

# JRC CONFERENCE AND WORKSHOP REPORT

## 2021 EU Conference on modelling for policy support : Workshops and training

### *Main messages*

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2021 EU Conference on  
modelling for policy support  
22 - 26 November - *online event*

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## **Foreword**

The [2021 EU Conference on Modelling for Policy support](#) took place fully online on 22 -26 November 2021.

This biennial Conference brings together researchers and policymakers from European and international institutions, Member States, universities, research institutes and consultancies to identify common challenges and solutions when using models to support policymaking across all policy domains.

The Conference has been organised by the Commission [Competence Centre on Modelling \(CC-MOD\)](#). CC-MOD promotes a transparent, coherent and responsible use of modelling to underpin the evidence base for EU policies.

This short report summarises the main findings of the Workshops and training interactive sessions.

## **Acknowledgements**

We are grateful to all organisers, panellists and participants for the rich inputs provided in the preparation and during the discussions.

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## **Abstract**

The [2021 EU Conference on Modelling for Policy support](#) took place fully online on 22 -26 November 2021.

The Conference, organised by the European Commission [Competence Centre on Modelling](#), brought together researchers and policymakers from European and international institutions, Member States, universities, research institutes and consultancies to identify common challenges and solutions when using models to support policymaking across all policy domains.

The event, fully online, gathered more than 900 scientists and policymakers. In addition to a rich scientific programme (keynote, contributed and scientific sessions based on the call for abstracts), the Conference also featured interactive Workshops and training to provide additional opportunities of exchange between modellers and policymakers.

The workshops have been organised by the [JRC Sustainable Development Goals team](#), the European Commission [Competence Centre on Modelling](#) together with [Sense about Science EU](#), the [Competence Centre on Foresight](#), the [Competence Centre on behavioural Insights](#), the [JRC Centre of Advanced Studies - Project Computational Social Science for Policy](#).

This short report summarises the main messages of these interactive sessions.

# 1 Introduction

Models are extensively used to analyse the environmental, economic, and social impacts of policies. The European Commission makes use of models throughout the policy cycle and is committed to sound and transparent use of evidence in the framework of the [Better Regulation](#) policy and [Open science](#) principles.

The [2021 EU Conference on Modelling for Policy support](#) brought together more than 900 researchers and policymakers from European and international institutions, Member States, universities, research institutes and consultancies to identify common challenges and solutions when using models to support policymaking across all policy domains.

The overview of the full Conference programme is available in Annex 1.

In addition to Keynote, contributed and scientific sessions based on the open call for abstracts, the programme of the 2021 Conference has been further enriched to provide additional opportunities of exchange of experiences and best practices between modellers and policymakers.

Workshops and trainings have been organised by the [Competence Centre on Modelling \(CC-MOD\)](#) in collaboration with JRC Units and external speakers to provide the opportunity of reflecting on modelling and beyond, with the objective of promoting sound evidence informed policymaking in the context of the EU Better Regulation policy.

The programme included the following interactive sessions:

- Workshop 1: Leveraging multidisciplinary tools and approaches for achieving the SDGs, organised by the [JRC Sustainable Development Goals team](#);
- Workshop 2 : We need to talk about models, organised by the [Competence Centre on Modelling \(CC-MOD\)](#) and [Sense about Science EU](#);
- Workshop 3 : Strategic Foresight and quantification link for better future-oriented policymaking, organised by the [Competence Centre on Foresight](#);
- Workshop 4 : Human models for human policies, organised by the [Competence Centre on behavioural Insights](#);
- Workshop 5 : Impact By Design: How to create social science models that effectively address policy needs?, organised by the [JRC Centre of Advanced Studies Project Computational Social Science for Policy - CSS4P](#);
- Training 1 : Social multi-criteria evaluation (SMCE) for ex-ante impact assessments, organised by the [Social Multi-Criteria Evaluation of Policy Options team](#) of the [Competence Centre on Modelling \(CC-MOD\)](#);
- Training 2 : An introduction to SIML@B: an online EC tool for global sensitivity analysis of models, organised by the [Sensitivity Analysis of Models \(SAMO\) team](#) of the [Competence Centre on Modelling \(CC-MOD\)](#);

This report provides an outline of the Workshops and Training main contents and messages emerged during the presentations and in the open discussion.



## **2 Workshop 1: Leveraging multidisciplinary tools and approaches for achieving the SDGs**

### **2.1 Objectives**

In the last two years the JRC has been working to map its own and Commission-wide models against the SDGs<sup>1</sup>, identifying the links between the models and the SDGs, targets and indicators. This project is expanding this mapping to a broader range of tools and approaches produced by a multitude of disciplines within the umbrella of Sustainability Science.

The aim of the project is to contribute to expanding the solutions space available for policy makers in designing interventions to achieve the SDGs. The objective of the workshop was to introduce the general ideas of the project and for participants to interact with the JRC team to validate, tailor, and improve the framing, the methods, and the way forward for the project.

In the last two decades, Sustainability Science research has identified and generated a variety of solution-oriented tools to govern the transition to a sustainable development paradigm. However, often these tools remain locked within the academic domain, invisible or unintelligible to decision makers who could instead benefit from adopting them. This mapping exercise will support the expansion of the EU capacity to govern the sustainability transformation by (see also Annex 2):

- providing visibility of the tools to users beyond the academic circles and across disciplinary silos;
- providing policymakers with a mix of qualitative and quantitative approaches beyond the neoclassical economic models which are currently dominating sustainability assessment in policymaking.

### **2.2 Outline**

Welcome and moderation:

Luisa Marelli, Deputy Head of Unit – Bio-Economy Unit, European Commission, DG Joint Research Centre

Introduction:

Bert Saveyn, Policy Officer, Evaluation & Impact Assessment, Regulatory Scrutiny Board Secretariat, Secretariat-General, European Commission

Setting the scene: Key messages

Prof Reinette (Oonsie) Biggs, South African Research Chair (SARChI): Social-Ecological Systems & Resilience; Co-director: Centre for Sustainability Transitions (CST), Stellenbosch University, South Africa; Researcher: Stockholm Resilience Centre (SRC), Stockholm University, Sweden; Co-chair: Future Earth Program on Ecosystem Change and Society (PECS)

Discussion:

Jacopo Giuntoli, Consultant for the DG Joint Research Centre, Bio-Economy Unit

### **2.3 Key points from the presentations**

Luisa Marelli gave a quick overview of the JRC portfolio of activities to support mainstreaming and implementation of SDGs into EU policies. One of the objectives of JRC work is to develop methods and interactive tools to support a comprehensive assessment of EU policies with respect to SDGs. She also introduced the KnowSDGs web platform<sup>2</sup>, developed by the JRC to make available JRC tools, indicators, methods and data to facilitate policymakers to identify links between a policy and SDGs, mapping of key interactions across SDGs, improve and facilitate the use of models to support the policy cycle, identify interlinkages among different goals and targets, and assess individual consumption footprints and impacts to SDGs.

