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Achieving Environmental Balance

EDITORIAL

Roger B Sperling, CVS

Last year I learned about achieving balance, two kinds of balance. An accident during a trip ruptured my right quadriceps tendon connecting the upper thigh muscles (quadriceps) with the patella (kneecap). I could stand but couldn’t walk without crutches for a week until I could get to proper medical care. The surgeon diagnosed the problem and performed the necessary surgery.

During my recuperation, the issue in my knee healed and I re-learned to walk with the aid of physical therapy. What I realized then was that the patella is responsible for achieving dynamic balance while walking. Upsetting its connection with the tendon required the slow recovery of my walking balance, even though the static, standing balance remained unimpaired. After eight months, the knee functioned almost as well as before. Walking—and both balance functions—had been restored.

The 50th anniversary of ecologist Aldo Leopold’s seminal environmental publication, A Sand County Almanac, was celebrated recently. In his essay, “The Land Ethic,” he wrote: “A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise.” Leopold’s in-the-round view of nature evolved from extensive study and research work with ecosystems. His view that nature is in a constant state of flux, not a static balance, was ahead of its time. This vision of two kinds of environmental balance means that it is not sufficient to achieve a static balance between humans and nature; a dynamic balance is essential to accommodate changes in the ecosystem.

Balance is both dynamic and static. Standing still is one kind of balance; walking is a far different one. Accommodating a static environment misses the dynamic balance of a changing ecosystem.

Value management is the best tool for achieving environmental balance. Value management balances environmental (and all other) projects three ways:

- **Wants vs. needs.** The old static approach to project development is to list all of the wants and figure out ways to accomplish them. The cost is then estimated and if the budget is exceeded cuts are made. The new dynamic approach is to determine the needs using the VM tool of function analysis.

  Focusing on the needs of a project sharpens the scope and balances the owner’s required functions with available funds. Taking time for this analysis is rewarded when true, underlying functions are revealed—like the function of dynamic balance performed by the kneecap.

- **First solutions vs. sets of alternatives.** Infrastructure projects may be designed from habit, using familiar first solutions that have worked in the past. Costs may or may not be considered fully in this static design selection process. As projects progress toward completion serious design issues suddenly can threaten successful on-time and in-budget completion. The VM approach is to develop a set of alternative solutions with comparative costs, so that design decisions are made with fully developed, dynamic options. Better balance of design solutions is achieved when sets of alternatives have been analyzed objectively.

- **Initial costs vs. life cycle costs.** Initial cost alone cannot define the cost impact of a project. This is a static method, compared to the dynamic VM way of calculating life cycle costs—accounting for all the costs of ownership during the lifetime of a project. Only with this long-term cost perspective can the proper balance between functionality and cost be achieved.

Thus value management helps balance environmental projects. Infrastructure projects—as well as environmental protection systems—that are needed to reach a dynamic balance with the environment, benefit from the application of the value methodology that balances functional benefits with true costs.

If, as others predict, the new century offers staggering environmental challenges—such as finding ways to protect the ocean’s bounty, stemming the tide of ecosystem and species loss, reducing the production of greenhouse gases, and creating a world without waste—then there indeed are a host of opportunities for the application of the value methodology.

In this environmental issue of Value World are articles on: project delivery of a water treatment plant; impacts of environmental issues on value management; strategic environmental choices; and interagency environmental cleanup. Other articles cover: value management as part of the project manager’s toolbox; applying value management to a value engineering program; and communicating without words.
Environmental Strategic Choice
Through Value Management


INTRODUCTION

Establishment of a comprehensive governing framework provides for the shaping and control of programs and projects, particularly for matters of major policy and complex or controversial issues, such as managing environmental sustainability. This is accomplished through proper identification and understanding of the issues at an early stage, together with establishment and clear focusing of the appropriate working group and involvement of review team members at the right times.

Early application of the value methodology as an integral component of the program or project development process leads to significant savings in schedule, staff time, capital costs and lifecycle costs. With the pressures that typically accompany the initiation and development phases of many projects, the value methodology can produce a high level of focused and tested information in a very short time. This enables well founded, collaborative decisions on program/project strategy, scope and key components.

The approach described provides a complete strategic thinking approach—from deriving a vision and principles, through to tested strategic direction to arrive at an acceptable schematic design/procurement specification. This approach is particularly useful where there is a wide and varied stakeholder interest. The approach:

- accommodates stakeholders' varying interpretations and use of the term environmental sustainability;
- is based on a very early application of the value methodology to focus or refocus strategy, define program(s) effectively and provide a framework to guide development of subsequent projects;
- illustrates how significant benefits may be derived through the application of the value methodology as the core tool set for improved business decision-making and control. This is accomplished by refocusing business programs and resources.

The following describes a means for involving stakeholders in the process of initially deriving or refocusing on strategic direction for optimal decision-making, which is achieved through alignment, or realignment, of stakeholder perspectives. Three specific and very successful applications of this approach have been development of:

- an environmental strategic plan for a city
- a river water quality improvement strategic plan
- a strategy for reducing greenhouse gas emissions.

Shared visions, principles, strategies and initiatives are identified, tested for practicality and developed in sufficient detail to enable subsequent implementation as originally envisaged. Through this form of structured, participatory planning and analysis, society-wide strategic choices are established on a firm and defensible basis. This allows effective major programs and related cost-efficient projects to proceed with confidence and encouragement of community-wide stakeholder acceptance towards the ultimate goal of sustainability.

ENVIRONMENTAL SUSTAINABILITY

Environmentalists and scientists have long warned of the need to change drastically the way in which our societies “live and do business.” In turn, many individuals and organizations who gain monetarily from traditional business practices have viewed such warnings with suspicion and disdain. This has led to adversity between those who promote industrial, commercial or residential growth for a community and those who advocate that such growth should be curtailed in favor of preservation of the environment as we know it. Significant opposing factions may emerge, divided between those representing monetary profit and short-term appeal versus preservation/restoration of the environment and long-term, socioeconomic considerations.

The terms “sustainability” and “sustainable development” are sometimes used interchangeably in environmental discussions. While often referred to as being the ideal environmental objective and as being “good business sense,” sustainable development does not have a concise, universally agreed-upon definition. Some say that the term “sustainable development” is in itself an oxymoron.

