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# Key issues of linking models for policy impact assessment in agriculture

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Model-based quantitative assessment of agricultural and trade policy options has a long tradition in Europe. The attendance and presentations of related EAAE seminars (BAUER and HENRICHSMEYER, 1989; HECKELEI et al., 2001; ARFINI, 2005; BARTOVA and M'BAREK, 2008) highlight the dynamic developments in this area and the continuously growing importance of model analyses as a basis for policy consultation. Though linking models is far from a new idea, recent years have seen a massive increase in the design and application of linked model systems, often supported by international networks and/or large (national or multinational) research projects. The proliferation of linked modelling is both demand and supply driven. On the one hand, the complex challenges European agricultural policy is facing in view of far reaching reforms (decoupling, liberalisation) and new areas of concern (climate changes, limited (energy) resources and food security) in a globalised world have increased the demand for corresponding comprehensive analyses. On the other hand, the 'boom' of linked modelling is also driven by the possibilities offered by the ongoing developments of powerful hardware and efficient software.

The obvious advantages of linking models for policy analysis compared to single model approaches – e.g. increased coverage, improved consistency of scenarios – are accompanied by a number of challenges:

*Theoretical consistency* is a key issue from a scientific viewpoint, and open questions arise in particular when linking models with different individual theoretical foundations, or when linking models covering different levels or scales.

The optimal 'degree' of the linkage is as much a *methodological* as a *philosophical* question, and depends on the objectives of the model system and team and the specific application. While full automation of model linkages improves consistency and reproducibility of the output from complex model systems, soft coupling, where feedback between models passes a 'human interface', stresses the didactic value of a diversity of approaches with possibly different model outcomes.

Practical and *technical* issues of the communication between models often dominate the daily work in linked model systems. Different definitions ('a cow is not a cow'), units, concepts, data sources and software, constitute time-consuming obstacles to efficient and consistent model linkages. The problems are frequently aggravated when linking models from different disciplines.

The establishment and, even more so, the sustainable maintenance of linked model systems is an *institutional* challenge. The successful long-term organisation of an effective

co-operation of different modelling teams needs to provide sufficient financial and/or human resources as well as deal with incentive problems. In addition to securing long-term financial resources, a key problem is the fluctuation of temporary personnel, which in particular affects universities but is also relevant at many other institutions. Linked model systems involve considerable costs for the scientists involved, as maintenance of the linked system is time-consuming and may reduce the flexibility for model development. It is therefore essential that clear measurable benefits from model linkage exist for all team members. The more people and institutions are involved, the higher is also the necessity for formal rules with respect to property rights and benefit sharing. A specific issue relevant for the scientific community here relates to the publication of peer-reviewed papers. Difficult to publish anyway (see below), the incentive for a publication based on linked model analysis may be further reduced with the need to include a high number of authors (see, e.g., VAN ITTERSUM et. al., 2008: 15 authors; PARKER et al., 2002: 45 authors).

*Communication* of results from linked model systems poses a challenge in itself. The huge amount of information generated and the often high number of models involved require a condensation which frequently creates a 'black box' problem. Publication in scientific journals is often difficult if not impossible, as length restrictions for articles make it difficult to present a model theoretical background for several models at the same time. For policy consulting, the (perceived) lack of transparency of complex multi-model systems often reduces acceptance of related results. Communication to policy makers is particularly challenging when individual model results differ: while model differences are often seen as a source for new insights in academic settings, policy makers generally require consistency in findings and messages, and appropriate care has to be taken to tailor presentation and explanations to the respective target group. Communication *within* the model group is quite another, often underestimated challenge, especially if the members of the groups come from different disciplines, as concepts and (meaning of) terminology often differ.

Due to those and other challenges, there is no universal approach for successfully linking models for policy impact assessment. Strategies to deal with the numerous challenges depend, among others, on the specific institutional setting, the objectives of the analysis and the individual team preferences. The papers presented in this issue discuss in-depth selected aspects of linking models, and provide examples of successfully dealing with the highlighted challenges under different conditions based on extensive experience of the respective authors.

The articles from BRITZ and from HELMING and BANSE revolve around methodological aspects of linking models. BRITZ discusses different types of model linking and illustrates these with examples from the CAPRI system. Specific attention is paid to more formalised approaches ensuring consistency across models. HELMING and BANSE draw on the extensive experience of LEI with linking models at different scales. They discuss the benefits and challenges faced when models are loosely linked, and highlight the importance of human resource development for the sustainable maintenance of model groups.

Institutional issues are at the core of the following two papers. SALAMON et al. discuss the challenges of establishing a large European network combining individual national models into one single model. They specifically also discuss the organisational and technical requirements and tools necessary to cope with the high number of institutions involved. DOMINGUEZ et al. describe the integration of several well-established economic models in a modelling platform for agro-economic policy analysis on the premises of the Joint Research Centre of the European Commission in Seville.

Communication to the two main target groups for model-based policy assessments are the topic of the last two contributions. Based on the experiences of the vTI model group, BROCKMEIER et al. discuss the many challenges and pitfalls in policy advice based on linked models, and identify strategies to overcome these. Their paper points specifically to the importance of the establishment of close and reflective linkages between modellers and policy makers. BURRELL contrasts these requirements to those posed by the scientific community. Drawing on her long experience as both a modeller and editor of the European Review of Agricultural Economics, she discusses the circumstances under which linked model studies can form the basis of peer-reviewed journal articles and provides some guidelines, which many model builders will find particularly helpful.

While surely not covering all aspects that arise in the field of linked modelling, the papers in this issue span a wide range from theoretical and methodological to institutional and issues of communication. The authors all draw on extensive experience in the field of linked modelling, and many

of the lessons learned were 'learned the hard way'. However, it is interesting and promising to also observe an increasing professionalisation, where insights and solutions from other disciplines, e.g., management, computer or communication sciences, are transferred and adapted to facilitate large-scale linked model systems.

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