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Evaluation by Simulation: Bridging the gap between communicative planning processes and evaluation with agent based modeling

Summary

During the last two decades, the adoption of communicative and participatory practices in the planning discourse has made substantial impact on regional policies for rural areas in the European Union such as in the LEADER programs. Regional policy strategies are consequently increasingly formulated as stakeholder oriented learning processes and qualitative objective statements. Their analysis and assessment thus suffers from a methodological dilemma: While quantitative approaches often struggle with low data availability or lacking measurability of the processes in question, the results of qualitative inquiries are hard to generalize and are often perceived as imprecise. This paper examines the potentials of agent simulation to bridge this gap by setting up simulation scenarios that help real-world stakeholders to follow and evaluate the consequences of their actions and their potential alternatives. The model is applied to case studies in Germany and Sweden.

1. Introduction

Current development programs for rural areas increasingly emphasize the collaboration of regional stakeholders in an attempt to turn planning into integrative and participatory processes that have been widely discussed and termed as governance approaches (Healey 1996, Amdam 2010). However still, evaluations of these processes face major challenges, for the impact relations between regional learning processes and presumable economic effects are complex in nature and barely to grasp with conventional empirical methods. This leads to the postulation to develop sets of methods that will be able to integrate these complexities and at the same time lead to precise evaluation statements. Agent based models prove advantageous in that respect as they do not require to exclude either one of the approaches for purely technical reasons. Furthermore, they are able to represent communication and learning processes among the modeled stakeholders from their own point of view without general simplifying assumptions. The specifications of the underlying model do not necessarily rely on quantifications, but can be formulated on text basis. Therefore however, a number of methodological challenges have to be resolved. Results of qualitative empirical research have to be adapted for model building, and at the same time, simulation results will have to be produced in a comprehensible way for the stakeholders in the processes analyzed.

This paper is organized as follows. The first chapter will elaborate in more detail about the contributions of social simulation to the analysis and assessment of communicative planning processes in general, while the second presents a research agenda to systematically develop an agent based model of a communicative planning process and its stakeholder network exclusively from qualitative interviews and participating observation results. During the simulation, the stakeholders, modeled as agents, cooperate in negotiating about development goals and project characteristics, and decide about fund spending. Finally, the results of a number of simulation scenarios are presented that serve to illustrate the consequences of sets of stakeholders' action

alternatives. The different simulation models for two case studies in Germany and Sweden are compared throughout the paper. In a conclusion, possible lines of future research are identified.

2. Social Simulation for the Analysis of Communicative Planning Processes

First, it seems important to point out that simulations cannot be clearly assigned to neither quantitative nor qualitative methods. Rather, for which form of analysis they are used, depends on the nature of the information they are based on. Simulations are not reliant on quantitative data, but on the contrary are able to precisely represent inductively generated information from qualitative empirical methods. The notion of precision in this context does not refer to an assumed representativeness of the empirical results, but to the process of transferring empirical results into simulation rules. This approach is innovative in its ability to create a simulation model from the perceptions and self-descriptions of the stakeholders from their own point of view and formulated in text instead of numbers. These text-based simulation rules may be phrased as reactive ("if – then") or proactive (goal seeking) statements, and may be static or variable.

For the analysis of social practices in general, this bears the opportunity to assemble an inside view of the processes in question, to precisely represent them in a model and finally reproduce them in a simulation. The simulation rules may subsequently be altered at will to examine the consequences of a wide variety of action alternatives for the stakeholders. This sort of application hence does not aim at a prognosis of future events, which is not likely to be successful in a communicative process, but at a more profound understanding of past events and at providing to the stakeholders an opportunity to self-evaluate their own performances.

Agent based simulation can be seen as a special form of social simulation. The approach originates from the research area of artificial intelligence. Agents serve as the elements of the simulation able to exchange information with other agents and the environment, to act upon changes in that environment or pursue their own agenda. They can thus be equipped with individual logics in their actions and decisions. Even differing concepts of perceived situations among the agents do not result in serious challenges concerning model construction, but are instead among the preconditions for autonomously setting, mediating and pursuing of objectives as it is attributed to social behavior (Goldspink/Kay 2008). This provides a new approach to analyzing communicative planning processes, characterized by the simultaneity of reactions to overt social constellations, effects of social interaction, and independent actions of stakeholders, considered as phenomena of complexity. The application of agent based simulation techniques seems to be especially promising in the way it is able to connect qualitative social research with simulation in a computer.

However, these considerations call for a new conception of the term 'model'. In the natural sciences, models are used to reduce the complexity of researched phenomena, assuming that simplifications are not only acceptable but also worthwhile in order to replace a high level of detail by a small number of general statements. For most social phenomena, this strategy is not adequate, which is one reason why qualitative methods of enquiry have been developed. On the other hand, also models can be conditional to specific situations (Edmonds 2008: 9). Furthermore, decisions and subsequent actions of humans can be modeled without fully representing the mental and emotional processes beyond them. Following the logic of qualitative enquiry, such a model should represent those procedures that are relevant to the stakeholders involved. In the area of social network

research, some attempts have been made to model their cognitive representations (Marsh/Onof 2008), which could prove exemplary for the modeling of qualitative information in general. Other researchers propose to introduce “mediating formalisms” (Gotts/Polhill 2009) to transfer both the descriptions (narratives) of the stakeholders into model designs, and vice versa translate model results into comprehensible, text based statements. That is why qualitative methods are especially suitable as information sources.

Using an agent based simulation to analyze and evaluate a communicative planning process as established in EU development policies for rural regions thus implies the representation of actions and social practices of the stakeholders in their own view. This is connected to two objectives: First, to accomplish a more profound understanding of the social processes observed, however not through a simplifying formalization of the stakeholders’ knowledge, but through a systematic exchange of this knowledge and its representations (Barreteau et al. 2003). The second objective is to support the stakeholders in making decisions with a special focus on the decision making process embedded in the mutual perceptions of actions of their own and others.

Agent based models are the first modeling approach to take an internal viewpoint on the processes analyzed and thus provide an opportunity to represent the standpoints and decision logics of the stakeholders, that might even be contradictory. The analysis of social processes is hence dissociated from the antagonism between quantitative modeling under simplifying assumptions about a course of decisions on the one hand and strictly phenomenological appraisal on the other. Simultaneously, qualitative empirical methods and computer simulation can be congregated into a single research design (Schenk 2010, Fig. 1). Evaluation of the processes in question unfolds when simulation results are compared to the stakeholders’ conceptions of the same processes, thus opening up space for their renegotiation. The following sections will now demonstrate such a research design in the two chosen study areas.