There are many erudite publications on the subject of sustainability. In 1987, “Our Common Future” coined the definition “sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs.” Various other publications support or refute a “sustainability crisis.” In 1996, “Sustainability and Acceptability in Infrastructure Development” stated “Sustainability runs the risk of being another such great concept that stumbles at the point of practical application. It is simple enough to set out guidelines, but does anybody really know how to approach the subject in respect of large-scale projects and their use? We suspect not.” “Our Ecological Footprint, Reducing Human Impact on the Earth” states “Understanding our ecological constraints will make our sustainability strategies more effective and livable. Ecological Footprint analysis should help us choose more wisely, which we think is preferable to having nature impose a choice of its own.”

This article does not presume to define sustainability or to judge whether certain practices are in fact sustainable. Rather, it refers to a process and successful applications for stakeholders to come together and reach agreement on what needs to be done, how, and to what extent. It redefines the process of strategic planning for both simple and complex situations.
STAKEHOLDER INVOLVEMENT

Environmental matters have a profound effect on our quality of life and that of future generations. In our urban environments, where most of us live and work, environmental considerations include pollution control, resource conservation, protection of natural heritage, community health, global impacts, and economic impacts.

An example of a simple function-logic diagram used to sort the key result areas of the plan is shown in Figure 1. This is a particularly useful diagram, as it may change several times to build stakeholder consensus on plan scope, framework and hierarchy of subject areas.

The environmental strategic plan was formulated through four key phases of stakeholder involvement:

- Phase 1. Initial concepts, compiled by a small public advisory committee
- Phase 2. Definition of issues, the consultation process, and community links through a broad-based pilot stakeholder group
- Phase 3. Feedback from a larger stakeholder group and other interested citizens on public discussion document
- Phase 4. Follow-up work on specific topics/aspects through special consultation groups.

The diversity of topics that may be encountered in a study for an environmental strategic plan is tremendous. Climate change, contaminated lands, natural heritage, indoor air, sustainable urban form, ambient air, agricultural lands, ozone layer, waste management, pesticides, energy management, noise, drinking water, odor, surface water, light pollution, ground water, electric and magnetic fields, industrial releases, and acid rain are just some of the diverse topics that may be encountered.

Under the banner of each topic, there is a whole host of issues and stakeholder perspectives. A FAST diagram for issues identification regarding sustainability is shown in a 1996 HKIVM Conference proceedings paper by Phillips’.

PROCESS

The problem of where to start may seem to be overwhelming and cause planning paralysis. On the other hand, some knowledge of the tactical requirements and practicalities is necessary to identify and develop meaningful strategies.

An example of a function-logic diagram used to develop a control process for formulating the subject environmental strategic plan and the related documentation is shown in Figure 2. This shows the three key final deliverables as:

1. Environmental Policy Document
2. Environmental Strategic Planning Framework

Deliverables 2 and 3 are referred to as “Framework” documents due to the plan being viewed as a “living document” rather than a finished tome. The policy document sets strategic direction, while the framework documents provide the methodology for individual departments to prepare plans and reports as corporate priorities dictate.

Following prioritization, topics may be categorized for action, further study or monitoring, as availability of funding, resources and data dictate. Prioritization of topics for examination is conducted in a manner similar to that described by the “Methodology for Rating Environmental Risks and Management Response Systems”, by Phillips in Value World, October 1995.

The overall process is similar to the value methodology (VM) job plan, but spread over a longer time period (typically several months) to suit the pace dictated by the stakeholder organizations and information flow. Under the aegis of the larger VM study, several smaller VM studies are conducted, each with their own job plan. Working involvement is required of the following groups:

• steering group(s)—identifies initial (rough) concepts
• core group—develops details
• wider/pilot stakeholder group (reviews interim outputs)
Careful selection of representatives is an essential requirement as is timing of their initiation together with ensuing continuous involvement.

In order to guide the process, a strategic focus diagram is used. The principles and application of the Focus diagramming method is explained in the 1998 SAVE International Conference Proceedings paper by Phillips\(^6\). The diagram is based on the concept of the FAST methodology, but is modified to reflect the strategic nature of this type of planning.

The strategic focus diagram provides a comprehensive “map” of the program or project under study. It addresses the key elements of a) purpose, b) constraints and, c) core values and operating principles. A tactical focus diagram is similar in format, but applies to the next stage of program/project development. In terms of the why/how layout, it is applied to the right of the strategic focus diagram. Application of the tactical focus diagram provides a more detailed level of strategy development and testing more suited to further examination of the priority topics arising from approval of the overall environmental strategic plan.

**CHOOSING THE APPROPRIATE LEVEL OF EFFORT AND DETAIL**

The approach to strategic planning, as described above, addresses the allegations of such a plan being too vague and impractical for implementation. On the other hand it is sometimes tempting to go into too many details, such that the plan is no longer strategic, or that there are too few resources available to ensure timely completion. This can be curtailed by deliberately limiting the strategic planning process to a framework that sifts, sorts, prioritizes and then guides subsequent “fleshing out” of working details. This is described further in “Focusing the Program, Projects & Teams: Strategic Choice and Defining Program Direction”, by Phillips, Proceedings of the SAVE International Conference, 1999.

The framework includes selected criteria for developing and testing initiatives that will support the agreed strategies. Examples are listed below.

**CONSIDERATIONS FOR TESTING INITIATIVES**

**Coarse Test**
- Jurisdiction/effectiveness
- Monitoring/indicators
- Sensitivities/unknowns
- Risks/uncertainties
- Constraints
- Potential for early action

**Fine Test**
- Benefit-cost
- Service levels/targets
- Life cycle costs/impacts
- Funding requirements
- Implementability
- Priority/schedule

**CONCLUSION**

The discussion above is based on applications of a successful process and of the issues encountered in building consensus—among an extremely wide range of stakeholders—for development of an agreed strategic direction. The text illustrates how the traditional value management process has been adapted and applied to align stakeholder views and to develop jointly acceptable strategies for moving towards agreed, long-term, sustainable solutions.

This adaptation of the value methodology provides a framework to facilitate internal and external stakeholder involvement and build trust—such that firm working relationships are established among professionals and lay persons alike, for a broad-based and extremely powerful, team working approach. These team members represent a great many organizations and interests, often initially exhibiting opposing ideals and motives.

