Gaming as the method to integrate modelling and participatory approaches in Interactive Water Management

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Abstract: At the science - policy interface there are several reasons to combine models with the participatory process to facilitate the complex policy making process but the communication of the two sides is often too hard to generate any meaningful results. In this paper we argue that to close the communication gap the rationale of the Meta – rule of complex policy making needs to be comprehended and coped with. Gaming as a participatory method can be used to organize the combined process. Through the literature review we summarize the principles of gaming and use them to analyze an empirical case where stakeholders participated in a water policy making process. A computer model called the Planning Kit Blokkendoos (PKB, in English: Box of Blocks) was used here to support the participatory process and is claimed to have had a marked impact on the complex policy making process. We conclude that the PKB tool provided the stakeholders with significant 'room to play' with the various policy alternatives and interweaved with the policy process.

Keywords: science – policy interface; interactive water management; Planning Kit Blokkendoos; stakeholder participation; simulation-gaming

1. INTRODUCTION

The study of the role of science in policy making has been often understood as the science-policy boundary work where scientific value, stakeholder interests and political powers all play their importance (Hoppe, 2005, 2010]. This understanding gives reasons to combine analytical modeling and participatory approaches together in order to generate and use science to improve policy making. [Hisschemöller & Tol, 2001; Stirling, 2006, 2008]. Through participation, science can enrich its body of knowledge and gain social credibility. This can be interpreted as a process where policy choice is influenced by the promotion of different scientific expertise, and the different scientific expertise competes to win its social support and political power [Wesselink et al., 2009].

However in practice it is often become difficult because the communication of the science and policy making is often too hard to deliver any meaningful contribution. In this paper we analyze the rationale of science-policy interface to understand the Meta – rules of policy making underlying the communication problems and argue that this could be coped through the notion of 'play' or through (policy) gaming. Play and games rely on certain principles that facilitate user-interaction (with models and with other players) but more importantly also on principles that enhance things like 'experimentation', 'safety', 'engagement' and 'motivation'. We assume that such principles (can) also have positive

effects in a complex policy process. In section 2 this will be done by first reviewing the literature of the existing communicating problems and the Meta –rules behind it; in section 3 we explain the principles of gaming to integrate modeling and participatory approach in detail and then followed by an empirical study in section 4 where a relatively simple simulation tool called the Planning Kit Blokkendoos (PKB, in English: Box of Blocks) was used in a highly complex policy process on water management and is claimed to have had a marked impact where we argue a plenty 'room to play' has been created.

2. SCIENCE AND POLICY COMMUNICATION

2.1 The Communication Problems

In some literatures it has been argued that the problem of using computer model and simulation in policy making is about the communication. One of them, the so-called *utilization of knowledge* school developed several theories about the productive interaction between knowledge producers and knowledge users [Caplan, 1979; Boogerd, 1997]. Caplan [1979], Weiss & Bucuvalas [1980] and Dunn [1980] for instance argued that scientists and policy makers are living in separate communities, with different languages, values etc. and that there exist many communication barriers between them. An important bottleneck for instance is the *lead time*. 'Policy makers are accustomed to working on immediate problems and meeting deadlines, whereas scientists see no harm in delivering a *better* model some time later.' [Boogerd, 1997: 732]. In many cases of developing models, much of the interaction between policy-makers / stakeholders and scientists / modelers takes place during meetings, facilitated workshops or game sessions. The model development and application process itself involves some steps, phases and implicit and explicit rules of interaction between the client and the modeler. The communication can cause many obvious things go right or wrong, such as the quality of the model and the requirements from policy makers. One of the communication barriers that often experienced is that the policy requirement which is often too implicit to be understood by modelers and input into analytical models and vice versa. Therefore the expert model tool often remains as the "black box" to users. This inherent communication problem between science and policy making give rise to all kinds of tensions that need to be accommodated and managed through the integrating effort. In many cases, the direct instrumental and practical solutions can be incorporated such as building *user friendly interfaces*, *user or stakeholder involvement* in the modeling process, proper problem framing, defining clear system boundaries and better communication of the model results. Joining the two rationalities also implies making trade offs, between professional values (as a scientist, a modeler or as a policy maker etc.) and the institutional requirements (the problem framing, the timing, and the modeling tools) where from the perspective of scientific rigorousness the added value is often not explicit enough.

