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# **VALUE-FOCUSED DEVELOPMENT OF A MULTIOBJECTIVE WATERSHED-MANAGEMENT PLAN IN HAWAII**

## **Abstract**

This paper describes a year-long effort that applied value-focussed thinking and the AHP to the challenge of facilitating public participation in the development of a watershed-management plan for the island of Hawaii. Given the intended audience of this volume, the paper focusses on the multiobjective methodology (value-focused thinking and the AHP) we used to guide the participants in their quest. However, we also offer commentary on the role and caveats of using such methodologies in and for facilitation of public participatory processes, and on the nature of consensus and how it is often construed and used in facilitation.

## **1. Getting started: background and context**

To relatively recent arrivals, the last thought conjured up by the dry rocky terrain of the “Big Island” of Hawaii’s western “Kona” coast is that of flood hazard. Kona’s watersheds are forming on a geologically young landscape, with drainage channels and catchments poorly defined and their boundaries sometimes hard to delineate. Add to this the infrequent rainfall, the high infiltration into the porous lava substrate, and the often bright and blinding desert-like sun, and the newcomer can be excused for ignoring flood potential.

Yet Kona has a well-documented history of floods that periodically ravaged the area for nearly a century until the early 1980s. Those who have lived there for several decades, let alone those whose families have been there for generations, can recount the damage that occurred during those events,

and there is growing concern among them that many activities in the watershed, especially the pell-mell development in coastal regions over the past 20-30 years, are making economies and communities ever more vulnerable to flood damage. Unfortunately, the collective human memory tends to focus on recent experience, and so where flooding and other potentially harmful phenomena have not occurred for a while, one tends to overlook or minimize their likelihood and significance.

It was this background and context that catalyzed a handful of long-time residents to group together in 2002 to initiate a concerted effort to reduce the risk of catastrophic flooding. Their efforts led to a funding proposal and subsequently a small grant from the Division of Forestry and Wildlife (DOFAW) of the Hawai'i Department of Land and Natural Resources, awarded to the Kona Soil and Water Conservation District (KSWCD) of the U.S. Natural Resources Conservation Service (NRCS). The grant was to support the development of a plan to confront flood hazard, and the KSWCD hired us, through Visions & Decisions LLC, to guide the process and facilitate the involvement and interaction of the community, local and state officials, and other interested stakeholders.

There are seven watersheds comprising the North and South Kona districts, with all but the Waiaha watershed extending outside the jurisdictional boundaries of those districts. These watersheds extend from the forested *mauka* lands on Mauna Loa and Hualalai to the sea (*mauka-makai*). Topographic ridges, or "drainage divides", separate individual watersheds. Ecosystems found within watershed boundaries range from rain forests to dry land forests to the marine environment, comprising diverse communities of plants, animals, and other living things that depend on the availability of soil and water. Since upland land cover influences flood regimes lower in the catchment, it was clear to us from the beginning that the stated concern with flood protection would likely need to be approached within the larger framework of watershed management.

The NRCS often uses a planning method known across the U.S. as Coordinated Resource Management, or CRM, which served as the model used by the KSWCD in the development of its grant proposal for this project. The proposal outlined the following guidelines for this work [3], which are extracted from the CRM guidelines:

- Watershed-management plan will be a voluntary program within this District.
- All interested and concerned agencies, organizations, and interest groups will be involved.

- Facilitation will be by a neutral party and will focus on common goals.
- The group will address two items by consensus at the start of the project. These are ground rules and common goals. The purpose of ground rules is to open lines of communication and create middle ground among all the stakeholders.
- Representatives of agencies and organizations will have authority to speak and make decisions for their respective entities. This will avoid wasted time to gain approval and confusion created due to misunderstanding.
- Management decisions will be made by consensus.
- Focus will be on what management practices are needed to improve natural resources, not agency policies or positions implemented in the past.
- Develop an understanding among committee members to build trust and commitment.
- Watershed management goals and objectives will be developed and prioritized in order to develop action plans.
- The neutral facilitator will monitor the process and ensure flexibility of the plan to address changes of land ownership, weather, and change of topography of this geologically young land area.

