modelling Framework (refer to section 6.3).

4 EEAB - Roles and Representatives

4.1 EEAB Members

To complement the scientific competences and expertise of the scientific and technical partners of the KNOWING Consortium, a larger pool of EEAB members was recruited composed of experts from a range of scientific backgrounds, including for example climate sciences, social sciences and humanities. These experts help to shed light on sectoral priorities from a practical perspective in relation to various discussed mitigation and adaptation measures and represent the following areas of expertise: Agriculture, Forestry and Fishing, Energy, Housing and Construction, Information and Communication, Land Use, Public Health, Transport, Water supply and Sewerage, Economic System, Manufacturing and Social Sciences.

After successful screening of EEAB members according to areas of expertise, they were invited to support the scientific and technical development of the project by providing expert feedback and input into the material produced by the project so far. In their respective roles, they enrich the ongoing activities to understand the climate-related risks faced by the different sectors, the adaptation and mitigation measures that are or can be taken by the different sectors, and the (inter-sectoral) risks and opportunities associated with these measures.

The Members of the External Expert Advisory Board are (in alphabetical order):

- **Carles Ibanez**, Senior Researcher and Head of Department of Climate Change at Eurecat - Technology Centre of Catalonia, brings to the EEAB his research experience in the field of aquatic ecology and sustainable management of water resources. He has been expert reviewer of the Fifth IPCC Report on Climate Change 2013: Impacts, Adaptation and Vulnerability (Working Group II).
- **Delphine Deryng** represents the European Centre for Medium-Range Weather Forecasts (ECMWF) and contributes extensive knowledge in the areas of climate change adaptation and mitigation, food and nutrition security and global agro-ecosystem modelling, as well as experience in scientific capacity building and stakeholder engagement. She was lead author of the Sixth Assessment Report of IPCC Working Group II, Chapter 5: "Food, fibre and other ecosystem products".
- **Elisabeth Frankus**, as a senior researcher at the Institute for Advanced Studies (IHS) in the research group “Science, Technology and Social Transformation” contributes her sociological expertise to the EEAB. In her work she is focusing on the topics of RRI, Artificial Intelligence, Virtual Reality, participatory methods and ethics.
- **Eric Koomen**, associate professor at the Department of Spatial Economics of Vrije Universiteit Amsterdam in the Netherlands, focusses on land-use change analysis, spatial modelling and policy support. In addition to his teaching activities he coordinates the 'Urban Environment Lab' at Amsterdam University College and enriches the EEAB with his perspective on physical geography and spatial economics.
- **Federico Riva** is a conservation biologist interested in biodiversity conservation and spatial analyses. His current projects as Post-Doctoral Fellow at the Carleton Department of Biology lie at the interface of landscape ecology, macroecology, conservation biogeography, remote sensing and ecological theory. he strives to enhance biological understanding to recommend effective conservation practices.

- **Hasse Goosen**, Director of Climate Adaptation Services, focuses his attention on the importance of knowledge transfer in the field of climate change and the question of how existing knowledge gets into people's heads. With the aim of better communicating the urgency of climate change and the need for adaptation, he founded CAS, where climate data is translated into tools that decision-makers can use.

- **Henry Neufeldt** is a Senior Researcher at UN Environment Programme and works primarily on transparency and leads the adaptation component of the Initiative for Climate Action Transparency (ICAT) and the development of the UN Environment Adaptation Gap Reports. The EEAB benefits from the IPCC AR6 WGII Lead Author's many years of experience in natural resource management, soil and water salinisation, agricultural development and climate change adaptation and mitigation.

- **Jeffrey Raven** is a specialist in sustainable und climate resilient urban planning and design and as director of the New York Institute of Technology shaped the Program in Urban and Regional Design. His professional practice focuses on US and international design projects and knowledge transfer as well as on the traditional influence and capabilities of architect-urbanists by bridging climate science, policy and design practice.

- **Josef Baumüller**, staff member at the Vienna University of Technology and lecturer at numerous other Austrian universities and universities of applied sciences, deals with business management issues in connection with sustainability, in particular with the integration of sustainability into corporate accounting. As an EEAB member, he wears the lens of sustainable finance.

- **Katharina van Bronswijk** is a psychological psychotherapist in behavioural therapy with her own practice in Germany. She is an active member of Psychologists/Psychotherapists for Future and has published widely on topics including the psychology of the climate crisis, barriers and opportunities for action, climate change and mental health in Germany. She also focuses on how the climate crisis can be communicated to children and young people.

- **Maria Pregnolato**, Associate Professor in Flood Risk Management and Resilient Delta Infrastructure at TU Delft, focuses on infrastructure resilience and risk management from natural hazards, in particular the impact of flooding to road networks, bridges and buildings. She is also researching the role of sensing and digitalisation within infrastructural assets exposed to flooding and natural hazards.

- **Reimund Schwarze** is Professor of Environmental Economics at the European University Viadrina, Frankfurt/Oder, and Head of the Climate Change and Extreme Events Research Group at the Helmholtz Centre for Environmental Research in Leipzig. Additionally, he is a member of the board of the German Committee for Disaster Reduction and scientific advisor to the UNDRR. He specialises in the fields of European and international climate policy, economic aspects of climate adaptation, management of natural hazards and environmental liability and insurance.

- **Ruperta Lichtenecker** is head of the Austrian Competence Centre for Climate and Health. As an economist, researcher and manager, she has many years of experience in the fields of science, administration, business and politics. She brings the following research interests to the EEAB: climate-neutral healthcare, climate change adaptation and resilience in the healthcare sector, public health and financing the healthcare system.

- **Sibel Eker** is a research scholar in the Sustainable Service Systems Research Group of the IIASA Energy, Climate and Environment Program and enriches the EEAB with her interdisciplinary research profile. This is characterized by the combination of systems analysis and engineering, decision sciences and social sciences. Her work brings a systems thinking and uncertainty focus to climate change and sustainability problems with model-based approaches.

- **Stefania Manca** is Director of Research at the Institute of Educational Technology of the National Research Council of Italy and worked on social media use in education and

communication for more than 10 years. Additionally, she is the Technical Coordinator of the Partnership on Adaptation to Climate Change of the EU Urban Agenda and brings her practical perspective of managing several European projects in the Genoa Municipality to the EEAB.

- **Ursula McKnight**, contributes as Senior Researcher at the Swedish Meteorological and Hydrological Institute her research background as an aquatic ecohydrologist based on contaminant hydrogeology and water resources engineering. With more than 15 years of experience in transdisciplinary research, she enriches the EEAB in her role as Scientific Director in the field of nature-based solutions.

5 SRG - Roles and Representatives

5.1 SRG Members

In order to fulfil the Stakeholder Reference Group's purpose of qualitatively assessing climate adaptation and mitigation measures in a co-creative workshop format, the careful selection of individual members was a high priority. The role of the members is characterised by the fact that they act on behalf of various interest groups both nationally and, where appropriate, locally. They represent various sectors at different levels (private sector, administrative level, NGOs, etc.), ranging from Transport, Energy Market, Public Health, Land Use, Housing, Agriculture, Economy, Tourism, Industry, Infrastructure, Trade and Insurance to EU governance. The current roles of experts were chosen to complement the local stakeholders engaged within the demonstrator regions.

After an initial screening of stakeholders by sector, the organisations and stakeholders considered most relevant were contacted directly by email and asked to participate on a voluntary basis. If no direct contact persons were known, it was requested that a candidate representing the organisation be nominated to participate in the high-level Stakeholder Reference Group and provide their respected feedback and expert opinion regarding the results developed in the project.

