Policy Lifecycle Related Tool Development in Environmental Sciences

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EXTENDED ABSTRACT

Model based tools can be powerful instruments for environmental policy design, decision making and management. The potential end-users however are often unreceptive to the benefits of environmental models as claimed in academic literature. One of the reasons for this gap between the scientific and the socio-economic impact of environmental modelling is the fact that actors in the academic and professional community often live in different worlds. Scientists are mainly driven by their ambition to score in the eyes of their peers with models and publications that are in the forefront of scientific advance. Professionals strive towards concrete results in practical environmental policy design, decision making and management.

This paper focuses on the communication between both parties as a means of closing the gap between science and practice. In the description of this communication process, the policy lifecycle of environmental issues has been given a central position. It is the main driving force for the professionals from governmental authorities and other not-for-profit organisations, who are involved in environmental policy making.

In section 1 the five phases of the environmental policy lifecycle are described: 1) initial reconnaissance; 2) recognition; 3) policy development; 4) implementation and 5) operational control phase. This gives a general framework for the way in which most environmental problems show up, are tackled and solved. In section 2 a general overview is presented of the types of environmental research that are relevant in the subsequent phases of the environmental policy lifecycle. This gives the basic information for a more detailed discussion in section 3 of the characteristics and requirements that should be fulfilled in order to enhance the socio-economic impact of scientific contributions to environmental modelling.

In section 4 concrete examples are presented of model based tools that were developed and applied by Alterra for: 1) participatory planning processes; 2) linking models and data from various sources through the interface of OpenMI; 3) interactive use of information and 4) the use of GIS in participatory settings. The tools were developed - independently from the PLC-concept - in response to the growing need for knowledge instruments that can support the design and implementation of environmental policies and plans in close interaction with the stakeholders involved. In retrospective one could conclude that the model based tools described in section 4 apply mainly to the PLC-phases 3 (policy development) and 4 (implementation).

The PLC-approach was used as a framework for an ex-post description of the socio-economic impact of Alterra's research in the self assessment for the Alterra Review 2002-2006 by an international committee of experts. The review committee highly appreciated the PLC-approach as a general method to link scientific developments to societal needs. This resulted in the recommendation to use it also more proactively as a tool to finetune the institutes' research strategy and policy with the demands of our stakeholders.

This paper is a first orientation on the possibilities to proactively combine the PLC-approach with the development of model based tools for collaborative policy design and planning. The existing model based tools are broadly accepted by the scientists involved. The discussions with the review committee and the stakeholders showed that the PLC-approach is a useful instrument to enhance the communication between researchers and end users. It still is too early to answer the question whether the PLC-approach will really influence and improve the future process of model development. The first reactions by modelling experts however are encouraging. Looking back on several cases, the insight in the PLC-phases helped them to better understand why stakeholders had been unwilling or hesitant to rely on the model outcomes. Alterra is currently working on a more proactive incorporation of the PLC-approach in model based tool development.

1. THE ENVIRONMENTAL POLICY LIFECYCLE (PLC)

The general concept of the product lifecycle (Porter, 1980) plays a prominent role in strategy development for private enterprises (Johnson, 2005). When an environmental policy is seen as a 'product' from a governmental authority, the concept of the product lifecycle can also be applied to environmental policy development. The PLC-approach was used to describe the socio-economic impact of Alterra's research in the self assessment that was made in preparation of the Alterra Review 2002-2006 by an international committee of experts.

Winsemius (1989) characterised the policy lifecycle for environmental problems by five phases:

1. In the **initial reconnaissance phase** some groups in the scientific community report environmental changes or phenomena that in their view ask for policy development and action in order to prevent future damage. Other experts however come with opposing views. The debate, if any, is mainly restricted to the academic world. The problem has not yet been accepted by policy makers as real, relevant and serious enough to take action.
2. In the **recognition phase** there is sufficient consensus within the scientific community and interest groups, to convince politicians, the press and the general public, that the environmental issue is relevant enough to be examined in more detail. Budgets are made available to investigate questions such as: where and to what degree does the problem occur? How will it develop in time? What will be the effects and who will be affected?
3. In the **policy development** phase the attention shifts toward action-oriented questions such as: which measures can be taken to prevent or cure the damage and what will they cost? What will be the effects in relation to the costs? Can the situation be tackled on a national scale or does it require international co-operation? Scenario studies are undertaken and policies are developed. New techniques are tried out on an experimental scale and evaluated on their possible effects and costs.
4. In the **implementation phase** the problem is solved or reduced to an acceptable level. The policy measures are designed in more detail. The institutional infrastructure (laws and regulations, plans, budgets, organisations, techniques, methods and procedures) is put into place and staff is recruited and trained for their new tasks. The designed policies and measures are executed.
5. In the **operational control phase** the problem is managed. The infrastructure is maintained and the effects are monitored and evaluated. Corrective actions are taken when necessary.

