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The Usability of Scenario Studies: the Case of the EUruralis from the Users' Perspective

Abstract: Scenario studies are seen as useful tools to support planning and decision making processes because they provide integrated projections of future trends and developments and their impacts on land use. They play an important role in facilitating cooperation and interaction at the science policy interface. This article contributes to new understandings of the role of science-based tools and instruments such as scenario studies at the science-policy interface. It uses a theoretical framework that connects the criteria of credibility, salience and legitimacy to the concepts of coproduction and boundary object to analyze the EUruralis project; a scenario study that addresses the future of agriculture and rural development in Europe. The findings demonstrate that aspects related to legitimacy contributed to the capacity of the EUruralis to function as a boundary object between the scientists and policymakers involved. They also show how cooperation in the EUruralis project resulted in joint learning and reflection. The article concludes by discussing the role of the EUruralis as a boundary object and connecting the findings to the concept of coproduction.

Keywords: EUruralis; boundary object; credibility; legitimacy; salience; coproduction.

Scenario Studies and the Science Policy Interface

Scientific knowledge plays an important role in current national and international environmental governance, planning and decision making. Particularly knowledge that pertains to future developments and trends is considered important as a basis for land use planning issues. Scenario studies are considered to be particularly useful in that respect because they are able to project the impacts of land use changes and illustrate future needs and issues in a complex context (Clavel et al. 2011). According to Kok (2006: 264), scenarios function as "plausible, challenging, and relevant stories about how the future might unfold that can be told in both words and numbers." In a similar vein, Kahn and Weiner (2000, cited in Kok 2006) state that scenarios are hypothetical sequences of events constructed for the purpose of focusing attention on causal processes and decision-points. Scenarios integrate existing knowledge about drivers and impacts of environmental and land use change. As such, they can contribute to knowledge utilization and to informed decision making in the face of uncertainty.

Several studies have highlighted the important role of tools and instruments such as scenario studies, models, maps, multi criteria analyses, or indicators at the science

policy interface (Turnhout 2009, Sterk et al. 2009, Stirling 2006, Hessel et al. 2009, Clavel et al. 2011). These tools and instruments are considered useful because they are science-based, which lends them a certain epistemic authority, while at the same time, they generate knowledge and information that is considered relevant for policy and decision making. By combining scientific validity and user relevance, these tools are considered crucial in bridging the gap between science and policy and enhancing knowledge utilization. However, their capacity to play such a role in improving the science policy interface depends on the extent to which they are able to meet the demands of the users (Sarewitz and Pielke 2007).

This article explores these demands by offering an analysis of user perspectives on the usability of scenario studies. It uses the EUruralis project as a case study. The EUruralis project is a scenario study that addresses the future of agriculture and rural development in Europe. The project, which started in 2004, has been initiated by the Working Group of Sustainable Development and System Innovation set up at Wageningen University and Research and commissioned by the Dutch Ministry of Agriculture, Nature and Food Quality (LNV). The EUruralis uses several scenarios to forecast the possible future of rural areas in the light of the current reforms of the Common Agriculture Policy (CAP). It was the explicit ambition to make the EUruralis useful for policymaking in EU member states and to provide topics for debate on long-term rural land use and agriculture (Rienks et al. 2008). An important feature of the EUruralis was that it involved policymakers in the project. Our analysis focuses on the perspectives of Polish scientists and policymakers on the usability of the EUruralis. Poland was one of the countries in which the EUruralis was introduced to enable Polish policymakers to use it while discussing the current rural development and agricultural issues. The introduction of the EUruralis involved several meetings in the Polish Ministry of Agriculture and Rural Development and in the Netherlands, for example in Alterra Research Centre, where Polish policymakers as well as scientists who were asked to verify the data input and the first results of the prognoses in the EUruralis version 1.0, study the EUruralis, and ask questions to the designers about the project. Currently, the EUruralis is not used in Poland. Our analysis is based on relevant policy documents and literature as well as on material from semi-structured interviews and questionnaires. Ten out of thirteen interviewees were with the prospective users of the EUruralis: Polish scientists and policymakers. The other three interviewees were Dutch representatives involved in the design of the EUruralis. In addition, fourteen questionnaires were sent out and five returned. The analysis focused on the assessment of the usability of the EUruralis, the reasons and criteria that were mentioned, and the characteristics of the science-policy interactions that took place in the context of the project. Also, respondents were asked to reflect on the EUruralis project itself, on the processes of cooperation and interaction involved, and on how this project influenced their practices. Before presenting the results of the analysis, the next section introduces the theoretical framework used in this research.