The current SRG members have all committed to provide advice and feedback throughout the project duration and actively engage in the process of co-creating tools and practical guidance for the widespread implementation of Climate Mitigation Pathways (see SRG Terms of Reference and signed Cooperation and Non-Disclosure Agreement). Their profound understanding of the specific needs, constraints and opportunities in implementing mitigation and adaptation measures from a sectoral perspective is of utmost value to the KNOWING consortium in pursuing the ambitious goal of supporting regions in their transformation towards a resilient and climate-neutral future.

In return, SRG members have the opportunity to engage with other high-level stakeholders and be recognised through project-related publications (e.g. Deliverables published on the KNOWING website) that include their contribution. For European DGs, depending on the position, it was not always possible to sign the NDA.

The members of the Stakeholder Reference Groupare (in alphabetical order):

- **Chiara D'Adamo**, Energy Engineer and Climate Analyst, represents (at the time of the first SRG workshop) the IEA (International Energy Agency), and therefore contributes her expertise on climate impact assessment and strengthening the resilience of global and regional energy systems.
- **Francesc Cots**, representing eco-union as a Senior Researcher and Project Manager, is a lawyer in the United States and Spain with a background in Environmental Sciences and

Technologies. As an SRG member he contributes his more than 20 years of experience in the fields of sustainability, climate change and energy transition.

- **Ivan Ivanov**, who represents EFFAT (European Federation of Food, Agriculture, and Tourism Trade Unions) acts as Political Secretary in the agriculture sector. He also is lead auditor and trainer with expertise in food and feeds quality management systems.
- **Jan Schmitz** is Policy Coordinator for the Trade Relations with the United States at the European Commission. He brings his economics perspective to the SRG and has published on topics including societal trust and economic growth and human capital cycles as a consequence of business cycles.
- **Kent Hakull**, Head of the Spatial Planning Division in the Norwegian municipality of Haugesund and member of the Executive Committee of the European Council of Spatial Planners (ECTP-CEU), contributes his interdisciplinary research background on topics ranging from international development to land use and community planning at both local and international levels.
- **Marija Jevtic**, as President of the EUPHA (The European Public Health Association) section on Environment and Health advocates for environmental health protection as well as for the Global Paris Climate Agreement, SDG's and the EU Green Deal as guiding principles and policy pathways for all experts and society at large.
- **Marco Mari**, former president at Green Building Council Italia, is a professor at the University of Bologna, where he specialises in sustainability and climate-friendly building design. He brings his experience from GBC Italia and many other national and international organisations to the SRG.
- **Mathilde Mousson**, as Policy Officer at DG RTD (Research & Innovation), Climate & Planetary boundaries Unit, contributes her expertise in the fields of earth system modelling, artificial intelligence, communication and knowledge transfer in climate science. She also qualifies for the SRG through her support of the EU contribution to the IPCC process and dissemination of IPCC outputs within the EC.

The SRG members are a pool of experts that is constantly being expanded and has been chosen, in the first approach, from institutions that are independent of specific regions, but are highly involved with regional authorities. Therefore, they complement the local authorities engaged via the demonstrator and follower regions.

The current members of both boards represent a diverse group of experts to engage with and form the starting point for the pool of members. The outreach activities, as f.i. detailed in D4.3, will be used to involve additional members.

6 Workshops – Input and Feedback

6.1 EEAB Workshop

The 1st EEAB workshop held online on June 26, 2023, provided a space for the cross-sectoral elicitation and knowledge-exchange focused on the key findings from WP1 literature review and the methodological approach for system dynamic modelling set in WP2. The event is designed as a highly interactive session which will see the participation of the sectoral experts part of the KNOWING EEAB, who are called to collaborate in a co-creation exercise aimed to highlighting the relevant cross-sectoral connections and the sectoral priorities with respect to different mitigation and adaptation measures.

Prior to the workshop, the selected experts were involved in filling out one online survey to indicate their area of expertise and their level of experience with climate mitigation and adaptation. This information was then also used within the workshop to present the members and provide an overview.

The workshop activities included informative sessions about KNOWING (general overview of the project; focus on WP1 climate influences and interrelations - methodology and results; focus on WP2 modelling framework - methodology and preliminary results) and interactive exercises aimed at identifying cross-sectoral linkages and the sectoral impacts of adaptation and mitigation measures. WP4 provided the workshop tools, integrated in the Miro board used as main online exchange platform to acquire harmonized feedback from the interaction (Figure 1, Figure 2).