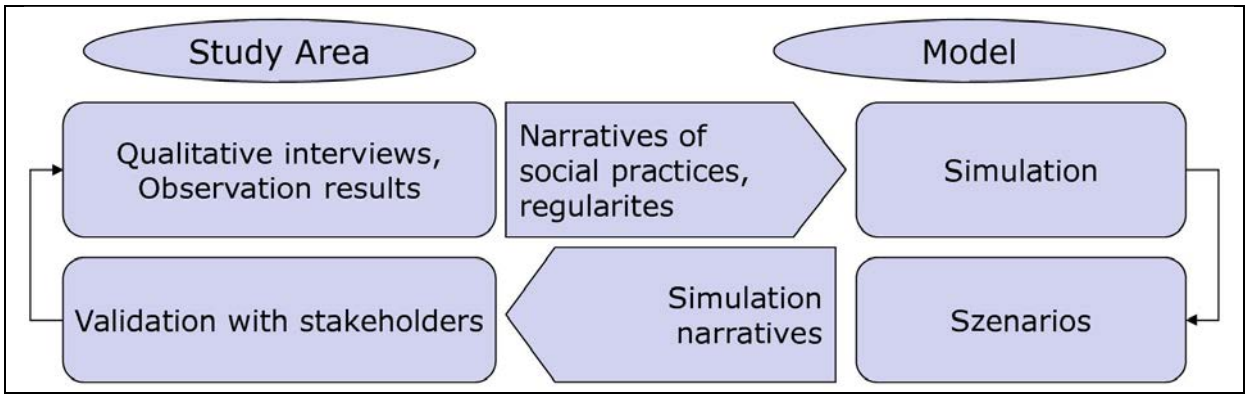

Fig. 1: Scheme for the methodological connection of social practices with agent simulation (adapted from Gotts/Polhill 2009).

3. Evaluation of communicative planning processes using agent based simulation

3.1 Study areas

Two study areas were chosen in Eastern Germany and Northern Sweden that both implement EU-funded, communication based development programs for rural areas in the LEADER framework. Although European, the local implementation can vary due to differing national regulations as well as more informal understandings of planning in general. However, the two study areas are comparable as they are both rural and sparsely populated and containing a regional centre, even though these characteristics appear on different scales in the two countries (Tab. 1). While the numbers of population are similar, the Swedish region "URnära" is a lot larger concerning its area. Because the regional centre Umeå is closer to the study area than in the German case, its immediate surroundings show gains in population, compensating for the population losses in the remainder of the region (-6.6%).

Table 1: Basic indicators of the study areas. Data: Statistisches Landesamt des Freistaates Sachsen, Statitiska Centralbyrån.

Name	"Sächsisches Zweistromland"	"URnära"
Country	Germany	Sweden
Population (2011)	49,942	67,011
Area	727 km²	9,371 km²
Population density (per km²)	68.7	7.1
Population development 2000-2010	-13.9 %	+1.8 %
Regional centre (approx. population)	Leipzig (500,000)	Umeå (80,000)

The LEADER program requires the participating communities to set up a mechanism to negotiate fund spending for projects and to integrate stakeholders from different sectors of the society. In both study areas, this is realized by a regional assembly consisting of representatives from the administrative (politicians), economic (entrepreneurs) and social (volunteers) sectors. However, the social practices performed within those external regulations differ from one another and will be described in more detail in the following sections.

3.2 Data collection and analysis

In a first step, the actions performed by the stakeholders have to be analyzed and the rules underlying the social practices performed by the stakeholders distilled in order to transfer them into a simulation model. Two qualitative methods have been applied for this task: Several meetings of the regional assemblies have been studied using techniques of participating observation and document analysis. The former was conducted without actually taking part in the discussions, in order to minimize the influence of the observer on the processes taking place. The observation protocols focused to a great extent on the ways of cooperation and networks among the representatives, and the evolution of the discussions in the course of the meetings.

A number of qualitative interviews with members of the regional assembly served as the second empirical source. The interviewees were chosen equally from the three stakeholder subgroups as indicated above. The interviews focused on issues that were not apparent from the observations of meetings, such as the arrangements of networks between the stakeholders (emergence and maintenance of relations), their ways of collaboration in the assembly (course of the meetings, their personal appraisal, and decision processes), and finally their own development goals for the region.

Through the combination of these methods, a comprehensive understanding of the collaboration process and its underlying communication structure was sought. While observations served to grasp the regularities in the stakeholders' actions, the interviews were capable of generating information about the motivations behind those actions. Another advantage of observation is that it helps to identify discrepancies between stakeholders' self reflections as expressed in the interviews and their overt behavior. However, due to the individual concept of agents, these contradictions may well be a part of the resulting simulation model.

3.2.1 Observation results concerning assembly meetings

The meetings usually begin with a report about recent events in the region's context and the LEADER program (changes of regulations, status of projects, the remaining budget etc.) Afterwards, the project applications are discussed and decided. In the German study region, the applicants can present their projects, so that the assembly members have the opportunity to pose questions, while in the Swedish region, the assembly members solely rely on the submitted project documents. In either case, the discussions and decisions in the meeting take place in absence of the applicants.

Using the observation protocols and partly also interview transcripts, the process of discussions and decisions could be captured. Figure 2 illustrates the prevalent arguments used in the discussion (exemplary for the German region), organized into six categories. Within these categories, discussion arguments can furthermore be subdivided into "pro's" and "con's". This assignment shall be exemplified in the case of category 3 ("financing"): In order to claim funding for a project, the applicant needs to cover a certain part of the costs. In the discussions, doubts about the financial capabilities of some applicants have occurred, especially when they were small enterprises or single persons (line 32 in figure 2). Due to bank legislations however, it is not the task of the assembly to inspect the financial background of the applicants. Because this fact appears in the discussions as well, it is consequently listed as the corresponding counter-argument. In this context, skepticism about the survival of the project is oftentimes expressed. Some members suspected that funding may be invested in a project that will not achieve the desired effects and will then be abandoned. In opposition to this argument is the notion that due to the own contribution of the applicant, she/he participates in both success and failure and hence has an own interest in the survival of the project (line 31 in figure 2).