Usable Knowledge

Connecting science and policy is considered important to improve planning and policy decisions and underpin them with a scientific basis. However, the science-policy interface is often characterised by communication problems and other difficulties. (e.g. Johnston and Soulsby 2004, Turnhout et al. 2007; 2008, Sarewitz and Pielke 2007). On the one hand, civil servants can exhibit a tendency to believe that their experiences are unique and better than those of others. On the other hand, scientists often perceive policymakers as science enemies who are not interested in their results (Pielke 2007). Moreover, the separation between science and policy is also considered important. Scientist must be able to maintain their independence from policy in order to be seen as neutral and objective, policymakers must be able to show that they are the ones who are in charge and not the scientific experts (Huitema and Turnhout 2009). Thus, the use of knowledge in policy and decision making cannot be assumed.

In light of these difficulties in connecting science and policy, it is not surprising that many authors claims that knowledge is often not used effectively (e.g. Meffe 1998, Bradshaw and Borchers 2000, Lawton 2007, Pohl 2008). If this situation is to improve, the production of usable knowledge should be enhanced. But what constitutes usable knowledge? Various authors in the field of knowledge utilization studies have come up with partly overlapping sets of criteria for usable knowledge (e.g. Rich 1991, Weiss 1995). Part of these criteria focus on the quality of knowledge. It is assumed that for knowledge to be usable, it should conform to scientific standards related to reliability and accuracy and it should be based on state of the art methodologies. In practice, experts involved in the production of usable knowledge tend to focus a large part of their efforts on technical issues and on enhancing the quality of knowledge (Turnhout et al. 2007). However, this is only part of the equation. As Lindblom and Cohen (1979) have pointed out the usability of knowledge is not only determined by its quality, but also needs to consider demands of users. Usable knowledge is relevant for users if it is delivered timely and if it is related to topics that are currently salient and that they are working on (Weiss 1995). Second, it has been demonstrated that knowledge users assess knowledge based on their prior knowledge, experiences and beliefs (Lindblom and Cohen 1979). Knowledge that confirms these beliefs has a much greater likelihood of being accepted as usable than knowledge that contradicts them. Finally, problem and action orientation are important for usable knowledge (Weiss 1995). From that perspective, interdisciplinary knowledge based on an integrative approach that addresses the different dimensions of a current societal and environmental problem is considered to be more usable than monodisciplinary knowledge (Sumner 2003), amongst others because it can be translated into realistic and effective strategies for action to address these problems.

Meeting the different criteria for usable knowledge is no simple matter. Especially relevance and quality are often considered to involve a balancing act, because the quality of knowledge is assumed to depend on distance from policy,

which will decrease the chances of producing knowledge that is relevant (Huitema & Turnhout 2009). Furthermore, the question which knowledge is considered usable crucially depends on the context in which it is developed and applied. Recognizing this implies conceptualizing the relation between knowledge production and use not as a 'chain of knowledge' from knowledge production–by science–to use–by policymakers–but as a dynamic science policy interface (Turnhout et al. 2007). In other words: "usable knowledge is co-produced in the context of everyday interactions between science and policy and the public" (Lemos and Morehouse 2005: 59).

In that light, the contribution of Cash et al. (2002, 2003) is interesting. They propose three main criteria: credibility, salience and legitimacy, which are explicitly considered as socially negotiated outcomes rather than essential characteristics of knowledge. Credibility implies that knowledge is seen as realistic and valid. This refers to perceptions of scientific quality—including the methods used and the reputation of the knowledge producers—as well as to aspects related to the completeness and transparency of a study. Salience refers to the relevance for a user, including the timing of knowledge and the link to decision-making agendas, or to choices an actor has to make. Salient knowledge is typically problem oriented. Often this requires a multidisciplinary approach to generate an integrated perspective of the phenomenon under study. Legitimacy is the most process oriented of the three. It refers to the fairness of the knowledge production and use process, including questions of the interaction, cooperation, deliberation and participation.

Cash et al. (2003, p. 8090) recognise that trade-offs and overlaps exist between the criteria and that they are ambiguous and subject to multiple potentially competing interpretations: "each actor [is] likely to enter the debate under different concepts of what makes information salient, credible and legitimate." Consequently, they argue that processes of communication and interaction are required to achieve acceptable levels of all three criteria. In such an interactive multi-actor approach, knowledge may perform a role of a boundary object. Star and Griesemer (1989: 393) have described the concept of boundary objects as

> an analytic concept of those scientific objects which both inhabit several intersecting social worlds […] and satisfy the informational requirements of each of them […]. They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, a means of translation. The creation and management of boundary objects is a key process in developing and maintaining coherence across intersecting social worlds.

Thus, the concept of boundary objects implies that usable knowledge allows for different interpretations and meanings in different social worlds as well as meets the demands of all those involved. Their role in facilitating communication across differences is often enhanced by the common vocabulary that boundary objects provide (Carlile 2002, Turnhout 2009).

In this article we use analyse users' perspectives of the credibility, salience and legitimacy of the EUruralis. Subsequently, the analysis provides a basis for further discussion of the EUruralis in relation to the concept of boundary object.

