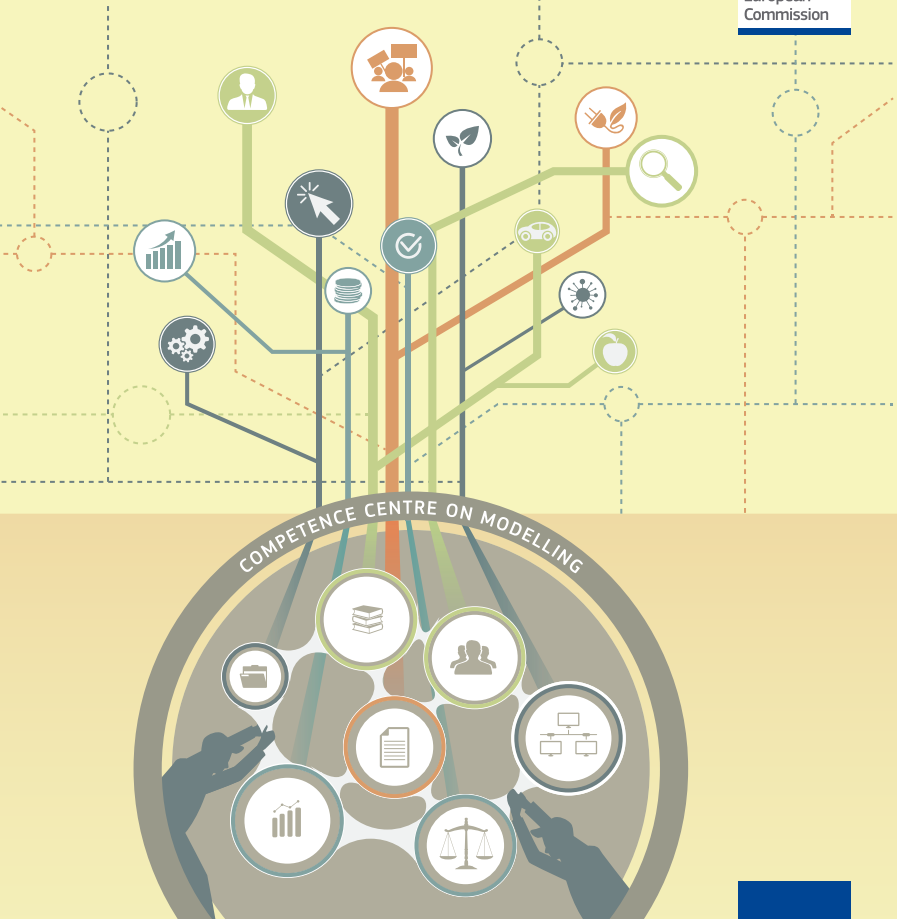
European Commission

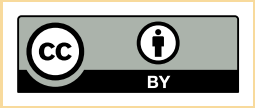


2021

The Competence Centre on Modelling (CC-MOD)

Overview of activities 2018-2020

JRC 123040
Ispra: European Commission, 2021



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The Competence Centre on Modelling (CC-MOD)

