

# MULTIMODE

## A Multiscalar and Multiagent Modelling Framework for Assessing Sustainable Futures in a Globalised Environment

**DURATION OF THE PROJECT**  
 Phase 1: 15/12/2006 – 31/01/2009  
 Phase 2: 01/02/2009 – 31/01/2011

**BUDGET**  
 800.000 €

**KEYWORDS**

Agent-based model, globalisation, policy support, spatio-temporal analysis, stakeholder dialogue, sustainability indicators

**CONTEXT**

With increasingly globalised economies, sustainable development becomes an even greater challenge to both policy and science because new opportunities and unknown risks created by globalisation are unevenly distributed between regions and between people. Policy should be able to provide measures to help different regions and communities benefit from these opportunities and cope with these risks in a sustainable manner, and science should take the challenge to contribute to design such measures. This research project aims to contribute to this challenge by developing an integrated modelling framework. Such framework will be implemented through a **multiscalar & multiagent model (MultiMode)** in which national impacts of global changes trickle down to the local communities through the adaptive decisions of institutions at the regional, provincial and communal levels.

**Methodology**

MultiMode has four closely interconnected work packages (WP): a meta-model of policy options and global scenarios (WP1), a multi-scale constrained cellular-automata (CA) model (WP2), a landscape scale agent-based model (ABM) of decision rules (WP3), and stakeholder dialogue and feed-backs (WP4). The policy options and scenarios at the global and European scale from WP1 will provide inputs to the CA of the WP2 and ABM of the WP3 as drivers of land use change and socio-economic decision-making processes. The meta-model of WP1 will use look-up tables and/or simple statistical functions of relevant global drivers (e.g., socio-economic, technological, demographic, climatic, etc.) and European policies (e.g., the Common Agricultural Policy, the European Spatial Development Perspective, the Water Framework Directive, etc.). The constrained CA of WP2 will generate spatio-temporal changes in the social, economic and natural environment, including land use, at different spatial scales. Results from the CA will provide the boundary conditions for the ABM of WP3 by describing the spatial dynamics in the environment of the agents (e.g., farmers). The novelty of the ABM in assessing future sustainability rests in its ability to capture the behaviour of individual decision agents in adapting to the changes in their environment. The ABM will also represent the institutional decision-making and planning at different administrative levels. Its results will be able to feed-back the CA about the impacts of their adaptive decisions on changes in the social, economic and natural environment. The feed-back mechanism between the CA and ABM will improve their practical use for assessing the indicators of sustainable development. In the ABM, adaptive decisions from agents are represented in social behavioural models (SBM). These SBM will be developed from the knowledge elicited through stakeholder dialogue and feed-backs in WP4. They will summarise both

**PROJECT DESCRIPTION**

**Objectives**

The overall aim of *MultiMode* is to promote sustainable development in Belgium in a globalised context through the development of an integrated, multi-scale modelling framework of economic activities and their associated land uses. The modelling framework will combine top-down and bottom-up models that address both urban and rural land use. Given the importance in spatial terms of agricultural land use, a specific focus will be dedicated on the sustainability of farming practices. Specifically, Multimode aims to generate multi-scale indicators of social, economic and ecological sustainability by integrating the empirical knowledge generated from different models.



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rational (e.g., economic optimisation) and sub-rational (e.g., imitation, social comparison) cognitive strategies of the agents. Moreover, the institutional and policy analysis in WP4, which will feed the CA and ABM models, will consider the links and interactions among the institutional agents as well as the influence of organisational hierarchy and subsidiarity on the sustainability of the individual agents and their environment.

### INTERACTION BETWEEN THE DIFFERENT PARTNERS

Partners have complementary scientific and empirical knowledge that are required to successfully design, develop and apply the Multimode modelling framework at the different administrative levels in Belgium and carry out case studies in different regions of Belgium. The allocation of work responsibilities of the partners in each work package is determined by their expertise required to successfully complete the work package objectives (see activities of partners below).

### Link International Programmes

MultiMode is of great relevance to the objectives and activities of the International Human Dimensions Pro-

gramme (IHDP) and the Intergovernmental Panel on Climate Change (IPCC).

### EXPECTED RESULTS AND/OR PRODUCTS

- 1) Integrated and validated models including meta-model of policy options and global scenarios, multi-scalar cellular automata model at the national, regional, provincial and communal levels, landscape scale agent-based models for the case study areas in the Flemish and Walloon regions, and behavioural models for selected farming communities in these regions.
- 2) A series of documented model runs consisting of time-series sustainability indicators and maps at the European, national, regional, provincial, communal and farm levels. These runs will be made publicly available at the end of the project in a digital form on the project website, a FTP-server or a CD-Rom.
- 3) Reports or working papers with full documentation of the work carried out, the main results, and recommendations for further analysis.
- 4) Minimum of two publications in internationally refereed journals or books by each partner.

### CONTACT INFORMATION

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### Follow-up Committee

For the complete and most up-to-date composition of the Follow-up Committee, please consult our Federal Research Actions Database (FEDRA) by visiting  
<http://www.belspo.be/fedra> or  
<http://www.belspo.be/ssd>

### PARTNERS - ACTIVITIES

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  - Collaborate with VITO on WP2