Visions & Decisions (V&D) led participants in the meetings through a process similar to these steps. Although similar, our approach differed in some key ways. We discuss the nature and significance of those differences in the final section of the paper, but three should be highlighted at this point. First, the shoe-string budget available, and the fact that we were based on the island of Oahu and not on the Big Island, meant that we would not be available *continuously* to facilitate and meet in person all who might want to participate, or to ensure the monitoring and response to the changes identified above. We thus made clear from the beginning that although we would guide and facilitate the process, a steering committee and Big Island residents would be responsible for the work required for process implementation and plan preparation. Second, and related to the first, since we would have no control over who attended meetings and participated, we could guarantee neither the representation of all interested stakeholders nor the participation of actual decision makers or their surrogates. Third, we pointed out that the term *consensus* more often than not is ill-defined, rarely if ever equates with unanimity and often yields “agreement” only under fatigue, peer pressure, or other kinds of duress, and that, therefore, given the time and budgetary constraints we faced and the divergent viewpoints and interests likely to be involved, ours would not be a process dependent on achieving consensus.

## 2. Methodology

The process we proposed and which was followed and executed during the year-long (2003-2004) project is an example of value-focussed thinking [1] within which was embedded the Analytic Hierarchy Process (AHP). Value-focussed thinking uses one's concerns and desires to articulate specific objectives, goals, and criteria that not only indicate *what* in a given situation needs to be improved but also *how* to improve it. The "how" involves specifying actions to take, either by identifying ones already existing and available, or by guiding one in the design of new ones. The identification and design follow logically from the values-derived objectives.

The AHP [5, 6] is a multicriterion prioritization methodology widely used in business and seeing ever more applications in planning and resource management. It uses a hierarchical structure to decompose a decision problem into relevant criteria, and a pairwise comparison methodology that leads to the prioritization both of criteria and of alternatives (actions and projects) [6]. This hierarchical structure, formally termed an *analytic hierarchy*, may be identical to the *objectives hierarchy* or *value tree* that plays the central role in value-focussed thinking, but it may also incorporate "means" elements that denote cause-effect relations\*. Elements throughout the analytic hierarchy are termed criteria, with those in the bottom-most level also called "alternatives". It is the prioritization of these alternatives that is the overall objective of an AHP analysis\*\*.

In the AHP, prioritization (tantamount to weighting) is effected through a pairwise comparison of the subcriteria ("children") of each non-alternative criterion ("parent") in the hierarchy. Comparisons are made on a 1-to-9 positive, fundamental scale indicating the relative dominance of one member of the pair over the other in determining, contributing to, or exemplifying the quality represented by the parent criterion. "Dominance" is usually in terms of "importance", "preference", or "likelihood". Each set of comparisons yields a positive reciprocal matrix, the components of the normalized right eigenvector

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\* In the literature of decision analysis (e.g. [2]), objectives hierarchies (value trees) are hierarchies of values and not cause-effect hierarchies; cause-effect hierarchies are termed "means-ends objectives networks" [1]. Analytic hierarchies, more general, subsume both and thus may have elements of both.

\*\* Note that the "alternatives" in an AHP hierarchy need not be choices or alternative courses of action. They may in fact be criteria that need to be prioritized or weighted. Thus, all alternatives are criteria of the hierarchy, but only the bottom-most criteria are alternatives.

of which represent the best approximation of the weights or priorities of the corresponding subcriteria. Multiplying up through the hierarchy yields the overall priority of each alternative. Since such priorities exist on a ratio scale, they may legitimately be multiplied and divided by priorities for criteria from other analytic hierarchies. As seen below, this will prove important for this analysis. Details on the AHP are readily found in the voluminous literature on it [5].