Introducing the EUruralis

The EUruralis is a computer based scenario model that presents forecasts of the possible future of rural areas in Europe while considering the current reforms of the CAP. It is a discussion-oriented tool to support policymakers in discussions about the future of agricultural and rural areas with scientifically sound data and methodologies for Europe in detail and with the global dimension becoming more important. An important feature of the EUruralis tool is that it links economic and biophysical domains and global and local scales (The EUruralis homepage, 2011). It has three versions. Whereas version 1.0 was released "to give an impulse to the discussion on rural development in the EU-25" (The EUruralis homepage, 2011) and presented forecasts on the country level, version 2.0. offered prognoses on the level of the European regions, had improved interactivity and included EU policy options on the future of the CAP and on biofuels. Version (3.0.) includes a new policy option, i.e. Reducing Emissions from Deforestation and Degradation policies (REDD) and a biodiversity indicator (see the EUruralis homepage for an overview).

The EUruralis is based on the DPSIR approach which distunguishes between "driving forces (D) (either direct or proximate or indirect or distant) affecting a defined system (ecosystem, agro-system) by so-called pressures (P) affecting its state (S). This can be seen as the impact, which has to be assessed from society's interests (negative or positive, acceptable or unacceptable). This assessment can lead to policy interventions (Response: R). These can be targeted at effects (mitigation, compensation) or—more fundamentally—at the direct or indirect drivers." (Klijn & Vullings (eds.) 2005: 36). It also addresses the People, Profit and Planet dimensions of land by recognizing that land use is "on the one hand the expression of societal needs, interest, economical laws, (Profit), techniques and on the other it exerts direct influences on the biophysical and partly socio-cultural values (Planet, People)" (Klijn & Vullings (eds.) 2005: 36).

The EUruralis includes four scenarios, which are derived from the IPCC-SRES[1] scenarios of global coverage (Klijn & Vullings (eds.) 2005:52). The two A—scenarios focus on the international cooperation—regional vs. global. The two B—scenarios focus on government intervention—extensive vs. limited. Scenario A1 "assumes multilateral cooperation on economic issues […], societies are driven by market-based solutions resulting in high economic growth rates" (Klijn & Vullings (eds.) 2005: 53). Scenario A2 "assumes a view that social and cultural values can best be preserved in regional political alliances, within which nation states should keep as much sovereignty as possible. No further enlargement of the EU will take place" (Klijn & Vullings (eds.) 2005: 54). Scenario B1 "assumes multilateral cooperation on issues aiming at fair distribution of wealth, social justice and environmental stewardship. Trade barriers are gradually removed" (Klijn & Vullings (eds.) 2005: 54). Scenario B2 "assumes that social and cultural values can best be preserved at the community level. […] self-reliance, environmental stewardship and equity are the keys to sustain-

[1] Intergovernmental Panel on Climate Change—Special Reports on Climate Change.

able development. Government intervention is necessary to facilitate negotiations between stakeholders and enforce decisions" (Klijn & Vullings (eds.) 2005: 54).

The basic input for the scenarios is provided by three models: LEITAP, IMAGE, and CLUE (Klijn & Vullings (eds.) 2005). LEITAP is an economic model, which is adapted from the Global Trade Analysis Project (GTAP). It aims "to support quantitative analysis of international trade, resource and environmental concerns in economic wide framework" (Klijn & Vullings (eds.) 2005: 63). IMAGE (Integrated Model to Assess the Global Environment) assesses the effects of global changes in population, agricultural production and climate on the environment. It "supports decision-making by quantifying the relative importance of major processes and interactions in the society-biosphere-climate system" (Klijn & Vullings (eds.) 2005: 77). CLUE (Conversion of Land Use and its Effects) is a land use model that allocates changes in the land use and "was developed for the spatially explicit simulation of land use change" (Klijn & Vullings (eds.) 2005: 83).

The EUruralis was designed in an interactive way and involved various stakeholders throughout the process. The initiative itself arose from a joint discussion with policymakers and scientists about the possibilities of developing a model that would provide projections on the development of rural areas and agriculture in Europe. The involvement of scientists and policymakers is also affirmed with the establishment of two groups. The Policy Advisory Group consisted of civil servants and gave advice on the policy relevance and orientation of the scenarios as well as on the presentation mode of the EUruralis (Klijn & Vullings (eds.) 2005). The Scientific Advisory Group consisted of representatives from Environmental Assessment Agency (RIVM), Agricultural Economics Institute (LEI), Wageningen University, and UNEP-GRID[2] in Poland and INRA-CIRAD[3] in France. The groups cooperated in the formulation of research questions, the building of the models, and the verification of the results. The EUruralis project members invited among others scientists from the Polish Institute of Agriculture and Food Economics and Polish Institute of Geography and Spatial Planning to comment on the results regarding the prognosis for Eastern and Central Europe.