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<sup>1</sup> The mapping, available at <https://knowsdgs.jrc.ec.europa.eu/intro-models>, has been elaborated based on contents of the EU Commission modelling inventory MIDAS (<https://web.jrc.ec.europa.eu/policy-model-inventory/>), giving access to the descriptions of models supporting Commission policies.

<sup>2</sup> <https://knowsdgs.jrc.ec.europa.eu>

The presentation gave a snapshot on the Models for SDGs tool, explaining how EC models' outputs can be directly or indirectly linked to SDG targets and EU/UN indicators, therefore screening which models could be suitable to quantitatively evaluate the impacts of policy options on SDGs. She clarified that the final goal of this project is to produce a practical toolkit, accessible by anyone and understandable by EU policymakers, to inform them about the appropriate tools to use, depending on the SDGs and policy cycle phase they are interested in. This could expand the toolkit already available within the EU Better Regulation Toolbox<sup>3</sup>.

Bert Saveyn introduced the role of SDGs in the EU Better Regulation. He highlighted that one key element of the Better Regulation Communication 2021 is the improved analysis of key impacts linked to SDGs for the twin transition. He explained that the SDG framework is added to the current comprehensive approach, meaning that i) each EC Impact Assessment, Evaluation and Fitness Check needs to identify the relevant SDG; ii) the Better Regulation Toolbox includes a new tool (tool #19), which also refers to the KnowSDGs platform, and this new tool gives detailed guidance on how to do it; and iii) the Impact Assessment (Annex 3) and explanatory memorandum to co-legislators need to include explicit identification of the relevant SDGs. He also highlighted some challenges for SDGs (such as the high number of different dimensions and metrics, difficulties to compare them and lack of addability), and the role of modelling (e.g. assessing the size of impacts and identify priorities in Impact Assessments, measuring trade-offs across goals and targets, and silo breaking across DGs and policy areas).

Prof Reinette (Oonsie) Biggs provided background on the preparation, content, and implications of their latest "Handbook of research methods for Social-Ecological Systems" (SES) (Biggs et al 2021)<sup>4</sup>. She explained how the handbook is meant to help readers navigate the variety of methods and approaches that can be employed to study complex SES. The handbook is structured in three main parts: 1) Introduction to SES research; 2) Methods for studying SES; 3) Synthesis and looking ahead. Prof. Biggs highlighted the complicated process, made of several background scientific articles and participatory workshops, which eventually led the co-authors to the current choice of methods and their classification. She then presented the main connections between methods, highlighting how certain methods linked to data collection and analysis (e.g. Ecological field data collection, statistical analysis, interviews & surveys) appear to be the most highly connected ones and to form a sort of foundation of SES study. Further, notable gaps among the methods explored are: 1) Few methods to support reflexivity compared to methods to support knowledge co-production; 2) Few methods to explore global scales compared to local, as well as few methods to explore cross-scale impacts; 3) Fewer methods to look at system dynamics compared to methods to study structures of SES; 4) Few methods that overcome human-nature dichotomy. Finally, Prof. Biggs highlighted the main challenges across methods as: defining system boundaries; disciplinary biases and incorporating multiple perspectives; context-sensitivity; power relations and complex causation.

Jacopo Giuntoli presented the initial project design and preliminary findings of the project on Leveraging multidisciplinary tools and approaches for achieving the SDGs. The project is linked to the Handbook by Biggs et al. (2021)<sup>4</sup> and aims to fill at least one of the gaps identified by the authors which is to bridge disciplinary silos to promote transdisciplinary research as well as to promote the uptake of these methods by policymakers to design effective interventions to achieve the SDGs. The core of the project relies on four main steps (see also Annex 3): 1) Extracting a large corpus of scientific literature from Scopus<sup>5</sup> linked to research programmes produced within Sustainability Science. This is done by defining a search query based on research topics and associated terms as defined by Clark & Harley (2020)<sup>6</sup>. After selecting articles, reviews, books, book chapters and editorials published from 2010 onwards, this search produced a corpus of more than 33000 papers. 2) Identify papers which are related to any of the SDGs or their underlying targets. This is achieved by applying the text mining methodology developed for mapping SDGs within EU policies as performed on the KnowSDGs platform. Specific meta data of the papers (abstract, title, author, keywords) are screened for direct SDG references and for a comprehensive list of more than 3500 SDG-related keywords to directly (i.e. an abstract mentions explicitly SDGs) or indirectly (i.e. an abstract mentions an SDG-related

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<sup>3</sup> [https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox\\_en](https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox_en)

<sup>4</sup> Biggs, R., Vos, A. de, Preiser, R., Clements, H., Maciejewski, K., & Schlüter, M. (2021). The Routledge Handbook of Research Methods for Social-Ecological Systems. Routledge. doi: 10.4324/9781003021339 Open access source here.

<sup>5</sup> <https://www.scopus.com/home.uri>

<sup>6</sup> Clark, W. C., & Harley, A. G. (2020). Sustainability Science: Toward a Synthesis. In Annual Review of Environment and Resources (Vol. 45, Issue 1, pp. 331–386). Annual Reviews. doi: 10.1146/annurev-environ-012420-043621

keyword) link the papers to the SDGs. 3) Identify papers which use any of the methods or approaches mentioned in Prof. Biggs' Handbook (Biggs et al 2021)<sup>4</sup>. The taxonomy of methods in the Handbook was used to devise a list of keywords that is used to categorize each paper. 4) The last step aims to assess whether any of the methods have been explicitly used to support governance and whether they can be associated to specific stages of the EU policy cycle (i.e. agenda setting, policy formulation, policy adoption, implementation, evaluation). The final goal of the project is to define a mapping linking research programmes to methods and SDGs, as well as methods to SDGs and to policy cycle phase. Further, the project aims to also generate a network of research groups linked to specific methods so that policymakers know where to find the required expertise if they decide to use any specific method.

## 2.4 Key points from the discussion

The discussion with the participants focused on how to improve the framework for the mapping and classification of the tools. The guided discussion focused on the following topics:

1. Goal and scope of the project: is the project salient? Can its scope or output be improved to better respond to the needs of policymakers or researchers? Are there similar exercises on-going or finalized?
2. Way forward and collaborations: one of the goals of the project is to foster transdisciplinary work across silos. The JRC would be glad to expand collaborations to carry out this project or to work on follow-up actions that support the governance towards a sustainable transition.

The first topic was discussed through specific polls and open questions in SliDo. The second topic was explored through a survey distributed among participants.