Application of the value methodology as an integral component of the program or project development process provides confidence in selection of workable and affordable strategic direction, together with providing a mechanism to manage the process of change. Change of some stakeholder attitudes is likely to be a key requirement in achieving progress toward environmental sustainability.

**REFERENCES**


Martyn Phillips is a value management consultant and principal of Team Focus - VMI Inc. in Alberta, Canada. He has 35 years experience mainly in civil engineering and on major infrastructure projects to $3.6 Billion construction cost. He has conducted studies for a variety of topics in several different parts of the world.
INTRODUCTION

Traditional linear processes currently in practice may not effectively incorporate feedback mechanisms to improve project design and lessons learned from the implementation of environmental “clean-up” or restoration projects. Member agencies of the Federal Remediation Technologies Roundtable (http://www.frtr.gov) recognize the importance of capturing this information and in 1993, initiated a coordinated and consistent approach to gather and document this data to effectively evaluate the information to provide maximum value for future projects.

Federal agencies are involved in a variety of activities to support value engineering objectives to increase the cost-effectiveness of hazardous waste remediation projects. Remediation projects include the evaluation of new technologies through field demonstrations and implementation of full-scale cleanups. These activities present important opportunities to gather data that may be valuable in identifying future applications of a technology.

WORKGROUP HIGHLIGHTS

In May 1993, an Ad Hoc Cost and Performance Work Group (Table 1) was created to improve the process of collecting, documenting, and managing cost and performance information for remediation technologies. The potential for value engineering cost savings and improvement to streamline the remediation process is significant. The benefits from this coordinated effort include:

- An increase in the availability of standardized data to help compare technologies and improve remedy selection
- Establishing a baseline of information about conventional technologies that can be used as a benchmark for evaluating innovative technologies. Innovative technologies are defined as technologies that do not have extensive cost and performance data, and typically exclude removals or excavations, incineration and pump-and-treat systems
- Establishing a framework for streamlining future data collection and reporting efforts.

The Ad Hoc Cost and Performance Work Group is an integral part of the overall Roundtable mission to promote the exchange of information about the development and use of technologies, and to identify and publicize more efficient, cost-effective methods of hazardous waste remediation. Information on the work group is published at the Federal Remediation Technologies Roundtable’s web site at: http://www.frtr.gov/cost. Several members of the Ad Hoc Work Group were trained in value engineering methods and use functional analysis in their efforts. To meet these goals, the Ad Hoc Cost and Performance Work Group:

- Provides continued support to the operation and maintenance of the cost and performance portion of the Roundtable web site, including electronic dissemination of case study reports
- Prepared more than 140 cost and performance case studies reports on remediation technologies available on the Roundtable’s web site at http://www.frtr.gov/cost
- Published compendium volumes of case study reports and corresponding abstracts.

GUIDE TO PREPARING COST AND PERFORMANCE REPORTS

The “Guide to Documenting and Managing Cost and Performance Information for Remediation Projects” provides recommended procedures for documenting the results of completed and on-going full- and demonstration-scale remediation projects. Use of this document provides a value-

Table 1: Points of Contact for the Cost and Performance Activities at Federal Agencies

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<tr>
<th>Federal Agency</th>
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<td>Robert Furlong</td>
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added component to clean-up efforts.

Developed by member agencies of the Work Group, the document describes a standard set of parameters and terminology for reporting matrix characteristic information and technology operation, cost, and performance data for 29 remedial technologies. Specific objectives were that the cost format be:

- Simple, straightforward, and easily understood by project managers in the field.
- Consistent with the terminology commonly used by project managers in the field.
- Focused on technology applications used for treatment or containment of contaminated soil and groundwater.
- Limited to those cost items that are related directly to the performance of a technology and to those items that would be useful in comparing unit costs (cost per unit of measure) for technologies and applications.
- A standard approach to reporting costs specific to a technology that will aid in comparing data among projects, both among a number of applications of a single technology and among applications of different technologies.

CASE STUDIES

The case study reports by the U.S. Environmental Protection Agency (EPA), the U.S. Department of Defense (DOD), and the U.S. Department of Energy (DOE) were prepared in accordance with a Roundtable guide for documenting site cleanups. The case studies present available information for full-scale remediation efforts and large-scale demonstration projects. They describe a wide variety of above-ground and in situ cleanup technologies, along with a variety of contaminants treated. The reports are meant to serve as a primary reference source and contain project information on site background and setting, waste source, contaminants and media treated, technology design and operation, performance, cost, regulatory requirements, points of contact, and lessons learned. Case studies range from 5 to 40 pages in length and provide varying levels of detail, reflecting the differences in the availability of data and information. Corresponding with each report, a one- to two-page case study abstract is provided that summarizes the information in the case studies.

As Table 2 shows, a wide variety of technologies have been documented by the case study reports for in situ and ex situ treatment of contaminated soil and groundwater. Over the past several years, the Roundtable has identified a substantial increase in the value of implementation of innovative technologies for in situ treatment of contaminated groundwater, including technologies such as air sparging, bioremediation, dynamic underground stripping, and permeable reactive barriers. Several supplemental technologies, such as air stripping or carbon adsorption, are also commonly used. Air stripping was used at approximately three-fourths of the case study sites with groundwater pump and treat systems in operation.

OBSERVATIONS AND LESSONS LEARNED

Within the 140 case studies are observations and lessons learned that reflect input from the remedial project managers, vendors, and the authors of the reports (as independent parties). The following subject areas are most frequently addressed are cost, such as total and unit cost data; performance, including comparison with cleanup goals; system design; and operation and system optimization.

These types of information are intended to build institutional memory and help support better value to decision-making in future applications of a technology. Some of the most common observations concern the importance of adequate site characterization, and factors affecting cost and performance, including items related to materials handling and contracting approaches.

FUTURE ACTIVITIES

Member agencies of the Roundtable are committed to using the guide and continuing to work together to collectively improve the process of documenting and managing cost and performance data. The Roundtable will continue to review suggestions from improving procedures for documenting remediation projects, and
recommendations for improvements to the web site. The web site is accessed by 300 distinct users each day, providing significant value-added improvements to future project designs.

In the future, it would be beneficial to develop a series of cost profiles for specific remediation technologies, based on actual data from ongoing and completed large-scale demonstrations and full-scale applications, that would show the costs for the technologies and the key factors that affected those costs.

