

AMBIO

Electronic Supplementary Material

This supplementary material has not been peer reviewed.

Title: A functional-dynamic reflection on participatory processes in modeling projects

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Table S1

First author (et al.)	Year	Topic	Main purpose of article	Functions of participation	Dynamics/phases	Participatory events	Degrees of involvement	Functional-dynamic reflection	Type of stakeholders	Number of stakeholders	Modeling method	Additional comment
Barnaud et al.	2013	Spatial representation in a participatory model	Address and discuss contested spatial issues within a participatory modeling approach	2, 7, 8	Rough process description, but no explicit timeline	Number of workshops	Cooperation (partly role playing games)	No reflection on that	Villagers and foresters	Pre-phase interviews (N = 30); later: n. a. (reference to other article)	Agent based modeling	Typical companion modeling approach with lessons learned regarding contested spatial issues
Batten	2009	Utilize the companion modeling approach for industrial symbiosis	Highlight issues by means of the national electricity market simulator (an integrated MAS)	2, 3, 4, 5,	n. a.	n. a.	Cooperation (partly role playing games)	No reflection on that	n. a.	n. a.	Agent based modeling	Companion modeling approach only conceptually
Beall et al.	2008	Endangered wildlife systems	Highlight knowledge integration by participatory system dynamics modeling	1, 5, 8	Process description but no explicit timeline	Meetings; discussions	Information to cooperation	Process description but no explicit reflection	Ranchers, farmers and land managers	9-11 people (9 stakeholder groups)	System Dynamics	
Cabrera et al.	2008	Sustainability in dairy farm systems	Describe an interactive and iterative process of collaboration	1, 2, 6, 5	Detailed timeline with types of participation	Interviews, Interaction, focus groups	Information, consultation, cooperation (?)	Interactive/functional and dynamic	Farmers, farm managers, consultants, etc.(detailed table)	> 10	Biophysical and socioeconomic model (based on MS Excel®)	
Campo et al.	2010	Research and development project using the companion modeling approach	Describe multiple methods of model evaluation	6, 7, 8	Schematic, detailed timeline with types of participation	Role playing games	Cooperation	Process view and explicitly dynamic mutual learning	Government, NGOs, community (detailed table)	59	Agent based modeling	Focus on mutual learning among stakeholders
de Mey et al.	2011	Integrated assessment model for sustainable farming	Illustrate the stakeholder involvement to implement a monitoring tool	6, 8	Schematic timeline with types of stakeholders involved	Discussion groups	Information, consultation	Explicitly functional-dynamic	Scientists, advisers, farmers	8-12 farmers; one model developer and one or two advisers	Visual multi-level assessment model	
deReynier et al.	2010	Integrated ecosystem assessment	Support decision makers by urging them to use ecosystem based management approach	3, 4, 5, 6, 8	Process description but no explicit timeline	Meetings	Information, consultation	Explicitly functional-dynamic	n. a.	n. a.	Management strategy evaluation; ecosystem model	
Elbakidze et al.	2010	Multi-Stakeholder process	Stakeholder analysis and multi-stakeholder collaboration in the long-term	5, 7, 8	Process description but no explicit timeline	Qualitative interviews	Information to cooperation (different for different stakeholder groups)	Dynamic perspective (but with different approaches, such as the participation ladder paradigm)	Civil, private, public	> 10	Model Forest	No actual modeling but stakeholder analysis
Espinoza-Tenorio et al.	2013	Fishery Management	The insights from this research aid in defining holistic management policies and support spatial allocations of use rights in local fisheries	1, 2, (5?)	Detailed structure description, but no explicit timeline	Interviews, workshops; fieldwork	Consultation	No reflection on that; not explicitly mentioned	Fishermen	> 10	Qualitative ecosystem modeling (loop analysis), Geographic Information Systems (GIS)	Immersed themselves in a "case encounter"
Franzén et al.	2011	Integrated modeling with stakeholder process	Scenario development for eutrophication management	2, 3, 5, 7	Detailed timeline with types of participation	Meetings	Information, consultation	Explicitly functional-dynamic	Policy makers, actors, customers	> 10	Coupled ecological, economic, and social model	
Gaddis et al.	2010	Community water resource problem and participatory modeling	Describe process: Stakeholders participating collecting data, creating the model, develop policy scenarios and interpret results	1, 2, 3, 4, 7, 8	Timeline with types of participation	Workshops	Up to collaboration (e. g. model selection and development)	Reflective process monitoring. Not explicit functional-dynamic perspective. But explicit reflection on different functions of participation	Different stakeholder groups, citizens	n. a.	Simple mass-balance models; spatially explicit Landscape Modeling Framework	Tendency towards "The more the better" in sense of the ladder of participation
Gaube et al.	2009	Stock-flow models and participative analysis	Discuss integrated socio-ecological model	2, 5, 6	Process description but no explicit timeline	Group meetings	Up to cooperation (Agent based modeling model)	Dynamic perspective but no explicit reflection on functional process	Municipal administration; business managers, women, farmers	n. a.	Agent based modeling, land-use change model, stock-flow model, scenario analysis	

