

**THE ENVIRONMENTAL TRILOGY PROJECT:  
BALANCING TECHNICAL, INSTITUTIONAL, AND CULTURAL PERSPECTIVES  
TO ENVIRONMENTAL MANAGEMENT**

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**ABSTRACT**

*"The significant problems we face cannot be solved at the same level of thinking we were at when we created them."*  
Albert Einstein

I've identified an initial set of three perspectives important to building an integrated, comprehensive approach to managing the environment--technical, institutional, and cultural. I've constructed an holistic model (called the Environmental Trilogy) for environmental management, encompassing at least these three perspectives and their interrelationships. In this paper, I outline the model and report the results of a working session facilitated at Virginia Tech in Blacksburg, Virginia, in October 1991, involving three representatives from each of the technical, institutional, and cultural perspectives. The institutional members of this group were people who understand institutional effects, rather than those who represent institutions. The working group discussed and analyzed the technical-institutional, technical-cultural, and institutional-cultural interrelationships of the environmental trilogy. The goals of the working group were to put structure on the environmental trilogy model, to facilitate the definition of variables, and explore relationships between and among variables. The working group members are to continue studying issues and components, perspectives, connections, and cause-and-effect in the models and report back to interested parties. The outcome is projected to be a more holistic, integrated view of the environment.

**MOTIVATION**

Discussions with Department of Energy, Native American, and states members in the State and Tribal Government Working Group (STGWG) revealed communication issues in dealing with environmental management. Stakeholders with differing perspectives, problems, and solutions inhibit the work of environmental managers who work from many disciplines, from many separate public and private agencies, businesses, and organizations. Translators are needed to define and relate the perspectives for those involved in environmental management. One of my objectives in developing this model is to provide a framework for teaching and supporting these translators. Through an understanding of these perspectives, translators then can help refine our understanding of the environmental trilogy to support environmental management.

I believe a holistic approach using the environmental trilogy is unique in its significant impact on real-world environmental problems (e.g., preparing an EIS). The integrated outputs coming from the environmental trilogy project will allow for a waste cleanup plan, EIS, or other environmental management tool to contain the spirit or essence of the environment, i.e., to have "soul." The Native Americans' environmental culture practices alert us to the importance of having

a plan relating to the spiritual side of nature and strengthens the cultural component of the environmental trilogy, balancing the three perspectives. We can't put "soul" in an environmental management plan without an understanding of the environmental trilogy. We can't help society understand the environmental trilogy until we have translators who understand the three perspectives and the connections among them.

The Environmental Trilogy (1) model is shown in Fig. 1. The technical perspective relies on scientific principles, laws of nature, and methods for implementing knowledge of those principles and laws into programs of both preventive and remedial nature. The institutional perspective anchors on regulations, laws of society, and policies. We usually approach and explain culture in human terms: values, norms, traditions, beliefs, behaviors, and attitudes. By broadening our perspective, we can study environmental culture where humans are just one component. Thus the cultural perspective recognizes the values, traditions, and norms of the environment as opposed to the values, traditions, and norms of the societies interacting with the environment. *I don't believe anyone has fully drawn the connections among these perspectives--institutional, technical and cultural--and we therefore aren't*

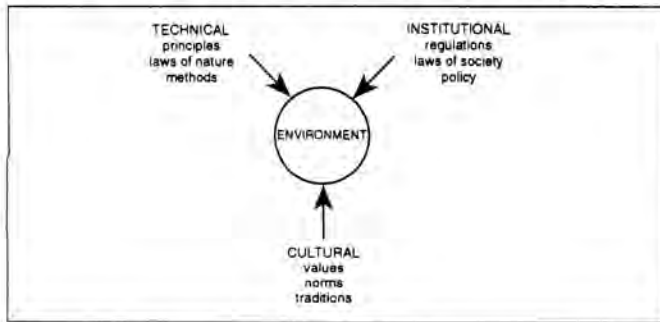


Fig. 1. A balanced approach to the environment must include a cultural perspective.

recognizing the full cause-and-effect implications of the inter-relationships among them.