Federal agencies are also in the process of integrating cost and performance reporting into other remediation activities. For example, EPA is in the process of revising its guidance for preparing Remedial Action Reports to include specific guidance for including cost and performance information. In addition, the USACE is working to include documentation of cost and performance information in their remedial contracting requirements.

Johnette Shockley is a civil engineer at the U.S. Army Corps of Engineers (USACE), Hazardous, Toxic and Radioactive Waste Center of Expertise, Omaha, Nebraska. She is an integral team member in the U.S. Army Corps of Engineers Innovative Technology Advocate Program. Shockley has her bachelor’s degree in earth science and a master’s degree in Civil Engineering.

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Project Delivery with Value Engineering for a Water Treatment Plant

Robert N. Jarnis, P.E.
Jae R. Kim, P.E.

INTRODUCTION

The Massachusetts Water Resources Authority (MWRA) is an independent public authority created in 1985 that shares responsibility with the Metropolitan District Commission (MDC) for the water supply system for the greater Boston area. MDC retains responsibility for managing supply sources, while MWRA has responsibility for development and operations of infrastructure used to treat and convey drinking water to the user communities. The water supply system serves 46 communities, including 1.9 million people and 30,000 businesses. The average day's demand is approximately 250 million gallons (mgd) per day.

The MDC/MWRA water supply system contains two major water supply reservoirs and three major watersheds: Quabbin Reservoir and Watershed, Weir River Watershed, and the Wachusett Reservoir and Watershed.

The Walnut Hill Water Treatment Plant Project (WHWTP) will provide treatment to the Quabbin/Wachusett Reservoir supplies serving the greater Boston area while at the same time allowing the new and existing transmission, storage, and distribution networks to function as an integrated system. The WHWTP is a key part of MWRA/MDC Integrated Drinking Water Quality Improvement Program components are watershed protection, new MetroWest Water Supply Tunnel (MWWST), covered storage, distribution system improvements, and phased water treatment improvements.

WATERSHED PROTECTION

The MDC and MWRA pursue an aggressive program of watershed protection, including:

- direct ownership/control through agreement of watershed land
- continued sewering of non-sewered areas within the watershed
- strengthened public access controls including fencing and additional ranger staffing.

METROWEST WATER SUPPLY TUNNEL

The MetroWest Water Supply Tunnel (MWWST) provides for a new 17.6-mile long tunnel to serve as a redundant transmission conduit for the existing, 60-year old Hultman Aqueduct, which is the sole means of transmitting water at the high service grade line to the greater Boston area. The MWWST is a deep (200 to 400 feet) rock tunnel, 14 feet in diameter.

COVERED STORAGE FACILITIES

MWRA has continued on its course to eliminate all uncovered distribution storage from active use. Prior to the improvement program, there had been 2.4 billion gallons of uncovered distribution storage. A series of storage projects will result in 250 million gallons (MG) of covered storage by the year 2004 with no active open reservoirs. Key projects include Norumbega, Weston, Spot Pond, Fells, Nash Hill and Blue Hills Quincy Reservoirs.

DISTRIBUTION SYSTEM IMPROVEMENTS

The condition of the old MWRA and community distribution pipes is being addressed by ongoing pipeline rehabilitation/replacement. The MWRA Capital Improvement Plan currently contains approximately $30 million annually for repair/replacement of old MWRA pipelines prone to leaks, valve problems, and water quality problems. In addition, MWRA has recently established a two-year, $30 million pilot program to provide financial assistance to water system member communities to accelerate rehabilitation of local water infrastructure.

PHASED WATER TREATMENT IMPROVEMENTS

The MWRA has initiated and implemented several important water treatment changes in the existing system to ensure attainment of Safe Drinking Water Act (SDWA) treatment and water quality goals. Projects included the following:

- Replacing chloramination with free chlorine as primary disinfectant, followed by ammonia/chlorine addition for secondary residual disinfectant maintenance;
- Beginning operation of the Interim Corrosion Control Facility in June 1996 to increase both pH and alkalinity in the treated water for Lead/Copper Rule compliance.

The cost to complete the MWRA/MDC Integrated Water Quality Improvement Program is estimated to be $1.6 billion as summarized in Table 1.

PROJECT OBJECTIVES

The objectives of the Walnut Hill WTP Project are to provide phased water treatment improvements including a staged construction approach that would allow a delay in the final selection of treatment process, to provide cost-effective construction, and provide a fully automated facility that will minimize additional staffing requirements. The phased water treatment approach required the design development of three separate treatment alternatives: non-filtration chlorine, non-filtration ozone, and filtration.
The project required that the design of the three treatment alternatives be completed as separate construction contract documents. All three treatment alternatives were carried through the 60 percent design phase. The filtration alternative was carried through to the 90 percent design phase to meet a consent order. The filtration alternative was carried through to the 90 percent design phase. The filtration alternative was carried through to the 90 percent design phase to meet a consent order.

PROJECT CONSTRAINTS
A number of project constraints, both externally imposed, as well as those imposed by the Authority, impacted the project. External constraints included a consent order with the Massachusetts Department of Environmental Quality defining schedule requirements for SDWA compliance, and growing understanding that public health may be better served by avoiding or postponing the construction of filtration facilities and starting only with improved disinfection facilities (non-filtration treatment alternatives).

There were a number of MWRA-imposed constraints, including need to draw on the "lessons learned" from the nearly completed $6.5 billion Boston Harbor Project (BHP) wastewater treatment improvements project and the lack of filtration treatment operational experience.

PROJECT DELIVERY APPROACH
MWRA opted for what can be considered a conventional project delivery approach: design, bid, and construction contract. This approach had worked well for the MWRA on the BHP and offered greater MWRA control and project input. The BHP was a $6.5 billion program to provide secondary treatment to the MWRA wastewater system, as well as provide a deep tunnel outfall. The project needed to meet stringent consent decree schedules and involved numerous design firms and numerous construction packages.

The conventional project delivery approach offered the MWRA greater control over the project. The decision on which level of treatment would be required was to come late in the project, after the time allocated for design was expended. The MWRA required control at this stage with regard to scopes and schedules.

