Collaborative Modeling for Water Management

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Collaborative decision-making is becoming the norm for environmental and natural resources management. Most federal agencies have policies or programs related to collaborative decision-making and the general approach has been promoted by President Bush with his Executive Order on Cooperative Conservation. Environmental and natural resource management decisions often involve complex technical and scientific issues, with computer models used to support the analysis.

Technical complexity can make a collaborative process particularly challenging to implement because stakeholders, public representatives, decision makers, and experts will all have different levels of knowledge and comfort with technical aspects of a problem. When left to experts alone, computer models can be seen as "black boxes" and may not be trusted by stakeholders and decision makers. An alternative is to involve stakeholders and decision makers in the development and design of decision support models from the beginning. This kind of approach can be referred to as collaborative modeling.

Collaborative Approaches

A variety of collaborative modeling techniques are available, such as the Army Corps of Engineers' (ACE) Shared Vision Planning, HydroLogics' Computer-Aided Negotiation, Sandia National Laboratory's Cooperative Modeling, and Van den Belt's Mediated Modeling. The ideas behind these approaches are still taking shape, but in general, their techniques can be characterized along a few dimensions, including:

- the *extent of stakeholder involvement* in developing models, ranging from actual coding to simply managing the model development process.

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- the *type of decision* for which the model will be used. Is it a broad problem, such as developing a long-term strategic plan for a watershed? Or is it a very concrete problem, such as developing new operational rules for a reservoir?
- the *level of conflict* among stakeholders and decision makers. Is this a new problem with little history, or is it an old fight with clear battle lines and positions?
- the *breadth and depth* of the model. Will the model cover only hydrology and hydraulics or will it include environmental and economic measures? What kind of spatial and temporal resolution will be used?

Shared Vision Planning

Over the last fifteen years, ACE's Institute for Water Resources has championed the Shared Vision Planning (SVP) approach. SVP was originally developed and piloted in five river basins as part of the National Drought Study. This method was an adaptation of ACE's traditional civil works planning methods, which are geared toward planning for capital investments (such as building new flood control reservoirs) and usually involve fairly centralized, technocratic analysis and decision-making. Yet drought planning was different, with no large capital outlays from the federal government and more decentralized decision-making. Therefore, researchers in the National Drought Study sought to modify ACE's traditional planning framework to allow greater collaboration among various stakeholders and decision makers.

The resulting technique is a combination of three common practices that have a long history in water resources management: 1) traditional planning; 2) technical systems modeling; and 3) structured collaboration with a broad range of stakeholders. What makes SVP unique is the manner in which these three practices are integrated. Teams of experts, stakeholders, and decision-makers are assembled early in an SVP study so that all affected and interested parties can influence the planning and decision-making process. A traditional planning approach, executed iteratively, is used to set objectives, develop performance methods, formulate and evaluate alternatives, and select the "best" ones.

Developing the Model

Aside from intensive and continuous collaboration, what most sets SVP apart is the use of collaboratively developed decision-support models. These models serve as the primary tools for plan formulation and evaluation, and are designed to be transparent and easy to use. SVP models are typically integrated tools in that they include hydrologic and hydraulic simulations, along with economic, environmental, and other performance measures. But what really makes these tools unique is that they are collaboratively developed with stakeholders, and, indeed, much of the collaborative process is structured around model building and use.

Collaborative modeling provides multiple benefits. Value issues are at the heart of most conflicts, but if they are disguised as factual disputes, a situation of "dueling science" results and little progress can be made. Collaborative modeling helps tease apart factual conflicts from value conflicts. The process builds trust in the analysis and allows stakeholders to arrive at a shared vision of how the system can work. Agreement on the key factual issues allows productive debate to take place on the core value issues. Collaborative modeling also fosters learning among stakeholders and decision makers about both the system and stakeholder needs. This kind of collaborative learning increases the chances that mutually acceptable solutions will be developed and implemented. Finally, as this learning takes place, people's objectives and preferences evolve. Continuous collaboration in the model-building process ensures that the model will address these evolving objectives and preferences.

SVP has been applied to a number of water management issues. In the pilot studies performed within the National Drought Study, at least some positive change in drought preparedness was recognized in four of the studies; one failure occurred (see sidebar). In the Southeast, SVP applied to a multistate, multi-river water allocation issue resulted in the region's first interstate water compact. Counties in a Virginia river basin used SVP to develop long-term water management strategies, and new alternatives for managing water levels in the Lake Ontario-St. Lawrence River Basin were developed with SVP and now await a final decision by policy makers.

Areas for Further Development

New applications will include water quality issues in the Willamette River Basin and permitting decisions within ACE's regulatory program. Software "wrappers" will be developed to link trusted, pre-existing models into a more transparent modeling framework. To better define the range of existing collaborative modeling techniques and their appropriate uses, we will be developing a collaborative modeling typology to describe the range of alternative techniques according to key characteristics like those listed above.

A priority in the near term is to improve and formalize the "soft side" of these methods. SVP and other collaborative modeling techniques will become more effective by infusing ideas and best practices from conflict resolution and related fields to address questions such as:

- What are the best ways to identify and involve important stakeholder groups while keeping the overall process to a manageable size and scope?
- What is the best way to utilize formal group facilitation methods?
- How should teams and committees be structured within the process? What roles should different groups play, and how should they relate?
- How should group decision-making rules be implemented for study management and for final recommendations?

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When Might Shared Vision Planning Fail?

SVP has been applied numerous times by ACE's Institute for Water Resources. Most cases concluded with at least some positive results, but there have been challenges and at least one clear failure. The biggest stumbling blocks relate to the people involved: their abilities, motivations, and incentives. These issues were summarized by Werrick and Palmer (2004), two of the original pioneers of SVP. People leading SVP efforts have to be competent with planning techniques, computer modeling, and group processes. Furthermore, they should be comfortable addressing contentious issues head-on.

In addition, stakeholders must have incentives to participate in full faith. If they see potential benefit to sidestepping or undermining the SVP process—or are inclined to prefer what conflict resolution professionals refer to as the best alternative to a negotiated agreement, or BATNA—then stakeholders are not likely to play fair.

These challenges can limit the success of SVP; they require astute planners and facilitators to help mitigate their impact on the ultimate outcome of a shared-vision process.

Werick, W., and R. Palmer, 2004. "Is shared vision planning right for you?" paper presented at the American Society of Civil Engineers Environmental and Water Resources Institute's Annual Conference, Salt Lake City, Utah.