Today in environmental management, we have clashing value systems. So we specify clear-cut boundaries between what is and what isn't acceptable. We argue whether returning to a pristine condition or to some other condition represented by a quantitative standard represents what is acceptable. We'll continue to set boundaries until we establish a consensus on our overarching fundamental philosophy. We use the analytic approach to deal with different value systems by defining acceptability boundaries and working to specify tasks to just meet requirements. What we want is a unified value system so we can figure out what is desirable. In this holistic approach, we must put more effort into finding the common concept of desirability and put less effort into specifying tasks for acceptability.

### THE ENVIRONMENTAL TRILOGY PROJECT

Based on the potential for contribution of the trilogy concept, Management Systems Laboratories (MSL) initiated a program to scope and operationalize the holistic approach to environmental management. The program starts with raising the issue of the holistic approach and then discussing the approach, defining its components, and modeling the components, all toward specifying areas for further study. The question, component, model discussion began with the October 1991 meeting in Blacksburg. A limited number of participants was invited to keep the atmosphere of a small informal group and to help us concentrate on a concept at the fringes of our understanding. Since the Blacksburg meeting, the participants and others have been studying issues, models, and perspectives stimulated by discussion in Blacksburg to prepare for a larger meeting to share study results with a broader representation of the environmental community. If the results of the broader meeting are as good as those from Blacksburg, I expect wide dissemination and discussion of the generated information.

#### Participants

The working group at the Blacksburg meeting included three groups of experts. The meeting was organized, facilitated, and documented by six Virginia Tech administrative and research faculty. The three technical contributors included expertise in biology, chemistry, and engineering from university distinguished and endowed professors and a member of the National Academy of Sciences. The three institutional contributors included expertise in state and federal government for planning, water resources, and hazardous materials transportation from three Virginia Tech professors.

The three cultural contributors included tribal, spiritual, and cultural leaders from the Umatilla, Yakima, and Shoshone-Bannock Indian Tribes. The facilitators contributed expertise in facilitation for consensus, environmental practitioner, organizational effectiveness, and program management.

#### The Process

The working group participated in five three-and-a-half-hour sessions during the Blacksburg meeting. The group also met together for all meals with lunches considered additional working sessions. One breakfast got so lively the group threatened not to go to the session room. For the first day, each person came prepared to present their perspective and how that perspective might connect with the other two perspectives. The participants individually and collectively considered how the perspectives might fit into a yet-to-be-defined model. During this session, the group realized holistic models might be different from analytic models. The group generated, listed, and discussed issues surfaced in the first two sessions. The group brainstormed a list of needs to increase holistic thinking and ways to improve holistic thinking. Finally, the group discussed the value of continuing the study of the model and listed next steps.

#### The Results

The small size of the group clearly worked toward lively sessions with open and honest input and comprehensive opportunity for each participant to express their views. Several times participants lamented that more people weren't present to hear what they considered to be valuable considerations and revelations. In hindsight, a larger group could have not only heard the interactions first-hand but also could have affected the group interaction negatively in terms of the lively and open exchange of views.

The group came back often to the idea that the trilogy may, in fact, include more than three perspectives, thereby rendering the number implied in the word trilogy into something different from three. Given that the trilogy is holistic, we may never be able to define and analyze all perspectives. There may be a kind of glue among the perspectives that we can inversely determine but will have trouble operationalizing. Even considering this possibility, the idea I'm considering here is that more than one perspective must be integrated synergistically in environmental management. When using the Environmental Trilogy model, recognize two caveats: 1) there may be more than three perspectives and 2) the trilogy model is analytic. The trilogy model is an analytic means toward an holistic end. Whereas, analytically each of us may come at a given problem from one of these perspectives with its different image, holistically all of us must meld individual perceptions into one for the whole, a combined perception where each of the specific concerns and values are traded for one synergistic approach.

Reflecting on the basic premise of the working group efforts, environmental managers must balance Western analytic thinking with holistic thinking. In the analytic approach, if the individual parts of what we're considering are perfect, then the whole is perfect. However, in the holistic approach, if the individual parts are perfect, the whole may not be. W. Edwards Deming makes this idea stronger. He says, "If the parts are optimized, the system will not be. If the system is optimized, the parts will not be. (2)" The sign that the holistic

approach is working is the resulting synergy. Synergy depends on the interfaces among the parts of the system. The performance of the whole results from the interactions, not from the addition of the parts. With good interaction, you get good performance of the whole. With bad interaction, you get bad performance of the whole.