Overview of activities 2018-2020

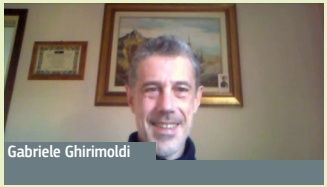
1 INTRODUCTION

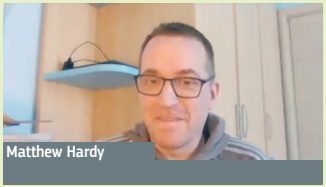
1.1 People @ CC-MOD

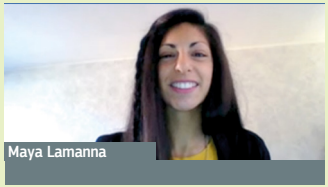

Ivano Azzini


Egle Basyte Ferrari

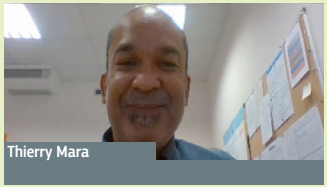

Thieffen Delabaere


Gabriele Ghirimoldi


Matthew Hardy

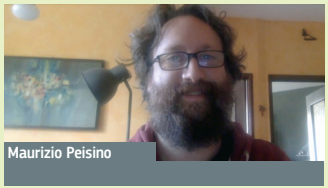

Maya Lamanna


Giulia Listorti


Thierry Mara


Giuseppe Munda


Nicole Ostlaender


Maurizio Peisino


Rossana Rosati


Eckehard Rosenbaum


Paul Smits

The CC- MOD team:
Ivano Azzini, Egle Basyte Ferrari, Thieffen Delabaere, Gabriele Ghirimoldi, Matthew Hardy, Leen Hordijk, D'Artis Kancs, Maya Lamanna, Giulia Listorti, Thierry Mara, Giuseppe Munda, Nicole Ostlaender, Maurizio Peisino, Rossana Rosati, Eckehard Rosenbaum, Fabiana Scapolo (Deputy Head of Unit), Paul Smits (Head of the Competence Centre on Modelling) and Xavier Troussard (Head of Unit).

1.2 Foreword

The European Commission's Competence Centre on Modelling (CC-MOD), launched in October 2017, promotes a responsible, coherent and transparent use of modelling to support the evidence base for EU policies.

CC-MOD further helps identifying common approaches to quality and transparency of model use, and facilitates dialogue between policymakers and modelling teams across the Commission.

CC-MOD is part of Unit I.2 'Foresight, Modelling, Behavioural Insights and Design for Policy' of the Joint Research Centre of the European Commission.

This brochure reports some highlights of CC-MOD activities.

VISIT US

https://ec.europa.eu/knowledge4policy/modelling_en

https://webgate.ec.europa.eu/connected/groups/cc-mod (Commission internal link)

EC-CCMOD@ec.europa.eu (e-mail)

2 CC-MOD MISSION

2.1 Objectives

- To promote a responsible use of models in EU policymaking
- To increase the transparency, consistency and quality of model use
- To improve the efficiency and effectiveness of modelling resources

2.2 Topics

- Corporate modelling inventory and knowledge management system MIDAS
- Sensitivity analysis of model output
- Peer review of models
- Transparency and coherence in science for policy
- Social Multi-Criteria Evaluation of policy options

CC-MOD collaborates with the Inter-Service Group on Modelling, the coordination body of all model users and developers across the European Commission. CC-MOD manages the Community of Practice on Modelling, the Commission-wide forum for the exchange of modelling-related knowledge and best practices in support of the EU policy cycle.

2.3 Services

CC-MOD main activities include:

- capacity building (trainings) and ad-hoc advice
- development of software tools
- facilitating dialogue between scientists and policymakers
- promoting and sharing best practices for model use in support to policymaking
- writing scientific publications, technical reports and guidelines

CC-MOD contributes to the Commission's Better Regulation policy, the Inter-Institutional Agreement on Better Law Making and the Communication on Data, Information and Knowledge Management at the European Commission. CC-MOD collaborates with the main international scientific networks and academic institutions.

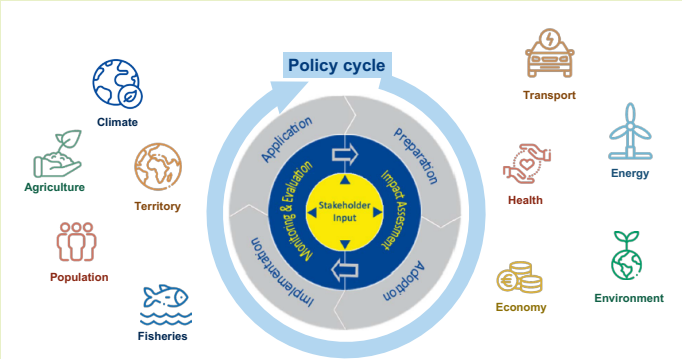
3 MODELS TO SUPPORT EU POLICYMAKING

Models are stylized representations of the real world that are used to make projections or to assess the behaviour of a system under specific (policy) assumptions. They provide support to policymakers throughout the policy cycle, from ex ante assessment for policy formulation, to policy implementation and ex post policy evaluation.

Policy areas characterised by frequent use of models in support to policymaking in the EU include, among others, climate and environment, economics, transport, energy, trade, and agriculture.

Model development and use entail close collaboration over time between modellers and policymakers.

The transparency, quality and coherence of model use in support to policies are key. Responsible model selection and use is crucial to deliver high quality, policy relevant results.