Discussing the goal and scope of the mapping, the totality of respondents agreed that this exercise might be helpful to support multidisciplinary research and to link research groups. A specific suggestion was made that the mapping tool could be helpful for researchers to find collaborations across different disciplines when writing and submitting proposals for Horizon Europe projects.

Secondly, a large majority of the participants found the tool to be also useful for informing policymakers. When asked to clarify the main reasons why the proposed tool would not be helpful, the responses could be classified in two main categories:

- a. Issues with procedural use of the tool by policymakers;
- b. Classification and integration of methods in the mapping tool.

On the first category, participants raised the issue that policymakers will benefit from the tool only if they will have also access to competent users of the methods. Some participants added that the mapping could be better used as a tool to engage policymakers with other stakeholders (including scientist and citizens) in a way to collectively choose the best methods for each context to explore sustainability issues. On the second category, some participants raised the issue that integrated models, that cut across several SDGs and uses several of the methods mentioned in the Handbook, might be missing from the current mapping.

We also asked the participants what the best way would be to inform policymakers about the tool and to promote its adoption and use. The participants brought forward several interesting and useful suggestions, among which:

- Define a user-friendly interface for the tool;
- Link to other relevant institutions (e.g. UN agencies) which might be interested in collaborating to develop the mapping and thus to promote it to a broad audience;
- Use available opportunities to present the tool directly to policymakers (e.g. within the Better Regulation Network);
- Once the tool is ready, it could be presented in workshops with potential users across Member States;
- Make explicit within the mapping tool the specific case studies where each method has been used;
- Connect with the experts and research groups identified in the mapping to both introduce the tool and to improve it with additional methods (e.g. with foresight practitioners).

Finally, the last step of the workshop included the distribution of a survey to identify participants who would be interested in collaborating with the JRC in further defining the mapping. The replies provided information about the tools the respondents regularly use, which SDGs they address, for which phase(s) of the policy cycle, and a feedback on the goal and scope of the current project set-up and other comments useful to improve the project.

## **2.5 Way forward**

The next steps of the project aim to better define and finalize the automatized literature review screening and classification by:

- Refine the keyword list for Biggs' tools;
- Define a method to link tools to EU policy cycle phase. In this regard, a possible approach would be to look for the tools within EUR-LEX<sup>7</sup> catalogue and then create an indirect link between tools and policy cycle phase.

Further, the next step will be the manual assessment of the final corpus of papers to identify whether the automatic screening has been accurate and to improve the analytical framework of the mapping, check the results of the automatic mapping versus the results of the survey, and extract specific case studies (i.e. linking methods to SDGs and to specific governance goals).

A more advanced version of the mapping will be further discussed with participants who expressed interest to do so, with the aim to publish a technical report by mid-2022.

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<sup>7</sup> <https://eur-lex.europa.eu/homepage.html>

## **3 Workshop 2: We need to talk about models**

### **3.1 Objectives**

Models are extensively used to understand policy issues and analyse the impact of interventions - in areas such as climate change and environmental degradation, pandemic response, economic growth, to name but a few. The effectiveness of policy decisions using model-based evidence depends on the data used by the model and the questions the model was designed to answer. Additionally, questions about quality and reliability of models are crucial.

So, how can we have confidence in models used for policy support - as the public, research bodies, or decision makers? How can we interrogate the quality of data, and the reliability and transparency of models used for policy support?

The workshop provided the opportunity to join a discussion between scientists, policymakers and citizens about overcoming the challenges of communicating and understanding the models used for policy.

The workshop was jointly organized by the European [Commission Competence Centre on Modelling \(CC-MOD\)](#) and [Sense about Science EU](#) following the [launch](#) of the EU [Commission modelling inventory MIDAS](#). MIDAS gives access to the descriptions of models supporting Commission impact assessments starting from July 2017.

### **3.2 Outline**

Opening remarks:

Salvador Barrios, Head of Unit - Fiscal Policy Analysis, DG Joint Research Centre, European Commission

Leen Hordijk, Special Adviser, Competence Centre on Modelling, European Commission

David Mair, Head of Unit Knowledge for Policy: Concepts and Methods, DG Joint Research Centre, European Commission

Alexia Maniaki-Griva, Head of Unit, Ex-Ante Impact Assessment Unit, Directorate-General for Parliamentary Research Services, European Parliament

Moderation :

Tracey Brown, Director, Sense About Science EU

Paul Smits, Head of Competence Centre on Modelling, DG Joint Research Centre, European Commission

### **3.3 ‘The questions you need to ask when confronted with model-based evidence’**

Policy decisions must be transparently informed by evidence. Models are key part of building this evidence by investigating the relationships between phenomena and analysing the potential impacts of policy options.

A set of structured questions, based on those that specialists ask, can enable policymakers and the wider public to question model use for policy, and help researchers to explain their model-based evidence and to keep it accessible, transparent and accountable.

A first set of these questions has been elaborated by CC-MOD in collaboration with Sense about Science EU, to cover aspects related to model structure (data and assumptions), model quality, transparency and communication of model results.

The document ‘The questions you need to ask when confronted with model-based evidence’ (see extract in Figure 1 below) has been shared to participants ahead of the Workshop for reflection and discussion.

## The questions you need to ask

*There is a set of structured questions, based on those that specialists ask, that enable policymakers and the wider public to question model use for policy, and help researchers to explain evidence and keep it accessible and accountable.*

First and most importantly, we should define the **policy issue at stake** and the policy questions.

Then, the following questions help to **assess** whether a certain model is the right tool to answer them, and to **interpret** results correctly.

### 1 What do we know about the **model**?

#### *About the **data***

- What are the sources?
- What biases or limits exist?
- What is missing, and is it relevant?
- What are the relationships between the data?
- What are the associated uncertainties?

#### *About the **assumptions***

- Are they well-founded?
- What has not been considered?
- What are the sensitivities of the model?

### 2 Is the model **transparent**?

- Are model inputs and outputs publicly available?
- Is the model code accessible?
- Is model development and performance documentation available?

### 3 What do we know about model **quality**?

- Has the model been peer reviewed and discussed in the scientific community?
- Have assumptions and results been discussed and validated with the expert community?
- Is there a statement on uncertainties and is it explained?
- Is the model being used in a new context? Does this introduce new limitations?

### 4 Is **communication** adequate?

- Are model results presented in a clearly understandable format?
- Are uncertainties clear?
- Are limitations explained as well as their implications for results?

**Figure 1.** Excerpt from the document ‘The questions you need to ask when confronted with model-based evidence’ (see reference section).

### 3.4 Key points from the discussion

Salvador Barrios reported on his concrete experience of using models for policymaking. Models help to shape policies, thus have an impact on our daily lives. The specific perceptions and needs of policy makers and citizens need to be taken into account to be able to effectively communicate with them about modelling results in support to policy. There is thus the need to create an open space of communication between modellers, policymakers, and the civil society.