2.2 The Underlying Meta-Rules

Besides the communication barriers in some literatures it has also pointed out that both public policy maker and model developer takes place within the wider context of a complex policy making process which often is ill-structured and full of wicked problems [Radford, 1977; Van Bueren and Klijn, 2003]. And in many cases both policy makers (the problem owner and his immediate audience) and the model developers / analyst are in trouble with understanding the wicked problem like the long term effects of climate change [Toth, 1989 & 1995; Funtowics and Ravetz, 1994; Saloranta, 2001]. In the policy process no one knows exactly what may go on and what strategy is proper to deal with what problem. Such erratic process of complexity may be captured by the underlying rationales. The policy makers and modelers are affected by that (ir)rationality and attempt to influence it during the process. Using computer model in such process need to therefore look at things like if, how and whether to fit the tool into the process. The erratic process takes into account common phenomena like disturbing events, deadlocks and stalemates, controversies and conflicts, wheeling and dealing, stakeholders entering and leaving the

arena, etc. These phenomena can be understood as Meta-Rules of policy making to deal with the wicked problem where science and social interests and policy powers confront and interweave [Kingdon, 1995]. Meadows and Robinson [2002: 290] studied the role of modeling in social policy making. They urged modelers to be more critical and transform their modeling practices, because the social systems they were studying were in deep trouble. Jasanoff [1990] and others have argued that scientists and model developers are mainly stakeholders in the policy process and that they are influenced by social, political and personal interests.

3. USING GAMING TO COMMUNICATE

In integrated assessment, gaming is regarded as one of the participatory methods. In the broad sense, there is the concept of serious gaming or simulation gaming which elaborate its principles such as 'experimentation', 'safety', 'engagement' and 'motivation' [Abt, 1970; Duke, 1974]. These principles can be used to cope with policy making problems [Duke & Burkhalter, 1996; Parson, 1994; Geurts et al., 2007] in the areas like spatial planning and water management to analyze e.g. social behaviors [Armstrong, 2000; Brewer 1974], communicate technology [Barreteau et al., 2000] and exercise policy making process [Brewer, 1986; Dolin, 1992; Duke & Geurts, 2004; Geurts et al., 1998]. Based on the existed experience, we argue that creating the context of playing while computer model is used in policy making raise the chance to narrow, close or bridge the communication problems and help to cope with the meta-rules of complex process [Mayer & de Jong, 2004; Mayer & Veeneman, 2002]. We argue that such a *context of playing* gives stakeholders considerable *room to play* with the problems, solutions and social political interests. To achieve such meaning play, first the computer model needs to be "playable" and arranged as the mediation tool in the participatory process.

3.1 Making Playable tool

A playable tool means a game like tool which embedded the principle of engagement. Like what designed in computer games, the digital environment and the information contained need to allow the stakeholders to interact with the model. Engagement is expected to be achieved through the interaction. The playable computer tool typically implies opening up the black box of scientific expertise, and to create a common platform to allow sharing knowledge between science and other disciplines. From the perspective of increasing the breadth and depth of the information for the usefulness of decision making, the game like model itself can not ensure it but need to be the necessity for this purpose. The systematic sub-disciplines under engagement are as below:

- (Attractive) visualization of the model tool
- Immediate feedback on actions and results
- Easy to start and provide different level of challenge
- Clear objectives and the underlying storylines
- Allow personalizing with the digital environment and the stories

3.2 Cope with the Meta Rules

Whit the playable tool a context of playing can be arranged to interweave the science, social interests and policy powers during the policy making process. The function of the tool is mediating. The "room to play" is created through the whole policy making process. Therefore the play will not only happen during the game or model use session, but embedded in the whole process of policy making to give enough room for the political players to exercise the solutions. Through this open and loose context of playing the players will have more chances to interact with each other and therefore enhance the chance to integrate and synthesis their scientific, social and political values. The systematic sub-disciplines of the "room to play" include:

- Easy to re-use, flexible and adaptable tools
- Openness: allow stakeholders to enter or leave the modeling / model use process (define conditions or rules) or to redefine, change their roles.
- Create safety in using the model, for instance by safeguarding the core values of stakeholders.
- Allow stakeholders to create their own 'meta play', create and adapt rules of interaction. Try and error.
- Give room for stakeholders to maneuver, change objectives, form coalitions
- Avoid dominance of 'the tool' in the policy process;
- Use the tool to create a sense of urgency, or to set issues on the political agenda
- Strategic timeliness, using the model with the opportunity
- Entrepreneurial approach: Use of model to cope with already existing solutions, problems and events or stakeholders. Facilitate the making of political trade-offs;

In the next section, we will illustrate our argument by looking at a case study where a relatively simple computer model had a significant impact on the policy process and outcome. The data generation is based on the archive review and interviewing 2 key participants (1 model developer and 1 administrator).