Models are extensively used in different policy domains to provide support throughout the policy cycle. Source: own elaboration based on SWD (2017) 350 final

4 CC-MOD ACTIVITIES

4.1 Corporate modelling inventory and knowledge management system MIDAS

Consistently documenting models and their use is the first step for a transparent and coherent use of models in support to the policy cycle.

For this, **CC-MOD manages MIDAS, the Commission Modelling Inventory and Knowledge Management System, which describes models in use by the Commission in support of the policy cycle**.

First developed in 2013, MIDAS includes information about the models, their quality and transparency, relevant references and documentation, as well as the support provided to Commission impact assessments.

Since 2017, the Better Regulation Toolbox requests that models used in Commission impact assessments are described in MIDAS. In 2019 MIDAS has been made accessible to the European Parliament and **is open to the public as of the end of 2020**. This important step will further help citizens and stakeholders to understand the Commission work on impact assessments.

By enhancing the transparency of models and traceability of their results, MIDAS contributes to the propagation of sound methodology underpinning the Commission's Better Regulation policy.

The home page of the MIDAS web application (copyright EU)

More on MIDAS at:
https://ec.europa.eu/knowledge4policy/modelling/topic/corporate-modelling-inventory-knowledge-management_en

Link to public version:
https://web.jrc.ec.europa.eu/policy-model-inventory

Further readings:

Acs, S., Ostlaender, N., Listorti, G., Hradec, J., Hardy, M., Smits, P. and Hordijk, L., *Modelling for EU Policy support: Impact Assessments*, EUR 29832 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-09671-9 (online), doi:10.2760/748720 (online), JRC117250.

Ostlaender, N., Acs, S., Listorti, G., Hardy, M., Ghirimoldi, G., Hradec, J. and Smits, P., *Modelling Inventory and Knowledge Management System of the European Commission (MIDAS)*, EUR 29729 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-02852-9 (online), doi:10.2760/900056 (online), JRC116242.

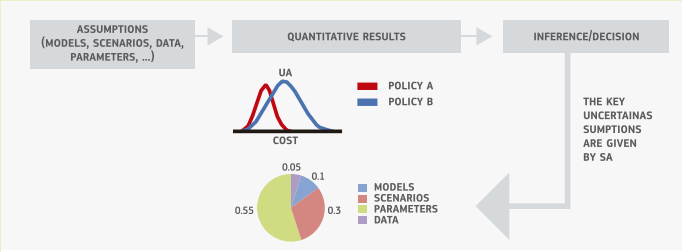
4.2 Sensitivity analysis of model output

Uncertainty and sensitivity analysis are crucial model quality assurance tools. While uncertainty analysis (UA) quantifies the variability of the model output, sensitivity analysis (SA) quantifies the respective contributions of each model inputs to the model output uncertainty. UA and SA are complementary and allow a comprehensive quality exploration of the model.

Services and tools for uncertainty quantification and sensitivity analysis are increasingly employed worldwide for the assessment, validation and verification of simulation models and computer codes.

The CC-MOD Sensitivity Analysis of Model Output (SAMO) team is involved in the following activities:

- support to and training of EC staff for uncertainty and sensitivity analyses (see Box)
- the development of a **Web-Application for Sensitivity Indices Estimate** allowing scientists to perform global sensitivity analysis of their models. A light version of the tool is currently available to Commission staff at https://web.jrc.ec.europa.eu/rapps/sensitivity/ (Commission internal link)



UA/SA is a valuable tool to highlight the key uncertain assumptions that drive model responses. This analysis is essential to inform decision-makers. Source: Azzini, I., Listorti, G., Mara, T.A., Rosati, R., 2020.

- training courses and ad hoc **support to Commission staff**, offering to modellers access to the state-of-the-art UA/SA techniques, and to policymakers an understanding of the role and importance of UA/SA in impact assessment
- support to the **International Conferences on Sensitivity Analysis of Model Output**, devoted every three years to advances in research on sensitivity analysis methods and interdisciplinary applications
- organisation of the **biannual JRC-SAMO Summer School**. From the basic principles, the programme guides the students, with exercises and applications, through the full range of recommended practices for UA/SA. Candidates can apply from all over the world and are selected based on CV and motivation letter

Recent publications

Azzini, I., Listorti, G., Mara, T.A, Rosati, R, *Uncertainty and Sensitivity Analysis for policy decision making. An introductory guide*, EUR 30432 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-24752-4, doi:10.2760/922129, JRC122132.