2. PLC-RELATED TYPES OF RESEARCH

Each phase of the policy lifecycle is characterised by specific types of research (Table 1).

Table – 1: Research activities per PLC-phase

Initial reconnaissance phase
Quick scans; general surveys, assessments and reviews; sampling methods; process oriented research of the physical, ecological, socio-economic and spatial system; simulation models
Recognition phase
Detailed and extensive surveys, inventories and assessments; pattern recognition; process oriented research of the physical, ecological, socio-economic and spatial system; simulations and experiments; policy analysis; identification of knowledge gaps and missing information
Policy development phase
Scenario studies; decision support systems; simulation games; design, evaluation and selection of policy-options; stakeholder analysis; pilots; cost-benefit analysis; environmental impact analysis
Implementation phase
Design, evaluation and selection of detailed planning alternatives; stakeholder interaction methods; capacity & institution building
Operational management phase
Monitoring and evaluation; impact assessment, decision support systems for operational management; training and capacity building

All phases of the policy lifecycle are supported with research activities aiming at the collection, quality control, storage, processing, interpretation and presentation of relevant data and information

The actual societal debate on global warming and climate change is a good example of the general dynamics of the policy lifecycle. The scientific indications for global warming led in 1988 to the initiative by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) to establish the Intergovernmental Panel on Climate Change (IPCC). IPCC's first activities were focused at the collection of scientific evidence for the process of global warming and the relations with human

activities. Although it is difficult to give a sharp indication of the transition from the initial reconnaissance phase to the recognition phase, the Second Assessment Report (IPCC, 1995) can be considered as the start of the recognition phase. It provided key input to the negotiations, which led to the adoption of the Kyoto Protocol in 1997.

The decade between 1997 and 2007 showed a growing involvement of various stakeholders in the debate on climate change. The scientific debate continued (Lomborg, 2001) and (Stern, 2006), but also actors from other sectors in society entered the debate (e.g. the movie "An inconvenient truth" by Al Gore). The involvement of the general public is illustrated by the fact that the issue of climate change frequently pops up in cartoons. The recent Fourth Assessment report (IPCC, 2007) marks the transition from the recognition phase to the policy development phase with a central role for adaptation and mitigation policies.

3. FINETUNING MODELLING TO PLC-PHASES

Models and databases can be part of many of the research activities in Table 1. For a good transfer of the model outcomes to the end-users, it is very important to be aware of the stakeholders involved, their role in the process of policy development and the consequences this can have for the modelling activities.

3.1. Shifting interests from target groups

It is obvious that the target groups for the research activities in Table 1 can vary strongly in relation to the stakeholders that are involved in a specific case or environmental issue. This should be elaborated in more detail in each specific case study and cannot be treated at this global level. Of a more general relevance are the changes in target groups directly related to the dynamics of the policy lifecycle. These will be discussed for the following categories of target groups: 1) scientists; 2) decision-makers (politicians and other high-level decision makers; 3) professionals (experts at governmental organisations, consultancy firms and ngo's) who are involved in the design and implementation of policy options and planning alternatives); 4) the general public and the press.

In the **initial reconnaissance phase** the debate on a specific environmental problem, is by definition restricted to the academic community and limited groups of professionals and activists. The decision makers, the press and the general public are more or less aware of the discussions in the scientific world, but are not yet convinced of the necessity to take further action. As a consequence, research budgets are limited. This situation will not change before the scientific community has convinced the decision-makers that action is needed. Therefore the strategic target of the research activities in this phase should be, to realize the transition to the recognition phase as quickly as possible.

In the **recognition phase** the public interest from decision makers, the press and the general public increases. Budgets are made available to study all kinds of questions, varying from very fundamental to strategic and applied. From a scientific point of view, this can be the most interesting policy phase, because there is room and budget to study many aspects of the problem, provided that the scientists give sufficient attention to explaining to the decision makers why it is relevant to study a certain aspect in more detail.