4. CASE STUDY: ROOM FOR THE RIVER

4.1 The Problem of Making New Water Policy

Raising and reinforcing dikes are for hundreds of years used in the Netherlands as the successful flooding control technology. However, an increasing number of experts maintain that this strategy cannot continue indefinitely due to the higher sea level, heavy rainfall brought by climate change and tendency of earth sink. From the middle of 1990's, the new thinking gradually gained ground and put into the official agenda of policy making. Scientists, policy makers and stakeholders began to interact actively during the solution finding process. This policy making is summarized in the slogan 'Room for the River'. In short, the strategy involves creating space for the river, rather than focusing solely on raising and strengthening dikes [Silva et al. 2001]. The measures that form part of this strategy include:

- Relocating the dikes inland. The river bed becomes wider and the river has more room as a result.
- Deepening the rivers and flood plains. The cubic meters gained mean more space for the river.
- The construction of bypasses. These are river beds or dry river beds that can carry water quickly towards the sea.
- The construction of retention areas. These are specially designed polders that can flood once every 10-20 years without causing too much damage.

The decision-making process was governed by legislation in a so-called Spatial Planning Key Decision (SPKD) and subject to parliamentary assent. The main involved stakeholders are the central government and the non central administration i.e. provinces, municipalities and water boards. In the second half of the 1990s, the government body responsible for the safety of the river areas, Rijkswaterstaat (the Directorate-General for Public Works and Water Management), compiled a large number of some 700 potential projects that fit in with this new policy by consultation with the local administrations. This eventually resulted in a government memorandum, for which the state secretary was politically responsible. In short, the goal of the decision-making was to make a short list of projects that were cost-effective but also had sufficient stakeholder support. But it soon became clear it was difficult because firstly there is the potential conflicting about chosen the suitable projects for a certain local area. For example the municipalities that are located along rivers would prefer not to have dike repositioning that involves relocating residents. Furthermore, the

need for retention areas is difficult to explain to those who live or have a business in such a polder; secondly, the timing of the strategy change is difficult to justify. Not everyone, however, is in agreement that now is the right time for a change of strategy. Certainly those individuals and administrators who seek to prevent the realization of a project in their area will argue that it has not been convincingly demonstrated that 'room for the river' is the only strategy at the present moment. They will argue that the dikes can quite feasibly be raised one more time and it will be difficult to deny this. Therefore such a policy making process would not automatically find support among the local administrations.

4.2 Using the model in the decision making process

A Black Box Tool but Remarkable Impact
To help select the projects a simply computer model The Planning Kit Blokkendoos (PKB) was developed as an expert system in the SPKD process to store and handle the huge amount of data about the hydraulic measures, and calculate their cost and environmental effects [1][Kors, 2004; Wesselink et al., 2008]. In December 2006 as the final outcome about 40 key projects had been affirmed by the Upper House of Parliament. A formal evaluation, a.o. based upon observations and interviews, showed that the computer tool Blokkendoos had been very useful to help the decision making process of SPKD. This was rather surprising because as an expert tool it has been criticized as the black box model and incomplete information. This meant that not all the interests can be taken in to account and the stakeholder should in any case trust what the experts told. Compared to these pitfalls is the fact that it had been quite successful in facilitating the erratic and volatile nature of the policy making process. Stakeholders confirmed that they believed and used the hydrological and economical consequences from the model in the negotiation process. We argue that this was caused by creating the context of gaming around the PKB. The feeling that the tool had been used 'to play with' was confirmed by the stakeholders who had been involved.

A Playable Tool
The playable characters of BlokkenDoos tool can be seen through the visualization and immediate effects. Participants are free to play the model by them selves and collaboratively as a tool to support their negotiations. The immediate feedback of effects in terms of graphs, but also pictures and 3D effects seemed to enhance engagement. Playing with the tool proved to be 'serious fun'. For example by clicking on one or more of the hydraulic measures in the model a schematic drawing will show how significantly this

strategy will reduce the water level, and at the same time shows precisely how the available budget decreased. Figure 1 shows the interface of PKB, including examples of pictures and 3D views. In the evaluation of the tool, some administrators stated that they very much valued the fact that they could immediately see the effects – hydraulic and financial – of the measures. This has proved conducive to the popularity of the model among administrators.
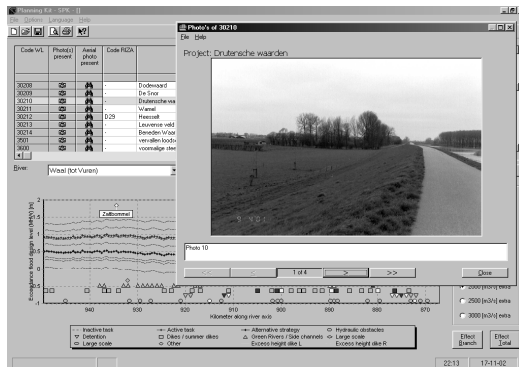
Figure 1: Screenshot of the Planning Kit Blokkendoos (PKB)