Azzini, I., Mara, T., & Rosati, R. (2020). *Monte Carlo estimators of first- and total-orders Sobol' indices. arXiv preprint arXiv:2006.08232.*

E. Pisoni, D. Albrecht, T.A. Mara, R. Rosati, S. Tarantola and P. Thunis, *Application of uncertainty and sensitivity analysis to the SHERPA air quality modelling tool. Atmospheric Environment*, Vol. 183, 2018, pp. 84-93. *https://doi.org/10.1016/j.atmosenv.2018.04.006*

Recent examples of models undergoing uncertainty and sensitivities analysis in collaboration with CC-MOD

- **SHERPA model, predicting air quality improvement linked to emission reduction scenarios.**
  Albrecht, D., Mara, T.A., Pisoni, E., Rosati, R., Tarantola, S., *Sensitivity Analysis of the SHERPA Air Quality Model*, EUR 29122 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-79935-8, doi:10.2760/78023, JRC110322.
- **ProGasNet simulator, developed by the European Commission to study the vulnerability of the gas network to different threats.**
  Mara T. A., Kopustinskas V., Rosati R., Stakelytė G., Praks P., *Security of gas supply with the ProGasNet simulator: an uncertainty and sensitivity analysis exercise*, EUR 28953 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-77155-2, doi:10.2760/818537, JRC109751.
- **Atmospheric dispersion module of the Accident Damage Analysis Module (ADAM) for consequence assessment, developed by the European Commission to support the competent authorities for the implementation of the Seveso Directive or other legislation for chemical safety and security.**
  Fabbri, L., Wood, M. H., Azzini, I., & Rosati, R. (2020). *Global sensitivity analysis of the ADAM dispersion module: Jack Rabbit II test case. Atmospheric Environment*, 117586. *https://doi.org/10.1016/j.atmosenv.2020.117586*

4.3 Peer review of models

An integral part of the model quality control and quality assurance at the European Commission is scientific peer review of models, including those developed by external contractors.

The review of models is carried out by an external scientific Review Panel closely following the 'Guidelines for the review of models used in support of EU policies'.

The review process assesses the theoretical framework, the empirical implementation, the model performance, the results of sensitivity tests stressing the model, and the peer reviewed state-of-the-art journal publications. The results are documented in a Model Review Report.

The review aims at verifying and consolidating the scientific credibility of models and identifying most promising and relevant areas for a future model development.

Recently published model reviews:

Ahlgren, E.O., Delarue, E., Glynn, J., Hordijk, L., Kancs, D., Münster, M., Kitous, A., Zucker, A., Kreuzer, F., Ferioli, F., Andrey, C. and Bossmann, T., *The METIS model review*, EUR 30388 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-22744-1 (online), doi:10.2760/28916 (online), JRC118638.

Hordijk, L. and Kancs, D., editor(s), Kok, C., Ongena, S., Pelizzon, L., Cariboni, J., Heynderickx, W., Maccaferri, S., Pagano, A. and Petracco Giudici, M., *Review of the SYMBOL model*, EUR 29233 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-85925-0 (pdf), doi:10.2760/607271 (online), JRC111667.

Soria Ramirez A., *POTEnCIA technical peer-review* – Related documents, European Commission, Seville, 2017, JRC108360.

4.4 Transparency and coherence in science for policy

Strengthening transparency in policymaking is a central commitment of the Commission Better Regulation Agenda.

This refers in particular to making the use of models and data for policy more visible, improving their comprehensibility for a heterogeneous audience and facilitating the testing and replication of results as well as their reuse by fellow scientists.

CC-MOD seeks to advance the further development of a consistent approach towards transparency to elucidate the structure and the causal mechanisms which make up a model, and the related data and information flows. Of particular relevance in this context is ensuring transparency and coherence of the assumptions of baselines, or reference scenarios, to be used as a benchmark for comparing alternative policy options.

CC-MOD is actively involved in awareness raising on the opportunities of the transparency of modelling, putting forward recommendations to facilitate the documentation of the modelling related evidence, increase transparency and improve the quantification of baseline assumptions in EU impact assessments.