Figure 1 depicts graphically the value-focussed procedure we followed, illustrating clearly how values, or value-laden interests, can be used to identify watershed-management actions. The goal of this process was to generate a broad range of alternative actions for the steering committee and other stakeholders to evaluate (via the AHP) and select for implementation in the Kona region. It consisted of the following steps:

**Step 1.** Identify the fundamental objectives and subobjectives (designated as " $O_i$ " in Figure 1) for watershed-management, as defined in the value tree.

**Step 2.** Identify the problems, obstacles, or difficulties that could potentially prevent an objective from being achieved (" $P_i$ " in Figure 1). A particular problem  $P_i$  may be associated with more than one objective  $O_i$ .

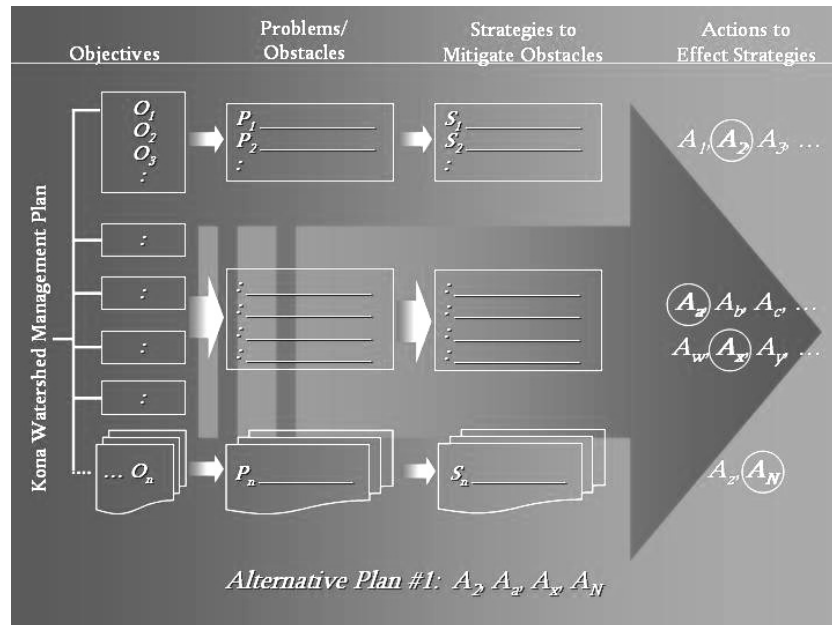
*Example:* Private landowners refuse or resist the construction of flood-control and drainage works on their property.

**Step 3.** Identify any strategies (" $S_i$ ") that could be implemented to overcome the problems, obstacles, or difficulties. Again, it is possible that a particular strategy may respond to more than one obstacle.

*Example:* For the example under Step 2, one strategy is to increase public awareness of potential flood hazard and work with landowners to encourage their cooperation to reduce the potential for flood damage or risk.

**Step 4.** Alternatively: Identify specific actions " $A_i$ " corresponding to each strategy that could be implemented to overcome or mitigate the obstacles. Some actions may address multiple objectives.

**Step 5.** This final step involves selecting various actions to be combined into several alternative watershed management plans for ultimate evaluation, as exemplified by the hypothetical "Alternative Plan #1" at the bottom of Figure 1. Since the procedure yields a large number of possible actions, this final step uses the rating procedure of the AHP to help evaluate the actions.



Note: A conceptual model showing how the planning process progressed from problem definition and identification of watershed-management objectives (as stated in the value tree [Figure 2]) to identification of actions to achieve those objectives. The variables are:

$O_i$  = watershed-management objectives listed in the value tree,  $i = 1, 2, \dots, n$ ,

$P_i$  = problems or obstacles that could prevent the associated objective from being achieved,  $i = 1, 2, \dots, n$ ,

$S_i$  = strategies to overcome problems or obstacles,  $i = 1, 2, \dots, n$ ,

$A_i$  = actions to effect strategies,  $i = 1, 2, \dots, N$ .

The list of actions developed using this process can be treated as a “menu” for formulating alternative plans, or sets of actions, for watershed management. “Alternative Plan #1” illustrates how any combination of alternatives  $A_1$  through  $A_N$  can be combined into a watershed-management plan, allowing for a high degree of alternative evaluation and selection in the planning process.