User Perspectives on the Usability of the EUruralis

This section discusses the results of our analysis in terms of the three criteria of credibility, salience and legitimacy.

Credibility

One of the aspects that spoke to the credibility of the EUruralis is its multidisciplinarity. Polish respondents emphasised that the EUruralis aggregates many disciplines and achievements of science. This allows for multidisciplinary analyses, helps to define, identify and understand complex situations, and promotes new ways of thinking

[2] United Nations Environmental Programme—Global Resource Information Database.

[3] Institut national de la recherche agronomique—La recherche agronomique pour le developpement.

about and dealing with them. This multidisciplinary approach is assured by the three-model-construction [LEITAP, IMAGE, and CLUE (Klijn & Vullings (eds.) 2005)] as well as by using the DPSIR and sustainability approaches. The EUruralis addresses people, planet and profit (the three Ps) issues, and includes knowledge about ecological properties, economic aspects and socio-cultural values from a wide variety of scientific disciplines including economics, ecology, climate science and land use studies. By integrating multiple dimensions and knowledge from multiple disciplines and sources, the EUruralis is considered to be credible and able to attract a broad audience.

The usage of the DPSIR approach and particularly the way it includes outside factors as driving forces and pressures contributes to its outcomes being seen as realistic. Examples of issues, which happened outside Europe but influence the CAP and the daily life and future of Europe's citizens include the growing population and income in such countries like China, India, and Brazil; the international trade barriers and opportunities; oil production and global change processes. So, in the EUruralis forecasts' drivers such as: natural forces (climate change, changes in sea level), geopolitical change and international trade, demography, world economy, technology development, consumer behaviour and policy considerations are taken into account (Klijn & Vullings (eds.) 2005).

The way the EUruralis presents its results (historic and temporary facts, figures and pictures of the EU 27), in an understandable manner by using maps, graphs and tables and in four contrasting scenarios, also contributes to its credibility. The EUruralis designers compared it to the commercial games like the SimCity and SimRural PC games because "it is a challenge for users to find themselves new reasons and manners for land use changes on the territory of the EU 27." Polish respondents indicated that they appreciated this way of presenting the results because it makes it much more attractive than a traditional scientific publication. They emphasised "the easiness of getting the results of prognosis" and they spoke about the simple and colourful maps, graphs, tables which made the project understandable for anyone. Generally, Polish respondents recognized that the way in which the EUruralis presented the results contributed to the usefulness of research in policymaking.

Nevertheless, the credibility of the EUruralis was also criticized. One of the weak points concerned the lack of continuous data from the past years from Eastern and Central Europe used in equations calculating the forecasts. This resulted in incorrect prognoses of changes in some regions, including Poland. Polish respondents were very critical about this, and one of them said: "if the results are not correct, this disqualifies a model and it cannot support policymakers." In the eyes of Polish interviewees, this strongly weakened the validity of the EUruralis and influenced its utilisation by potential users in Poland.

Salience

The EUruralis was intended to serve as a tool to support discussions about policy issues and possible actions at the European level. The way of presenting the results in

contrasting scenarios was appreciated because it linked up with current policy issues. Responses to version 1.0 made clear that forecasts on a country scale were not considered to be very relevant and usable. Several scientists and policymakers expressed during interviews that they would prefer region specific information. Version 2.0 rectified this. According to a scientist working for the project these changes improved the relevance of the EUruralis: "[The Eururalis] has been improved by showing the data at the regional level." The EUruralis's salience was also enhanced by adding policy options that constituted hot issues on the international rural arena (CAP market and income support policy, bio-energy and less favoured policy). It was assumed by the designers that the 2.0 version could be relevant mainly to civil servants, NGOs, farmer associations, environmental and nature groups, colleagues in research and for purpose of educational workshops.

Apart from appropriate data resolution scales, the salience of the EUruralis lies partly in its capacity to help decision makers in setting priorities. As one of the respondents explained:

> there is a long list of issues […] in the context of rural development such as water, soil, climate changes, employment in rural areas, innovations etc. But policymakers are looking for a shortlist of issues to be discussed. So the EUruralis helps them to make this list. […] It contributes to putting together a shortlist of important issues that should be changed or embedded in European law.

One particular aspect of salience is problem orientation. The DPSIR approach mentioned earlier contributed to this as well as the multidisciplinarity approach of the EUruralis and its use of sustainability indicators. It also used so-called 'meta indicators' that integrate scores for the three Ps for specific countries and regions and assess differences between, among other, east—west, north-south, EU 15 and EU 10. This was purposively done to generalize results and present them in a policy relevant way that would be understandable for inexperienced users (Klijn & Vullings (eds.) 2005). According to several respondents, the prognoses of changes based on societal, economic and environmental indicators and the combination of economic and environmental models enabled them to look at issues from a broader perspective. Apart from problem orientation, action orientation is important for salience as well. Respondents appreciated the integrated character and future orientation of the scenarios that provide forecasts on what may happen in agriculture and rural areas in Europe in ten-year intervals until 2030. As such, the EUruralis facilitated discussions on policy issues regarding the effects of the accession of new member states and the implementation of environmental directives on land use.