A key component of the process is the building of trust. As David Mair emphasised, when communicating on evidence supporting policy, in addition to ensuring the excellence and transparency of the models used an important element is taking into account citizens values. This is key to tackle cognitive biases. In this respect, in addition to asking whether 'model assumptions are well founded', one should also consider whether models are indeed addressing the value spectrum that society would like to see addressed. This brings back to consulting citizens on which are the questions they would like to be answered by models.

As suggested by Leen Hordijk, the 'Harvard's triplet' (Cash et al, 2003) is a useful checklist about using models for policy analysis. This includes credibility, which refers to peer review, publications, open access; legitimacy, that is an inclusive process involving all stakeholders; salience, to make sure the relevant policy issues are addressed. Leen Hordijk also stressed how the scientific credibility of models cannot merely be established through publications in peer-reviewed journals, but also needs model comparison exercises, in-depth site visits and/or scrutiny by a panel of external experts. Models that are not well documented and not (partially) publicly available shall not be used for policy analyses. Many scientists are much keener on developing and applying models than on the cumbersome task to write detailed model documentations; often external reviews force modellers to invest in documentation. Also, model results published without quantitative or qualitative uncertainty statements should be used with caution in policy analyses. Many models cannot be used in a predictive manner, but are instruments for better understanding interrelationships between model variables and policy issues addressed. The use of a model outside of its application range can be damaging for the model's credibility.

Alexia Maniaki-Griava expressed support for the European Commission and JRC commitment to evidence based policymaking, and stressed the importance of accessibility, transparency and consistency for model use in support to Commission impact assessments. Especially in the case of very complex scenarios, there is a crucial need to present results in an understandable way. Improvements have been done but further efforts are needed. It is important to clearly explain also what cannot be covered by models. Also, the Commission modelling inventory MIDAS is important for transparent communication. The link to the MIDAS model description can be included in the appraisals of Commission impact assessments carried out by the European Parliamentary Research Service.

The following discussion emphasised how further efforts should ensure that communication of models results is understandable by policymakers and the public. Communication could be channelled at different levels and to different audiences.

The 'Questions to model based evidence' are regarded as an important step in this direction. An aspect that should be added is model type, and whether it is fit for purpose. Also, it is important to acknowledge the possible limitations of applying modelling results which might be produced at an aggregated level to more detailed and specific contexts, as well as the limitations deriving from specific cases that cannot be included or recognised in the data or assumptions. In addition, more and more models use Artificial Intelligence. The explainability of these models require careful attention. Related to scientific credibility there is the importance of being clear about the history and quality of the input data. The same holds for the assumptions – a key question is whether they are well-founded and supported by the stakeholders. Also, adequate resources should be invested to ensure that detailed model documentation is in place.

All these elements will be taken into account for further updating the document.

### 3.5 References

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## **4 Workshop 3: Strategic Foresight and quantification link for better future-oriented policymaking**

### **4.1 Objectives**

- To explore the added value of integrating forecast and strategic foresight methods in policy making.
- To showcase ongoing future-oriented work that combines qualitative and quantitative approaches for a defined policy question.

### **4.2 Outline**

Presentation: Shared Socio-economic Pathways (SSPs) for European and Austrian agriculture and food systems: the Eur-Agri-SSPs and the AT-Agri-SSPs

Hermine Mitter, Senior Scientist, University of Natural Resources and Life Sciences, Vienna (BOKU)

Discussants:

Cornelia Daheim, Head, Future Impacts Consulting

Florence Buchholzer, DG Agriculture and Rural Development, European Commission

Robert M'Barek, DG Joint Research Centre, European Commission

Vicky Pollard, DG Climate Action, European Commission

Fabiana Scapolo, DG Joint Research Centre, European Commission

Moderation: Eckhard Stoermer and Tommi Asikainen, Competence Centre on Foresight, DG Joint Research Centre, European Commission

### **4.3 Key points from presentations and discussants**

Fabiana Scapolo highlighted the vocabulary used in different disciplines when describing the uncertainty concept and how its understanding differs in forecast and foresight. Modelling mainly aims to project future developments based on trend extrapolation and expert judgement or probabilistic forecasting. Strategic foresight scenarios provide a coherent view on plausible futures based on an analysis of different dimensions (Dorsser et al. 2018). Futures research aims to strengthen the links between forecast and foresight to better inform policy making, and enable policy makers to deal with uncertainty and complexity better, in a volatile world.

Hermine Mitter, BOKU, introduced the global Shared Socioeconomic Pathways (SSPs, O'Neill et al. 2017) and their extension for European (Eur-Agri-SSPs, Mitter et al. 2019, 2020) and national agriculture and food systems (AT-Agri-SSPs). These pathways describe drivers of plausible futures, which can serve as input to integrated assessments to model and quantify potential impacts. The 'nested approach' for scenario development enables cross-scale and cross-sectoral analysis and comparison of model results. A transparent and systematic participatory process, with a high level of stakeholder engagement is the basis for developing the scenarios and provides legitimacy and richness of the results. The protocol-based development of the scenarios allows to harmonize qualitative and quantitative approaches such as integrated assessments of agriculture and food systems. Results for policy makers are, among other things: recommendations for efficient land and water use under climate and policy scenarios, identification of cost-effective policies and an analysis of trade-offs between economic and environmental objectives (Karner et al. 2021, Mitter and Schmid 2021).

Vicky Pollard described how DG Climate Actions used SSP from an IPCC report for their modelling, as part of their suite of forward-looking instruments used for evaluation of policies and impact assessments. A crucial element is to define and specify the assumptions for the long-term outlook up to 2050, on economic growth, behavioural change and social innovation, industry demand for circular products, technological innovation and other relevant parameters.

Florence Buchholzer expressed the policy need in DG Agriculture and Rural Development to improve links between strategic foresight and quantification. In the recent EU Agriculture Outlook report, projections for

agricultural markets and farm income up to 2031 are based on modelling and expert judgement. To expand the long-term perspective until 2050, megatrends were used to cover a longer time horizon and to take a broader look beyond agricultural sectors. The agricultural outlook serves as baseline for impact assessment and input for models. To understand transformations in the landscape of farming and farmers, the 2020 EU Agriculture Outlook Conference presented a foresight study on “farmers of the future”. To future proof new policy initiatives, megatrends analysis can be used in impact assessment, according to the updated better regulation guidelines.

Cornelia Daheim, founder of Future Impacts, looked back in time and reviewed historical approaches of combining qualitative and quantitative methodologies. These include the State of the Future Index (SOFI) of The Millennium Project, as well as several approaches developed by foresight think tanks. The key factor to make these combinations successful is understanding that both approaches have a ‘different vocabulary’ and different concepts. Using a combination of both approaches can increase their impact. Involvement of policy-makers in the process is a key lever.