An important aspect of the selected Project Delivery Approach for the WHWTP was the greater control offered to the MWRA during the design stage. MWRA wanted the capability to influence the design approach employed to address the various project constraints noted above. A project team was formed to allow the design to develop with the benefit of a series of external and internal reviews. The project team consisted of three engineering consultants:
• design engineering (DE)
• design management (DM)
• construction management (CM).

DESIGN APPROACH
There were three noteworthy aspects of the project design approach: 1. obtaining permits before bidding, 2. successive design reviews, and 3. up-front operations planning.

1. Obtaining Permits. A number of permits were required from local, state, and federal agencies, all with various levels of jurisdiction over the project. It was a goal of the project to have these permits in hand before bidding of the construction contracts.

2. Successive Reviews. The design approach included thorough reviews at the 30 percent, 60 percent, and 90 percent design levels to ensure both a quality design product, as well as ensure adequate MWRA input at all stages of progress.

In addition to the drawings and specifications, specialty reports were also prepared and submitted for review, including monitoring and control plans, construction planning reports, geotechnical reports, energy management plans, operations planning reports, and testing, training and startup plans.

The external reviews at the 30 percent and 60 percent design stages (including both detailed design review and value engineering reviews) were conducted at the time of review package submittal. The design team made a presentation to the entire review team that included an account of what was submitted, as well as an overview of the project status at the time of submittal. Separate breakout groups were then formed to present single-discipline designs in detail to specific reviewers. These presentations proved very helpful in allowing the entire review team to be current with the design at that submittal time, as well as allow the reviewers to meet their design team counterparts.

All design comments were documented using an electronic data base spreadsheet. Each review comment required a written response that was added to the review comment spreadsheet. Responses were then reviewed by the MWRA and by the design reviewer. Responses that indicated revisions would be made and incorporated for subsequent submittal were noted and revisited at the next submittal. Responses that were either not understood, or considered not acceptable to either the DM or the MWRA staff, were discussed and resolved. The design review process, including presentation, review period, response period, and resolution required six to eight weeks.

The value engineering (VE) portion of the review occurred simultaneously with the DM review. The VE review and comment preparation period was limited to one week. To facilitate the

Table 1
MCD/MWRA Integrated Water Quality Improvement Program

<table>
<thead>
<tr>
<th>Program Component</th>
<th>Estimated Construction Cost ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watershed Protection</td>
<td>$8.6</td>
</tr>
<tr>
<td>MetroWest Supply Tunnel</td>
<td>$621</td>
</tr>
<tr>
<td>Covered Storage</td>
<td>$176</td>
</tr>
<tr>
<td>Distribution System</td>
<td>$457</td>
</tr>
<tr>
<td>Phased Treatment</td>
<td>$334</td>
</tr>
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</table>

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process and to allow the VE comments to be more focused, preliminary VE comments were reviewed with the DE and the MWRA at mid-week. Review comments that were inappropriate because the design intent was not understood (or not clearly presented in the earlier submittal) were discussed and often deleted. This allowed more VE development and evaluation time for those items most likely to benefit the project.

The CM was selected by MWRA and added to the review team at the 90 percent submittal stage. Reviews focused on the administration of the contract documents and the constructibility of the design.

3. Up-front Operations Planning For the completed design to offer an ease of operations and maintenance and meet MWRA’s goal of being highly automated with reduced-staffing levels, “ease of operation” was an integral part of the design process, and not a late-stage add-on. Operational input was obtained via reviews at all submittal stages. The review panel members were assembled for a four-day review workshop at the 30 percent filtration design stage. The panel reviewed the design layout, staffing patterns, level of instrumentation, maintenance facilities and training requirements. A wrap-up presentation was made to the MWRA on the fourth day of the workshop with a written summary of 95 specific review comments.

PROJECT BENEFITS
The project benefits of the Project Delivery Approach were considerable for each aspect of the design approach. The result of the permitting component of the project approach was that the majority of the required permits were obtained before the construction packages were bid. The DM reviewed the design details at the 30, 60 and 90 percent submittal stages. There were literally thousands of DM comments, as every design discipline was involved. Comments were detailed and thorough and resulted in a complete review and check on the design details. The process also allowed MWRA to see slightly different, but acceptable, design approaches, and an opportunity to select their preference.

Value engineering evaluations were conducted at the 30 percent and 60 percent design submittal stages for both the non-filtration and filtration treatment alternatives. In this manner, many common components such as the storage tank and post-treatment facilities were evaluated twice for each submittal. Generally, VE comments made on the first submittal were resolved prior to the subsequent submittal and were not repeated.

A total of 90 VE comments were presented with a combined total potential cost savings of almost $85 million. Some of the proposed VE changes were mutually exclusive so a total of 42 comments were accepted with an estimated construction cost savings of $36.4 million.

Table 2 presents a summary of the VE Comment/Resolution in nine categories by design discipline. Resolution of the VE comments resulted in 47 percent of the comments accepted, totaling 42 percent of the potential VE construction cost savings. The three categories that offered the greatest construction cost savings were: process, structural and yard piping. The net VE cost savings of $36.4 million is approximately 11 percent of the estimated $334 million construction cost for the filtration treatment alternative.

COST OF PROJECT DELIVERY
The cost of the project delivery approach is estimated to be the cost of the engineering required to complete the designs and the external reviews. These costs are summarized in Table 3. Project components presented include external engineering costs and do not include costs

<table>
<thead>
<tr>
<th>VE Comment Category</th>
<th>Number of Comments</th>
<th>Value of Comments</th>
<th>Accepted Value of Comments Accepted</th>
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<tbody>
<tr>
<td>Process</td>
<td>27</td>
<td>$39,253,000</td>
<td>12 $20,492,000</td>
</tr>
<tr>
<td>Structural</td>
<td>17</td>
<td>$18,999,000</td>
<td>8 $3,644,000</td>
</tr>
<tr>
<td>Architectural</td>
<td>7</td>
<td>$2,277,000</td>
<td>2 $444,000</td>
</tr>
<tr>
<td>Electrical</td>
<td>5</td>
<td>$2,028,000</td>
<td>2 $1,777,000</td>
</tr>
<tr>
<td>Building Services</td>
<td>7</td>
<td>$1,813,000</td>
<td>2 $242,000</td>
</tr>
<tr>
<td>Yard Piping</td>
<td>11</td>
<td>$11,875,000</td>
<td>6 $8,761,000</td>
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<td>Site</td>
<td>6</td>
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<tr>
<td>Operations</td>
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<td>5 $830,000</td>
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<td>Total</td>
<td>90</td>
<td>$85,912,000</td>
<td>42 $36,448,000</td>
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Table 3
Estimated Cost for Walnut Hill WTP Project Delivery