The **policy development phase** often shows a shift in interests from the target groups. During the first stages of this phase the interest among decision makers grows to a maximum. When the main policy options have been developed, evaluated and decided upon, there often is a decline of interest from politicians and other high-level decision makers. They turn to new issues that still are in the recognition phase and leave it to the professionals and decision makers at lower levels to work out the policies in more detail.

The interest from the press and the general public generally follows the same pattern. This may change however when new, more concrete, or detailed information becomes available during the policy development process. Then the changed perception of the consequences can cause sudden peaks of renewed interest in the issue. This often is the case when detailed assessments of the consequences show that the main policy options have to be revisited because:

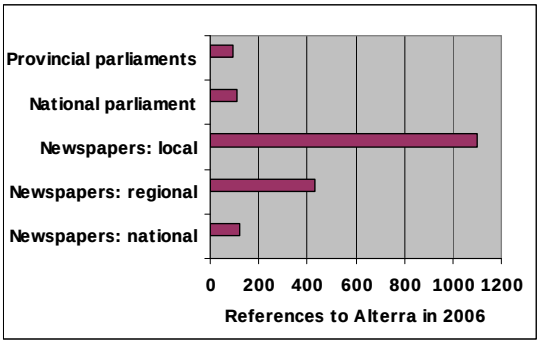
- The negative effects of the policy measures for some interest groups in a region are much more negative than was expected and already included in the evaluation of the main policy options.
- The policy measures 'hit' unexpected groups of stakeholders in a serious way.
- The policy measures have negative effects that are very unevenly distributed over the regions involved. This can be a reason for regional and local authorities to ask for adaptation of the policy.

In the **implementation phase** the interest from the stakeholders generally coincides with the pattern that was described above for the final stages of the policy development phase. The interest from

politicians is mainly restricted to those directly involved at regional or local level. The most important group of actors in this phase are the professionals working in the design and execution of detailed plans. Mostly they have they initiative and the other parties – including the scientists – are generally involved in more reactive roles.

A group of stakeholders that must not be forgotten is the local population. Often these people have a direct interest in the plans, are well informed and can provide valuable additional information to the professionals, or – when neglected – turn out to be difficult opponents. Scientists often focus on parliamentary documents and articles in national newspapers as indicators for the socio-economic impact of their work. This especially reflects their contributions during the recognition and policy development phases. Fig. 1 presents an inventory of Alterra's impact in parliament and press in 2006. The number of references to Alterra in regional and local newspapers is 4 to 10 times as high as in national newspapers. Most of the articles in regional and local newspapers refer to policies and plans in the implementation phase.

Fig. 1: References to Alterra in 2006



In the **operational control phase** the interest in the environmental problem is relatively low compared to other PLC-phases. The monitoring and evaluation are mainly done by the professionals. The role of scientists is very limited; the role of politicians, the press and the general public is close to zero. This only changes when the implemented measures are not giving the expected results. Example: the floods in the Thames region in the UK during the summer of 2007.

3.2. Consequences for modelling activities

The general overview presented in 3.1 can be translated in characteristics and recommendations for the scientific research and modelling activities during the subsequent PLC-phases.

The advice to keep the **initial reconnaissance phase** as short as possible can be realized by the following recommendations:

- Focus on the key aspects in the main question for this PLC-phase: is the problem relevant and serious enough to take further action?
- Use state-of-the-art models that can count on broad support in the scientific community. The use of controversial models should be restricted to situations for which no consensus models are available.
- Avoid scientific disputes on aspects that are not essential for the key questions to be answered in this phase. Postpone research on this type of questions to the next phase.
- Give much attention to the communication of the model outcomes to the decision makers, the press and the general public. Linkages between models and GIS can greatly support the communication process, but also the communication of non-geographic types of information needs special attention.

Modelling activities in the **recognition phase** should anticipate on the following trends:

- A growing demand for multidisciplinary models;
- A growing demand for β/γ-integration, the combination of expertise from science (β, e.g. hydrology, ecology) and social science (γ, e.g. economy, sociology);
- A growing demand for action perspectives. Models should not only give insight in the environmental processes, but also in the possibilities for tackling the problem. It is essential to include this aspect in the studies, in order to keep the end-users interested in the problem.

The characteristics of the **policy development phase** and the **implementation phase** are roughly the same as described above for the recognition phase. Important additional elements (to be treated in more detail in section 4) are:

- A growing demand for tools that can support collaborative planning with inputs from all target groups involved in the problem;
- The flexibility to anticipate or react on new questions that come up during the policy development or implementations.

For the he **operational control phase** no general recommendations can be given here. This is too much depending on the specific aspects of each individual case.