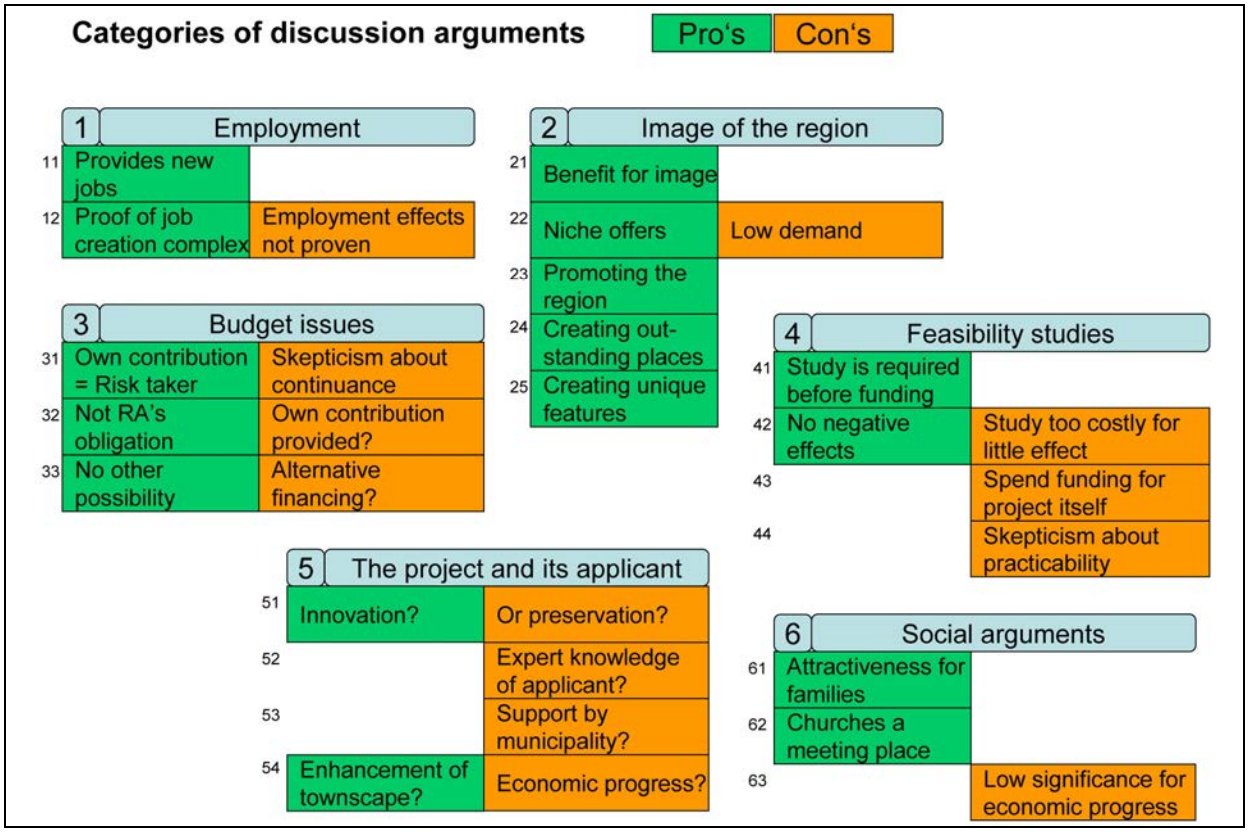

Fig. 2: Categories of discussion arguments

Not all categories equally provide "pro" and "con" arguments. For instance, when talking about the "image of the region", the assembly members argue widely positively. Merely, the positive argument that a project will create a "special offer" that helps to attract visitors to attractions not to be found likewise anywhere near, is mitigated by the argument that such an attraction might struggle with low demand in its "niche", which may again jeopardize its existence (line 22 in figure 2).

Even though discussions may evolve in different intensities and with varying tendencies (supportive or controversial), projects are seldomly dismissed, and if not approved, returned to the applicant for improvement. The reasons for that become apparent from the stakeholder interviews: In the German study region, the final decision about the fund allocation is not made by the assembly, but by a regional government agency, which is partly perceived as an inappropriate double examination, resulting in a generally generous attitude towards the applications. Secondly, a lower funding boundary of 5,000 Euros functions as an obstacle for small investments resulting in a generally low number of projects, so that the available budget is by far not exhausted. This has however changed in a later phase of the study period (see section 3.4.2).

A similar scheme of discussion arguments and their categories has been deployed for the Swedish counterpart. It also accounts for the fact that the discussions are structured quite differently from the German case. While in the latter, the entire assembly exchanges arguments and then makes a decision, in Swedish assembly first discusses the projects in the three subgroups (administrative, economic, social) of members and each of those suggests a vote. A following joint discussion then prepares for the final vote.

3.2.2 Results of the qualitative stakeholder interviews

Because functioning and trust based networks are considered important in communicative planning processes, they should be integrated in the simulation and therefore had to be addressed in the interviews as well. In particular, the interviews focused on the construction, the development and the current quality of the existing networks. Three sorts of networks have been identified by the stakeholders (in both case studies): The first group of contacts results from ties before the existence of the LEADER region. Especially in rural areas, this sort of strong local involvement is typical, but is often rather a means of identity building than of actual significance for the LEADER process. The second group of contacts does play an important role in this, but did not originate from it. Bindings of political stakeholders often fall in this category, as they have further means of communication and opportunities for exchange apart from the LEADER institutions, which are often perceived as additional structures ("with the same people" as quite a few of the interviewees mentioned). In case those ties are stronger than the relatively fresh ones in the LEADER context, incentives for new bindings are low, remain arbitrary and do not lead to stronger networks. Finally, a strikingly high number of stakeholders denoted themselves as "outsiders" or "newcomers" to the process, leading to a suspicion of being generally cut off from procedures.

Another important aspect of the interviews was to address the development goals of the stakeholders for their region. These were connected to the aspects of the submitted projects that assembly members regarded as important for the region and that made significant contributions to convince them in their decision. They were complimented from the observation results of the meetings and assigned to categories. Again, the German case serves as an example for figure 3. The relative importance of the categories "ideas/development" (2) and "image/tourism" (4) highlight the emphasis on innovative and highly visible projects in the LEADER philosophy. Two of the categories may deserve further elaboration: "personality/trust" (3) refers to the confidence of the decision makers that a submitted project will be realized, depending to some extent also on a personal impression of the applicant. The category "money" (5) summarizes some quite differing economical arguments: While "earnings" (51) and "economic stability" (55) refer to the survival chances of a project, "distribution" (52) and "not our money" (53) reveal a desire to allocate funds as simply as possible.

Just like the others, the category "townscapes" (6) appeared in interviews in both study regions, this one however in quite contrary sense. While it was an important aspect of LEADER funding in Germany to preserve the rural settlements ("tidy and decent townscapes" (61)), the majority of the stakeholders in the Swedish region were frustrated with spending funds for renovating and modernizing rural building structures simply to replace owners' commitment to their real estate, or that soon afterwards decayed.

1	Jobs
11	Create jobs
12	Create living places

2	Ideas/Development
21	Innovative idea
22	Development
23	Uniqueness
24	Synergies
25	Creative projects
26	Encourage acitvity

3	Personality/Trust
31	Reliability of applicant
32	Good presentation
33	Certain realization

4	Image/Tourism
41	Tourist aspects
42	Tourist highlights
43	Create something special
44	Create image with large projects
45	Light house projects
46	Spill-over effects

5	Money
51	Earnings
52	Distribution
53	Not our money
54	Money does not harm
55	Economic stability

6	Townscapes
61	Tidy and decent townscapes
62	Village development
63	Preserve rural fabric

7	Regulations
71	Complying with regulations
72	Opportunities to support

Fig. 3: Categories of stakeholders' development goals.

3.3 Transferring the analyzed communicative and behavioral regularities into an agent model

This section will now focus on the derivation of agent rules for the simulation from the results of the qualitative analysis of the communication structures and regularities in the stakeholders' actions. Due to the rule based structure of agent models, the identified regularities can be blended in without the need to quantify any of them. Vice versa, also the simulation results can be extracted in text form in order to make them comprehensible for the stakeholders and allow them to self-evaluate their actions (fig. 1).

Table 2: Elements of the simulation model

Agents (acting entities)	
Regional Management	• Organizes and chairs assembly meetings • Assists applicants in submitting projects
Regional Stakeholders	• Applicants for project funding • Assembly members, discuss and decide applications, act on their own or in cooperation with others of their kind
Resources (static entities)	
Projects	Starting with projects funded in 2009, plus those generated in later simulation scenarios
Discussion arguments	Derived from interviews and observations
Development goals	Derived from interviews

The model distinguishes between acting ('agents') and static entities ('resources'). In this case, the agents represent the stakeholders, while the projects (starting with projects funded in 2009, plus those generated by agents in later simulation scenarios) and the discussion arguments and development goals derived from the empirical analysis are inserted as resources (table 2). The

simulation is organized in modules, each of which covers specific tasks of the simulation. Because the model is further developed for the German case, the description will focus on that example. The implementation of the Swedish case is performed similarly; any significant differences are especially noted.

Module 1) Project creation

The simulation starts with the study period which corresponds to the year 2009. A list of all projects dealt with in this year was available containing information on their budget, affiliation to one of six project categories, and the name of the applicant. From examining the project records it is evident that the regional management meets approximately once a week with individual stakeholders to prepare applications. Correspondingly, the meeting of the agent "regional management" with one of the "stakeholder" agents is simulated at an average of every seven days to create projects that are added to the agenda of the following meeting of the (simulated) assembly. During the simulated year 2009 the existent projects were started out with, for the following scenarios, the agents are to create new projects on their own. This process can experience some variety and will be closer elaborated in chapter 3.4.