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Estimated Cost $ million</th>
<th>Percent of Design Cost</th>
<th>Percent of Estimated Construction Cost $ million</th>
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<td>Design Production</td>
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<td>Permitting</td>
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<tr>
<td>Operations Planning</td>
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<tr>
<td>Construction Planning</td>
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<td>1.5</td>
<td>0.06</td>
</tr>
<tr>
<td>VE/DMS Reviews - DE</td>
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<tr>
<td>VE/DMS Reviews - DMS</td>
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<tr>
<td>CM Review</td>
<td>$0.80</td>
<td>7.7</td>
<td>0.24</td>
</tr>
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</table>

incurred by the MWRA for its staff to manage and administer the engineering contracts or participate in project reviews.

Reviewing the costs presented in Table 3 reveals interesting aspects of this project delivery approach. The design production costs were 3.92 percent of the estimated filtration alternative construction costs. This is a relatively small percentage considering that their costs include carrying the three treatment alternatives to 60 percent and two alternatives to completion. Also, the cost for the external reviews by DM, VE and CM totaled an estimated $3.54 million, which includes time spent by the DE to evaluate and respond to review comments, and which is only 1.1 percent of the estimated filtration alternative construction cost. This low percentage compares favorably with what can be considered as a normal change order percentage of four to five percent. Realizing that these reviews would significantly reduce the potential for change orders during construction, the effort should be considered as cost effective.

SUMMARY
The MWRA implemented a conventional project delivery approach of design, bid and construction. With this approach they were able to address the key project constraints of meeting consent order milestones, draw on “lessons learned” from other major MWRA projects, as well as develop three treatment alternatives before selecting the appropriate treatment approach.

The selected project delivery approach allowed permits to be obtained and requirements incorporated into the bid documents, successive and thorough internal/external reviews, as well as up-front operating planning.

Major benefits of the project delivery approach were complete owner input at all design stages, thorough external reviews of design details, and value engineering savings estimated to be $36.4 million, 11 percent of the estimated $334 million filtration alternative construction cost.

Robert Jarnis has nearly 30 years of experience in water and waste-water environmental projects. He has worked on various projects related to design and construction of treatment facilities. He has worked in Kenya, Saudi Arabia and Singapore. Jarnis is an active member of American Water Works Association, serving on several committees of the regional section. He currently serves on the Board of Directors for the Pan American Group of the International Ozone Association. He possesses a BSCE in civil engineering from Northeastern University, a MsCE from the University of Wisconsin, and is a registered professional engineer in several states.
Increasingly, owners are turning to alternative project delivery systems in an attempt to control costs, meet schedules, and reduce litigation. Public agencies that have traditionally depended on separate design and low-bid contracting are using various alternative methods in which the design team, construction management, and the contractor are contractually bound to each other as well as to the owner. As a result, the project managers (owner, design, and construction) are finding themselves in unfamiliar roles with changing responsibilities. Formal value management is one of the tools that project managers can rely upon to fulfill their responsibilities and meet project goals.

GC/CM: A TRUE ALTERNATIVE?
Over the past five or six years, most major state agencies and many municipalities have explored alternative delivery processes for public projects. Design/build, GC/CM (general contractor/construction management), construction management at risk, and various combinations of these have all been introduced in pilot programs, and many have been endorsed by permanent legislation. Among the alternatives, the GC/CM method has received inordinate attention. In this method, the contractor is selected primarily on the basis of qualifications, and the construction process, including sub-bidding, is controlled through a management contract with the owner. Often this team is inserted early in the design process and may even have contractual responsibilities to manage the design phase.

I recently heard yet another presentation on a university construction project using the GC/CM delivery method. During this presentation, it was noted that the partnering activities, the claims avoidance panels, and the candid cooperative problem solving are highlights in the project. The presenters proudly passed out a list of “value engineering cuts” that the team had implemented, but they lamented the inability to meet budget or schedule within the current booming construction environment. From this presentation and many similar reviews of the newer project delivery approaches, I maintain that the solutions for cost and quality control will not only be achieved by changing roles and responsibilities, but also by changing and sharing the tools used for the management process. These tools, covering design, cost planning, scheduling, and construction management require more rigorous and more creative application.

Enough university, corrections, transportation, health care and technology, social services, and even K-12 education projects have been completed with alternative contracting to draw some conclusions about their effectiveness compared to traditional low-bid projects. Results thus far are mixed. The general consensus is that working relationships are easier through the design and construction phases but that costs and claims have not been reduced. More recently, in fact, costs have risen at the same or more alarming rates than in traditional low-bid projects.

Perhaps the greatest benefits from these pilot programs is the willingness to introduce and use many additional tools that have seen only token use in the past and for the design and construction industries to share some of the tools they have kept to themselves. For example, the construction side has, as a matter of course and necessity, relied on good critical path methodology scheduling for complex projects, and with formal construction management now at the design phase, design teams are learning better formal scheduling methods. In the other direction, “systems” cost estimating methods such as UNIFORMAT and LCCA (life cycle cost analysis), long used by designers to shape procurement or specification options and can only be achieved by changing and sharing roles and responsibilities, but also by changing and sharing the tools used for the management process. These tools, covering design, cost planning, scheduling, and construction management require more rigorous and more creative application.

UNDERSTANDING VALUE ENGINEERING
An interesting aspect of this cross-fertilization between design and construction tools is the impact on the tools themselves. Each “side” has for years used terms for some of these tools (again often in a promotional sense) that rather loosely define processes used more rigorously by the other industry.