Gouttenoire et al.	2013 Livestock farming systems	Show the usefulness of causal mapping with stakeholders (farmers) to help them redesign their livestock farming systems	1, 2, 8	Process description but no explicit timeline	Interviews, workshop	Consultation, cooperation	No reflection on that	Farmers	> 10	Causal maps	
Haapasaari et al.	2013 Integrated Fisheries Model	Use of participatory modeling to inform a Bayesian model	4, 6, 8	Schematic steps and description but not explicit timeline	Six modeling workshops, final meeting	Consultation, cooperation	Explicit process illustration - functional-dynamic	Resource user groups, NGOs, managers, decision makers, researchers	Average number: 10	Bayesian Belief Networks	Essential role of the facilitator; legitimacy; social learning
Haase	2013 Flood risk management	Characterize prevailing flood risk management Discover respective vulnerabilities and identify barriers and options of adaptive capacity	(1), 2	Schematic, detailed timeline with types of participation	Interviews, workshops	Information, consultation	Explicit process description (but no functional-dynamic reflection)	Municipal and village council heads; national scientists	n. a.	System Dynamics	
Lagabrielle et al.	2010 Companion modeling approach for biodiversity integration in land-use planning	Report of three participatory modeling sequences	2, 3, 4, 8	Timeline description with types of participation	Workshops	Information, consultation	No reflection on that	Researchers; National Parks authority, civil society	> 10	Agent based modeling	Partly reflective on functions of participation (during the three sequences)
Landström et al.	2011 Coproduction of flood risk knowledge in participatory modeling approach with competency groups	Review and illustrate the participatory modeling approach with competency groups	1, 7	Timeline description with types of participation	Three workshops (competency groups)	Cooperation	Expertise as "situational"	Interdisciplinary scientists, local residents	6 to 7 project team members and 5- 8 local members	Hydrological model	
Langsdale et al.	2009 Multidisciplinary modeling with stakeholders for water resources	Highlight the use of workshops within a river basin	1, 2, 4, 7	Detailed timeline with types of participation	Group meetings; five workshops	Cooperation	Reflective on process and functions; less on dynamic but more on evaluative aspects	Provincial ministries, local government agencies, and environmental NGOs	10 -19	System Dynamics	
Leclerc et al.	2009 Action research project on land use modeling experiment	Critically reflect on adapted companion modeling approach	1, 2, 5, 7	Detailed timeline with types of participation	Six workshops	Cooperation	Not explicitly reflected on that	Extensive table; farmers, state officials, local technicians, etc.	n. a.	Farm-level optimization model; regional land use change simulation model; Agent based modeling	Reflective and critical but not very systematic
Martínez-Santos et al.	2010 Conflictive water management	Reflection on the role of participative modeling in conflicting settings	1, 3, 8	Timeline with types of participation	Meetings	Up to collaboration	No reflection on that	Water management, farmers, environmental NGOs	15 - 30	Groundwater flow model; Bayesian Belief network	Stakeholders define research goals
Mazzorana et al.	2012 Scenarios for hazard assessment and subsequent modeling	Demonstrate structured knowledge integration	3	Process description but no explicit timeline	n. a.	Consultation	Only the first phase of a modeling approach. No reflection on the whole process	Professional experience in applied natural hazard management	10	Formative Scenario Analysis	
Millington et al.	2011 Agent based model for <i>Land Use and Cover Change</i> on wildfire regimes	Presentation of a case study with local stakeholders' model evaluation	3, 4, 7	Process description but no explicit timeline	Interviews	Consultation	No explicit reflection on functional-dynamic perspective. But reflection on degrees of participation	Farmers, land-use planners, real estate agents, etc.	7	Agent based modeling	Substantive consultation for the evaluation of model results
Molina et al.	2011 Integrated Assessment for the European Water Framework Directive	Describe and interdisciplinary exercise with scenario development and participatory modeling	2, 3, 4, 6, 7	Process description but no explicit timeline	Questionnaire, meetings	Consultation to cooperation	Functional-dynamic process reflection	Detailed table provided: River basin authorities; water supply, agriculture, etc.	23	Bayesian Networks	
Naivinit et al.	2010 Simulation of rice production and labor migration	Companion Modeling to facilitate local participatory process - local problem solving, shared representation among stakeholders	2, 5, 7, 8	Detailed timeline with types of participation	Workshops	Consultation	Functional-dynamic: but no explicit reflection ()	Farmers	11	Agent based modeling	Mainly workshops with stakeholders
Ritzema et al.	2010 Data scarcity in modeling for environmental planning	Investigate the role of stakeholders to help with data scarcity and address knowledge	2, 4, 8	Detailed timeline with types of participation	Workshops, survey	consultation, cooperation	Reflection on the degree of participation (functional dynamic, but no different stakeholders)	Farmers, fishermen, land owners, NGO's, government agencies, research organizations	> 10	One-dimensional, non-steady state model for water movement and water quality	