Module 2) Invitation to the regional assembly

Usually every second Wednesday of a month, the regional assembly will congregate to deliberate about the latest project applications. In the Swedish study area, the group meets at wider intervals, which can easily be implemented in the simulation. One week ahead, the regional management sends invitations to the assembly members. This is implemented in the simulation by adding the meeting to the respective agents' schedules. The meeting itself is represented by saving a list of the agents met and the exchange of arguments when discussing the applications.

Module 3) Discussions in the regional assembly

In this module, the discussions of the assembly members among one another are simulated. The agents pipe up and bring forward discussion arguments from a pool of available arguments as investigated empirically (fig. 2). The course of the discussion is logged by the regional management agent. Because a clear assignment of argument categories to groups of agents is not empirically supported, the starting point of discussions is chosen largely at random. However, depending on the category of the project in question, arguments are preselected in a way that is consistent with the meetings' observation results (table 3).

Table 3: Assignment of discussion argument categories to project categories

Project category	**Argument categories (numbers according to fig. 2)**					
Refurbishment (public buildings)						6
Refurbishment (corporate buildings)	1		3		5	
Refurbishment (private buildings)			3		5	
Feasibility Studies				4		
Tourism / Recreation		2				
High speed internet infrastructure						6
Road improvement	no discussions					

In case more than one argument category is available, the simulated discussions tend to remain in one of them at first, in which the single arguments may also be brought forward repeatedly. The longer the discussion runs, the more likely it will turn to a new argument category, but might as well return to a previous one. Furthermore, a few particular sequences of arguments are excluded to preserve consistency. The total length of a discussion is limited depending on the total number of arguments available. Table 4 shows a simulated course of discussion as an example.

Table 4: Simulated course of discussion in the regional assembly (anonymized). Key to stakeholder symbols: P=political, E=economic, S=social, A=administrative. The numbers indicate the position of the argument in fig. 2; '+' and '-' refer to positive and negative arguments respectively.

Project ID	20101114	**Project category**	Feasibility study
Initiator	P6	**Partner**	P2
Course of Discussion in Regional Assembly			

• P8 says: Study is required before funding (41+)
  ○ E1 replies: Study too costly for little effect (42-)
• S2 says: Study has no negative effects (42+)
  ○ S5 replies: Study has no negative effects (42+)
  ○ A4 replies: Skepticism about practicability (44-)
• S3 says: Study is required before funding (41+)
  ○ S4 says: Study is required before funding (41+)
  ○ A2 replies: Skepticism about practicability (44-)
• P8 says: Spend funding for project itself (43-)			

Date	08-12-2010	**Supporting votes**	13	**Dissenting votes**	3

In the Swedish case the discussions are organized differently. All interviewees described a procedure in which the three groups of stakeholders involved (political, economic, and administrative) discuss project applications separately before filing a suggestion to the joint assembly. In the three groups, the stakeholders make an effort to take a group specific perspective on each application, i.e. the economic representatives discuss predominantly economic and financial aspects and so forth. In the simulation, this can be implemented as a different form of preselecting arguments.

Module 4) Decision

When the discussion has come to an end, the assembly members entitled to vote decide about each project application. A project is approved if the number of supporting votes is greater than that of dissenting votes. In this case, the application is removed from the list of pending projects and its budget subtracted from the total budget available.

In the assembly meetings observed, projects were seldom turned down (see chapter 3.2.1). For the simulation however, it appeared worthwhile to assume dynamic decisions influenced by the course of discussion beforehand. That way, the decision results in the simulation are opened for the design of alternative discussion and decision scenarios, which aim at supporting decision mechanisms in situations where the available budget is shrinking and projects will have to be prioritized. An impact of the discussions on the decisions is indicated in several of the interviews. In order to maintain a consistency of decisions and discussions inside the simulation, the agents decide predominantly according to the proportion of the own 'pro' and 'con' arguments in the discussion to support or dissent a project. Agent that had been silent during the discussion direct their vote according to the total numbers of 'pro' and 'con' arguments, thus being 'convinced' in the course of discussion.

3.4 Course of simulation and investigation of scenarios

The simulation model is illustrated by activity graphs (example shown in fig. 4). Activities of agents are located in the boxes attached to the nodes of the graph. The edges indicate the sequence of activities and are equipped with constraints under which the activity pointed at may be started. The rhomb in the center is a decision node, from which the simulation branches to activities, but does not contain such itself. The simulation starts at the solid dot; one tick in the simulation corresponds to a day.

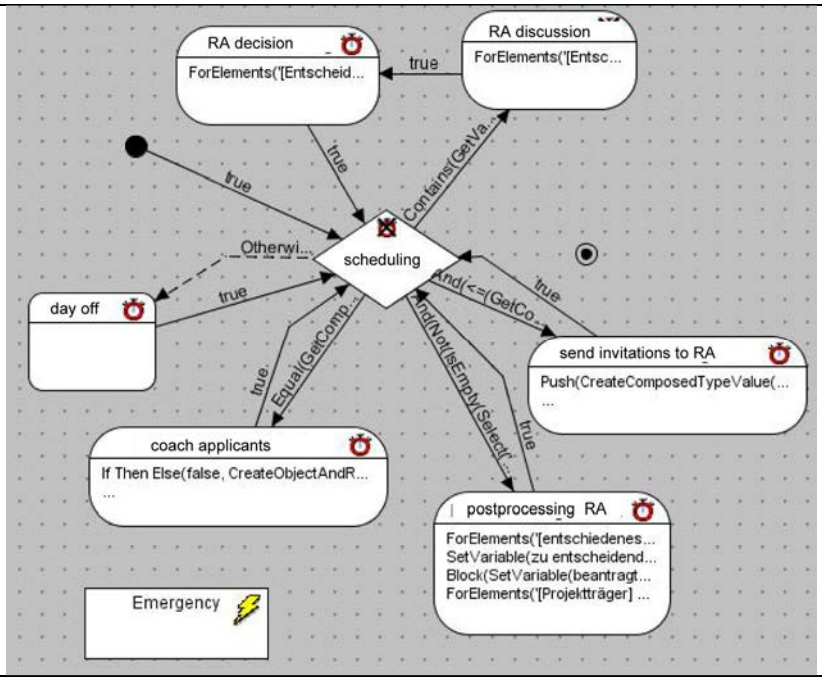

Fig. 4: Activity graph of the agent 'regional management'

3.4.1 Building networks

During the simulation the networks constructed between agents can be observed. Just like their real world counterparts, the agents have additional opportunities to meet and exchange information apart from the assembly meetings. From the interviews, it became evident that especially the political stakeholders maintain much stronger networks among each other than with the rest of the group due to additional opportunities of interaction in other institutions. It follows for the simulation that firstly some groups of agents differ from others by their frequency of meeting their fellow agents and that secondly this has consequences for the intensity of ties in the network. Thus, every agent saves a list of other agents met with those met most recently being tossed to the top of that list. The position that a particular agent holds in a list of a fellow agent may hence be interpreted as the intensity of that tie. Note that they are also directed, i.e. one agent may have a strong tie to another agent, while the latter has stronger ties to other agents than to the former. Observing the medium intensities of ties of specific groups of agents over time, meetings of agents are indicated by the jumping up of intensities while they slowly decrease thereafter (fig. 5).

