Participatory modelling and sustainability research: concepts, means and aims of knowledge integration

Barbara Smetschka, Veronika Gaube
Alpen-Adria Universität Klagenfurt | Wien | Graz, Institute of Social Ecology Vienna (SEC)
Schottenfeldgasse 29, 1070 Vienna, Austria

In this paper we want to show how participatory modelling served as a means of knowledge integration in a transdisciplinary project on sustainable agricultural development in Austria.

Concepts of knowledge integration

Transdisciplinary research aims at achieving both: to address the complexity of real-world phenomena while focussing on problems relevant to stakeholders. Sustainability research needs knowledge integration between various actors in order to enhance the probability of implementing innovative and sustainable solutions. Furthermore, the integration of various types of knowledge in order to make the commonly created knowledge effective is essential. This requires a common effort of stakeholders, experts and scientists from various disciplines. Departing from concepts of interdisciplinary and transdisciplinary knowledge integration developed by ISOE and IFF (Jahn, T. 2005, Winiwarter, V. & Wilfing, H. 2002)) and the concept of three types of knowledge defined by Swiss researchers - systems, target and transformation knowledge (Pohl, C. & Hirsch Hadorn, G. 2007, Hirsch Hadorn, G. et al. 2008) - we try to develop a process-oriented path for transdisciplinary research. Scientists can support this process by providing 1) data on different scales and issues, 2) knowledge on ecological, economic and social contexts and 3) skills in transdisciplinary process-oriented methods. We would like to show our experience with the method of participatory modelling that approaches all three challenges.

Models as a means of knowledge integration

Intermediary concepts serve as a baseline for transdisciplinary research. They help to develop common research questions and results that can be translated into different contexts in a way to be relevant for stakeholders and scientists at the same time. Sustainable development is often used as a common concept, which can be easily used – everybody likes to refer to it – but is difficult to be transformed into common knowledge and recommended action. Intermediary objects, as described by Vinck (Vinck, D. 1999) in a study on the role of material objects in complex working processes, can support translation, transformation and the following knowledge integration. Participatory modelling is a method which uses models as intermediary objects in two ways: as a means to create knowledge and as a means to achieve knowledge integration.

Models can be used to reach a better understanding of dynamics within a system, to reconstruct dynamics of past or ill-documented systems and to develop future scenarios on the one hand. On the other hand they are useful to structure communication processes on recommended actions. Many examples of modelling sustainable development without stakeholder involvement exist (e.g. IPCC 2007). With participatory modelling we try a further step towards implementing knowledge on paths for sustainable development into societal action.

Working with models as a strictly formalized method requires a reduction of complexity which presents the major challenge in inter- and transdisciplinary teams. At the same time, modelling in interdisciplinary teams requires a precise discussion and negotiation on variables and their mutual interactions and therefore fosters the knowledge exchange and integration across various disciplines. The same holds for the integration of stakeholder perspectives in models. Consequently, the involvement of stakeholders throughout the whole research and modelling process is essential: defining relevant questions, integrating their knowledge as experts and finally finding more sustainable development paths.

Agent-based modelling is a computer simulation technique that allows for simulating different actors as agents, the socioeconomic and natural environment they are embedded and the interactions among agents and between agents and their environment. The simulation of these agents and their interactions according to the needs of a transdisciplinary working group makes these kinds of models particularly attractive. The similarities with a computer game add to this attraction (see figure 1). Additionally the equidistance of a computer game to the working practice of scientists and stakeholders involved helps to foster the transdisciplinary process.