4. MODEL BASED RESEARCH TOOLS

The tools mentioned below were developed - independently from the PLC-concept - in response to the growing need for knowledge instruments that can support the design and implementation of environmental policies and plans in close interaction with the stakeholders involved. In retrospective one could conclude that the tools apply mainly to the PLC-phases 3 (policy development) and 4 (implementation).

4.1. Participatory planning processes

The schematization of the participatory planning processes is based on the general concept of "co-production of knowledge". The tools provide scientific and technical guidance on process steps and task that lead to reliable and reproducible results. The tasks are described unambiguously, scheduled and monitored. An effective process management and support system distinguishes different types of users, identifies their interests and information needs. An example of a process support tool is ProST, a more generic version of the MoST tool developed by the HarmoniQuA project (Scholten et al., 2005). ProST is part of the Integrated Solution Support System (I3S) of AquaStress and supports the process of integrated water management (de Zeeuw et al, 2007).

4.2. Open Modelling Interface

The Open Modelling Interface (OpenMI) is a tool to link models and data from different knowledge domains. It was developed in the EU FP5 project HarmonIT aiming at integrated water management in hydrological catchments. The main objective of the HarmonIT project was to provide a widely accepted unified method to link models (Gijsbers et al, 2002). OpenMI provides a standardized interface to define, describe and transfer data between software components. Since the release of OpenMI in early 2006 the environmental domain adopted the OpenMI in several European projects, like SEAMLESS. Within SEAMLESS agricultural and agri-environmental policies are assessed by linking macro economical models to farm management and crop production models (van Ittersum et al., 2007).

4.3. Interactive tools

Interactive tools support experts and end-users in participatory planning process with feedback and learning. Different types of tools can be used. One example is a quick scan tool for scenario based policy evaluation.. A successful application of this type of tool is BERISP. The main objective of BERISP is to allow planners to review different types of landscape uses and habitat distribution against scientific knowledge on risks of pollutants for organisms (Cormont et al., 2006).
Another example is the Sustainability Impact Assessment Tool (SIAT) of the EU FP6 project Sensor (Verweij et al, 2006). SIAT supports policy makers in assessing social, environmental and economic impacts of landuse related policies.
A very effective way of learning is to play simulation games, because they are motivating and offer a safe experimenting environment of micro worlds facilitating a deeper and more integrated understanding (Martin, 1999). A successful example is NitroGenius, a game to simulate the Dutch Nitrogen problem (Erisman et al., 2002). The four players represent stakeholders (Government, Industry, Agriculture and Society) who have to work together to solve the nitrogen problems against the lowest costs and social consequences. However, just like in real life, each player also has his own individual targets, which are not necessarily in line with the collective target to solve the nitrogen problems.

4.4. The use of GIS in participatory settings

Recent years showed an increased use of GIS in participatory settings like community mapping or Public Participation GIS (Craig, et al. 2002). It has been noted that stakeholder participation in spatial planning benefits significantly from a common geographic notion and basis.

Fig.2: MAPTALK™

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A good example of shared uses of geographic information in participatory planning is MAPTALK™. This is an interactive ICT-tool for spatial planning (Wien et al., 2003), with a focus on early phases in rural planning processes were ideas of stakeholders are explored and shared. It gives the stakeholders information about the region and presents directives and restrictions for the specific rural planning case. Stakeholders can

express their views on planning alternatives by drawing on the map. These ideas are gathered and processed by the system. The facilitator of the process can review the ideas and stimulate discussion. The tool can be used in a group decision room setting and on an interactive table (figure 2).

4.5. Use and acceptance

The PLC-approach was used as a framework for an ex-post description of the socio-economic impact of Alterra's research in the self assessment for the Alterra Review 2002-2006 by an international committee of experts. The review committee highly appreciated the PLC-approach as a general method to link scientific developments to societal needs. This resulted in the recommendation to use it also more proactively as a tool to finetune the institutes' research strategy and policy with the demands of our stakeholders.

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5. CONCLUSIONS

The PLC-concept can help to reduce the gap between modelling experts and end-users. It gives insight in the dynamics of the policy process for environmental issues and the questions and aspects that are the most relevant in the subsequent phases. This enables modellers to:

- Improve the scope of their modelling activities by focusing on those aspects that are needed most in each particular phase;
- Improve their communication with specific target groups in the policy process;
- Improve the timing of their activities and the communication with the end-users;
- Be more effective in acquiring research budgets by anticipating on the next steps in the policy process and the stakeholders involved.

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