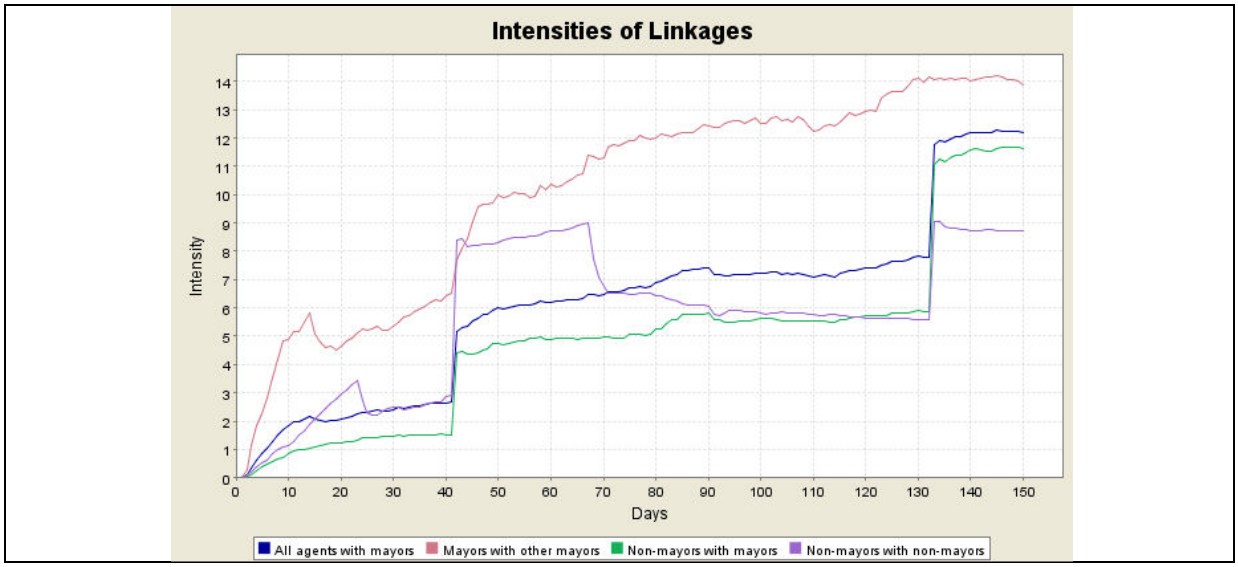

Fig. 5: Evolution of ties intensities of several groups of agents during the simulation.

3.4.2 Decision scenarios

In order to take a closer look on the decision processes of stakeholders and in doing so identifying possible alternatives, further decision mechanisms apart from those elaborated in section 3.3 were tested. The scenario ‘Supporters and Objectors’ served to investigate the relevancy of cooperation and mutual consent in the regional assembly, while in the scenario ‘Reduced Budget’ several alternative decision rules were compared with respect to the ways in which projects can be prioritized when funds are scarce.

Scenario 'Supporters and Objectors'

For the first scenario, a varying number of agents were arbitrarily assigned to one of the groups named 'supporters' and 'objectors'. Both of them are characterized by bringing forward only positive or only negative arguments in the discussion. Because the distribution of arguments influences the decisions (see ch. 3.3), alterations of the assembly's decisions can be observed directly. Figure 6 shows the votes on projects depending on a varying percentage of supporters and objectors ('non-neutral discussants'), with each graph indicating a certain proportion of supporters and objectors. Because the decision processes vary in every simulation run, the graphs cannot be interpreted individually. However, it becomes evident that the distance grows with an increasing number of non-neutral discussants, indicating increasing positive votes with more supporters and vice versa.

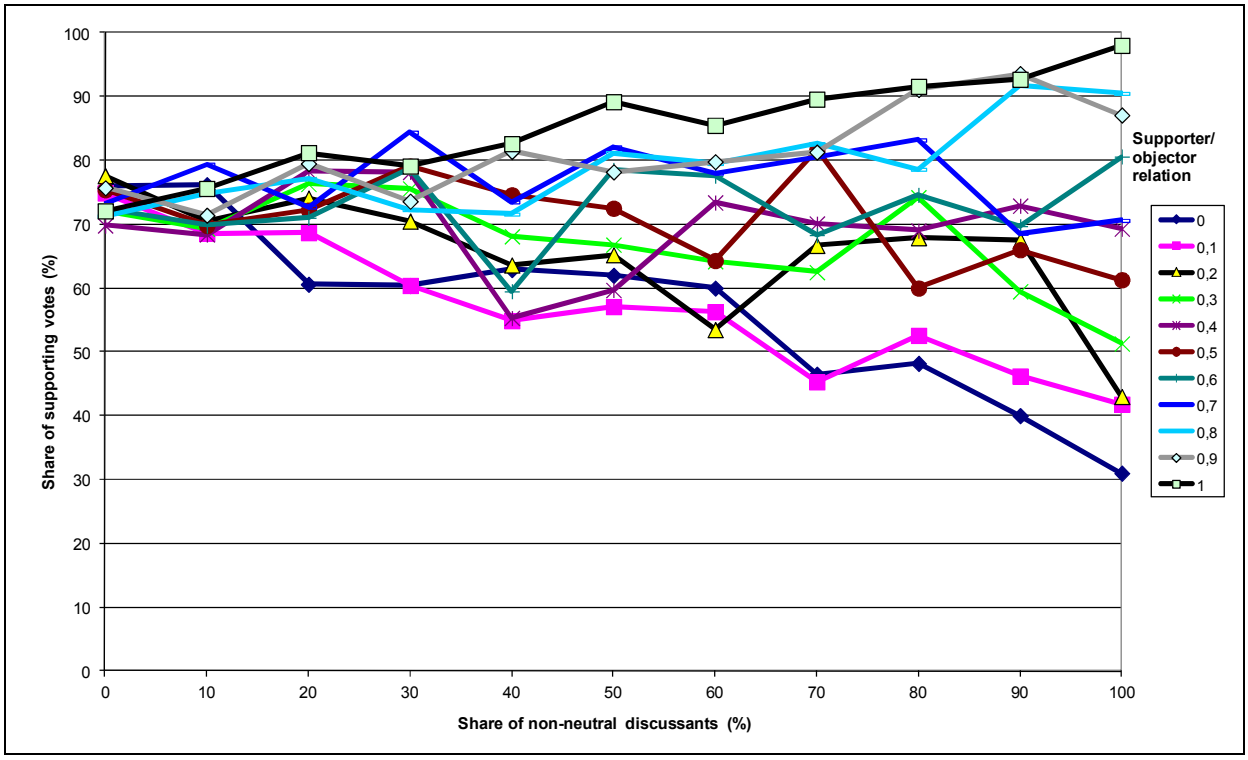

Fig. 6: Shares of project applications decided positively depending on variations in discussing behavior.

Scenario 'Reduced Budget'

In the study year of 2009, project applications were not turned down for financial reasons. However, in the near future funds are expected to decrease partly as an incentive to create sustainable cooperation structures, and partly due to increasing numbers of applications facing finite funds. In this situation it will be inevitable to prioritize projects under uncertainty, as at the time of decision, future projects worth funding are unknown. The simulation scenario 'Reduced Budget' is entitled to support the decision makers in comparing possible alternatives for prioritization rules on the basis of their impacts on past decisions. As a result, the stakeholders are expected to reject those

prioritization rules by that projects would have been dismissed in the past that appear essential to the stakeholders.