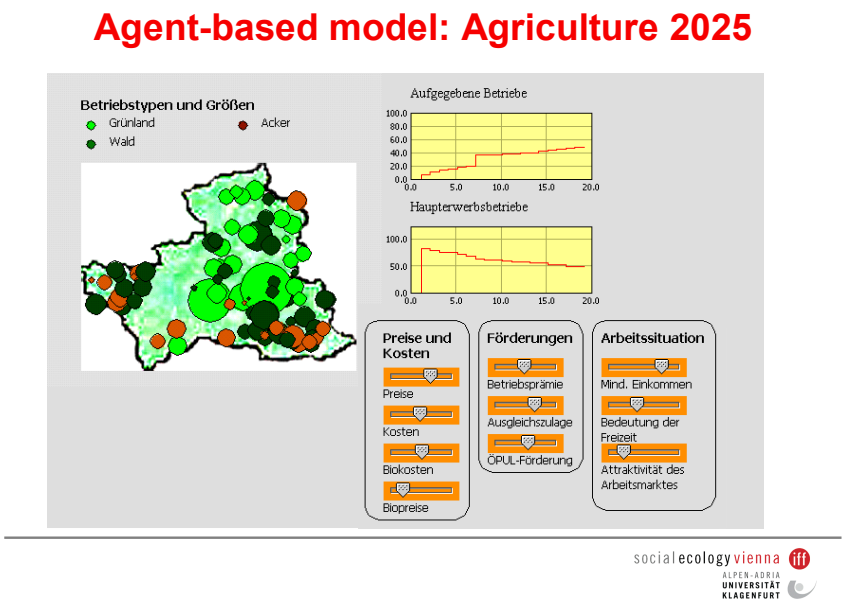

Figure 1: Agent-based model of Hainfeld

Aiming for sustainable development in Austrian land use

This paper presents the case-study of an agent-based model of an Austrian region with single farm households as agents. The model simulates how changes in socioeconomic and political conditions affect patterns of land use, agricultural production and the socio-economic situation within this region. Structural changes in agriculture among others induced by changes of subsidy systems and market prices of agricultural products influence decisions of farmers regarding their agricultural production. Farm households and their decision finding process with its ecological, economic and social implications represent the basis of the agent-based model which we developed for two Austrian villages. Time-use data serve as means to formalize social processes, as indicator for quality of life and to integrate a gender perspective. The decision-making process of each agent is simulated within a "sustainability triangle" (see figure 2) representing each farm with its ecological, economic and social dimensions (Gaube, V. et al. 2009; Smetschka, B., Gaube, V., & Lutz, J. 2008; Smetschka, B., Gaube, V., & Lutz, J. 2009).

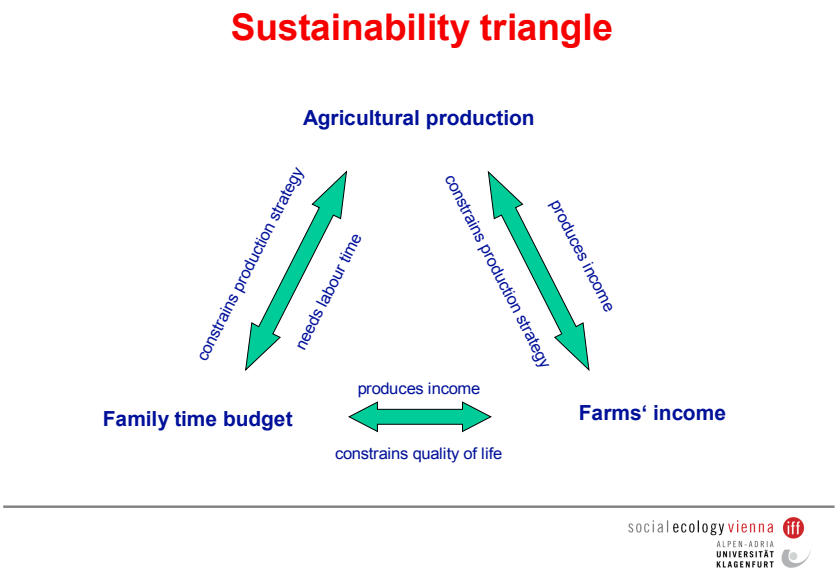

Figure 2: Sustainability triangle

Participatory modelling allows for integrating the most relevant issues in the model and for developing scenarios (globalization, trend and sustainability scenario) and strategies together with the stakeholders. The main outcomes of the agent-based model show that increasing forest area caused by a decline of agriculture in Austria could be reduced in a sustainability scenario which assumes that agricultural production becomes more attractive through fair prices and subsidy systems. Nevertheless, workload on farmer women will still increase. Solutions to enhance the success of any effort towards sustainable development by integrating time use and gender aspects are needed.

The presentation will focus on the process of participatory modelling, where farmers were involved in designing the agent-based model and creating scenarios. Participatory modelling shows its strength in structuring communication on future scenarios and on recommendations for action towards reaching the targets of the various groups involved in transdisciplinary research. The model was handed over to the stakeholders and can be used for discussion and education processes to find sustainable paths in agricultural development.

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