Figure 1. Process for identifying actions

### **3. Implementing the methodology**

#### **3.1. Planning committees and public participation**

If Step 1 of a value-focussed procedure is to identify and structure the criteria and objectives reflecting the values of the parties in a problematic situation, then Step 0 must be to determine who those parties are and establish a framework and process for their participation and interaction.

At the start of the planning process, the grant coordinator and others from the Kona community formed a core planning group, which V&D designated as the Kona Watershed-Management Plan Steering Committee. A core group of five to seven individuals participated or contributed in some way throughout the planning process, with other members of the steering committee participating on an *ad hoc* basis. A second, larger group of more than 40 stakeholders was identified to participate in stakeholder meetings; some of the stakeholders were also identified as members of the steering committee.

A series of eight steering committee and stakeholder meetings were held between January and November 2003. Attendance at the steering committee meetings varied, ranging from five to ten individuals, with regular attendance and participation by the “core” group. The first stakeholder meeting was held in late April, and attended by nine individuals, including some of the “core” group from the steering committee. A second meeting of stakeholders and the steering committee was held at the end of July, with two stakeholders attending although all of them had been invited. One additional meeting was convened in June to begin coordinating with individuals whom the steering committee identified as technical and local experts who could contribute to the planning process in several ways, but particularly, to assist in the development and evaluation of flood- and watershed-management actions identified during the planning process.

To elicit watershed-management concerns from the community at large, three community meetings were convened in north, central, and south Kona on weekends in late March. Except for members of the steering committee, KSWCD board members, and NRCS and DOFAW staff already involved in the planning process, only four community members attended. Despite the low participation, the input of the participants and the conversations that stemmed from their concerns was critical for furthering the steering committee’s work on the watershed-management plan.

### 3.2. Challenges related to public participation

Although the KSWCD strived to involve over 40 stakeholders and a larger group of citizens in all stages from problem definition to identifying and ranking watershed-management actions, the process was challenged by low participation. For example, except for the core group noted above, successive steering committee meetings were often attended by different people who either missed one or more previous meetings or were new to the process. Consequently, in several meetings more time than was anticipated was spent reiterating the overall watershed planning goals and the spirit and intent of the procedure to involve stakeholders in the planning and decision processes and explaining the planning process to newcomers in sufficient detail to enable them to participate on the same level as the regular participants. Other explanations included recapping what had been accomplished in prior meetings, reiterating the desire to continue moving forward, and encouraging new participants to accept the work completed to date and agree to contribute to the forward progress. While newcomers' input was welcomed and essential for contributing to a richer outcome for the process and to engage a broader public, the timeframe for developing this plan prevented ongoing debate of the planning method, the questioning of the motivations for watershed-management planning in Kona, and critique of accomplishments by the core participants in prior meetings.

Another challenge concerns the representation of community interests in the plan development. The steering committee and stakeholders who participated in most meetings remained largely self-selected and committed to the implementation of a watershed-management plan in Kona. To encourage community participation, the KSWCD purchased advertising space once a month in the Sunday edition of the *West Hawai'i Today* newspaper to publish succinct summaries of the watershed-planning process, to provide progress reports and explain the watershed-management objectives, and to invite the general public to attend steering committee meetings or volunteer to help in other ways. Eight advertisements were run from May through December, and during that time only one person contacted the NRCS office expressing interest to become involved.



### 3.3. Problem definition

In the first three committee meetings and in the community meetings in March, the facilitation team focused the steering committee for the first three months on problem definition by eliciting participants' concerns about Kona's watersheds. Conflict arose in the very first meeting when it became clear that despite the initiators' overwhelming worries about flood protection, the project's funder, DOFAW, was primarily concerned with "watershed management", including conservation and promotion of native ecosystems. Whereas the former typically focusses attention on the lower part of a catchment, the latter focusses on the uplands. We were able to mitigate the problem by explaining that "flood protection" and "flood-hazard mitigation" could easily be subobjectives of the higher-order "watershed management" objective.