Successful environmental management requires holistic thinking. For success, environmental managers need an overarching philosophy and a constancy and consistency of purpose (3). Philosophy and purpose come from participatively-generated and universally-supported mission, vision, and principles statements. Holistic thinking requires ultimate understanding of the issue under consideration. The environmental manager must replace the logic of the uninformed with the logic of the informed. If we interpret Deming's concept of profound knowledge (4) as being properly informed, we'd have to include technical, institutional, and cultural understanding in the needed knowledge base. I believe we're indulging in uninformed analytic thinking; and we're not going to be successful until we do informed holistic thinking.

In the past, production of a good or service has often been the starting point and the continuous focus of our attention and effort. Figure 2 shows the traditional approach as starting with production and related resources (time and money). Based on production needs, we bring in the technical approach to determine technological constraints on more and better production and the risks associated with not having technology as good or as soon as our competition. Knowing what technology we need to meet production needs, we consider the institutional approach in terms of legal, regulatory, and policy constraints and the risks associated with changes in institutional forces. Given these technical and institutional considerations to meet production, we back fit goals and objectives, develop our guiding beliefs, and try to wring out environmental values of some kind, hopefully all dovetailing with our production needs. This traditional approach may give us short-term production success and satisfaction; but we're finding the traditional approach leads to many long-term problems. We may, in fact, be mortgaging our future. The needed approach is to learn how to cope with the short-term impatience of those focusing on production needs, to work the progression in reverse to the traditional approach to gain long-term results our progeny will be proud to inherit.

Realizing that environmental managers must work the steps in Fig. 2 from environmental values toward production needs (in opposite direction to the arrows of the traditional approach), Fig. 3 emphasizes the players and their tools for environmental management. Figure 3 emphasizes the idea

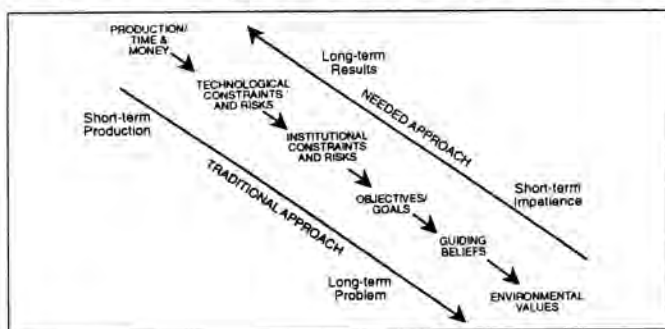


Fig. 2. We've been starting with production.

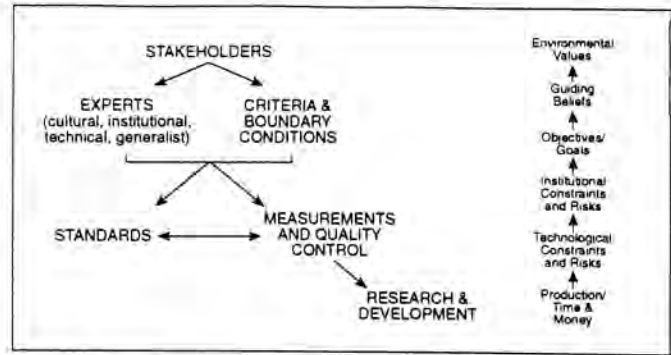


Fig. 3. Together, stakeholders and experts set and evaluate standards and measurements.

that stakeholders and the experts they choose must help set and evaluate standards and measurements for production and technological and institutional constraints resulting from the criteria and boundary conditions of the environmental values, beliefs, and goals and objectives. In Fig. 3, the place of stakeholders and their effect on experts and criteria and boundary conditions leading to standards and measurements is intentionally aligned with the suggested approach to the steps from Fig. 2.

Figure 4 expands on Fig. 3 by suggesting some of the questions the stakeholders and experts must ask in continually monitoring the production system for improvement. The questions shown in Fig. 4 are intended to represent more comprehensive and more penetrating questions in practice and to show the relative roles of the stakeholders, their experts, and measurements. Figure 5 emphasizes the alignment of the players and tools (stakeholders, experts, standards and measurements, and research and development) from Fig. 3 with the steps from Fig. 2. By cross-walking between the steps, with arrows showing the suggested approach and the sources of indicators used to accomplish those steps, we see where we get and how we combine and compare indicators with the approach steps to carry the process from environmental values, through the cultural, institutional, then the technological perspectives to get to the appropriate production. The working group called the model in Figs. 2-5 the idealistic model, because the model illustrates what we should aim for.