In general, a large variety of rules for prioritizing projects is imaginable. This investigation focused on rules to ensure that projects claiming a considerably high share of the budget would require a broad support in the assembly. One possible option would be to stipulate that projects claiming more than 20 per cent of the remaining budget should require two thirds of the votes in the assembly. In case of lesser support, these projects would at first be deferred to be discussed again if the budget is not exhausted by the end of the year.

Start budget	End budget	Number of supported projects	Number of deferred projects	all	Power plant Mutzschen	Barn Ganzig	Landscape preservation	Church Sornzig	Street lamps Bucha	Demolition Reppen	Leisure facility Loßwig	Broadband Sornzig-Ablaß	Forestry building Staupitz	Road improvement Kreina	hair dresser store Mutzschen	Road improvement Staritz	Town square Wohlau	Church Weißnig	Street lamps Grauschwitz	Broadband Wermsdorf	Barn Schönnewitz	Church Terpitz	Leisure facility Schweta	Regional management	Church Calbitz	Leisure facility Beckwitz	Leisure facility Staupitz	Leisure facility Weßnig	Church Sörnewitz	Church Ochsensaal	Rectory Börln	Broadband Dahlen
3000000	929486	23	0	23	ok	ok	ok	ok	ok	ok	ok	A	A	ok	ok	ok	ok	A	ok	A	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	A
2700000	1397060	17	0	17	ok	A	ok	A	ok	A	A	A	A	ok	A	ok	ok	ok	ok	A	A	ok	ok	ok	A	ok	ok	ok	ok	ok	ok	A
2400000	819372	21	0	21	ok	ok	ok	ok	ok	A	ok	A	ok	ok	A	ok	ok	ok	ok	A	A	ok	ok	ok	A	ok	ok	ok	A	ok	ok	ok
2100000	382572	21	1	22	ok	ok	ok	ok	ok	A	ok	A	A	ok	A	ok	ok	ok	ok	ok	A	ok	ok	ok	ok	ok	ok	ok	Z	ok	ok	A
1800000	212916	18	3	21	A	A	ok	ok	ok	ok	ok	A	A	ok	ok	ok	ok	Z	ok	A	A	ok	ok	ok	ok	ok	ok	ok	Z	Z	ok	A
1500000	277	16	2	18	ok	A	ok	ok	ok	A	ok	ok	ok	ok	ok	ok	ok	Z	ok	A	Z	A	ok	ok	ok	A	A	ok	V	V	V	V
1200000	3348	15	3	18	A	ok	ok	ok	ok	ok	ok	ok	A	ok	Z	ok	ok	ok	ok	A	Z	A	ok	ok	A	A	ok	V	V	V	V	Z
900000	19010	11	2	13	ok	A	ok	ok	ok	A	ok	Z	A	ok	ok	ok	ok	A	ok	ok	V	V	V	V	V	V	V	V	V	V	V	Z
600000	2002	10	2	12	A	A	ok	ok	ok	A	ok	Z	Z	ok	A	ok	ok	A	ok	ok	V	V	ok	V	V	V	V	V	V	V	V	V
300000	18240	4	2	6	A	ok	ok	ok	V	V	V	V	V	V	V	ok	V	V	V	Z	V	V	V	V	V	V	V	V	V	V	V	Z

ok	approved projects
D	deferred projects
R	rejected projects
E	budget exhausted

Fig. 7: Impacts of decreasing budgets on project decisions using the prioritization rule “Costly projects with low support will be deferred”.

Figure 7 shows the impacts of decreasing budgets (rows) on project decisions (columns, in the order of year 2009 from left to right). Deferred projects are marked with the letter D, turning up at varying positions for each simulation run, whenever they fail to receive the required support. In the lower part of the chart shows situations with a fairly low assumed starting budget, so there is a high pressure for priorizing. Small projects budget wise are still approved though.

Because of the variations possible in the discussions and subsequent decisions examining more simulation runs will draw a more relevant picture. It thus becomes evident which projects are most often deferred or objected (fig. 8). Gradually declining budgets lead to increased pressure on projects in the course of the simulation year. However, not only expensive projects (such as ‘Broadband Connection Wermsdorf’ or ‘Ochsensaal Church’), but also some struggling to accumulate enough support (‘Hairdresser Store Mutzschen’) are affected by deferral.

By request of the stakeholders, two additional decision rules were tested:

1. In order to increase the efficiency of the sessions, small projects (less than 20 per cent of the remaining budget) can be approved without a formal voting if they comply with the general funding regulations. This rule promotes a full exhaustion of the available budget, which is indeed an important quality measurement for the funding sources, but seriously limits open options towards the end of the year or in low budget situations in general. Supposedly, a hard upper limit on the projects' financial volume would reflect the goal in a more suitable way.
2. Expensive projects may require the support of designated groups of assembly members (e.g. the mayors). This resulted in more projects being deferred, because it added obstacles to the decision process. In that it is irrelevant, which one of the subgroups is equipped with such a privilege. In situations with low available budget, small projects are still approved, while more expensive ones have the tendency to be dropped. It is thus left to the stakeholders to decide on the practicability of such a rule or to suggest new alternatives.