Robert M'Barek, JRC, highlighted that future-oriented studies need a baseline (i.e. the assumption covering no policy change) and a variety of scenarios. This can be approached in different ways, including combinations of foresight and quantification approaches. From a forward-looking modelling perspective experimenting with new ways that benefit from foresight thinking is useful; including grasping the meaning of uncertainty, better addressing technological innovation and developments and considering behavioural change. Appropriate tools are needed to deal with the complexity, and to analyse and communicate trade-offs and synergies of policy implications in the context of the global policy objectives of Sustainable Development Goals, their targets and indicators.

#### **4.4 Key points from the discussion**

The plenary discussion tackled two areas: (i) how to involve policy making and expert knowledge in the process and (ii) how to reduce the gap, or, create a link between forecast/forward-looking modelling and foresight.

Policy makers and experts should be involved from the beginning, and throughout the study in order to achieve the best impact. Their involvement is crucial, because otherwise the study can be biased and miss the policy option considerations that the policy maker is interested in.

Another discussion focused on the need and availability of resources to do studies. Developing several scenarios and forecasts/forward-looking modelling needs the involvement of many people. Limited resources puts a limit on how wide a study can be developed. It was noted that building scenarios on an existing, widely accepted scenario framework such as the SSPs may help to reduce the myriad of scenarios that may partly disagree. It was also noted that to inform policy makers, it is often required to deliver results in a short time-frame, which also limits possibilities.

A rich discussion about ‘interlinkages’ between foresight and forecasting highlighted the need for a “common vocabulary”. Making these interlinkage is not a new idea, but how to make them practically feasible requires many steps, and skilled collaborators who know the approaches of both fields. It is not necessary to develop a wide range of new tools, the work could build on established methods, such as Shared Socioeconomic Pathways and integrated assessments, semi-quantitative or system dynamics approaches, etc. Willingness to bridge these fields and interdisciplinary approaches are needed. A first step towards this goal was this workshop and there was agreement that further collaboration between these fields would be fruitful. For its use in the assessment of policies, the processes have to be robust, fulfil high quality requirements and be transparent, in order for it to be possible for the results to be used to justify policy decisions.

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## **5 Workshop 4 : Human models for human policies**

### **5.1 Objectives**

- To explore the added value for policy-making through the integration of realistic models of human decision making;
- to discuss how policymakers should be involved in the process;
- to showcase ongoing future-oriented work.

### **5.2 Outline**

Presenter:

Nina Schwarz, Assistant Professor, Department of Urban and Regional Planning and Geo-Information Management, University of Twente

Discussant:

Jesus Barreiro-Hurlé, DG Joint Research Centre, European Commission

Moderator:

Hendrik Bruns, DG Joint Research Centre, European Commission

### **5.3 Key points from presentation and discussant**

Hendrik Bruns opened the workshop and highlighted the importance of audience interaction. Hendrik stressed the importance of scientific evidence on human behaviour to inform European policies, as provided by the Competence Centre on Behavioural Insights. He stressed the limits of human rationality, highlighting bounded rationality, willpower, and self-interest, and the fact that this is relevant for policy effectiveness and policy design. He also highlighted similarities between models and experiments.

Nina Schwarz introduced her talk by outlining what behavioural theories and agent-based models (ABM) are. She explained why behavioural theories contributed to policy making and why these should be informing models. She highlighted that behavioural drivers in models allowed insights into potential societal responses to changing settings (such as policies), that models can be used as virtual test beds for theories, that theories can be a common denominator, e.g. for model comparison, and that theories can help narrow down the scope of what to include in a model. She then focused on the different steps in the modelling cycle. Specifically, she focused on the necessary steps to find and select a theory, formalise a theory, translate the formulation into code, and finally document these tasks. Parameterisation was a specifically important focus. She also highlighted the implications for analysis, since heterogeneous agents with complicated decision-making required different analysis than models with rational agents or aggregate approaches. After focusing on the documentation of a model, Nina discussed open challenges. Open challenges referred to the data scarcity paradox, a better link between behavioural scientists and modellers, as well as the robustness of findings & validation.

Jesus Barreiro-Hurlé brought in his experience from using models at the European Commission and contributed to the debate with first hand experience. He brought in valuable input from his perceptions regarding the challenges and potentials of including behavioural insights into modelling as perceived by policy makers. There is a need and added value for strengthening the link between behavioural scientists and modellers. It would be important to see how much the modelling results would actually change following better integration of behavioural aspects. While we might actually be overoptimistic on how much results would actually differ, this exercise is a very important low hanging fruit to counter criticism on possibly unrealistic assumptions on human behaviour in models. Behavioural drivers allow insights into potential societal responses to changing settings, including policies. This could also help to increase the number of measures that can be tested in modelling exercises.

Surveys on Slido revealed that the majority of the audience that participated in the survey (around 30 people over all questions) self-identified as modellers, followed by behavioural scientists, policy makers, and none of the above all in similar numbers. The most prominent reason given for why behavioural theories or other

insights should be included in models was that "Behavioural drivers in models allow insights into potential societal responses to changing settings (incl. policy)". This was followed by models being used as virtual laboratories to test theories, indicated by around half of respondents, that "theories narrow down the scope of what could be included in a model" by a quarter and "theories as a common denominator" indicated by a few. As for reasons why respondents typically use models including human decision-making, prediction/forecasting, causal explanation, hypothesis tests, illustration, and to a lesser degree analogy, and facilitation of learning were mentioned (it was possible to choose multiple). All participants agreed that policy makers should be included in the formulation of the question, as well as, to a lesser degree, in the communication and hypothesis creation stage. Less participants thought that analysing the model, choosing the model structure, and implementing the model were tasks that policy makers should be involved in. Around three quarters of the participants indicated that they thought the output of a behaviourally informed model would be more or vastly more informative than a non-behaviourally informed model. No one expected the output to be more or less the same, or be less informative. Around a quarter did not know. Participants also rated the importance of different model aspects in their wishlist. Transparency of the model and validation of the model were both rated by almost everyone as important or very important. Easiness of communicating results and the ability to predict/forecast were rated as important or very important by the majority. Low time and cost resources required were only deemed as at least important by around a quarter of the respondents.

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## 6 Workshop 5: Impact by Design: How to create social science models that effectively address policy needs?

### 6.1 Objectives

The increasing complexity of the issues that policymakers are called to tackle alongside the urgency with which such issues need to be tackled calls for the benefits from ex-ante modelling and simulation techniques, which are increasingly powerful, precise, and rich in the level of information and details they can provide. At the same time, scientists and modelling practitioners, both in the private sector and in academia, are extending the frontier of what is possible to predict through a simulation model.