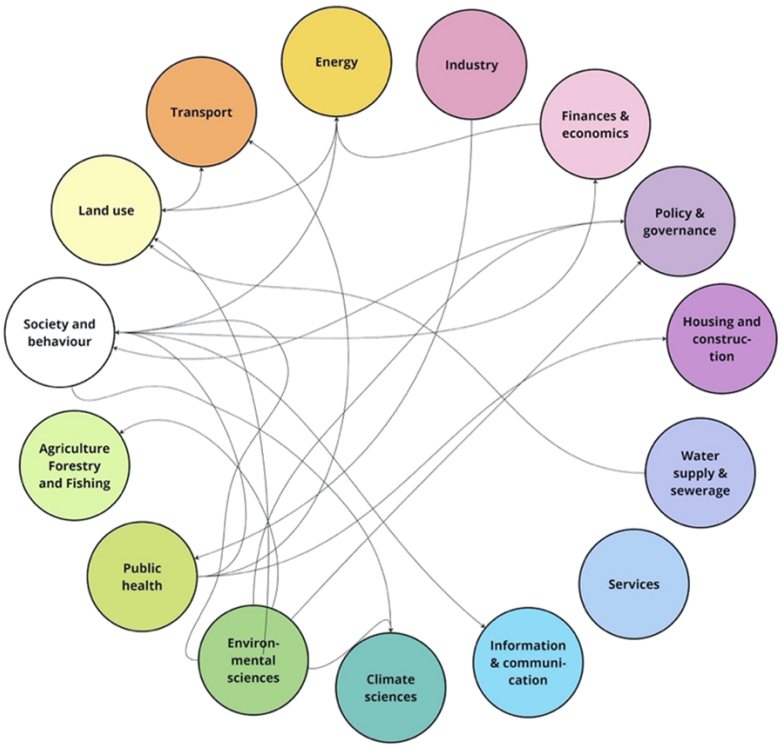

Figure 1: EEAB Workshop. Interactive step on cross-sectoral linkages

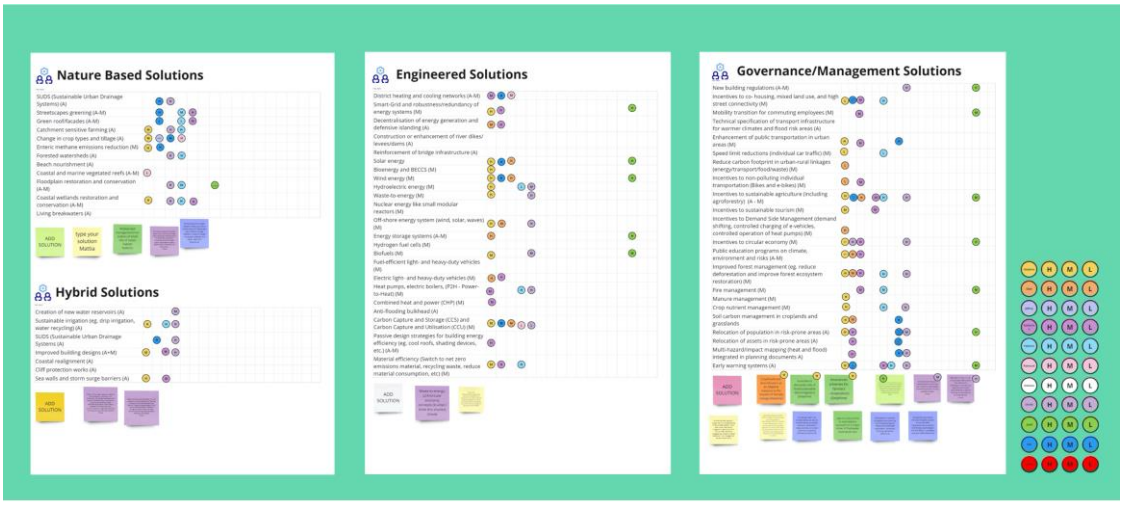

Figure 2: EEAB workshop. Interactive step on sectoral impacts of adaptation and mitigation measures.

The structure of the workshop was as follows:

Session 1: Welcome/ice-breaker Miro session including introductions (30 minutes)

Session 2: Overview of KNOWING project (20 minutes)

Session 3: Work Package 1 “Identify climate influences and interrelations” - methodology and results (40 minutes)

Session 4: Work Package 2 “Develop Modelling Framework” - methodology and draft output (40 minutes)

Session 5: Sectoral impacts of adaptation and mitigation measures (60 minutes)

Session 6: Introduction to climate interactions table with group input on sectoral interrelations (60 minutes)

Session 7: Post-workshop activities (guidance and timeline for feedback on climate interactions table) (15 minutes)

Session 8: Wrap up (15 minutes)

In the first interaction, the experts were asked to link the sector they represented with other relevant sectors, providing concrete examples about such cross-sectoral linkages, to be considered within WP2 in the development of causal loops in the SD modelling framework.

In the second interaction, the experts were prompted with a series of tables summarizing and clustering the main climate adaptation and mitigation measures from T1.1, subdivided into four categories: Nature Based Solutions, Hybrid Solutions, Engineered Solutions and Governance/Management Solutions (breakdown of measures collated by T1.1 and T1.2 given in Figure 3). Experts provided their opinion about the relevance of the measure (low, medium, high) from a sectoral perspective. They had also the chance of contributing by adding new measures not included in the tables and providing additional comments through sticky notes.

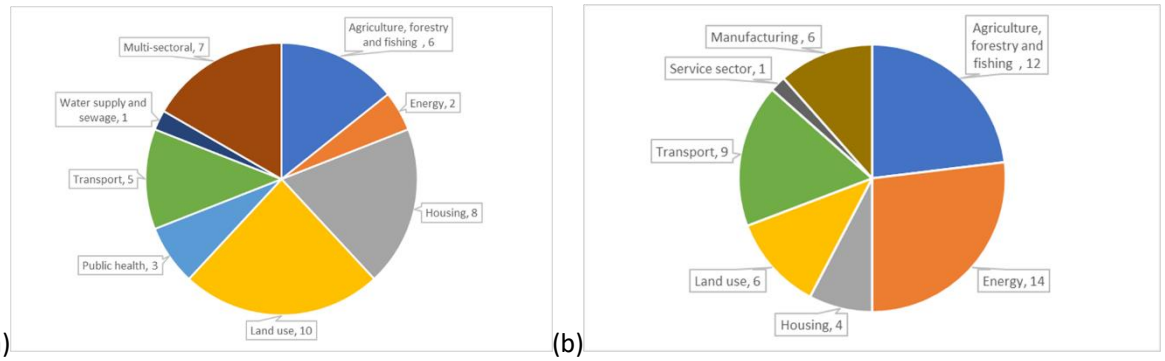

Figure 3: Caption. Number of adaptation (a) and mitigation (b) measures collated for each sector as part of KNOWING literature review.

The results of the interaction, including the notes taken by KNOWING facilitators about experts’ comments, have been included in the general feedback and recommendation from the EEAB.

6.1.1 Input and feedback: Sectoral impacts of adaptation and mitigation measures

Following the workshop, further input was sought on the following elements which were given in an online interactive spreadsheet. For the purposes of feedback, the members were given access to the ‘simplified interactions table’. The simplified climate interactions table condensed the information into simple matrix of risks/measures and response risks/opportunities/impacts. The table contained sheets

for risks, adaptation and mitigation measures. For each sheet, the risks (or adaptation/mitigation measures) were listed (and numbered) for each of the sectors. On the horizontal axis, columns were given for each sector with all of the identified response risks, opportunities and second-order impacts listed and colour coded.

- Second-order impacts – For risks, we were interested in second-order/cascading impacts between sectors e.g. the risk "Heat on energy generation facilities" (Energy Sector) has the associated second-order impact of "Disruption of household electricity during heat events" (Housing). These were given in green text.
- Opportunities – For adaptation and mitigation measures, we were interested in any co-benefits for other sectors, or the implementing sector itself e.g. implementation of several renewable energy measures in the energy sector can lead to the opportunity "Reduction of air pollution impacts on health" (Public Health). These were given in green text.
- Response risks – Response risks emerged from the definition: "Result from the potential for such responses not achieving the intended objective(s), or from potential trade-offs with, or negative side-effects on, other societal objectives, such as the Sustainable Development Goals" (IPCC, 2022) e.g. Hydropower may have the response risk of "Potential impacts on fisheries and other ecosystems from hydropower" (Agriculture, forestry and fishing). These were given in red text.

Where the sign of the impact is uncertain, entries were given in amber text. Additionally, for adaptation measures, there was a final column for "Impact on emissions/sequestration". An example of table is given in Figure 4.