The set of scenarios contribute to saliency as well because one can "analyze [for example] how driving forces can influence biodiversity and ecosystems (Verboom et al. 2007). The set of scenarios enabled also discussion of policy relevant issues and contextualized the user towards broad issues of globalization, cultural identity, environmental awareness and international solidarity, which are typically at the roots of long term scenario studies" (Klijn & Vullings (eds.) 2005). "Such scenarios help in making alternative assumptions, beliefs, and attitudes explicit, and illustrate how they influence future conditions" (Verboom, et al. 2007). The scientists involved in the

design of the EUruralis admitted that "perhaps, scenarios are overlapping, but if things are happening in all four scenarios than there is high possibility of a true prognosis. If things are happening only in one scenario, it is probably some kind of extreme." Also most of Polish interviewees recognized the scenarios as a positive feature; whereas, one Polish scientist understood this as limiting the number of options and stressed that "it is not possible to fully predict possible changes in the project if they are treated linearly because in nature there are no linear events." Polish respondents expressed their curiosity an interests in the EUruralis results projected in the time horizon and admitted that it contributed to their knowledge. In that sense they indicated that the EUruralis is policy and action oriented.

Legitimacy

Although the EUruralis involved stakeholders and was introduced in a several countries, it was mainly Dutch scientists that were involved in its design. Particularly in the early stages of the EUruralis, participation of actors from other countries was limited. One of the respondents indicated that this was a weak point of the project and that it would have been better to include a broader group of actors (scientists and policymakers) from various countries.

During the project, interaction increased. There were many informal contacts between policymakers and scientists involved for example by phone, emails. As one of the respondents recalls:

> during the preparation of the EUruralis version 2.0, there were many informal working meetings in the Netherlands, where policymakers and scientists met. In fact, the majority of these meetings took place outside the Dutch ministry, in scientific organizations, where policymakers felt they could discuss issues more openly.

The interactions between the various actors concerned among other discussing policy options and preferences, translating policy questions into model equations, and experimenting with different ways to visualize and present the results. Although these processes required interaction, they were largely science-based with policymakers assisting the process by providing feedback and specific inputs. Interestingly, the EUruralis itself enhances interaction as well. Users can choose between different domains and levels of information and they can explore different options and the implications for rural areas. It thus offers possibility to create relations between different domains and levels of information.

The cooperation between policymakers and scientists in the project was generally appreciated by the respondents. They felt that it contributed to bridging the gap between policy and science. Moreover, they felt that the EUruralis encourages dialogue between policymakers and scientists on the possible implications of changes for policy by offering a common terminology and vocabulary. Cooperation in the EUruralis provoked reflection on the differences between science and policy. As one of the respondents explains:

> scientific and policy domains differ enormously and it is important that everybody has an open mind. It is not possible for all scientists to understand what policymakers need and vice versa. I think in general

that policymakers overestimate the impact of policy and tend not to look on the real long term and also broader then their own region or country. […] Scientists focus mainly on their own topics and tend to keep on modelling.

Reflection on the differences between the domains also implied recognition of the importance to overcome them. However, this was not considered to be easy. According to the respondents useful interactions were possible but they require a lot of work. As one of them explains:

[achieving a productive] science-policy interface requires a lot of effort. In the EUruralis we have invested a lot, but even then it was not always successful. Other research projects have to invest a lot more into making the policy-science interface more successful.

According to the respondents, cooperation in the project not only contributed to the awareness of how science and policy differ also to an increased appreciation of the actor's different perspectives. The scientists involved were happy to learn that policymakers were interested in models and results. As one of the respondents states:

I found that policymakers are also specialists. We spoke with policymakers from ministries of agriculture and rural development. They were very much interested in detailed impact assessments of rural development policy.

Another respondent admitted to have learned a lot for example about the importance to explicitly address issues of relevance, and to present forecasts to policymakers in an understandable way. The policymakers involved increased their understanding of the various complexities involved in modelling and realized that scenarios and prognoses cannot show and predict everything. The EUruralis was identified by one of the respondents as

a good learning experience for scientists of different discipline to cooperate and to connect each other's models and to understand each other's language.

Respondents were asked also to reflect on the project itself, its initial goals and its actual function in practice. Some realized that perhaps the expectations for the EUruralis had been a bit too ambitious. Initially, the EUruralis was assumed to be a decision support tool not only for policymakers but also for broader audiences. One of the respondents makes clear that this assumption was perhaps misguided: "the model can be used as an instrument by scientists to analyze research questions posed by policymakers. Also it might also be useful for students as a learning tool and that is it." However, this was considered to be very valuable. As one of the respondents explains:

maybe the most important contribution of the EUruralis lies not necessarily in the results and prognoses it produces but in the way it facilitates policy discussions that are scientifically supported and deal with important trends and issues in rural areas in Europe.