The process of aligning the efforts and the research produced by the academic world with the needs and desiderata of policymakers can be a cumbersome one. Communication between stakeholders appears to be the key for success of this alignment process and, for this reason, our objective is to present two success stories of science-policy interaction and dialogue, one relative to the integrated assessment of emission mitigation strategies in climate change policy, and a second one related to the use of advanced macroeconomic modelling in policymaking.

The overarching goal of this workshop was to gather, via an informal analysis of these two case studies, some insights on fostering dialogue between policymakers and scientists, especially those involved in the design and application of modelling techniques to inform social policies. It also aimed at highlighting the most effective ways to engage policymakers in the process and how to adapt approaches for achieving a better science for policy link.

The event has been organised by the [JRC Centre of Advanced Studies Project Computational Social Science for Policy - CSS4P](#).

### 6.2 Outline

Michele Vespe, Team Leader, Digital Economy Unit, DG Joint Research Centre, European Commission, introduced the project [Computational Social Science for Policy](#), highlighting the objective, the first deliverables and presented the team.

Before the open discussion, two topics were presented, the so-called “Researcher vs. Policymaker perspectives” on Macroeconomic policy and on Economics of climate change. The aim of these talks was to show experience in communicating modelling results to policymakers.

Topic: Macroeconomic policy

- “How DG ECFIN and the JRC cooperated during the COVID-19 Crisis” by Luca Onorante, Economic Analyst, Finance and Economy Unit, DG Joint Research Centre, European Commission
- “How DG ECFIN and the JRC cooperated during the COVID-19 Crisis” by Susanne Hoffmann, Statistical Assistant, DG Economic and Financial Affairs, European Commission

Topic: Economics of Climate Change

- “Mathematical modeling for climate change policies” by Massimo Tavoni, Politecnico di Milano and RFF-CMCC European Institute on Economics and the Environment
- “Delivering the European Green Deal. The “Fit for 55” package: modelling in support of policy design” by Quentin Dupriez, Policy Officer, Strategy and Economic Assessment Unit, DG Climate Action, European Commission

Each speaker had a 7' talk that followed these guidelines:

- Which was the policy/research topic of interaction?
- How did you define the objectives of the project?
- How did you handle the interaction process?

- Which were the results from a scientific perspective? And from a policy one?
- Which was the impact of the project's results?

### 6.3 Key points from presentations

Topic: Macroeconomic policy

GDP forecasting models went into crisis due to an unpredictable event (COVID-19). Traditional economic forecast is unable to produce a quick assessment and macro data come with a lag, as effects of COVID-19 are not visible. Joining nowcasting techniques and timely available "big data" could improve the assessment of the impact of the pandemic on the economy.

Partnership between JRC and DG ECFIN is allowing to build a global dataset that includes commodity prices on international exchanges; Google searches concerning the automotive market, holidays, job applications. Furthermore, other national datasets include several air quality indicators (pollution as indicator of activity); aviation, industries, and passengers; Dow Jones news-based indicators on themes such as economy, unemployment, inflation; G-Delt news-based sentiment analysis, AirBnB data, etc.

Topic: Economics of Climate Change

Modelling tools are critical to evaluate policy options and their impact and to understand the interaction between proposals and their overall coherence.

Going from policy options to modelling scenarios requires careful work and close interaction with modellers. Each scenario reflects an alternative balance of instruments. Each model is designed to assess specific issues, all working simultaneously.

Building a trustworthy relationship between modelling and policy is a complex process which requires transparency and a full investigation and disclosure of uncertainties. Uncertainty auditing needs to be embedded in the science-policy interface by design, by enforcing good practices (such as global sensitivity analysis) and ensuring a mutual exchange between the modelling and policy communities.

### 6.4 Key points from discussion

After the presentations, the interactive session called "Towards guidelines and keywords for science-policy dialogue" started with a series of Sli.do questions to participants, to get the feeling about their thoughts on the communication in the science for policy cycle.

Sli.do revealed a predominance of researchers in the audience with respect to policymakers and an almost equal share of public sector and academia representatives around Europe.

The participants were asked to think about their last science-policy interactions, and to think about how much time is needed to address a policy question both from a scientific perspective and from a policymaker perspective. As expected from a scientific side most of the audience replied that the time needed goes between one and two years, while the reasonable reaction time for a policymaker is a few weeks.

One of the questions was about the design of the policy issue and the participation of the two 'sides': in this case, most of the respondents said that they co-designed them. Then, participants were asked which kind of impact their works had: the biggest group replied that they had significant policy impact and some research impact, followed by around a third stating that they achieved a balanced policy and research impact.

The Sli.do went on a more communication-related part, asking which was the most used tool in the science-policy interaction, highlighting meetings, workshops, and videoconferences. It was also asked feedback to participants on how satisfied they were with the interaction between stakeholders: around half were not much satisfied, while around a third were completely satisfied and a smaller group not at all satisfied. Then it was finally asked what the key aspect is in creating social science models that effectively address policy needs, and the results are available in the following word-cloud:



The Q&A session revolved around the issue of communication among stakeholders in such complex project environments. In particular, the use of specific digital tools (web-conferencing, project management) was discussed and commented, alongside the importance of the presence of a trust relationship between scientists and policymakers. Additionally, one of the takeaway messages of the workshop was also relative to key role of so called “science-policy bilinguals”, individuals that are particularly able to talk and understand both the science and policy side of real-world issues.



## 7 Training 1 : Social multi-criteria evaluation (SMCE) for ex-ante impact assessments

Organisers: Giuseppe Munda, Nicole Ostlaender, [Social Multi-Criteria Evaluation of Policy Options team](#) of the [Competence Centre on Modelling \(CC-MOD\)](#), DG Joint Research Centre, European Commission

### 7.1 Objective

SMCE is a methodology that allows comparing policy options by integrating a plurality of technical aspects and social views in a coherent and transparent manner. In this training, participants got an introduction to the overall methodology, its application in impact assessments, and a brief introduction to the SOCRATES software which has been specifically designed in the spirit of SMCE.

### 7.2 Content

The training aimed at presenting a SMCE operational framework useful for answering the following key question: how can we integrate a plurality of technical aspects and social views into its ex-ante impact assessment in a coherent and transparent manner (coherence and transparency being key requirements of the European Commission Better Regulation policy)? The main achievement of SMCE is the fact that the use of various evaluation criteria has a direct translation in terms of plurality of values and dimensions used in the assessment exercise. SMCE accomplishes the goals of being inter/multi-disciplinary (with respect to the research team), participatory (with respect to the community) and transparent (since all criteria are presented in their original form without any transformations in money, energy or whatever common measurement rod).