Measure	Agriculture, forestry and fishing	Construction	Education	Energy
Agriculture, forestry and fishing [1] Reduce food loss and food waste [2] Shift to balanced, sustainable healthy diets [3] Reduce deforestation and degradation [4] Afforestation, reforestation and forest ecosystem restoration [5] Improved forest management [6] Fire management [8] Manure management [9] Crop nutrient management [10] Bioenergy [11] Soil carbon management in croplands and grasslands [12] Sustainable intensification of agriculture (including agroforestry)	• Reduction of pressure on land from agricultural production [1,2] • Better quality and more continuously-produced wood [5] • Land regeneration, reduced soil erosion and land degradation, increased biodiversity and forage quality (controlled fire management) [6] Increased food security [12] • Enhanced income through improved top soil quality [9] • Adverse impacts on economic stability agriculture sector [2] • Reduced agricultural output due to competition for land [3,4,5]	• Reduced land for housing purposes [2,3]	• Increased demand for education on nutrition [1,2]	• Less manure usage = less energy/natural gas demand [8]
Energy [1] Renewable energy: solar energy [2] Renewable energy: wind energy [3] Renewable energy: hydroelectric power [4] Renewable energy: Bioenergy [5] Renewable energy: geothermal energy [6] Nuclear energy like small modular reactors [7] Carbon dioxide capture, utilisation (CCU) and storage (CCS) [8] Marine energy [9] Waste-to-energy [10] Energy storage for low-carbon grids [11] Demand-side mitigation options// Demand Side Manegement [12] Smart-Grid [13] District heating and cooling networks [14] Combined heat and power (CHP)	• Positive impact of wind farms on fish stocks (the foundations acting as artificial reefs, spillover effect of areas where fishing is banned) [2] • Increased yields resulting from biochar by-product when used as soil amendment [4] • Increased agricultural productivity through use of anaerobic digestion/can produced nutrient-rich fertiliser [9] • Modified risk of flooding in downstream areas (sign dependent on construction/management) [3] • Reduced agricultural output due to competition for land [1] • Negative impact on biodiversity due to clearing of vegetation and fragmentation of ecosystems [1] • Impact of marine wind farms on fisheries [2] • Potential impacts on fisheries and other ecosystems from hydropower [3] • Reduced production as biofuel production can increase competition with agriculture [4] • Negative impact on biodiversity due to water pollution from geothermal production [5] • Potential negative impact on local marine biodiversity [8] • Contamination of groundwater through nuclear waste [6]	• Modified risk of flooding in downstream areas (sign dependent on construction/management) [3]	• Modified risk of flooding in downstream areas (sign dependent on construction/management) [3]	• Reduced vulnerability to disruption due to distributed grid [1,2] • Reduced vulnerability to flooding as no need for water cooling [1,2] • Can support the expansion of low-carbon grids and renewable electricity generation [10] • Flexibilisation of the energy demand to stabilise the electricity grid and increase of the energy security by the usage of renewable energy systems [11] • Modified risk of flooding in downstream areas (sign dependent on construction/management) [3] • Potential increase in vulnerability during high-heatwave events due to lower PV- efficiency [1] • Increased vulnerability to correlated low wind/low temperature event [2] • Increased energy system vulnerability during heat wave events [6] • Increased localised energy system vulnerability in coastal areas [8]
Housing [1] Energy efficiency (Building design and performance)				• Reduced energy demand [1] • Reduced demand for further generation [1] • Large implementation of P2H technologies may increase peak load

Figure 4: Example of simplified climate interactions table (mitigation measures)

We were interested in any feedback/comments from the EEAB members' areas of expertise on the collated lists of risks, measures, and response risks/opportunities/second order impacts. Members were asked to enter their input using the comment function in the "Review" tab. We were interested in the following information:

1. In the three tabs (Risks, Adaptation, Mitigation) members were asked to check the entries in the first column. They were asked whether there are any important missing risks, adaptation measures or mitigation measures which are not listed under their sectors of expertise (it was also asked to check that these are not already listed under another sector).
2. Are there any measures/risks which the members deemed not important/not essential?
3. For each of the three tabs, are there any missing response risks, opportunities, or second-order impacts (these are given for each sector in the right-hand side of the table)? Additionally, for adaptation measures, are there impacts of emissions and sequestration (final column)?

4. Are there any response risks, opportunities or second-order impacts which are deemed not important/not essential?

5. Finally, the members were asked to provide references/case study examples of any of the missing measures/responses.

Responses to the follow up survey included information on how different climate measures result in feedback loops in the context of social tipping points. In the agriculture sector additional measures were suggested including use of green ammonia as a fertiliser, agroforestry on grasslands and feed innovation (e.g. livestock feed leasing to less methane emissions). The suggested measures were noted and add additional detail to the broader measures already identified. In particular, for the use of green ammonia, it was mentioned that this may promote the cost reduction in electrolysers (and as a result energy storage, renewable energy production and EV adoption, hence given a link to the energy and transport sectors). It was stated that lower cost of renewable energy and hydrogen production affects the agriculture sector through reducing the costs of green ammonia production. As an additional opportunity related to reduced land pressure, it was mentioned that this also stimulates the adoption of regenerative agriculture practices.

For renewable energy (in general), there was the suggestion that this might lead to risks of resistance, a rise in conspiracy theories and psychosomatic symptoms, and that this depends on the communication and participation in renewable projects. This was deemed out of scope for the types of reactions studied in these two tasks, but was judged to be more appropriate for the behavioural responses aspect. It was noted also that the rise in adoption of long-haul transport as well as EV passenger cars should be included. It was stated that public procurement of low-carbon food stimulates adoption of sustainable and healthy diets.

6.1.2 Integration of EEAB Recommendations into CIC-related Measures Inventory

Due to the timing of the workshop on the 26th of June 2023, results were not available to feed into Deliverable 1.1 'Literature Review Summary' (submitted 30th of June 2023). Similarly, the post-workshop feedback on the simplified interactions table was not available for integration into Deliverable 1.2 'CIC-related Measures Inventory' (submitted July 31st), although feedback from the interactive workshop sessions, including recommendations on response risks and opportunities of measures was included in the document. Recommendations, feedback and comments from both the workshop and post-workshop activities have been recorded and will be integrated into Deliverable 1.4a and 1.4b the Simplified and Final Climate Interactions Knowledge Databases. This will be informed through an updated version of the 'climate interactions table', which was created by WP1 during the course of T1.1 and T1.2 to simplify the information in the Literature Review Summary (D1.1) and the CIC-related Measures Inventory (D1.2) for the use in the development of the Causal Loop Diagrams in T2.1. The 'climate interactions table' is not a deliverable in itself or defined output in the KNOWING description of work, rather it was created as means for of internal communication/translation of evidence from the literature for response risks and opportunities as well as other key data into a format that feed into the KNOWING knowledge base and could be visualised in D2.1 (a simplified version of this table was included as part of D1.2, CIC-related Measures Inventory).

6.2 SRG Workshop

The 1st SRG workshop, held online on July 20, 2023, provided a space for assessment of adaptation and mitigation measures in relation to climate benefits, co-benefits and opportunities for/barriers to implementation from the individual stakeholder perspective. The event included an interactive session involving the KNOWING SRG members, who are called to collaborate in a co-creation exercise aimed to highlighting these aspects with respect to measures identified, including their refinement following the EEAB workshop, supporting an integrated approach to climate mitigation, adaptation and SDGs across the identified CICs.

Prior to the workshop, the selected stakeholders were involved in a short online survey to indicate their area of work and level of experience with respect to implementation of climate mitigation and adaptation measures. The workshop activities included informative sessions about KNOWING (general overview of the project; focus on WP1/WP3 collection of adaptation and mitigation measures and introduction to the KNOWING demonstrator regions; introduction to the KNOWING Knowledge Database and Website) and the interactive exercise.

WP4 provided the workshop tools, integrated in the Miro board used as main online exchange platform to acquire harmonized feedback from the interaction (Figure 5).

Figure 5: EEAB workshop. Interactive step on sectoral impacts of adaptation and mitigation measures.

In the interaction, the stakeholders were prompted with a series of tables summarizing and clustering the main climate adaptation and mitigation measures from T1.1 (as updated following the input of EEAB). The stakeholders provided their opinion about the relevance of the measure (low, medium, high) with respect to the following aspects:

- Impact on adaptation / mitigation
- Cost effectiveness
- Time for implementation
- Risks associated to implementation
- Associated social co-benefits
- Associated economic co-benefits
- Associated environmental co-benefits

They had also the chance of contributing by adding new measures not included in the tables, and providing additional comments through sticky notes.

The results of the interaction, including the notes taken by KNOWING facilitators about experts' comments, have been included in the general feedback and recommendation from the SRG.