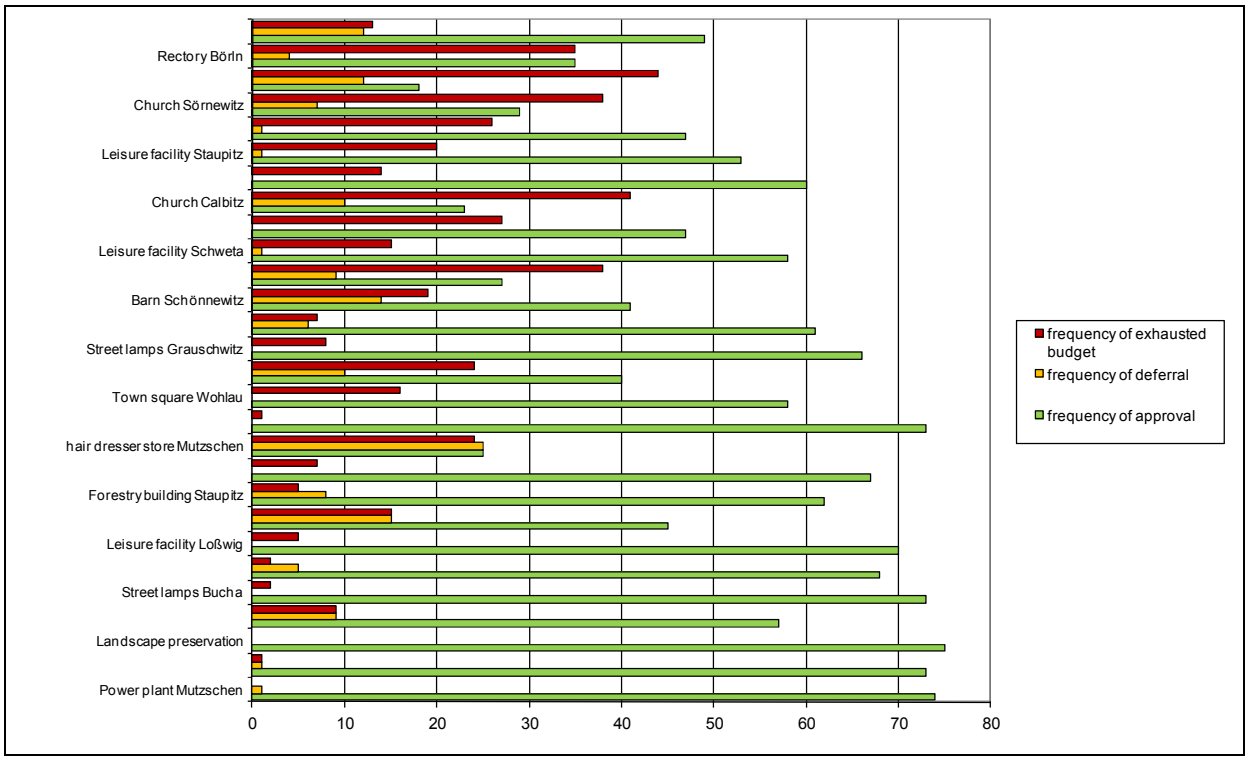

Fig. 8: Frequencies of approval and deferral decisions with decreasing starting budget after 100 simulations runs (horizontal axis) in the course of simulation year 2009 (vertical axis).

3.4.3 Project creation scenarios

Because the stakeholders' learning processes are a crucial goal for the EU funding of rural development, their assessment is essential for coming to conclusions about the program in general. Therefore, they were also focused on in simulation scenarios, where learning usually implies that agents can remember events, and comply their future actions with experiences in the past. Applied

to the process of project creation, agents can recall past projects and direct their new projects by imitating successful strategies (further details below). In a scenario named ‘cooperating agents’, a simulation was implemented, in which agents are additionally equipped with development goals for the region, and project creation is made subject to negotiating processes among agents about those goals.

Learning Agents

Assuming agents have a memory constraint of two years, the simulated learning process was limited to the decision on a project category according to table 2. Two variations seem feasible: firstly, the straight-forward imitation of other agents’ decisions, so that new projects are created of the categories that have dominated the scene in the past; and secondly, the agents may comply their decisions for a project category with the most successful options, i.e. those that have received the broadest support in the assembly.

As a result, the number of projects in each category, as they were created by the agents over time was recorded (fig. 9). In both cases, tourism projects were dominating the scene within a relatively short time period, due to the fact that already 2009 such projects were in the majority, and their overall positive image that leads to a strong link with positive arguments in the discussions (fig. 2).

Comparing these simulation scenarios with the categories of projects decided in 2010 and 2011, some differences occurred though: Road improvement projects brought forward by the municipalities showed the highest share, while in 2011, the refurbishment of private buildings dominated the picture. For the evaluation of the processes in question, this may have multiple implications: Supplementary empirical material (such as project lists of subsequent years) can be included in further versions of the model to advance the previous assumptions and hence achieve a more profound understanding of the learning process. In case the additional information does not lead to consistent agent behavior, it can be concluded that the learning process sought for have not affected the stakeholders’ actions as intended. This result is the sole merit of a simulation that could not have been achieved by conventional analysis.

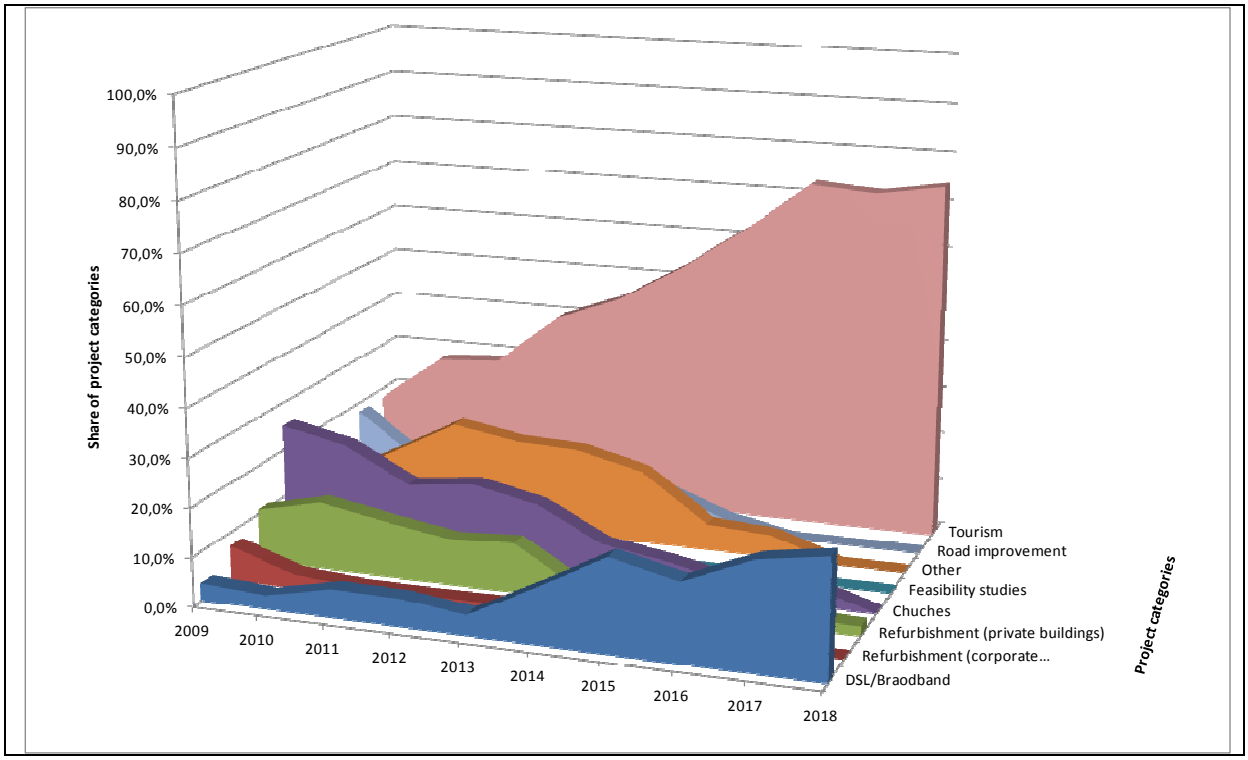

Fig. 9: Distribution of project categories in the scenarios 'learning agents' with the alternatives 'imitation' (left) and 'success in past assembly votings' (right).

Cooperating Agents

One other important aim of participatory planning is to strengthen regional cooperation between stakeholders, which is why the implications of these for fund spending were more closely examined in the simulation. In this scenario, the agents were to create projects in collaboration with their peers. Although a number of simulations on negotiating processes have been constructed and their results published, the social science research about the design of such simulation models is in a fairly early state (Hollander/Wu 2011). Typically, the present simulations start out with a number of assumptions subsequently underpinned by empirical evidence. A crucial challenge lies in the fact that a number of influencing factors (social control, norms etc.) are hard to grasp empirically. In this case, a similar approach to the problem is applied: On the basis of some assumptions, a possible implementation in a simulation model is demonstrated, and further approaches towards an improvement of empirical inputs are identified.

From the interviews, a number of development goals of the stakeholders had been extracted (fig. 3). A selection of these was at first randomly assigned to every agent. In the course of the simulation, the agents prepare project applications by negotiating the type of project in three steps: (1) Selecting negotiating partners that agree in a minimum of two of the development goal categories from figure 3 with the current agent; (2) contacting the negotiating partners on average twice a week to inquire for cooperation that the partner will reply to positively or negatively according to a weighted random decision depending on the share of goals the two have in common; and (3) selecting a partner for a project that returned the most positive replies. The type of project that matches best the development goals of the involved partners is in turn selected for the application.