Recent publications

Basyte Ferrari E., Rosenbaum E., Listorti G., Ostlaender N., *Opening and improving policy development to increase public trust: transparency of evidence-based regulation in the debate on EU Better Regulation Agenda*, in De Benedetto M., Lupo N., Rangone, N. (eds.), The crisis of confidence in legislation, Nomos, 2020, ISBN 978-1-5099-3985-5.

Marques, Alexandra; Hradec, Jiri; Rosenbaum, Eckehard, *Baseline Assumptions in EC Impact Assessments*, EUR 28951 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-77153-8, doi:10.2760/982695, JRC109839.

4.5 Social Multi-Criteria Evaluation of policy options (SMCE)

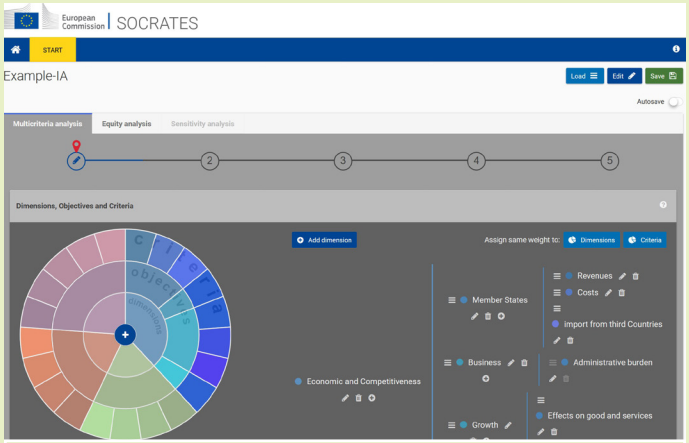
Models are widely used to identify the likely economic, environmental and social impacts of policies. Policy impacts can also be quantified using other methodologies, or only in a qualitative manner.

Once the likely policy impacts have been assessed, be they of a quantitative or qualitative nature, **to compare the different policy options** Multi-Criteria Decision Analysis (MCDA) and in particular **Social Multi-Criteria Evaluation (SMCE), explicitly designed for public policy, is a useful methodological and operational framework in ex ante impact assessment**.

SMCE multi-dimensional approach allows tackling policy domains where the plurality of social views and the multiplicity of technical criteria can be considered together, in a coherent and transparent manner. Mathematical models guarantee consistency between assumptions used and results obtained. This allows taking into account a wide range of assessment criteria, all shown in their original units of measurement, without the need of being transformed in monetary terms.

CC-MOD current activities in this field include:

- Development of a **web-based SMCE software tool** (SOCRATES) for impact assessment to support policy officers in the transparent ranking of policy options. CC-MOD designed the tool, created its mathematical algorithms (all published in international scientific journals) and implemented the application, with particular attention to user-friendly interfaces



SOCRATES is the web-based software tool developed by CC-MOD to support policy officers in the transparent ranking of policy options with Social Multi-Criteria Evaluation.

- **Trainings** and ad hoc support to Commission and European Parliament staff on the use of SMCE for analyses supporting ex ante impact assessment

- **Collaboration** with the International Atomic Energy Agency (IAEA) for environmental remediation (MAESTRI project). CC-MOD participates in the Coordinating Committee for the project scientific management, and is responsible for training on SMCE

- **International scientific collaborations** with the main academic institutions in the field, in particular the European Working Group on Multi Criteria Decision Aid

Recent publications

Azzini I. and Munda G., *A New Approach for Identifying the Kemeny Median Ranking, European Journal of Operational Research*, Vol. 281, 2020, pp. 388-401. *https://doi.org/10.1016/j.ejor.2019.08.033*

Munda G. *A social multi-criteria framework for ex-ante impact assessment*, EUR 28752EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-72293-6, doi:10.2760/909528, JRC107899.

Munda G. *On the use of Cost-Benefit Analysis and Multi-Criteria Evaluation in ex-ante Impact Assessment*, EUR 28768 EN, Publications Office of the European Union, Luxebourg, 2017, ISBN 978-92-79-73213-3, doi:10.2760/311199, JRC107900.

4.6 Support to the EU Better Regulation Policy

CC-MOD contributes to the Commission's Better Regulation policy for transparent and evidence based policymaking.