Röckmann et al.	2012 Fishery Management	Analysis and description of participatory processes in four case studies of the JAKFISH project	1, 2, 7	Process description but no explicit timeline	Questionnaire, meetings	Consultation, cooperation, collaboration	Detailed analysis of the process: purpose of participatory modeling, level and timing	n. a. (four case studies)	6	Graphical modeling and Bayesian influence diagrams; bio-economic model	No model use intended
Ruankaew et al.	2010 Integrated resource management	Companion modeling approach with Role playing games and agent based modeling	2, 7, 8	Timeline with types of participation	Field workshops, role playing games	Consultation	No reflection on that	n. a.	n. a.	Agent based modeling	Typical companion modeling approach
Salerno	2010 Social-ecological systems management in mountains	Present new participatory modeling framework with case studies	1, 2, 3, 5, 7	Timeline with types of participation	Workshops	Consultation	Yes; fairly explicitly reflected	Resource organizations and other resource persons, including senior government officials, NGOs, WWF	n. a.	System Dynamics	
Sandker et al.	2010 Conservation on the landscape	Participatory modeling to implement a landscape approach to conservation and development	2, 4, 5, 7	Schematic steps with functions; no explicit timeline	Workshops	Information, consultation, cooperation	Explicit functions, but no reflection on dynamic aspects	NGOs, policy makers, scientists	> 10 (6 case studies)	System Dynamics	Achieving policy impacts; learning, facilitator, communication among stakeholders, "throw-away model"
Simon et al.	2010 Forest management planning	Companion modeling approach with agent based modeling	2, 7, 8	Schematic timeline with types of participation	Discussions	Consultation, collaboration	Explicit process, but no reflection of functional-dynamic aspects	Farmers, forest managers	n. a.?	Agent based modeling	Typical companion modeling approach; focus on shared representation and empowerment to understand and make better decisions
Smajgl	2010 Sustainability in Indonesia	Multi-level participatory modeling - challenge stakeholder beliefs	1, 2, 4, 8	Detailed timeline with types of participation	Meetings, workshops	Consultation, collaboration	Functional-dynamic process reflection	Decision makers from multiple levels of government	n. a.	Agent based modeling	Collaboration about model started at the stage of the project proposal
Squires et al.	2011 Marine fisheries	Case study in public participation in natural resource decision-making	1, 2, 6, 8	Timeline with types of participation	Meetings, workshops	Information to cooperation	Functional-dynamic process reflection	Commercial fisheries etc. (detailed table)	n. a.	Bio-economic modeling	
Suwarno, et al.	2009 Forest Management in Indonesia	Participatory modeling to improve partnership schemes	1, 3	Schematic timeline with types of stakeholders involved	Meetings; survey interviews	Consultation, cooperation, collaboration (define system boundaries, etc.)	Not explicitly reflected but implicitly implemented.	Members of cooperatives, forest district agency	7 (core team), 60 (additional from villages)	System Dynamics	
Thompson et al.	2010 Knowledge about greenhouse gas emissions in an urban ecosystem	Integrate Scientist and Stakeholder Knowledge	2, 4, 6	Detailed timeline with types of participation	Five workshops, questionnaire (Table overview)	Consultation, information, cooperation	Functional-dynamic process reflection	City managers (local municipalities), utilities, industries, environmental NGOs, etc.	45 in total	System Dynamics	Mediated Modeling in Workshops
van den Belt	2013 Integrated freshwater management	Show the usefulness of the mediated modeling approach in a case of New Zealand	2, 4	Process description but no explicit timeline	Six workshops	Information to collaboration (joint model building)	Partly considered but not explicitly reflected	Five stakeholder groups (industry, farming, local & regional authorities, environmental groups, indigenous people)	In total: 20	System Dynamics	Mediated Modeling in Workshops (Stella Software)
Vayssières, et al.	2011 Sustainability of dairy enterprises	Interactive simulation of various management strategies with diverse stakeholders	5, 6	Process description but no explicit timeline	Immersion, visits, meetings	Consultation, cooperation (?)	Functional-dynamic process reflection	Farmers	6	Stock-flow model	Mainly one type of stakeholders (farmers) - model tailored to these cases
Videira, et al.	2010 Support integrated sustainability assessment processes	Participatory Modeling Approach	1, 4, 5	Schematic, detailed timeline with types of participation	Three Workshops	Consultation to collaboration (model)	Acknowledges different engagement levels in different phases (not explicitly functional)	Land parcel owners, representatives form 29 organizations	14 / 43 in total (different participation per workshop)	System Dynamics	Group model building; mediated modeling; external facilitator very useful!

Worrapimphong et al.	2010 Fishery Management	Companion Modeling to facilitate local participatory process and finally enable improved informed discussion among heterogeneous stakeholders	2, 5, 7, 8 Schematic steps and process description; no explicit timeline	Role playing games	Consultation, cooperation	Explicit process, but no reflection of functional-dynamic aspects	Local fishermen one trader local government officers	24 (fishermen) n. a. (officials)	Agent based modeling	Typical companion modeling approach; focus on shared representation and empowerment to understand and make better decisions
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Note: n. a. = not available (that is, no information was given in the article).