In the last decades, SMCE has been applied successfully in various geographical and cultural contexts worldwide. Currently, JRC is developing a software tool, called SOCRATES (SOcial multi-Criteria Assessment of European policieS), explicitly designed for IA problems. Three main components constitute the core of SOCRATES: multi-criteria, equity and sensitivity analyses. The objective of SOCRATES is NOT substitution of policy-makers through a mathematical model, on the contrary, the objective is to improve their understanding of the main features of the problem at hand, such as key assumptions, degree of uncertainty, robustness of results and overall technical and social defensibility of options chosen.

### 7.3 Keypoints from presentations and discussions

The main topics tackled were:

- 1) An informal introduction to the main concepts of Multi-Criteria Evaluation, in particular incommensurability and multidimensionality, the idea of compromise solution, variety of information and compensability versus non-compensability.
- 2) What's special about Social Multi-Criteria Evaluation (SMCE), in particular the relation between a plurality of social points of view and their translation into a set of criteria. The importance of the policy process structuring the decision problem and the related concept of scientific quality.
- 3) SMCE key concepts for ex-ante Impact Assessments. In particular, the importance of transparency throughout the whole process, consistency between the problem structuring and the results obtained, homogeneity across a variety of studies and repeatability of calculations.
- 4) Brief introduction to the SOCRATES software by means of a real-world example. Particular emphasis was put on the topic of weights and its robustness analysis.

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## **8 Training 2: An introduction to SIML@B: an online EC tool for global sensitivity analysis of models**

Organisers: Thierry Mara, Rossana Rosati, [Sensitivity Analysis of Models \(SAMO\) team](#) of the [Competence Centre on Modelling \(CC-MOD\)](#), DG Joint Research Centre, European Commission.

### **8.1 Objective**

The aim of the training course was to introduce SIML@B, an online tool recently developed by the JRC to allow modellers/practitioners to perform the global sensitivity analysis of their computer model response. The role of uncertainty and sensitivity analyses in model-based decision making and some theoretical background necessary to interpret the outcomes of SIML@B were initially recalled. Furthermore, the new tool was illustrated in detail and some online examples shown.

### **8.2 Content**

The European Commission is committed to transparent and evidence-based policy making throughout the policy cycle. Simulation models are increasingly used in impact assessments to provide support to policy makers across a wide range of areas. Understanding and communicating uncertainty in model outputs is essential to ensure transparency and responsible use of models (a.k.a. uncertainty analysis). Identifying the most important sources of uncertainties is also a relevant task to undertake (a.k.a. sensitivity analysis). Uncertainty and sensitivity analyses should be systematically performed in modelling activities in support of policy making.

Monte Carlo simulations are the straightforward method to propagate sources of uncertainty in order to quantify the variability in the model response of interest. The identification of the sources mainly responsible for the uncertainty in the output is often not trivial. The training course focused on the identification of the relevant sources of uncertainty with the help of SIML@B, an online tool developed by the Joint Research Centre .

Some exercises (using Excel) were performed to guide the participants throughout the use of SIML@B and to ensure a comprehensive interpretation of the results provided by the tool.

The introductory part of the course aimed to familiarise participants with the needed theoretical notions. The training course was designed to be interactive and participatory.

### **8.3 Key points from discussion with the participants**

The presentation and demonstration of SIML@B by the trainers was followed by stimulating exchanges with the participants, as well as further demo exercises. The participants were able to interact with the trainers via the webex chat while the trainers replied orally.

Thierry Mara started his presentation by recording the important role that Uncertainty Analysis (UA) and Sensitivity Analyses (SA) of computer model responses can play in policy/decision making and especially in the policy cycle of the European Commission (EC). Then, he recalled the main steps to carry out UASA: basically, Monte Carlo simulations for UA and variance-based sensitivity indices were introduced for SA. These latter can be calculated with SIML@B from a Monte Carlo simulation data set.

Rossana Rosati made a demonstration of the SIML@B tool. She first described the structure of SIML@B which is composed of a main introductory module and three modules which specifically implement a SA method. Therefore, the modules allow us to compute three different types of sensitivity indices. Rossana focused on the SIML@B module computing variance-based sensitivity indices which should be considered as one of the most relevant methods. A step-by-step approach was carried out during which it was shown:

- how to upload the data set to analyse,
- how the data set must be structured, and

- how to run the module
- and finally how to interpret the results.

Overall, the training was much appreciated by the participants. The audience was very diverse with both confirmed users of UASA and completely novices in the field. During the discussion, several relevant concerns were raised:

- 1) the issue of models that require too much time to run and are highly parameterized. In this case, Monte Carlo might not be relevant (because would take too much time). The trainers argued that screening analysis methods can be employed instead of quantitative methods (such as variance-based methods). Another way to circumvent this issue is to group the model inputs.
- 2) the case of models with correlated inputs. The issue here is that variance-based methods require that the input variables be independent of each other. In practice, this is not always the case. The trainers pointed out that the other two modules of SIML@B can cope with correlated input samples. However, they warned the participants that, when the inputs are correlated, the interpretation of the sensitivity indices is a bit tricky.

The next action to undertake is the release of SIML@B to the public and the fostering of the tool (e.g. via further trainings, Conference, the K4P website [https://knowledge4policy.ec.europa.eu/modelling/topic/sensitivity-analysis-models\\_en](https://knowledge4policy.ec.europa.eu/modelling/topic/sensitivity-analysis-models_en)).

## Annex 1 : Overview of the programme of the 2021 EU Conference on modelling for policy support

Conference website :

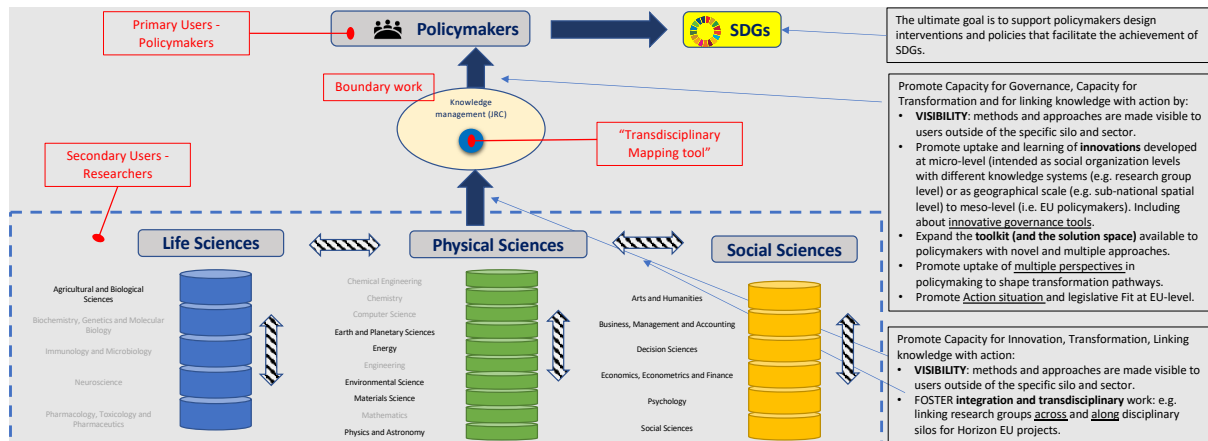
[https://knowledge4policy.ec.europa.eu/event/2021-eu-conference-modelling-policy-support-collaborating-across-disciplines-tackle-key\\_en](https://knowledge4policy.ec.europa.eu/event/2021-eu-conference-modelling-policy-support-collaborating-across-disciplines-tackle-key_en)