In 2017, CC-MOD participated in the **Working Group on Quantification in Commission Impact Assessments and Evaluations**, involving the Regulatory Scrutiny Board, the Secretariat General and the Joint Research Centre. The group was set up to analyse possible information deficits on data sources and to assess possible methodological knowledge gaps.

In 2019, CC-MOD authored the **literature review in support of the Stocktaking of the Better Regulation**, providing an overview of the debate on the Better Regulation Agenda emphasizing main achievements, challenges and observations for further improvement.

Further readings:

European Commission (2015) *'Better Regulation for Better results - An EU agenda'*, COM (2015) 215 final, Brussels, 19 May.

European Commission (2017) *'Better Regulation Guidelines'*, SWD(2017) 350 final, Brussels, 7 July.

Listorti G., Basyte Ferrari E., Acs S., Munda G., Rosenbaum E., Paruolo P., Smits P. *2019. The debate on the EU Better Regulation Agenda: a literature review*, EUR 29691 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-00840-8, doi:10.2760/46617, JRC116035.

Listorti, G., Basyte-Ferrari, E., Acs, S., and Smits, P. , *Towards an Evidence-Based and Integrated Policy Cycle in the EU: A Review of the Debate on the Better Regulation Agenda. JCMS: Journal of Common Market Studies*, 2020 *https://doi.org/10.1111/jcms.13053*

RSB SG and JRC Working Group (2018) *Quantification in Commission Impact Assessments and Evaluations*, Brussels, available at: *https://ec.europa.eu/info/publications/report-rsb-sg-jrc-working-group-quantification-commission-impact-assessments-and-evaluations_en*

5 EVENTS

- Launch of the European Commission's Competence Centre on Modelling, 26 October 2017, Brussels, *https://ec.europa.eu/jrc/en/event/conference/launch-cc-mod*

- Opening of MIDAS to the European Parliament. The MIDAS touch: Opening up the Commission's knowledge base for model use in EU policymaking, session at the Science meets Parliament event, 7 February 2019 *https://ec.europa.eu/jrc/en/event/conference/science-meets-parliaments-2019*

- EU Conference on Modelling for Policy support: Experiences, challenges and the way ahead, 26-27 November 2019, Brussels *https://ec.europa.eu/knowledge4policy/event/eu-conference-modelling-policy-support-experiences-challenges-way-ahead_en*

  The event brought together more than 200 researchers and policymakers from the Commission, European and international institutions and agencies, Member States, universities, research institutes, and consultancies, to discuss common challenges and solutions in the use of models to support policymaking.

- Launch event for the opening of MIDAS to the public, virtual seminar organised with Sense about Science EU: *Models in decision making*, 2 December 2020.

  A virtual seminar for EU policymakers on understanding, using and communicating simulation models, to identify the basis of a short guideline on key questions to answer about their transparency, quality and reliability.

"The Commission is committed to a culture of evidence-based policymaking. [...] The role of modelling in support of the policy process is then expected to increase in importance in the EU and in the Member States."

Veronica Gaffey

Veronica Gaffey, Chair of the Regulatory Scrutiny Board, opening remarks, EU Conference on Modelling for Policy support, Brussels 2019

"This Conference was about cross-cutting issues that we all encounter, be it transparency, how we communicate with policymakers and vice versa, how we deal with uncertainty, and so on."

Leen Hordijk

Leen Hordijk, special adviser to the Competence Centre on Modelling, EU Conference on Modelling for Policy support, Brussels 2019

EU Conference on Modelling for Policy support 2019 – presentations by CC-MOD

- ***The MIDAS touch - Maintaining an overview of model use by the EC through the EC Modelling Inventory and Knowledge Management System MIDAS.***
  Ostlaender N., Acs S., Listorti G., Hradec J., Smits P., European Commission, Joint Research Centre; Hardy M., Ghirimoldi G., UniSystems

- ***Modelling for EU policy support: impact assessments.***
  Acs S., Ostlaender N., Listorti G., Hradec J., Smits P., European Commission, Joint Research Centre; Hardy M., UniSystems; Hordijk L., Special Adviser, European Commission, Joint Research Centre

- ***Challenges and opportunities of integrated policy modelling.***
  Hordijk L., Special Adviser, European Commission, Joint Research Centre; Kancs d'A., European Commission, Joint Research Centre

- ***Knowing unknowns: adapting uncertainty and sensitivity analysis for impact assessment and policy-making.***
  Becker W., Rosati R., Albrecht D., European Commission, Joint Research Centre

Presentations are available at:
https://ec.europa.eu/knowledge4policy/event/eu-conference-modelling-policy-support-experiences-challenges-way-ahead_en

6 SELECTED INVITED PRESENTATIONS

- G. Listorti, keynote speaker at 10th International Congress on Environmental Modelling & Software Society (iEMSs 2020) 14 - 18 September 2020. Title of the presentation: 'Promoting evidence-based policymaking: using models for EU policy support'.