After the participants reviewed the perspectives and discussed models and the holistic approach, they collectively generated a list of rules for the holistic approach to environmental management. From these results, I've condensed six rules: 1) Consider relationships and interactions over components; 2) Get stakeholders' predecisional involvement and work Fig. 2 in the direction of the needed approach; 3) Get a

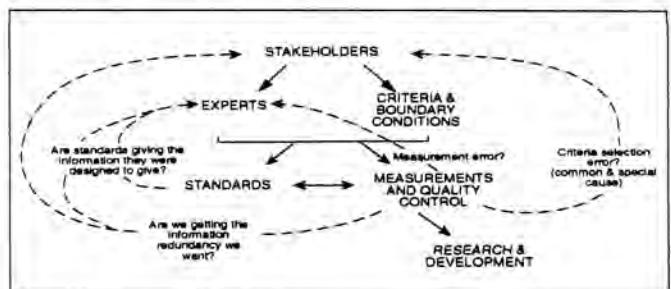


Fig. 4. Stakeholders and experts must continually monitor the system for improvement.

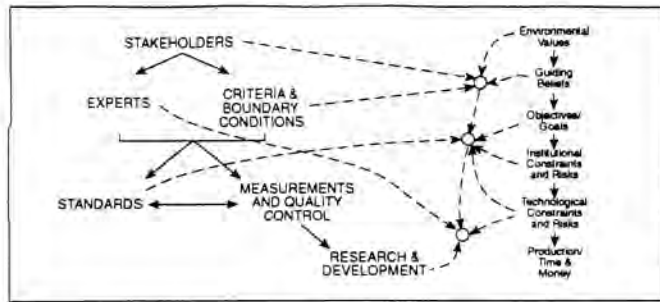


Fig. 5. We resolve differences by comparing indicators and approach steps.

systems integrator in addition to a strategic manager; 4) Listen to what the environment tells us; 5) Break discipline barriers to eliminate parochial advocacy to a technology or one of the perspectives in Fig. 1 (5); and 6) Consider permanency of the environment and those who evolve with it over transient needs and peoples.

We're interested in how the components, or parts, of a system are related and how they interact through that relationship. The interaction is the key to the gestalt (6) idea. We're probably not going to be able to separate out, define, and explain an interaction, but we must understand the interactions in total before we can apply the holistic approach.

The environment operates according to natural laws. We can allow our technical, institutional, and/or even our cultural laws to cause us to work against where the environment is heading, or we can go with the flow by listening to what the environment tells us. Obviously, we fight a flood because of the relative impact of the humans on the flood and its aims and objectives versus the impact of the flood on the humans and their aims and objectives. However, in most interactions of humans and the environment, the relative impact is reversed. In these cases we should flow with the environment because the long-term outcome is going to be best for everyone. So we should spend more effort figuring out where the environment is ultimately going and join in toward that direction rather than focusing on one instance in the environment's variation and reacting to it.

Toward the end of the Blacksburg meeting, the participants listed issues raised during the discussions they thought deserved more consideration. The issues serve as a starting point for study, presentation, and discussion in later gatherings on the holistic approach to environmental management. I've condensed the list to eight issues: 1) The unique and unexplored needs of and abilities for environmental communication; 2) Analytic versus holistic models as environmental management models; 3) The transference of principles of other holistic approaches like gestalt psychology and quality management to the Environmental Trilogy; 4) The translation of the idealistic model of Figs. 2-5 and other models from the Blacksburg meeting into practice; 5) The difference in the time dimension for environmental management and its perspectives; 6) The number, identity, and characteristics of the perspectives in the Environmental Trilogy model; 7) The knowledge and skill environmental managers need to be system integrators; and 8) The removal of barriers that rob people of their ability to think holistically and work and communicate interactively, starting with discipline barriers in the university.