This shows how during the process, the EUruralis came to be interpreted and used in different ways than was originally anticipated.

The EUruralis as Usable Knowledge and Boundary Object

The previous section has presented different perspectives on the usability of the EUruralis in terms of its credibility, salience and legitimacy. The credibility of the EUruralis appears to lie primarily in its multidisciplinarity, its broad DPSIR approach and its clarity in presenting the results. By integrating different domains and knowledge, the EUruralis is able to attact a broad audience and is considered credible because it offers a realistic representation of the problems and issues at hand. However, the lack of data was considered to decrease its credibility. The salience of the EUruralis appears to lie in its ability to connect with currently salient policy issues related to the future of the CAP, the implementation of EU policies and the implications of these for rural areas and in presenting the prognoses in four contrasting scenarios. The future-orientation of the scenarios and the way they present the results ensure action orientation of the EUruralis.

In terms of legitimacy, the EUruralis was characterized by an interactive set-up. In order to make the EUruralis a relevant and usable support tool for policy discussions, the project aimed at the involvement of users. Scientists and policymakers cooperated in the project and were involved in joint processes of knowledge production. Our findings also show that to a certain extent, science and policy remained separate communities with different objectives and activities. Thus, the EUruralis was able to facilitate the interactions between scientists and policymakers, but did not completely collapse the two. Still, those involved did not remain unaffected. Cooperation in the EUruralis triggered reflection on the differences between science and policy and the importance and possibilities of overcoming them. Additionally, a learning process was involved, which resulted in increased knowledge and appreciation of each others' perspectives.

It has to be highlighted that the respondents valued different things in the EUruralis and their perceptions were very differentiated. Whereas scientists focused more on the construction of the scenarios and the calculation and generation of results, policymakers focused on the EUruralis' problem and action orientation, relevance and its possible usage in their work. For example, the multidisciplinary approach of the EUruralis was appreciated for different reasons. Scientists appreciated the scientific challenge of coupling models from different disciplines. Policymakers valued the integrated perspective and the link to action that the multidisciplinary perspective offered. The way of presenting the results was also perceived differently. Scientists presented the results in such a way, including different policy options, in order to enable their use in policy discussion, while some of the policymakers focused on whether the prognoses were true. And this turned out to be an important issue due to the lack of data in some European regions. Finally, perspectives of the EUruralis changed over time as well. Actors started to recognize that the initial ambitions of the EUruralis were perhaps unrealistic and that the current role that the EUruralis played in the facilitation of discussions was equally valuable.

Our analysis so far on the perspectives of the credibility, salience and legitimacy of the EUruralis makes clear that the EUruralis was flexible and ambiguous enough

to support different interpretations. As a result of this combination of flexibility and stability, the EUruralis was able to perform as a boundary object (Star and Griesemer 1989). It meant different things to different people and people had different reasons for wanting to be involved in the project. Still, it was able to satisfy their different needs and facilitate communication and interaction between them. Moreover, our analysis confirms earlier observations about the role of boundary objects in facilitating communication by providing a common vocabulary and offering space for learning and reflection (Turnhout 2009, Carlile 2002).

However, this role as a boundary object was not present from the start. Our analysis of the legitimacy of the EUruralis points to the learning and reflection that took place during the process. The processes of cooperation and interaction involved resulted in the generation of new knowledge and understandings of scenario studies, the recognition and appreciation of differences and the emergence of commonalities and shared interests and perspectives. Its capacity to function as a boundary object was not engrained in the scenario study itself but the outcome of the process. This demonstrates that processes of knowledge production and use are context specific (e.g. Turnhout et al. 2007). The questions of what will be taken to be usable knowledge or what kinds of knowledge will be considered to be of credible, relevant, action oriented and so on, are context specific. Different people, scientists or policymakers in different EU member states will value different things and will interpret knowledge and science based policy tools such as the EUruralis in different ways.

The Role of Scenario Studies: Coproduction In-the-Making

Planning and decision making is an endeavour, which requires an integrated and future-oriented approach. Our analysis exemplifies that scenario studies can in principle contribute to these processes by connecting science and policy. The hybrid character of the EUruralis, based on scientific input from different disciplines as well as input from policymakers, facilitated this role at the science policy interface.

According to Cash et al. (2002; 2003), knowledge is effective if acceptable levels of credibility, salience and legitimacy are obtained. As Cash et al (2002, 2003) have pointed out, there is the possibility of trade-offs and overlaps between these criteria. Our analysis has demonstrated that the respondents indicated different aspects of what makes the EUruralis salient, credible and legitimate. The processes of interaction and cooperation involved in the the EUruralis project were important in ensuring its legitimacy. However, these processes contributed to its credibility and salience as well.