Steering committee and community meeting participants were asked to identify their watershed-management concerns and objectives for watershed management for the Kona region. In an iterative process, we structured the participants' concerns and objectives into a value tree. Six versions of the value tree were created, reflecting continual refinement throughout the planning process, including the period after the problem definition phase, with each version integrating both clarifications of previous value statements and new concerns into the structure. The final version (Figure 2), integrates many natural and man-made aspects of natural resource management, including hazard abatement and public safety, assuring economic sustainability, assuring preservation of biodiversity and ecosystem management, facilitating plan implementation through favorable institutional and policy structures, and sociocultural elements such as preserving the quality of life and cultural resources in the Kona region.

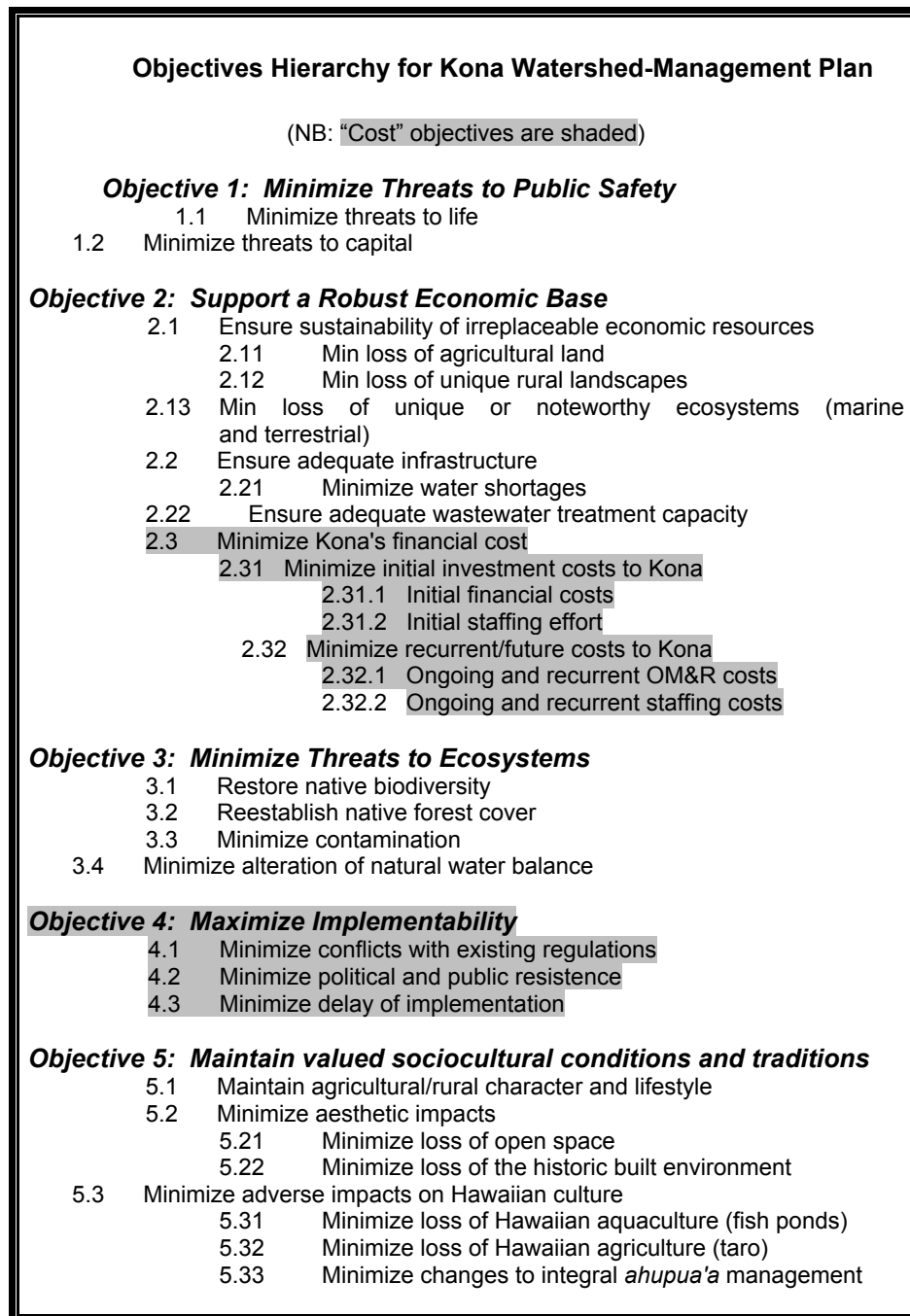


Figure 2. Objectives Hierarchy for Kona Watershed-Management Plan

### 3.4. Identification of watershed-management actions

From April through November 2003, the planning process involved the steering committee, some KSWCD board members, a larger group of stakeholders, some technical experts, and self-selected members of the community to develop a list of actions (means) that would enable the KSWCD to make progress towards the watershed-management objectives, as articulated in the value tree (Figure 2). Actions were identified by a systematic process that drew upon the fundamental watershed-management objectives listed in the value tree, with a goal of developing a “menu” of actions that could be integrated into different alternative plans for evaluation and selection by the community. To complement the list of actions developed in this process, actions identified in steering committee and community meetings during problem definition were included on the menu.

Using this method the steering committee, some stakeholders (self-selected), and the facilitators developed a suite of 24 broad watershed-management strategies and an accompanying list of 114 actions to be considered in the final phase of the planning process. This list was organized into a matrix, and included in the final report [4]. The report summarizes who will be responsible for implementing or whose support is needed to implement each action, the objectives that would be satisfied by each action, and new money in capital and recurring operating budgets necessary for implementation, if any.

### 3.5. Prioritization of objectives and rating actions

The watershed-management objectives shown in Figure 1 were decomposed into two hierarchies, a risk-reduction “benefits” or “effectiveness” hierarchy, and a “cost” hierarchy. The elements comprising the “cost” hierarchy are those shaded in Figure 1. Although the prioritization of the objectives and subcriteria was done with the usual pairwise-comparison procedure typical of AHP, as previously described, the large number of actions required us to use the ratings procedure instead of pairwise comparison. That procedure has one define ratings classes (intensity categories) for each of the lower-most criteria, and then assign each alternative to the most appropriate class for each sub-criterion. One then compares pairwise the *ratings classes* with respect