6.2.1 Input and feedback: Interactive measures assessment

Cost-effectiveness, impact, barriers and timeline of measures

Participants were asked to assess the relevance/priority level of the measures listed in the Miro Board by copy-pasting a H, M or L sticker in the table. This was done for the elements of 'cost effectiveness',

‘impact on adaptation/mitigation’, ‘time for implementation’, ‘risks associated to implementation’ and social, economic and environment benefits. Table 1 displays those measures where a particular element of a risk were indicated to have at least one participant indicating a high level of relevance/priority (please note, none were judged to have a high risk to implementation, so this is not included here).

Table 1: Indication of relevance/priority of assessed measures (measures included where at least one participant indicated a high relevance/priority in at least one element, given with an X).

Measure	Adapation (A) or Mitigation (M)	Cost effectiveness	Impact on adaptation or mitigation	Associated social benefits	Associated economic benefits	Associated environmental benefits
SUDS (Sustainable Urban Drainage Systems)	A		X			
Green roof/facades	A		X	X		X
Catchment sensitive farming	A		X	X		X
Change in crop types and tillage	A		X	X		X
Enteric methane emissions reduction	M			X		X
Floodplain restoration and conservation	A/M					X
Coastal Wetlands restoration and conservation	A/M	X	X	X	X	X
Smart-grid and rubstness/redundancy of energy systems	A/M	X	X		X	
Decentralisation of energy generation and defensive islanding	A	X	X			
Heat pumps, electric boilers (Power to Heat)	M	X				X
Material efficiency	A	X			X	X
New building regulations	A/M	X	X			X
Incentives to co-housing, mixed land use, and high street connectivity	M	X				X
Incentives to sustainable agriculture (including agroforestry)	A/M		X	X		X
Incentives to demand side management (demand shifting, controlled charging of e-vehicles, controlled operation of heat pumps)	M	X			X	X
Improved forest management (e.g. reduce deforestation and improve forest ecosystem restoration)	M		X			X

Multi-hazard/impact mappting (heat and flood) integrated in planning documents	A	X	X	X	X	
Early warning systems	A	X	X	X	X	
Crop/livelihood diversification	A		X	X		X
Incentive to demand side of sustainable food/diet	A			X		X

For agricultural, it was stated that biofuels are not the ideal solution from the agricultural perspective due to the competition for land for food production. This is seen in the widespread deforestation in South America. It was also stated that organic production requires more space than industrial production. Measures around the shift to nature-based/sustainable agricultural production were rated highly with social benefits in addition to environmental and were given "H" score here. It was also remarked that the time perspective in terms of implementation is difficult to assess, there will be shifts in jobs and also in crops and production processes which result in short term issues, but will result in benefits in the long term. Due to this, it is very important to ensure a just transition for workers and farmers, particularly in the early period. It was argued that nature-based solutions will create more jobs. Time is also an issue regarding the period different types of soils need to recover from industrial production to be turned into organic production. It was strongly recommended that the transition needs to be democratic and participatory.

In terms of public health, it was argued that early warning system for health are only a secondary prevention. We need to consider health from a systems perspective taking into consideration aspects such as architecture and agriculture and should use both adaptation and mitigation measures together. There is also a need for a redefinition of health when considering climate change.

In terms of energy, it was argued that coastal wetland restoration is one of the most effective measures. It was also argued that measures around energy saving is an important resilience measure as during heat waves energy supply is stressed from two sides - increased demand and less efficient production, so any measure which reduces demand can increase resilience. Decentralisation of energy was also argued to reduce stress and increase resilience, and is strongly associated with renewable generation. It was also stated that we need to diversify in terms of geographical aspects and not be reliant on a limited number of countries, especially as certain critical materials for renewable sources are even more concentrated in certain locations than fossil fuels.

There is currently no scenario leading to net-zero conditions around 2050, so the focus was more on measures which are most effective with regard to contributing to net zero. The connection between energy supply and demand is also important to understand. In the building sector, the most cost-effective solution is to include climate resilience in the design. Higher costs can be recovered ten times if planned well. It is very important for people do understand benefits in the future, even if a solution does not seem to be the best at the moment. It was also argued that decisions around efficiency and use can be taken out of the hands of consumers by including in the design/regulation phase – for instance air conditioning pre-settings have been raised in India.

Response risks and opportunities

As with the EEAB workshop, participants were given the opportunity to feedback on particular aspects in the gathered measures. To this extent, the participants were given access to the 'response table'. The Response Table displays the opportunities and response risks associated that each sector may face as a result of either its own action on mitigation and adaptation, or actions by other sectors. The first column of the table listed the response risks and opportunities that each sector may face. The column was split into several sections for each sector (the sector was given in the next column). And the third column

stated whether the entry is a response risk or opportunity. A breakdown of the number of response risks and opportunities for the measures captured in KNOWING is displayed in Figure 6.

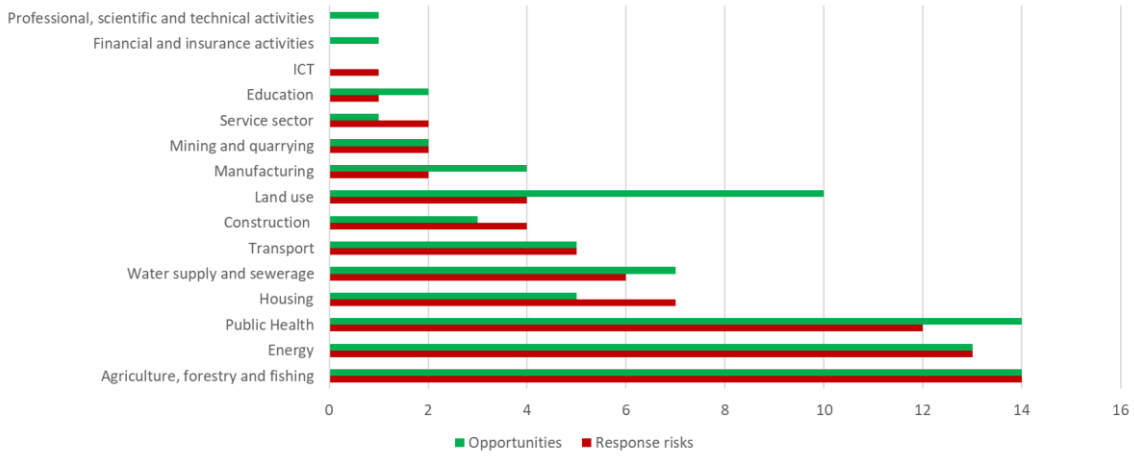

Figure 6: Number of response risks (red) and opportunities (green) faced by each sector as a result of the measures captured in KNOWING

The 'originating from' column states which measure the response risk or opportunity emanates from (response risks/opportunities can emerge from several different sources). The next column indicates whether the response risk/opportunity is a result of mitigation measures, adaptation measures or both. A blank column was left for the input of the SRG on the priority/importance of the response risks/opportunities in terms of the impact that risks will have on the sector or the potential benefits that the opportunities may provide. 'Response of sector' indicated actions which the sector may take to reduce the response risk or capitalise on the opportunity.
We were interested in feedback and comments from the participants areas of expertise on the collated lists of 'responses'. Members were asked to enter their input using the comment function in the "Review" tab for questions. We were interested in the following information:

1. Whether the response risk/opportunity was considered important in terms of priority by the member (Low, medium, high).