The random assignment of development goals is certainly an obvious starting point for additional empirical work, although problematic as the anonymity of the results can then hardly be sustained. However, the course of cooperation inquiries, replies, and cooperation agreements can be adapted to the social practices of the stakeholders, even if they may be contradictory. This will only be opposed to an increased research effort, which can be relevant when the number of involved stakeholders is high.

Analogous to the previous scenarios, the projects created by the agents are then submitted to the simulated regional assembly, discussed and voted upon. The agents then have the opportunity to evaluate their cooperation, either by documenting the success of their project in the assembly, or by reviewing their individual satisfaction with the project in terms of the share of their own development goals that the project fostered. One surprising result of this simulation experiment was that for a majority of the newly created projects a rather low agreement of the agents on development goals was necessary. Approximately two thirds of the projects were created by partners with less than half of the cooperation replies positive, thus indicating a limited agreement of the agent involved (fig. 10).

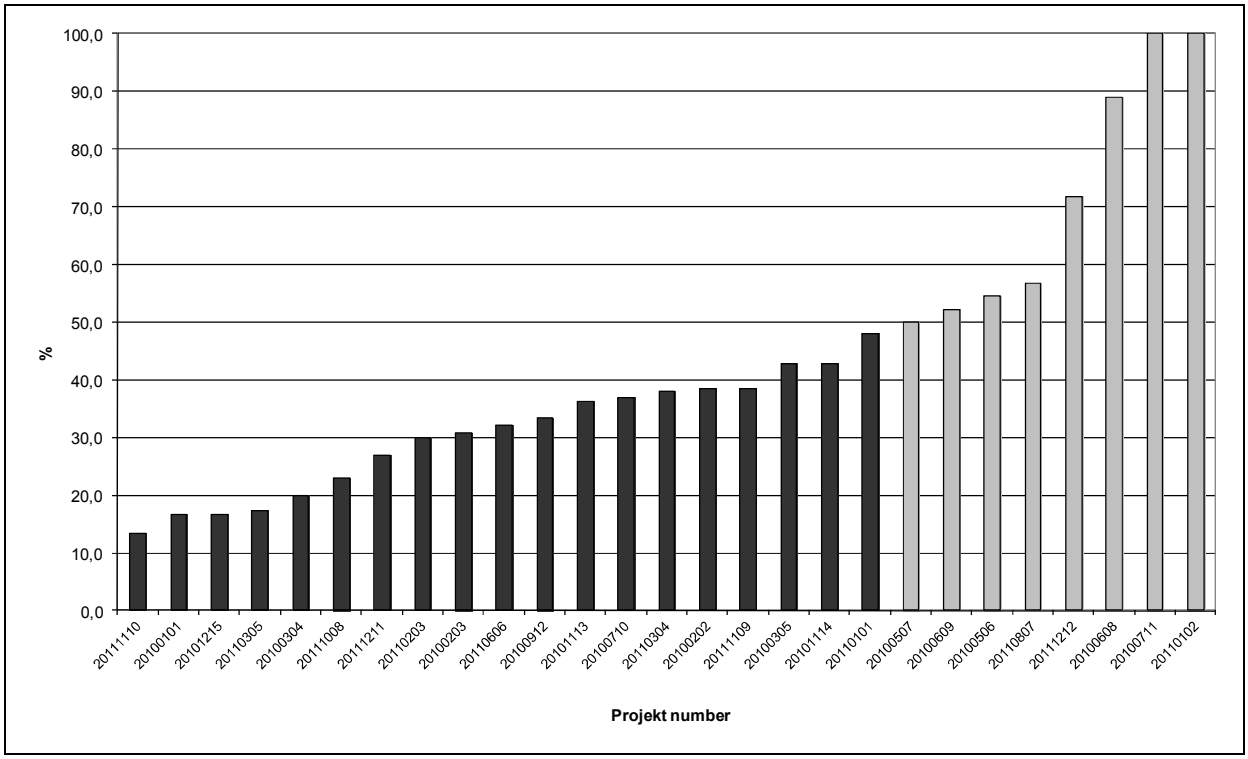

Fig. 10: Degree of agreement regarding development goals at project creation, measured by the share of positive replies on cooperation inquiries of agents among each other.

4. Conclusion

The starting point of this paper was the notion that the evaluation of regional development processes faces a serious dilemma: Due to the increasing relevance of communicative and participatory procedures in planning, the processes in question cannot be adequately represented by quantification, causing the identification of success indicators to be difficult. On the other hand, mere qualitative descriptions frequently lack political acceptance. Agent based simulations bear the possibility to combine the advantages of the two approaches: The examined processes can be precisely modeled, without depending on quantifications, and relying entirely on empirically grounded and text based action rules of the stakeholders. For the purpose of their examination, the social sciences provide a rich variety of modern qualitative research methods, a selection of which (interview, observation) were applied for this study.

In the further course of the paper it became evident that the examined actions of the stakeholders can in principle be transferred into rules of a simulation model, in part requiring substantial empirical effort. Although not all aspects of the social practices of the stakeholders could be integrated in this first version of the model, and not all methodological challenges could be resolved, the simulation resulted in a more profound understanding of the social practices, decision alternatives, and their consequences both by the researcher and the stakeholders, enabling the latter to self-evaluate their actions and hence enriching the cooperation process.

To conclude, some potential criticisms of this approach shall be addressed. Although agent based simulation originated from research in artificial intelligence, including the creativity of stakeholders in a simulation model is not possible. This is however not crucial, as it is not the intention of this work to predict future developments of the processes studied, but rather to shed light on processes of the past by their precise representation and demonstrating the consequences of possible alternatives in order to encourage stakeholders to redirect their actions in the future if perceived necessary.

Furthermore, questioning the efficiency of this approach to evaluation is also legitimate. Efficiency usually refers to the relation of an achieved result to the required effort. Concerning the empirical input, the presented approach proved quite costly. Unlike a mere empirical study, the results gained also needed to be transferred into the simulation model. Concerning the benefits however, the approach resulted in a more explicit disclosure of action alternatives, potentially facilitating stakeholders' learning from the simulation results.

In some communications with the stakeholders, it was finally also observed that the approach bears the risk of an overestimation of its potentials. Positively speaking, the comprehensibility of simulation events and their text based representation ('simulation narratives', see fig. 1 and tab. 4) leads to confusions with occurrences in the real world. Consequently, a clear separation of results of the empirical study and the following simulation is required.

Overall, the potentials of an innovative combination of qualitative social science methods with techniques of social simulation resulting in a new appraisal to analyze and evaluate stakeholder constellations was demonstrated, potentially offering applications to other areas of social science as well.

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Appendix: Interview Outline

- Some personal information: activities, relation to the region, functions in URnära
- How did URnära come into place? How did you get involved?
- Emergence of contacts, frequency of contacts, with whom?
- Are topics of URnära talked about outside of official meetings?
- Working in the LAG grupp: agenda of meetings, working atmosphere, course/delevopment of discussions
- Decisions about projects: important aspects? Are aspects discussed? If yes, which and why? Which aspects are important to you and why? Which arguments are convincing and why?
- Own projects: Have you been involved in a project? Finding of partners, discussions about aims and scope of projects
- Outside contacts

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