to the subcriterion in question, deriving an importance weight for each class. The alternative then receives the weight of each class to which it is assigned, those weights are themselves weighted by the product of the respective criterion priorities, and then that weighted sum becomes the score for each alternative.

Since it was not possible to carry out such an analysis for all seven watersheds comprising the N. and S. Kona districts within the project's budgetted financial and calendar limits, the team chose the Waiaha Watershed as the single case for which to conduct a complete analysis. That would serve as a model for the remaining analyses that would be done later by the KSWCD and community alone.

V&D led the Steering Committee through a group AHP evaluation of the actions using Team Expert Choice (TeamEC<sup>TM</sup>) decision software [7]. As described above, the benefit and cost criteria were first prioritized with respect to their relative importance for the Waiaha watershed. (Since different watersheds have different attributes and problems, the criteria would be weighted differently for each one. For example, the planning priorities for the Kiilae watershed will likely be different from the planning priorities in the Kiholo watershed where the climate is drier and dry land forests dominate). Then each of the 114 actions identified in this planning process was rated and prioritized on both "benefit" and "cost" dimensions. The resulting benefit and cost scores for each action were used to compute the benefit-cost ratio and therefore determine the actions that would contribute the most to achieving the watershed-management objectives. The actions with the highest benefit-cost ratios are considered to be the "best-choice." These benefit-cost ratios can be used to guide decisions about which actions or projects to undertake, what type(s) of grants or other financial assistance to apply for, and how to combine actions into different watershed-management strategies. While the actions with the highest benefit-cost ratio would be preferable to lower-ranked actions, the ratings method preserves all of the actions introduced to the decision process and therefore allows a high degree of flexibility in choosing among alternatives. Although the benefit-cost ratio implies a strict order of preference among the proposed actions, there is in fact a whole suite of very good ("efficient" or "Pareto optimal" in technical terms) projects from which one may comfortably choose. As in the benefit-cost ratio, this indicates that it would be ill-advised to select projects or actions with higher costs unless they also exhibit higher benefits.