2. For the associated responses of sector, comments were sought on whether these were appropriate.

3. Examples of the response were requested.

4. Additional measures were sough (with associated examples where available).

In terms of agriculture, it was argued that nature-based solutions are associated with high environmental benefits and also high social benefits, as it also means reduced use of pesticides which increases the health of workers. Changing crop types leads to high environmental and social benefits, as mono-/export-driven production is based on automation/machinery and less work force. Enteric fermentation was also mentioned - reduced methane production due to more sustainable and less meat production were cited as benefits. Another high social benefit of more sustainable food production and less meat is a healthier diet and improved health outcomes. More forestation is also relevant as carbon sinks, as carbon capture technologies need to be complemented as they are not yet effective.

It was argued that there are issues with raising awareness for shifting to more plant-based nutrition. A barrier will be acceptance by people, so a just transition is needed. It was also stated that nature restauration laws also meet opposition from farmers' organisations. It was stated that they have legitimate fears as jobs may be in danger, but the measures are needed.

In terms of public health, it was argued that education is necessary, but not enough and that more capacity for changing mindsets is needed. A partnership with the population on an individual basis is required. Health aspects need to be considered in all sectors. Positive examples include some new

processes and activities like slow food, local food etc. For the energy sector, economic benefits can be viewed from the perspective of avoided costs. This includes avoided social costs, for example health costs due to flooding. But such cost-benefits analysis is difficult with little research available. The benefits are also increasing more in the future due to mitigation due to the avoided costs of climate impacts.

6.2.2 Integration of SRG Recommendations into CIC-related Measures Inventory

Due to the timing of the workshop on the 20th of July 2023, there was limited scope to include feedback from the session into the Deliverable 1.2 'CIC-related Measures Inventory (submitted 31st of July 2023), and no opportunity to include feedback from the post-workshop activities. However, feedback from the earlier EEAB workshop activities (although not the post-workshop activities were available). As with the EEAB workshop, recommendations, feedback and comments from both the SRG workshop and post-workshop activities have been recorded and will be integrated into Deliverable 1.4a and 1.4b the Simplified and Final Climate Interactions Knowledge Databases. Again, this will be informed through an updated version of the 'climate interactions table'. As with the EEAB workshop, 'climate interactions table' is not a deliverable in itself or defined output in the KNOWING description of work, rather it was created as means for of internal communication/translation of evidence from the literature for response risks and opportunities as well as other key data into a format that could be visualised in D2.1 (a simplified version of this table was included as part of D1.2, CIC-related Measures Inventory).

6.3 EEAB consultation for Task 2.2 (Sector model coupling to quantitative SD model)

The EEAB consultation (2nd EEAB Workshop) for Task 2.2 (Sector model coupling to quantitative SD model) was held online on October 11, 2024 to support the mapping of the relevance of the proposed "flows" and "influences", to identify missing quantitative parameters, and/or to highlight significant uncertainties that may require further analysis to improve the robustness of sub-SD models behind the KNOWING quantitative SD model and the reliability/usability of the results for decision-makers.

Following EEAB experts participated and provided their feedback:

- **Carles Ibanez**, Senior Researcher and Head of Department of Climate Change at Eurecat - Technology Centre of Catalonia (an additional bilateral meeting was performed afterwards to obtain more specific feedback for the flooding SD model)
- **Henry Neufeldt**, Senior Researcher at UN Environment Programme
- **Katharina van Bronswijk**, psychological psychotherapist in behavioural therapy with her own practice in Germany
- **Maria Pregnolato**, Associate Professor in Flood Risk Management and Resilient Delta Infrastructure at TU Delft
- **Sibel Eker**, research scholar in the Sustainable Service Systems Research Group of the IIASA Energy, Climate and Environment Program

The event was designed as an interactive session in which sectoral experts from the KNOWING EEAB were asked to participate in some exercises. These exercises, supported by tools provided by WP4 via a dedicated Miro board (refer to Figure 7 and Figure 8) were aimed at highlighting the strengths and weaknesses of the overall SD modelling framework from a quantitative perspective and with a view to evaluating its applicability to other case studies. Starting from each sub-SD component, status and specific open issues were presented.

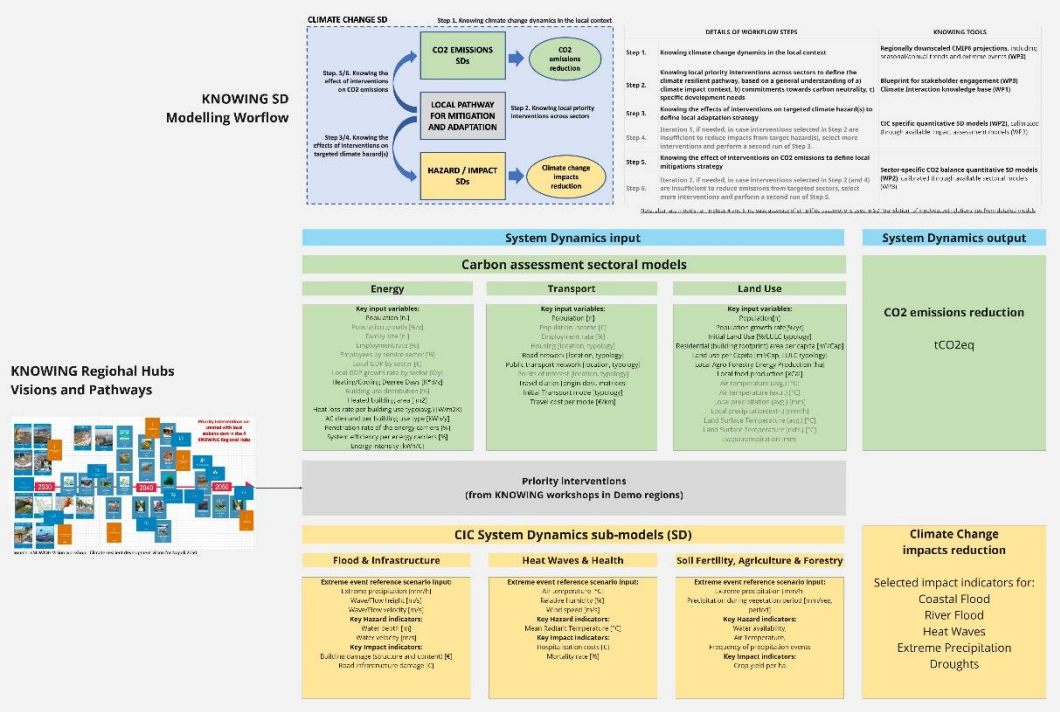

Figure 7. EEAB consultation. Presentation of the methodology underpinning the KNOWING quantitative SD modelling framework, introduced at the initial stage of the process.