Coping With the Meta-Rules
It is still remarkable that the model really stimulated administrative interactions. In our view, this impact cannot be explained by the playable tool itself i.e. by looking at the

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[1] The PKB tool has been built by Delft Hydraulics (now part of the Deltares) by the commission of the ministry of transport, public works and water management.

characteristics of the tool (which in gaming terms actually is quite simple) or the quality of the interaction between policy-makers and modelers. The decision-making regarding the selection of projects was an inter-administrative negotiation process in which the model was of great value and was even a key factor. The question is, of course, why was the model able to have this function, in spite of the rather unilateral interpretation of the model at central level? The explanation lies in the latitude – freedom - given to local administrators to play their 'administrative game'. In other words, the use of the tool was guided by strategic meta-rules for playing with the PKB in the policy-process.

The strength of the model is that it gave administrators considerable latitude and it could be de-emphasized and even dispensed with at crucial moments in the decision-making process. The flexibility afforded by the model lay in the many possible combinations of projects. Local administrators were faced with the task of selecting a basket of projects. The projects were indeed described 'rigidly and unequivocally' in the model, but there was considerable leeway in the combination of measures. Many of the administrators interviewed pointed this out. They were of the opinion that the model gave them considerable freedom to select *combinations* of measures. Indeed, administrative freedom lay at the level of these combinations. They also felt that they had been given sufficient opportunity to justify the combination of measures they eventually selected.

4.3 Discussion: Cope With Meta Rules, Not the Black Box

Remaining as a Black Box model, the pros and cons of this working method speak for themselves. There is a risk, however, that the result of the calculations is not accepted by participants in the decision-making process on the principle of 'not invented here.' But interestingly, the participants did not question the model while 'playing' with it. The playing with the tool did not fully open the black box itself. But it created enough active engagement and interaction between the black box model and the participants. Using Models Simulations and Games in such a way have a big stake in the policy making process. At crucial moments, the state secretary de-emphasized the importance of the model and gave administrators freedom to transcend the model in order to realize their own, local objectives. If, for example, a new road was needed in a municipality and a dike was to be repositioned, the state secretary would agree to the construction of the road provided that it was built over the dike. Another example: if a measure could be realized in such a way that it also served a recreational purpose the state secretary would applaud this. Local administrators made grateful use of this opportunity. Projects were modified with great ingenuity, as a result of which they were transformed into locally desired projects. Thus, local administrators now had a very different attitude towards the process. Initially, they had been hesitant about the projects: 'It's necessary, but preferably not here'. Subsequently, however, they became enthusiastic proponents of the projects. The shell of play provided the stakeholders the chance to come up with new solutions. The stakeholders could exercise different decisions in the model as well as design their own decisions by using it. Table 1 identifies the different functions of participation and MSG tool in the SPKD process.

5. CONCLUSION

In this contribution, we discussed the communication problems between science and policy and link it to the endeavor of integrating modeling and participation. Based upon a brief literature reviewing we argue that the communication at the science – policy interface is characterized not only by the contract – client communication but also the rationale of Meta – rules of complex policy making underlying. And that they must be addressed differently. In this sense creating the *context of play* around the computer tool can be seen its importance to increase the chance. The *context of play*, base on the theory of gaming, generates the principles of engagement and room to play. A high quality interactive tool and effective communication between stakeholders and modelers is a good start, but in itself not sufficient for a better understanding of the impact of models in the policy making process, especially in the interactive policy making where intervention the social and political values are such important. The example of the Planning Kit Blokkendoos

demonstrates that a large part of the success or failure of modeling tool in the policy making process, depends upon the meta-rules and the way in which they are able to create or make use of the opportunity of the interweaving.

Table 1: the different functions of the integrated modeling and participation in decision making process

Decision making process					
Integration of modeling and participatory process	Modeling process			Model use with the characters of gaming	
	Data base	Hydraulic models	User-friendly interface	Playable tool	Play around the tool
Stakeholders participation	Moderate integration	No integration	No integration	Moderate integration	High integration
Explanation of interaction	Using stakeholders' local knowledge and preference to input the technological options, but in an incomplete way	Remain black box, no stakeholder contribution to the knowledge generation this part	The interactive method to present information is designed by modeler	Stakeholders interact with the tool with the expected moderate cognitive distance.	Stakeholders interact with each other through using the tool. The tool plays a facilitation function to the negotiation process.

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