## Summary and conclusion

We believe this project has demonstrated the effectiveness of applying value-focussed thinking and the AHP to the facilitation of community participation in resource management. The endeavor succeeded in organizing a diverse set of people with divergent interests, helping them articulate their concerns clearly and precisely, leading them to identify and design actions and policies that can help them achieve their objectives, and enabling them to prioritize those actions on the basis of the participants' values, the actions' relative effectiveness, and the resources available. Moreover, these accomplishments were attained within a tight deadline, demanding logistics, and a laughably tiny budget.

We regard the development and acceptance of the value tree as the crucial and most important achievement. It made very clear and precise what at first were nebulous or ambiguous views and claims, in the process dissolving in many cases what appeared to be incompatible stances. Although the funders' (DOFAW) and the project initiators' (steering group's) concerns seemed initially at loggerheads, use of the criteria and objectives in the value tree enabled the identification of actions that addressed both sets of issues. The value tree also provided a clear record of what had been agreed on, facilitating summary and recap to late arrivals, stemming "attendance drift", and documenting the process for third parties such as potential funders and later grant recipients.

These benefits notwithstanding, we cannot claim that the intervention was wholly successful; it encountered a number of pitfalls and registered what we regard as some failures along the way. Most of these relate to the challenges of facilitating public participation in politically contentious decision-making. As we discussed above, despite considerable efforts on the team's part, public participation remained scant. Although this obviously *can* jeopardize the comprehensiveness of the concerns addressed, it *need not* necessarily do so, as the full range of concerns can be elicited from even a small group of informed people. More problematic is the burnout of the few who shoulder the many and ongoing activities required to bring the process to a close. In addition, those community volunteers who shoulder such burdens are rarely decision makers who have authority to commit resources to implement the decisions made. When bonafide decision makers did attend the meetings (e.g. state congressmen), they came with the intention of pushing their agendas,

frequently trying to derail the process by contesting something long earlier decided or questioning the MCDM methodology. As many MCDM practitioners working in the public sphere have observed, a major strength of MCDM – making values clear and precise – can be a disadvantage when decision makers and stakeholders stand to lose power or persuasion if what they claim as facts are seen instead as value-laden viewpoints. We sensed this to be the case on more than one occasion.

Finally, facilitation of public interaction is *hard* work that requires consummate skill to do well in politically charged or sensitive situations. One reason is because public participation itself is hard work, requiring energy and commitment by a public that has other things to do and often wonders why officials and others paid to plan and manage resources are not taking care of it themselves. Although we are convinced that we made many errors that other facilitators would've not made, and that we ourselves have much to learn and perfect as regards facilitation, we also believe that knowledge of MCDM can help facilitators do better in these and other cases. Many times we have observed clumsy facilitation by people who indiscriminately mixed and confused “priorities” with “objectives”, “criteria” with “ranks”, “ranks” with “weights”, and even positions and principles. Using the terms incorrectly and inconsistently not only confuses their clientele, it undermines the confidence the latter have in them. In addition, we think the primacy given by most facilitators to *consensus* is not only misplaced but counterproductive. Insisting on it before progress can be made, frequently means that little progress is made at all, with seemingly endless discussion frustrating many initial participants, causing them to lose interest and stop participating, with those that remain claiming in the end that “consensus” had been reached. We have our doubts, and feel that approaches that can clearly identify tradeoffs, priorities, and corresponding actions are preferable.

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