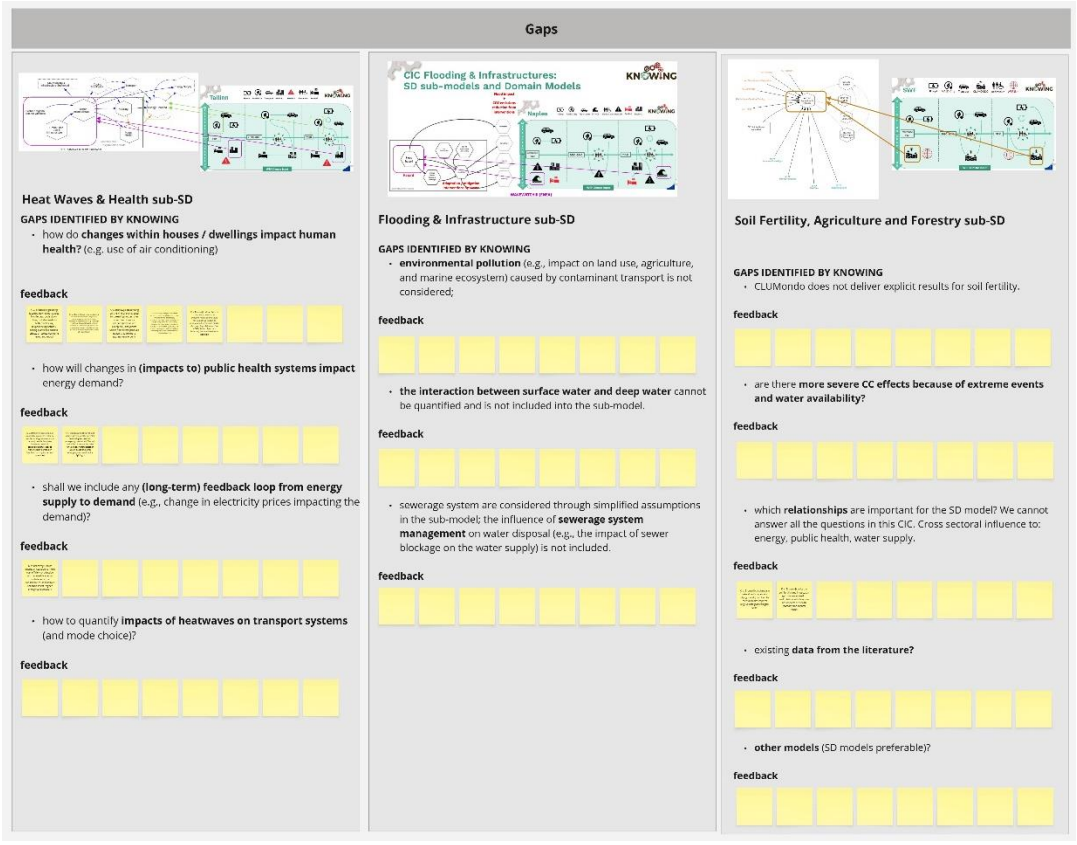

Figure 8. EEAB Workshop. Interactive session focussed on the identifying potential solutions to address the key gaps within each sub-SD model, as previously identified by modeller.

The EEAB consultation consisted of three key phases:

- **Preparation and engagement of relevant experts.** Experts were formally invited to participate in the 2nd EEAB Workshop. The topics for discussion with the EEAB were elaborated further, and a corresponding Miro board was set up by UNINA Team. Additionally, Deliverable 2.2 was disseminated to the EEAB members to facilitate the consultation process.
- **Implementation of the 2nd EEAB Workshop.** The workshop was structured into two main steps:
  1) a general introduction covering the objectives of the KNOWING project, expected outcomes, the focus on Deliverable 2.2, the development process of the KNOWING SD modelling framework, CICs, available DMs within the Consortium, and the required input/output variables;
  2) an interactive session explaining the methodology used via the Miro platform, enabling the mapping of data gaps and procedural difficulties (e.g., through Post-it, diagrams, tables, etc.) behind the proposed SD modelling framework.
- **Collection and synthesis of experts' feedback:** Experts provided their asynchronous feedback through the Miro platform over 3-4 weeks, ensuring flexibility for in-depth contributions. The collected feedback was then synthesised and analysed by the T2.2 working group to identify key-insights and refine the modelling framework accordingly.

Note that the EEAB consultation for Task 2.2 was performed slightly later than originally planned (M24). This turned out to be more useful for the development of the overall framework, because defining the interfaces between SD model and DM (as documented in D2.2) was not yet completed until M24, and for practical reasons it was then decided to delay these EEAB activities after summer.

6.3.1 Input and feedback: quantitative SD model framework

Concerning the current stage of quantitative SD model framework development, several open issues (gaps) had been identified that require further attention, particularly in light of exchanges with the EEAB.

Table 2 and Table 3 summarise feedback provided by experts on some relevant questions for these gaps concerning CIC sub-SDs:

Table 2 – *Expert feedback on the "Heatwaves & Health CIC" sub-SD.*

Heatwaves & Health sub-SD				
Q1: *How do changes within houses / dwellings impact human health? (e.g., use of air conditioning)*				
(-) The use of air conditioning can exacerbate asthma or allergies, and some individuals may be sensitive to temperature fluctuations (e.g., catching a 'cold'). This could result in an increased number of sick leave days and a reduction in productivity.	(-) Depending on the types of plants used for greening buildings, this could potentially lead to more allergies if the plants are allergenic. Additionally, plants under heat stress produce pollen that is often more aggressive and allergenic.	(-) Increased city greening could potentially lead to a rise in vector-borne diseases (e.g., ticks or mosquitoes), as plants and water sources may provide a habitat for these vectors. As a result, there may be a need for pest control measures (for mosquitoes, ticks, and even bacteria).	(+) Increased city greening would act as natural air pollution filters, potentially leading to a positive impact on respiratory diseases. This could also benefit neurological conditions (e.g., ADHD) which are linked to air pollution.	(+) Greening facades and similar interventions help cool urban areas while also promoting better well-being. Experiencing nature and seeing plants have positive effects on stress hormone levels and overall mood.
Q2: *How will changes in (impacts to) public health systems impact energy demand?*				

(-) Protecting vulnerable groups (e.g. the elderly, and healthcare workers performing manual tasks) from the heat through increased use of air conditioning leads to an increase in energy demand, particularly in hospitals, nursing homes and medical clinics.	(-) Heatwaves (and other extreme weather events) result in a higher demand for emergency medical assistance. The use of electric vehicles (EVs) will also increase the need for electricity in transportation, including for police and other emergency services such as firefighting.
Q3: *Shall we include any (long-term) feedback loop from energy supply to demand (e.g., change in electricity prices impacting the demand)?*	
(-) Lower energy prices, resulting from more cost-efficient production through renewable energy, combined with increased awareness, could lead to a rebound effect, resulting in higher energy consumption.	

Table 3 – *Expert feedback on the "Soil fertility & Agriculture CIC" sub-SD.*

Soil fertility & Agriculture sub-SD	
Q1: *Which relationships are important for the SD model? (We cannot answer all the questions in this CIC. Cross-sectoral influence on: energy, public health, and water supply)*	
(-) Changes in natural landscapes, such as the decline of forests, can lead to mental health impacts (e.g., solastalgia, and ecological grief).	(-) A loss of soil fertility and its impact on agriculture can lead to malnutrition, which in turn affects both physical and mental health.

Table 4, on the other hand, summarises the experts' feedback on specific topics related to the overall modelling process:

Table 4 – Expert feedback on targeted key-topics, related to the overall modelling process.