Techniques for environmental communication are new and difficult for environmental managers to do. In fact, environmental communication may be more sophisticated than risk communication, another new and difficult communication issue we're beginning to learn about (7). The complicating factor in environmental communication over the present understanding of risk communication is the need to incorporate holistic thinking both in the sender and the receiver of the communication.

The role of the integrator is one of the most difficult, important, and ill-defined roles in the holistic approach to environmental management because of the variety of perspectives and tasks and the diversity of information needing coordination at many levels of the organizational complex and among the many stakeholders concerned about an environmental activity. Environmental management requires a manager who knows how to integrate the many facets of a complex program. Top management must include a systems integrator.

Others have studied integrating multiple perspectives (8) and the holistic approach. We would be remiss if we didn't understand the work of others in these areas as we work on environmental management.

### Next Steps

The participants are studying the issues from the Blacksburg meeting and are preparing papers for presentation or finding knowledgeable people on the issues for them to prepare papers for a larger follow-on meeting with broader participation. The information from the Blacksburg meeting is being discussed by the STGWG for their use and feedback to the Blacksburg participants. Some of the faculty involved in the Blacksburg meeting have used the results in their college classes. A detailed report of the Blacksburg meeting including more models, descriptions of rules and issues, and additional implications is available on request from the Management Systems Laboratories at Virginia Tech.

### SOME INTERPRETATIONS

Those of us who are rooted in Western, or European, culture and are analytically trained (e.g., engineering, accounting, sciences, law, and medicine) have great trouble even conceiving of how to go about holistic thinking, let alone understanding holistic thinking well enough to model it. But, even the most devoted analytic thinkers may slip into holistic thinking a time or two, when dating or buying a house or a car, for example. As Dr. Kosaku Yoshida says when illustrating the holistic approach: "When you go out on a date, would you evaluate whether your date has intelligence: 95 points; appearance: 96 points; emotional stability: minus 20 points? Do you evaluate your partner like that? If you get a date, turn off the light and get the smell and get the total understanding. You [are] not going to analyze. You're going to capture the entire feeling. That I call ultimate understanding (9)." In holistic thinking, we strive for ultimate understanding. I believe environmental management requires holistic thinking and, therefore, ultimate understanding.

Have you ever ranked alternatives when buying a car or house or choosing a school to attend. You carefully list all the criteria important to your decision and even consider the relative importance of the criteria. By intuition or calculation, one car, house, or school clearly excels over the others. But you buy a different car or house or choose a different school

instead, just because it feels right! Analyzing the date, car, house, or school doesn't work. You can't or don't list all the criteria and their importance. You don't want to admit a gadget in the car or the personality of the salesperson affects you. Or, for holistic thinking, you really aren't hiding anything from yourself; you just, in your heart, prefer a particular car.

The top government or company official for environmental management could turn off the lights (like in the Yoshida example) and come up with the priorities for the agency's or company's environmental management funding. That would be an holistic approach. He or she could either forget the analytic model for priorities or compare the results of the analysis to the holistic result. But, the top official's analytic-thinking constituents wouldn't accept the result of his or her individual holistic thinking. (The constituents drive different cars, don't they?) If any one constituent turned off the lights, he or she would come up with priorities somewhat different from the top official. So how can all the constituents collectively come up with holistic priorities? Not through an analytic model and not by tallying up all our individual results. The constituents need to come together and work as a group so they get synergy through the holistic approach and we get more for our environmental management money.

The only way I know how to come up with priorities as a group is to bring everyone, or their representative, together who has a stake in the priority decision and collectively derive holistic priorities. That's the holistic model. So far, only the human mind can come to a conclusion with incomplete or missing data. The human mind can come to a gestalt with some criteria and importances clearly defined and others only in their hearts, undefinable. A group of human minds can consider things no analytic model can and the group can render a synergistic answer. So, we have to figure out how to effectively bring stakeholders together to come up with the best answer through holistic thinking.

I believe the holistic model requires human minds rather than equations, algorithms, or computers because only the human mind and heart can bring together and relate all the issues, characteristics, nuances, alternatives, and importances needed for the holistic approach. The group of participating stakeholders must include everyone (or their representative) who will gain or lose by one alternative being selected or ranked over another. This holistic model allows the emphasis of perception over reality. Analytic models can't deal with perception. We must accept that in endeavors like environmental management a perceived barrier can be as effective as a real one. Until we include perception, we'll not get acceptable answers when solving environmental problems.