Thus, interactive and participatory processes that are considered legitimate are instrumental in the production of knowledge that will be considered credible and salient. Not only because the interactive processes affected the EUruralis itself, but also because they involved learning and reflection. It was in the context of these processes that the EUruralis was able to perform as a boundary object. Thus, our analysis shows how a boundary object such as the EUruralis by connecting science

and policy also changed them (Van Egmond and Zeiss 2010). The EUruralis might be considered as an example of coproduction in-the-making (Jasanoff 2004); a situation in which different actors—scientists and policymakers—not only interact and cooperate, but also change their perspectives on science, policy and the relation between the two. Although the EUruralis project was not used in Poland as a support tool while discussing the current rural development and agricultural issues, it was a significant learning exercise for both Polish scientists and policymakers. Based on the Dutch practice, they experienced how the interactive development of such multidisciplinary and participatory projects could be organized. However, it remains to be seen whether this will lead to changed practices in science, policy and the science-policy interface of those who were involved in the introduction of the EUruralis project. That is why, we have used the term coproduction *in-the-making*.

To conclude, scenario studies such as the EUruralis, which are situated in a policy context and which demonstrate different policy alternatives, are potential examples of usable knowledge, because they are able to bridge the gap between science and policy and link knowledge supply to users' demands. The findings of this study are particularly relevant as the need for such tools in complex and long term issues such as agriculture and rural development is likely to increase. However, our analysis has also pointed to the importance of designing these processes in such a way that they contribute to the achievement of acceptable levels of credibility, salience and legitimacy. Particularly, the importance of legitimacy should not be underestimated as a necessary requirement for facilitating constructive interactions, openness and mutual learning. If this is taken into account, scenario studies have a great potential in addressing complex issues and in stimulating reflection and coproduction.

Annex: List of Interviews and Questionnaires

- 6 interviews with employees of the Ministry of Agriculture and Rural Development: April 2007, Warsaw, Poland
- 2 interviews with employees of the Institute of Agricultural and Food Economics—National Research Institute: April 2007, Warsaw, Poland
- 1 interview with an employee of the Institute of Geography and Spatial Organization, Rural areas study group: April 2007, Warsaw, Poland
- 1 interview with an employee of the Institute of Land Reclamation and Grassland Farming, Department of nature protection in rural areas: April 2007, Warsaw, Poland
- 1 interview with an employee of the LNV: May 2007, Wageningen, the Netherlands
- 1 interview with an employee of the LNV and Environmental Assessment Agency in the Netherlands: May 2007, Wageningen, the Netherlands
- 1 interview with an employee of Alterra Wageningen University and Research, Department of Landscape—project coordinator: May 2007, Wageningen, the Netherlands

- 1 questionnaire by an employee of Alterra Wageningen University and Research, Department of Landscape—project coordinator: 2009
- 3 questionnaires by scientists of the EUruralis team: 2009
- 1 questionnaire by an employee of the LNV and Environmental Assessment Agency in the Netherlands: 2009

References

Bradshaw, Gay and Borchers, Jeffrey, G. 2000. "Uncertainty as information: Narrowing the science-policy gap." *Conservation Ecology*, 4 (7), [online] URL: http://www.consecol.org/vol4/iss1/art7/.

Carlile, Paul. 2002. "A Pragmatic View of Knowledge and Boundaries: Boundary Objects in new product development." *Organization Science*, 13 (4), pp. 442–455.

Cash, David; Clark, William; Alcock, Frank; Dickson, Nancy; Eckley, Noelle and Jager, Jill. 2002. "Salience, Credibility and Boundaries: Linking Research Assessment and Decision Making." *KSG Working Papers Series RWP02-046*. Retrieved January 30, 2011, from http://ssrn.com/abstract=372280

Cash, David; Clark, William; Alcock, Frank; Dickson, Nancy; Eckley, Noelle; Guston, David; et al. 2003. "Knowledge Systems for Sustainable Development" *Proceedings of the National Academy of Sciences* 100 (14).

Clavel, Lucie; Soudais, Julie; Baudet, Denis and Leenhardt, Delphine. 2011. "Integrating Expert Knowledge and Quantitative Information for Mapping Cropping Systems." *Land Use Policy* 28 (1), pp. 57–65.

Hessel, Rudi; Van den Berg, Jolanda; Kaboré, Oumar; Van Kekem, Arie; Verzandvoort, Simone; Dipama, Jean-Marie and Diallo, Binta. 2009. "Linking Participatory and GIS-based Land Use Planning Methods: A Case Study from Burkina Faso." *Land Use Policy* 26 (4): 1162–1172.

Huitema, Dave and Turnhout, Esther. 2009. "Working at the Science–Policy Interface: a Discursive Analysis of Boundary Work at the Netherlands Environmental Assessment Agency." *Environmental Politics* 18 (4): 576–594.