TOPIC: Modelling workflow			
The focus has been on a very broad conceptual scope, with limited progress on quantitative modelling, which is a key promise of the KNOWING project. It is suggested to begin quantitative modelling on a smaller scale, either within a specific DM or in a simpler form that covers the wider scope.	One of the challenges may lie in realizing the physical model of the real effect(s) of the impacts at the local level. How is the impact measured?	Another important consideration is the applicability of the model to other CSs. This raises questions regarding the model's transferability.	It is crucial to consider how to tackle the issue of spatialization, as many variables (e.g., land use) are spatially distributed, making it a central aspect for many DM. Furthermore, if the SD model is implemented cell by cell, how can the interactions between adjacent cells be captured and recorded?
TOPIC: land use emission modelling parameters			
When considering land use and energy, it should be taken into account how externalized emissions could be incorporated (e.g., through the use of products produced in China for European markets), such as by analyzing the footprints of products, technologies, and materials.			
TOPIC: "Heatwaves & Health CIC" modelling parameters			
Other health impact parameters should be added (e.g., productivity loss, sick leave days, increase in violent crimes, aggression, suicidality).			
TOPIC: "Flooding & Infrastructure CIC" modelling parameters			
The focus seems to be on the road network. It is suggested to consider other types of networks (e.g., powerline).	It is suggested that the impact of flooding on people on the street should also be considered.	There are no health impact parameters (e.g., mortality due to floods, injuries, or rates of PTSD and other mental health issues like depression) related to flooding. These shoul be considered.	

TOPIC: "Soil fertility & Agriculture CIC" modelling parameters	
There are still no parameters for soil fertility or biodiversity (e.g., thickness of the humus layer or soil and forest biodiversity). This should be considered.	It is recommend to distinguish between the different types of species in the area considered.
TOPIC: Climate mitigation / adaptation to consider	
The reduction of GHG emissions in terms of CO2eq helps measure mitigation potential, but it does not account for adaptation. Reviewing the impact literature and measuring adaptation potential by evaluating the reduction in expected impacts could be useful.	For mitigation, it appears the focus seems to be on CO2 only, not other GHGs. It is recommended that this distinction be made more explicit.

Also, at the time of submitting D2.2 in M25, several open issues remained, as identified by the T2.2 working group. These were also considered during the discussion with the experts. It became also clear from the feedback of EEAB, however, that some of these aspects require further investigation to ensure the robustness and applicability of the proposed modelling approach:

- How to combine the DM with different time scales and spatial resolutions?

  The KNOWING DMs are quite different in their time scales and spatial resolutions. Due to this, it is not easy to combine them within one quantitative SD model. We have several DMs, which simulate the impact of events (e.g., heat waves), however, the overall quantitative SD model shall mainly be used for backcasting and thus will have to be simulated over a longer period of time. To combine these approaches, it is important to translate the short-term impacts of one single event into an (average) long-term impact, considering the expected frequency of the event.

  CIC specific approaches have been defined, e.g. for flooding and for urban heat waves (microclimate impact) and are documented in detail in D2.3 (M33) and upcoming deliverable D2.4 (M42).

- How to deal with highly interconnected DMs?

  Some DMs influence each other in a very interconnected way (with high time resolution), such as the energy supply and energy demand sub-model. This would require a high frequency of data exchange between these DMs and increase the already high complexity of the overall quantitative SD model.

  It was agreed that the SD model will not include any short-term dynamics but consider the effects of such dynamics only in a time-aggregated manner.

- How to get valid information (data) for all DEMO regions?

  Not all DMs are running in all DEMO regions – this will probably lead to additional gaps for the calibration of the SD (sub-)models for certain regions; it has to be analysed how far the results from other regions can be taken over and generalised.

- For which measures (interventions) to apply the Human Behaviour Model (Coping Typologies) developed in KNOWING?

  How to quantify the impact depending on the behavioural responses to certain interventions?

  For a certain subset of interventions defined in Deliverable D3.2, the impact depends on behavioural responses. These need to be analysed in more detail, and, accompanying interventions should be defined. Examples: Subsidies for supporting mitigation measures such as electric

vehicles, PV panels or greening; restrictions or providing alternatives for energy-intensive adaptation responses such as the usage of air conditioning.

6.3.2 Integration of EEAB Recommendations into quantitative SD model framework

As documented in the previous section, punctual feedback has been received on both the framework in general and several open points that have been raised for discussion. For several (mostly CIC specific) comments provided by the experts, analysis together with DM experts is currently still ongoing in T2.3 how far a consideration within KNOWING is possible. This also incudes causal relationships which cannot be quantified by means of KNOWING DM, and therefore other approaches have to be selected. A final evaluation with respect to these comments and documentation of restrictions of the KNOWING Modelling Framework will be given in D2.4 (KER2).

Following feedback has already been considered and integrated within the further development and calibration of the SD model (Task 2.3):

- Spatialisation of the Flooding SD Model: For better calibration of the model against DM results (HECRAS, SFINX, ICM Infoworks), the model area is segmented into three different types of land cover.
- Integration of Flooding SD Model into overall SD Model and consideration of flooding impact (damage curves): A refined approach has been defined between AIT and UNINA in January 2025, following the expert consultation.
- Definition of “key output variables” for each CIC (e.g. related to health impacts or flooding impacts on infrastructure): This triggered a cross-WP discussion to finalise a corresponding set of variables, to be documented in D3.3/4/5 and D2.4.
- Definition of the scope of the quantitative model (“suggest to start quantitative modelling in a smaller scope, either in one of the domains or in a much simpler way covering the wide scope”): By more detailed analysis of the input / output data available from DM runs, it was clarified which domains will be considered for each of the CICs / demonstrators, and where the model has to work with simplified relationships or even skip them completely (documented in D2.3).

7 Conclusions

The current EEAB and SRG board members’ cover a variety of expertise, both scientifically as institutionally and therefore represent a solid base. They added considerable value to the understanding of the potential applicability and associate response risks and opportunities of the measures captured in the KNOWING literature review, as well as introducing new measures which had not been captured or considered at that point.

For time and efficiency reasons, as many experts were highly time pressed and saw a physical meeting critical to organize within their agendas, the first and second meeting took place online. Nevertheless, the discussions were lively, and the understanding of the content was ensured. This was also reflected by their feedback and recommendations.

In general, the first EEAB workshop (in first reporting period) provided additional academic insight into the measures in terms of further evidence from the literature. The SRG group provided additional tacit knowledge in terms of the applicability of the measures and especially the potential ‘response to responses’; how stakeholders in various sectors may respond to the responses of other sectors. Some key recommendations from the workshops include the greater inclusion of biodiversity as a consideration in the later stages of the project, inclusion of psychological risks associate with all elements (risks, mitigation and adaptation options), as well as the confirmation that 2nd order responses are an

appropriate and realistic place to stop in terms of modelling. Moreover, the SRG and EEAB workshops were useful in confirming that the approach to the literature review was sound and that the measures selected were largely appropriate.

The second EEAB workshop (and subsequent consultation phase) served to verify the general approach for quantifying the KNOWING SD Model based on the results of detailed and specific domain models, and to receive feedback how to close certain gaps that have been identified. While the latter did not result in too many new insights, the general discussion with the experts was still very fruitful and provided several important recommendations that have already been implemented within task 2.3 or will be considered during the final phase of WP2 (and in collaboration with WP3).

References

IPCC, 2022: Summary for Policymakers [P.R. Shukla, J. Skea, A. Reisinger, R. Slade, R. Fradera, M. Pathak, A. Al Khourdajie, M. Belkacemi, R. van Diemen, A. Hasija, G. Lisboa, S. Luz, J. Malley, D. McCollum, S. Some, P. Vyas, (eds.)]. In: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovern-mental Panel on Climate Change [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Die-men, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lis-boa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.001

Annex A: Data Summary

No (new) data sets relevant for KNOWING Data Management Plan were used or produced in preparation of this deliverable.

Security and Ethics:

The work performed in this deliverable is not considered sensitive in terms of ethics or security.

Annex B: Ethics Considerations

No relevant ethical areas for KNOWING were touched in preparation of this deliverable.