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Model management, model governance and modelling of modelling for water policy and beyond

As part of the Water Policy Innovation Hub, on 8th July 2022 a workshop was held on governance of models and modelling at the Humanities, Sciences & Engineering Campus of the Vrije Universiteit Brussel, with the support of the Erasmus+ Programme of the European Union.

Modelling for water policy and beyond has reached a stage of adoption in which models frequently have an institutionalized role in policy design, project approvals, and compliance, amongst other decision-making contexts both directly in government and in supporting consulting and research. As such, the stakes for good modelling practice have increased, requiring both formalization of practices and attention to avoiding lock-in and enabling adoption of modelling innovations in the longer term.

Recent research includes social science studies of modelling practice and action research in modelling practice change. Formalisation of model management and model governance can be seen as a form of modelling of modelling processes, which in turn raises the need to apply modelling best practice to how we represent and reason about the complex systems involved in modelling itself.

While recognizing that different jurisdictions and contexts will have different needs and solutions for these problems, the aim of this workshop was to support coordination of research efforts internationally, including in Europe, USA, and Australia to 1) anticipate and better understand issues and opportunities involved in institutionalization and/or government use of modelling, 2) develop shared methods, tools, and initiatives to support improved model management and governance.

The workshop started with an introduction to model management, model governance and modelling of modelling and existing work on this topic. Participants then canvassed model management, model governance, and modelling of modelling initiatives in government, civil society, and research across their research areas and countries of origin, and identified opportunities for new work and potential for a harmonized international and national research and development agenda. The workshop concluded with development of promising ideas (ultimately focusing on a journal special issue), followed by an informal networking dinner.

As described in a 2020 paper, management of numerical models includes governance, operational support, and administration of modelling. Model management has deep implications throughout an organisation for how models are used, how decisions are made, and how uncertainty is addressed, and making changes often has ripple effects through the organisation that need to be accounted for.

Governance is “the totality of interactions of governments, other public bodies, the private sector and civil society, aiming at solving societal problems or creating societal opportunities.” (Meuleman 2013). Model governance therefore offers a less task oriented and more systems oriented view of how modelling is used in an organisation, or in a policy or regulatory context, which includes

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consideration of power dynamics in the role of models vs. other sources of evidence and ways of making sense of the world and informing decisions.

Modelling of modelling has taken a variety of forms. The use of modelling has been described as a sociotechnical system, and social science methods have been applied to understanding modeller's decisions. Formal numerical methods have examined the value of information and optimal design of experiments – targetting how models and their predictions can best be improved. More generally, monitoring design and model and data investment planning are common activities within government and non-government agencies world-wide. Efforts to improve transparency of modelling efforts have extended to formalising records of engagement and decision making to promote more effective adaptive management and governance – including of how modelling is used.

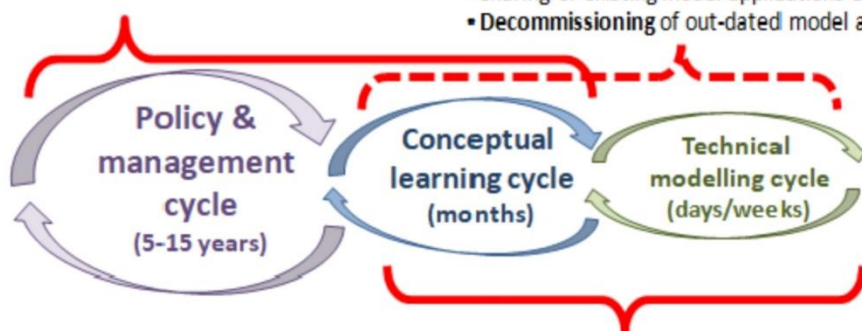
A broad range of opportunities for further work were identified, with collective efforts ultimately focusing on issues relating to use of models in a regulatory context and to managing changes in numerical models over time. A special issue is being developed on “Socio-environmental systems modeling in regulatory contexts” for the journal Socio-Environmental Systems Modelling with guest editors and authors from multiple continents. The workshop therefore marks a time where critical mass has been reached to develop a body of scholarship and decision support that collects international empirical and theoretical contributions that advance understanding of how modeling occurs in regulatory contexts and how modeling processes in these contexts could be improved.

Functions of the modelling system

- Models **fulfill** regulatory requirements or core organizational functions
- Models support **communication** and policy insight
- Models help **organize information** and data
- Models influence the **collection** of new information

Modelling tasks of an agency

- **Development** of new model applications & replacement of legacy models
- **Operation** and maintenance of existing model code, model components or model applications; reproduction of results
- **Updating** of existing model applications & incorporations of new information
- Sharing of existing model applications and version control
- **Decommissioning** of out-dated model applications and code



Leverage points of model managers

- Establishing and managing supportive **cyberinfrastructure**
- Developing and implementing operational **procedures**, guidelines, standards
- Accessing relevant **knowledge** and skills

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