WaterSim: A Study of Water-related Decision-making Under Uncertainty

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ABSTRACT

The Decision Center for a Desert City (DCDC) has developed an interactive model designed to facilitate decision-maker interactions around long-term water supply and demand in Maricopa County, Arizona. The model titled, "DCDC WaterSim" is designed for interactive display and serves as a boundary object to inform water-related decision-making on issues of long-term sustainability in central Arizona.

The WaterSim project employs perspectives from modeling, geography, anthropology, and psychology to understand the process of decision-making under uncertainty. The research objectives are designed to (1) determine the extent to which stakeholders can use the model for decision-making, (2) elicit feedback from stakeholders to reincorporate in the model, (3) examine stakeholder discourses around Arizona water decisions and decision-making, and (4) examine the decision-making dynamics that foster the expression of dissent and the building of consensus.

The data collection consists of a series of 12 focus groups held at the Decision Theater at Arizona State University. The focus group sessions were held with three kinds of water decision-making groups: policymakers, data analysts, and consultants. Focus group discussions were collected in audio and video format, and transcribed into text form. Once the transcripts have been coded, the researchers will use a variety of text analysis methods to analyze the data. Coding of these transcripts fall across four major themes related to the interface of science and policy: (1) the model's credibility, saliency, and legitimacy, (2) the reconciliation of supply and demand of information between scientists and policymakers, (3) uncertainty, and (4) modernity.

DATA COLLECTION

Water Experts are recruited to participate in a 90 minute focus group whereby they interact with the DCDC WaterSim model (Figure 1).

Using a trained facilitator, participants are presented the model in a scripted format and demonstrating 3 different scenarios.

Then, the participants are asked to respond to a personal survey with demographic information and three follow-up questions about the model and presentation.

1. How relevant is the model to your needs as a decision-maker (or the needs of decision-makers in your workplace?
2. What is your opinion of the scientific adequacy and the technical information presented in this model?
3. Do you think that the information presented here is fair, unbiased, and respectful of stakeholder values?

Finally, there is a group discussion of the three questions to elicit more information related to WaterSim and to allow the observation of interactions between the different water experts.

The design of this study seeks to involve water experts in the development a water model that seeks to better integrate science and policy as well as exploring the local rhetoric and cognitive processes involved in expert decision making and resource management.

Decision Theater: Focus Groups are held in the theater
Each participant sits at the table facing the screens with a laptop

DATA ANALYSIS

Researchers will apply text analysis methods to analyze transcripts of the focus groups. The process involves the development of a code book with deductive and inductive themes

Coding Scheme		
Research Themes	Variable Names	Description
Knowledge Systems (Cash et al. 2003)	Credibility	The scientific adequacy of the technical evidence and arguments (Data Quality and Modeling Mechanics)
	Saliency	The relevancy of the assessment to the needs of decision makers (Adopt, No Adopt, and Would Adopt)
	Legitimacy	The perception that the production of information and technology has been respectful of stakeholders' divergent values and beliefs, unbiased in its conduct and fair in its treatment of opposing views and interests (Bias and Respectful of Values)
Reconciling Supply and Demand	Supplied Information	Scientific Information supplied by DCDC during the WaterSim presentation and/or focus group
	Unsupplied Information	Scientific Information no supplied by DCDC during the WaterSim presentation and/or focus group
	External demanded information	Scientific information that participants state they want or need from DCDC as part of the WaterSim presentation and/or focus group that is not included in the model
	Internal demanded information	Scientific information that participants state they want or need from DCDC as part of the WaterSim presentation and/or focus group that is included in the model that may or may not be explicitly shown.
	Outcomes	A value preference that is articulated by water experts
Uncertainty	Political Uncertainty	Uncertainty about political actors and events that influence water management decision making
	Climatic Uncertainty	Uncertainty about climate change that influences water management decision making
	Communication	Strategies, techniques, or methods to communicate uncertainty
Modernity	Vulnerability	A vulnerable individual, group, or social system can be driven to total structural reorganization, chaos, or extinction by stressors, hazards, or shocks
	Resilience	A system that is able to adapt to a stresor without changing fundamentally and can come to rest in multi-stable states
	Controllable Nature	Expression of the idea that humans have the ability to control nature through the use of technology, planning, and other modernist development approaches
	Uncontrollable Nature	Expression of the idea that humans do not have the ability to control nature through the use of technology, planning and other modernist development approaches
	Controllable Human Behavior	Discussion of the need for controlling human behavior or controlling personal conservation.

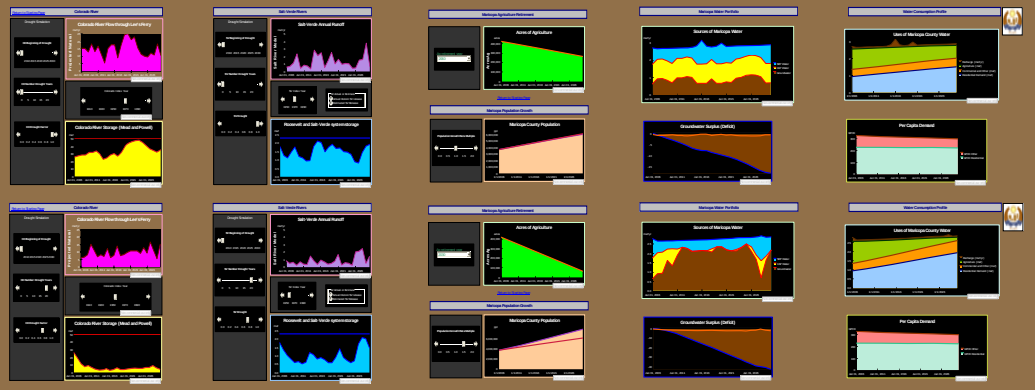

Figure 1. WaterSim Model
Top: Scenario without a drought
Bottom: Scenario with drought and change in population demands

CONCLUSION

The DCDC seeks to refine a framework for understanding the effectiveness of social and political systems that link knowledge into action. The model serves as a boundary object and centerpiece of a type of knowledge system that can inform water policies and issues for long-term sustainability in central Arizona.

The interaction of participants with WaterSim serves two main functions. First, the participation enables insight into the extent as to which types of knowledge systems and cognitive processes are involved in discussion of water issues and policy. Second, the model enables feedback of stakeholder groups in the area regarding a resource use and policy.