Jasanoff, Sheila. 2004. *States of Knowledge. The Co-Production of Science and Social Order*. New York: Routledge.

Johnston, Eilidh and Soulsby, Chris. 2004. "The Role of Science in Environmental Policy: an Examination of the Local Context." *Land Use Policy* 23 (2): 161–169.

Kahn, Herman and Weiner, Anthony, J. 2000. *The Year 2000: A Framework for Speculation on the Next-Thirty-Three Years*. New York: McMillan.

Klijn, Jan, A. and Vullings, (Wies), L. A. E. (eds.). 2005. *The EURURALIS Study: Technical Document*. Wageningen: Alterra-report 1196.

Kok, Kasper; Rothman, Dale, S. and Patel, Mita. 2006. "Multi-scale Narratives from an IA perspective: Part I. European and Mediterranean Scenario Development." *Futures* (38): 261–284.

Lawton, John. 2007. "Ecology, Politics and Policy." *Journal of Applied Ecology* 44: 465–474.

Lemos, Maria, C. and Morehouse, Barbara, J. 2005. "The Co-production of Science and Policy in Integrated Climate Assessments." *Global Environmental Change* 15 (1): 57–68.

Lindblom, Charles and Cohen, David, K. 1979. *Usable Knowledge. Social Science and Social Problem Solving*. London: Yale University Press.

Meffe, Gary. 1998. "Conservation Scientists and the Policy Process." *Conservation Biology* 12 (4): 741–742.

Pielke, Roger. 2007. *The Honest Broker. Making Sense of Science in Policy and Politics*. Cambridge: Cambridge University Press.

Pohl, Christian. 2008. "From Science to Policy through Transdisciplinary Research." *Environmental Science and Policy* (11): 46–53.

Rich, Robert. 1991. "Knowledge Creation, Diffusion, and Utilization. Perspectives of the Founding Editor of Knowledge." *Knowledge Creation, Diffusion, and Utilization* 12: 319–337.

Rienks, Willem, A.; Hoek, Steven; Verweij, Peter, J. F. M.; Lokers, Rob and Vanmeulebrouk, Bas. 2008. "Eururalis, a discussion support tool for rural Europe." *iEMSs2008: International Congress on Environmental Modelling and Software*. Wageningen, The Netherlands: Wageningen University and Research.

Sarewitz, Daniel and Pielke, Roger. 2007. "The Neglected Heart of Science Policy: Reconciling Supply of and Demand for Science." *Environmental Science and Policy*, 10: 5–16.
Star, Susan, L. and Griesemer, James, R. 1989. "Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907–39." *Social Studies of Science* 19 (3): 387–420.
Sterk, Barbara; Carberry, Peter; Leeuwis, Cees; Van Ittersum, Martin; Howden, Mark; Meinke, Holger et al. 2009. "The Interface between Land Use Systems Research and Policy: Multiple Arrangements and Leverages." *Land Use Policy* 26: 434–442.
Stirling, Andrew. 2006. "Analysis, Participation and Power: Justification and Closure in participatory multi-criteria analysis." *Land Use Policy* 23 (1): 95–107.
Sumner, Jennifer. 2003. "Relations of Suspicious: Critical Theory and Intrerdiscilinary Research." *History of Intellectual Culture* 4 (1): 1–12.
The EUruralis homepage. 2011. Retrieved January 27, 2011, from http://www.eururalis.eu/index.htm
Turnhout, Esther. 2007. "Ecological Indicators: Between the Two Fires of Science and Policy." *Ecological Indicators* (7): 215–228.
Turnhout, Esther. 2009. "The Effectiveness of Boundary Objects: The Case of Ecological Indicators." *Science and Public Policy* 36 (5): 403–412.
Turnhout, Esther; Hisschemöller, Matthijs and Ejisackers, Herman. 2008. *Science in Wadden Sea Policy: from Accommodation to Advocacy*. 11 (3): 227–239.
Turnhout, Esther; Hisschemöller, Matthijs and Ejisackers, Herman. 2007. "Ecological Indicators: Between the Two Fires of Science and Policy." *Ecological Indicators* (7): 215–228.
Van Egmond, Stans and Zeiss, Ragna. 2010. "Modeling for Policy, Science-based Models as Performative Boundary Objects for Dutch Policy Making." *Science Studies* 23: 58–78.
Verboom, Jana; Alkemade, Rob; Klijn, Jan, A.; Metzger, Marc, J. and Reijnen, Rien. 2007. "Combining Biodiversity Modeling with Political and Economic Development Scenarios for 25 EU Countries." *Ecological Economic* 62 (2): 267–276.
Weiss, Carol, H. 1995. "The Haphazard Connection: Social Science and Public Policy." *International Journal of Educational Research* 23 (2): 137–150.

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