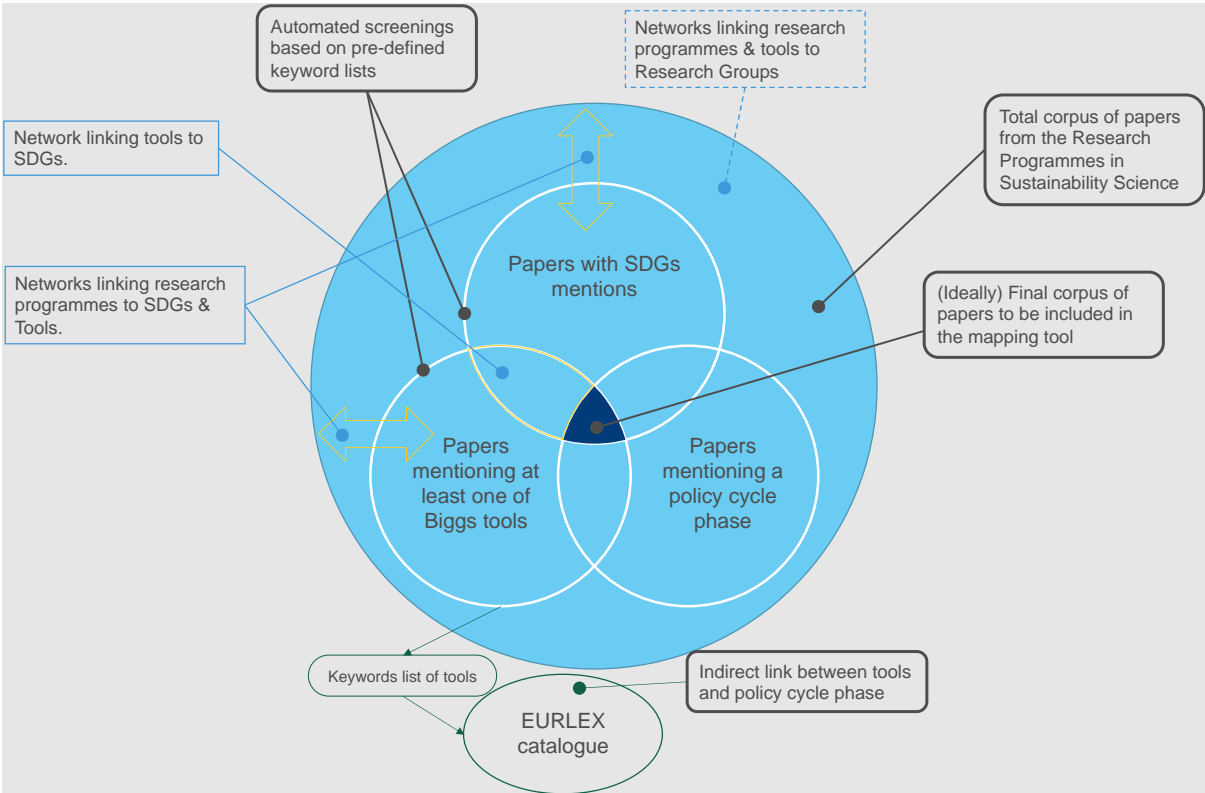
### Programme at a glance

	22.11 Monday	23.11 Tuesday	24.11 Wednesday	25.11 Thursday	26.11 Friday
09 30	<b>KEYNOTE 1</b> Modelling for the emergency: the Earth4All experience	<b>KEYNOTE 2</b> Economic models and the COVID-19 pandemic	<b>KEYNOTE 3</b> Modelling tools for policy support in (real) time of crisis	<b>SESSION 6</b> Multidisciplinary approaches, integrated assessment and model linkages	<b>CONCLUDING SESSION</b> Modelling for policy, main messages and the way forward
10 50			<i>break</i>		
11 00	<b>SESSION 1</b> Ensuring model quality	<b>SESSION 3</b> Scenarios and data	<b>SESSION 4</b> Modelling complex systems for policy	<b>SESSION 7</b> Using model related evidence for policy: processes and experiences	<b>POSTER SESSION</b>
12 45			<i>lunch break</i>		
13 30	<b>SESSION 2</b> Transparency of models and their use	<b>TRAINING 1</b> Social multi-criteria evaluation (SMCE) for ex-ante impact assessments	<b>SESSION 5</b> Assessing and communicating uncertainty in model results	<b>TRAINING 2</b> An introduction to SIML@B: an online EC tool for global sensitivity analysis of models	<b>SESSION 8</b> Combination of qualitative and quantitative methods
14 50	<b>CONTRIBUTED SESSION 1</b> Co-design of modelling-based services for climate change adaptation related policy support under the EU DestinE Initiative	<b>WORKSHOP 2</b> We need to talk about models	<b>CONTRIBUTED SESSION 2</b> Modelling for the Banking Union	<b>CONTRIBUTED SESSION 3</b> Climate change adaptation modelling as a tool for decision-making support	<b>SESSION 9</b> Communication and visualisation of model results
16 20			<i>break</i>		
16 30	<b>WORKSHOP 1</b> Leveraging multidisciplinary tools and approaches for achieving the SDGs	<b>WORKSHOP 3</b> Strategic Foresight and quantification link for better future-oriented policymaking	<b>WORKSHOP 4</b> Human models for human policies	<b>WORKSHOP 5</b> Impact By Design: How to create social science models that effectively address policy needs?	<b>CONTRIBUTED SESSION 4</b> Highlights from the EU Open Data Days: how open data can support policy-making
18 00					

## Annex 2: Schematic representation of the role of the mapping tool at the boundary between science and policy and its potential role in promoting capacities for Governance, Transformation and for linking knowledge with action (as defined by Clark & Harley (2020)).



**Annex 3: Schematic representation of the automated review screening employed in the project on Leveraging multidisciplinary tools and approaches for achieving the SDGs.**



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