Consider a note here on how decision makers use the results of a model, whether it be analytic or holistic. The model results aren't answers, they're only information. However, information is the difference between a guess and a decision. The decision maker will have to use holistic model results just like they do analytic model results--as input to their decision. The decision maker knows an analytic model's results are only as good as the variables and their relationships in the model, the boundary conditions, and the data put into the model. Likewise, an holistic model's results are only as good as the representativeness of the stakeholders thinking and feeling together, the data or information they have to work with, and the process through which they interact. The decision maker can use the holistic model as support for their decision just

like he or she would use an analytic model. The decision maker can show the results of the model and describe the makeup of the model and how it works, describe the strengths and weaknesses of the model, and state the decision. The advantage of the holistic model duplicates the advantage of holistic thinking--synergy. Synergy is what you get when the holistic approach is working. In synergy the whole is greater than the sum of its parts.

A component of the holistic approach to environmental management is establishing an overarching fundamental philosophy. Once we have a long-term philosophy we set a constancy of purpose so everything can follow the philosophy, including goals, objectives, priorities, and task specifications. In analytic thinking, we can't function without clear-cut objectives and detailed task specifications. The holistic approach then asks us to first agree among all stakeholders on an overarching philosophy for environmental management--a philosophy for both the goals and the process of our management activities. A difficult requirement for using the holistic approach is the need for ultimate understanding and for dealing with the logic of the informed. The significant value of this approach is that holistic thinking focuses us on what is desirable, whereas analytic thinking puts acceptability first. Figure 6 illustrates the difference between the acceptability and the desirability concepts (10). In analytic thinking, anything inside a given boundary is acceptable. In holistic thinking the most desirable is the center of the area of interest. As we get farther from the center, the result is less desirable. When common ground is limited, we reach for acceptability, not desirability. In environmental management, when stakeholders have different value systems (cultures) we tend toward analytic thinking. Therefore, trying to get holistic thinking from people of different value systems is difficult. Analytic thinking supports science, individualism, and discovery. Science and discovery certainly are critical to a 30-year clean-up goal. Holistic thinking supports management, consensus, and optimization. Management, consensus, and optimization are also critical to a 30-year clean-up goal. For environmental management, clearly we want to blend both holistic and analytic thinking in a situation where our differences force us toward analytic thinking.

We don't have to define desirability precisely. A rough estimate will do. So defining the area's center is easier than precisely defining the area's boundary. When judging whether an activity is acceptable or unacceptable we define the boundary exactly and argue over the definition and whether the activity in question meets the definition. So a rough definition of desirability is not only easier, it's better. Furthermore, when we define exact boundaries, people will focus on the boundary and meet lower requirements.

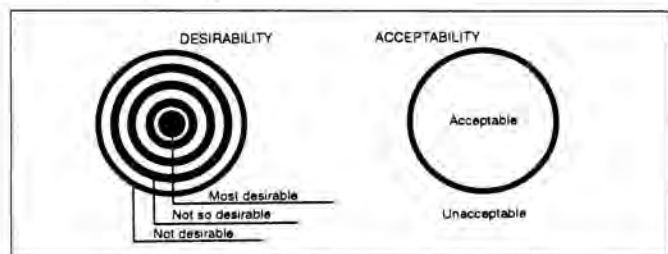


Fig. 6. When common ground is limited, society reaches for acceptability, not desirability.

### THE BOTTOM LINE

The answer is to optimally blend holistic and analytic thinking and to trade off individualism and technology against unified *values and management*. Holistic thinking is in itself oriented toward this blend. The environment deserves a profound understanding of the harmonious blend of science and management.

### ACKNOWLEDGEMENTS

The pronoun "I" is used throughout to separate all of us affected by environmental management (we) from the authors (I). However, please recognize "I" is more than one contributor to this work. The preparation of this paper is funded by the United States Department of Energy (DOE) Grant No. DE-FG02-88DP48058. Management Systems Laboratories thanks the DOE's Office of Environmental Restoration and Waste Management for providing us the real-world laboratory for the research, development, and testing of state-of-the-art management tools, processes, and models for understanding how to make them successful.

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