- G. Munda, invited speaker, Reframing The EU II. Relationships Matter: EU Policy-Making Born of Relational Political Agents, Brussels, Belgium. 2018. Title of the presentation: Fairness in public policy analysis.

- G. Munda, invited speaker, Holistic Approaches to Decision Making in Environmental Remediation Projects, on-line seminar co-organised by IAEA-ENVIRONET MAESTRI Project, ENA and SHARE. Lecture on Social Multi-Criteria Evaluation for environmental management.

- N. Ostlaender, invited panelist to the Biennial Workshop V, International Centre for Earth Simulation (ICES) Foundation 10th Anniversary, 3rd December 2019, Geneva, Switzerland, Panel session 9 - A Challenging Mix - Science, Storytelling, Giving Advice and Policy-Making.

Organisation of international Conferences

- G. Listorti and P. Smits: organizers and chair of the session Modelling for Policy Support in the European Union, 10th International Congress on Environmental Modelling & Software Society (iEMSs 2020) 14 - 18 September 2020.

7 OTHER PUBLICATIONS

Azzini I., Rosati R. *Improved Algorithm-IA for main and total order indices estimation. Oral Presentation: Ninth International Conference on Sensitivity Analysis of Model Output (SAMO2019)*, Universitat Oberta de Catalunya, Barcelona, 28-30 October 2019.

Greco S., Munda G., *Multiple-Criteria Evaluation in Environmental Policy Analysis, in Clive L. Spash (editor) The Routledge Handbook of Ecological Economics: Nature and Society.* Abingdon, Routledge, 2017, pp. 310-319. ISBN: 978-1-138-93151-0. *https://doi.org/10.4324/9781315679747*

Hradec, N. Ostlaender, C. Macmillan, S. Acs, G. Listorti, R. Tomas, X. Arnes Novau, *Semantic Text Analysis Tool: SeTA*, EUR 29708 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-01518-5, doi:10.2760/577814, JRC116152.

Ivanova, O., Kancs, D. and Thissen, M., *EU Economic Modelling System: Assessment of the European Institute of Innovation and Technology (EIT) Investments in Innovation and Human Capital*, EUR 27796, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-79-57276-0, doi:10.2791/184008, JRC100796.

Munda G., Albrecht D., Becker W., Havari E., Listorti G., Ostlaender N., Paruolo P., Saisana M., *The Use of Quantitative Methods in the Policy Cycle*, Chapter 18 in V. Šucha, M. Sienkiewicz (eds): Science for Policy Handbook, Elsevier, pages 206-222, 2020, ISBN 9780128225967, doi:10.1016/B978-0-12-822596-7.00018-8.

Munda G., Matarazzo A., *On the Impossibility of Using "the Correct" Cost-Benefit Aggregation Rule, Journal of Economic Studies*, Vol. 47, No. 5, 2020, pp. 1119-1136, *https://doi.org/10.1108/JES-06-2019-0269*

Munda G., Multiple-Criteria Evaluation in Public Economics and Policy, in M. Doumpos, J.R. Figueira, S. Greco and C. Zopounidis (eds.) – New Perspectives in Multiple Criteria Decision Making. Springer International Series in Operations Research and Decision Theory, New York, 2019, pp. 297-313. ISBN 978-3-030-11482-4. *https://doi.org/10.1007/978-3-030-11482-4*

Munda G., *Dealing with fairness in public policy analysis*, EUR 28751 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-72292-9, doi:10.2760/75185

Ostlaender, N., Bailly-Salins, T. Hardy, M., Perego, A., Friis-Christensen, A., dalla Costa, S., *Describing models in context – A step towards enhanced transparency of scientific processes underpinning policy making, International Journal of Spatial Data Infrastructures Research*, Vol.10, 2015, pp. 27-54, doi: 10.2902/1725-0463.2015.10.art2

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