One process that has suffered the greatest misidentification, particularly in the GC/CM environment, is value engineering. Although some designers share culpability, contractors for years have loosely used the term value engineering for a process that generates random lists of cost-cutting ideas, usually in an attempt to negotiate a project back within an awardable budget after a “bid bust.” The result is usually a quick off-the-cuff listing based on individual experience. The lists generated in this fashion usually address procurement or specification options and can whittle away at cost. Very few in the construction industry understand the creative formal value engineering process (also called value analysis or value management) that most designers are exposed to during the schematic or design development stages of a project. This process, when applied properly, seeks creative breakthrough alternatives that maintain or even increase functionality and quality while reducing costs. Using interdisciplinary teams, the process defines projects in terms of prioritized functions, and then methodically analyzes multiple...
### STAFFORD CREEK CORRECTION FACILITY

#### CRITERIA PRIORITIZATION

<table>
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<tr>
<th>CRITERIA</th>
<th>HIGH</th>
<th>MED</th>
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<td>1</td>
<td>19</td>
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</tr>
<tr>
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<td></td>
<td></td>
<td></td>
</tr>
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<td>13</td>
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<td><strong>SUBTOTAL</strong></td>
<td>94</td>
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<td>96</td>
<td>4,661</td>
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</table>

**WEIGHTED CRITERIA**

- STAFF SECURITY: 445
- STAFF EFFICIENCY: 400
- FUTURE FLEXIBILITY: 385
- INMATE SECURITY: 325
- USE PROVEN METHODS: 280
- FACILITY LONGEVITY: 280
- MAINTENANCE COST: 271
- COMMUNITY SECURITY: 241
- MULTIPLE USE OF SPACES: 235
- ENERGY COST: 235
- SELF-CONTAINED SERVICES: 226
- FUTURE GROWTH: 220
- EASE OF CONSTRUCTION: 220
- MAXIMIZE USE OF PROTOTYPE BLDG. SYSTEMS: 211
- EXPEDITE CONSTRUCTION SCHEDULE: 196
- INITIAL COST: 169
- MAXIMIZE USE OF PROTOTYPE LAYOUTS: 163
- SITE CIRCULATION: 160
- VANDALISM: 109
- NATURAL LIGHT: 109
- MAXIMIZE SITE SIZE/DEVELOPMENT: 82
- MAXIMIZE USE OF PROTOTYPE PROGRAMS: 55
- FRUGAL IMAGE: 52
- MINIMIZE SITE SIZE/DEVELOPMENT: 31

*Exhibit 1*
alternatives for both higher order and supporting functions. The analysis considers costs as well as the owners prioritized criteria, as shown in Exhibit 1. The process can be applied to entire projects or to specific components. It thus is valid as a creative problem-solving tool throughout a project.

Throughout the Pacific Northwest, many formerly strong, mandated value engineering programs are being eroded because owners are being told that the early contractor involvement in the design/build or GC/CM process substitutes for formal value engineering. This may be true for constructability, but with most contractors lacking exposure and training in value engineering, the owners are giving up the largest opportunity for true value-based cost planning and are receiving projects whose specifications and components are downgraded during the cost-cutting exercises. Most owners think they are getting more value engineering, but with stronger contracted construction management services, many owners are even further removed from daily project management, and are not part of the implementation or decision-making phase of the value engineering. Formal value engineering includes in the work plan an implementation phase in which concepts can be objectively presented to appropriate owner decision-makers.

As the owners turn over more responsibility to a consolidated project management team, they do increase their risk as a result of decreasing checks and balances; but if owners insist on rigorous, formal value management from their project management team, they will be reassured of cost control while maintaining quality. Although the concepts that define formal value engineering are simple, they do require some training and practice, and they are best implemented with skilled leadership and facilitation.

There are five defining aspects to value engineering. Many professional project managers have experienced some or all of these aspects in other settings, but most are unaware that value engineering is a rigorous process that excels when all components are applied at the right time and in the right order. Exhibit 2 shows a typical proposal criteria matrix. This rigorous analysis assists the entire project team in prioritizing criteria and making consensus decisions.

With the inflationary pressures in our current boom economy, owners should be increasing the use of formal value management. Multiple phase studies using both independent and trained in-house teams, and all using rigorous function analysis will prove to be the greatest tool in the owners’ and managers’ toolbox for delivering quality within reasonable budgets. The process will provide some of the third-party checks and balances offered by the independent contractual relationship the owners maintained between designer and contractor. At the same time, it will build consensus around breakthrough concepts with its interdisciplinary, nonjudgmental approach.

The future will include more design/build, GC/CM, and even other creative delivery methods, all offering improved human relations and fewer surprises. But owners, taxpayers, and politicians will continue to demand fiscal responsibility. If alternative approaches do not deliver improved value, the cry for even more cutthroat low-bid contracting will increase. To preserve the benefits of these alternative methods, it will be necessary to increase the use of rigorous value management tools.

Eric Meng leads the architectural/engineering/research firm MENG, with offices in Seattle, Washington, and Portland, Oregon. He is both an architect and a Certified Value Specialist, and has led more than 350 value analysis studies. He frequently presents papers, workshops, and training seminars throughout the world.

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### Essential Components of the Value Engineering Process

- Use of a rigorous work plan in which each phase in the process is applied separately and in order. The typical work plan includes six phases: information, functional analysis, speculation, analysis, development, and implementation.

- Complete understanding and analysis of project and component functions and their relative importance to project goals. Functional analysis is the one discipline that sets value analysis apart from most other quality improvement processes.

- Exploration and search for multiple alternatives. Many creativity techniques are used from basic brainstorming to synthetics and all are applied toward the basic functional components of the project.

- Use of multidisciplinary teams, preferably with some independence and with trained leadership.

- The use of cost, both first cost and life cycle cost, as a primary criteria measurement. Cost is used as s tool to force definition of project components (but other project criteria are used as well) to analyze alternatives that meet quality.
### WASHINGTON STATE DEPARTMENT OF CORRECTIONS

#### STAFFORD CREEK CORRECTION CENTER

#### BEST - VALUE ANALYSIS STUDY

### PRIORITIZED PROPOSAL SUMMARY WITH CRITERIA ANALYSIS

<table>
<thead>
<tr>
<th>PROPOSAL</th>
<th>CURRENT</th>
<th>VE PROP</th>
<th>LIFE CYCLE</th>
<th>PRESENT VALUE</th>
<th>STAFF SECURITY</th>
<th>FUTURE FLEXIBILITY</th>
<th>INNATE SECURITY</th>
<th>PROVEN METHODS</th>
<th>LONGEVITY</th>
<th>MAINTENANCE COST</th>
<th>COMMUNITY SECURITY</th>
<th>MULTIPLE USE</th>
<th>SELF-CONTAINED</th>
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Criteria weight for each proposal:

- C2a: 1 Story Vs. 2 Education
- C2b: 1 Story Vs 2 Services
- Pta: Minimum Security Config.
- S0: Site Plan
- S2: Site Size
- P7a: Youthful Detention
- A4: Healthcare
- P5: Max Security Housing
- P2: Central Administration
- A6: Visiting
- A5: Library
- C1e: Building Volume
- B6b: HVAC Cooling
- B6c: Food Service
- P6: Gymnasium
- B4: Acoustics
- P1b: Minimum Security Location
- S1: Parking
- B5: Plumbing
- S4: Landscaping
- C1a: Building Volume
- B2b: Roofing
- A1: Plant Maintenance
- S6: Water Reservoir
- S3: Fencing
- S8: Sanitary System
- B6b: HVAC Central Plant
- CONSTRUCTION SCHEDULE
- S5: Irrigation
- B3: Interior Partitions
- S9: Storm System
- A2: Food Service
- S3: Paving
- A3: Warehouse
- B1: Exterior Wall Construction (esc)
- P7b: Youth Education Staffing

Exhibit 2
Environmental Impacts on Value Analysis Studies

Ginger R. Adams, CVS, FSAVE
Michael S. Adams, AIA, PP, CVS

ABSTRACT

Environmentally driven projects have made impacts on the traditional value method pre-study event, job plan, and implementation phase. To be effective, the traditional approach needs to accommodate demands for environmental information, specialist team members, and the like—and to commence value studies as early in project development as possible. Additional, and not so obvious, impacts to value analysis studies include team composition, the use of new tools and techniques, better use of older tools, broadening of boundaries, and formal implementation. Renewal of the value methodology demands continuous improvement and an awareness of other value-improving practices.

THE PROBLEM AND THE OPPORTUNITIES

The mere mention of environmental issues is often met with a frown and a groan as the project team considers navigating through a web of regulatory agencies, corporate concerns, and private group interests, while simultaneously being held to tight cost and aggressive schedule constraints.

Of course, the term “environmental” may mean many things: degradation of air quality, destruction and mitigation of wetlands, threats to the supply and distribution of clean water, noise abatement, protection of endangered species, or even the proliferation of advertising billboards and other equally sterile elements in the urban and suburban built environment. We are still learning about not only the immediate environmental and ecological effects of construction, for example, but also the wider range of effects our buildings and constructions have on the people who inhabit them and on the overall economic surround as well.

The problems are not insignificant. In addition to multiple overlapping jurisdictional complications and the detailed submission and review processes, there is also the matter of communicating with a great number of stakeholders about matters that are both emotionally and technologically charged—and not always easy to explain or understand. The situation, on occasion, reaches such a level of potential adversarial combative ness that project sponsors are led, in resignation, to abandon the old acronym NIMBY (Not In My Back Yard) in favor of a new one: BANANA (Build Absolutely Nothing Anywhere Next to Anything).

With increasing frequency, these problems (and the need for solutions) become part of the project development process—and therefore, part of the value analysis study process. The opportunities for value practitioners involved with environmentally driven projects are of two types: those that are reasonably obvious accommodations from within the traditional value study job plan and those that are not so obvious and demand more fundamental adjustments to the value method.

OBVIOUS OPPORTUNITIES

Because of the breadth and nature of environmental determinants, value studies commenced during conceptual project development have a better chance of producing value-improving results before commitments to a particular course of action narrow or eliminate any other alternatives being considered. “Earlier is better” certainly applies to these types of projects.

Additionally, project environmental concerns significantly reinforce the importance of the pre-study event. Before commencing the study, the team needs to firmly establish the nature of the problem (as distinct from the symptoms) under examination and the consequences of solving or failing to solve the problem. Further, confirmation of study objectives, metrics, team members, roadblocks to implementation, and information requirements should also be accomplished.

On the foundation of a well-planned pre-study event, the information phase will therefore also benefit from the gathering, distribution, and analysis of environmental data in addition to the usual project specific information. We would also expect that environmental costs would appear as well in preliminary cost models and that project development schedules would explicitly recognize activities and duration for environmental research, report submissions, and reviews.

Function analysis and FAST diagramming will also need to recognize explicitly environmental functions of project planning, design, and delivery decisions. Early recognition of these drivers will assure better integration of environmental concerns into the overall design.

The success of brainstorming during the creative phase will rest on the success of accomplishing prescribed activities in all prior phases—especially team selection (pre-study); acquiring regulations, costs, and schedules (information); and function identification (function analysis). Environmental ideas may be developed as either an individual category or in concert with other categories depending on the nature of the project under study.

Equally important, environmental criteria (and metrics identified during the pre-study event and information phase) will need to be included among those used to evaluate ideas generated in the creative phase. The goal is to leave a clear record of objective decisions made that can be retraced by non-team.
members who may wish to understand the study process and decisions.

Development of individual ideas will need to recognize the environmental impacts and, in supporting material, account for related costs and value enhancements. Predictably, such supporting documentation will be more multimedia in nature to convey the intent of the proposed alternatives. The presentation of draft findings will also benefit from graphic and multimedia supporting information.

**SOME NOT SO OBVIOUS OPPORTUNITIES**

In addition to the above impacts, the following represent some not so obvious opportunities to make more fundamental and beneficial adjustments to the value method.

**Team Composition**
First, an example.

A recent value study of a proposed state highway project included private citizen team members from five neighborhood associations who were opposed to the project because of the construction and long-term traffic impact on their daily lives. The value study provided an opportunity for the project developer to demonstrate clearly the need for the project. The citizens, with a more detailed understanding of the project plans and reasons therefor, were able to develop creative solutions to what they perceived would be negative impacts to their neighborhoods. While saving a number of large trees and mitigating some wetlands impact were part of the environmental issues associated with the new highway, the residents’ concerns were considered important enough to make them an integral part of the solution process. More than 50 people, most from the residential area impacted by the project, attended the preliminary presentation of the value study results on the last day of the study.

Environmentally driven projects demand inclusion of stakeholders beyond the traditional owner/designer/constructor triumvirate. Value studies have not consistently been so inclusive and, in this regard, the value method shares a performance problem with the practice of partnering. The benefits of expanding the team to include all those with a vested interest are substantial: a chance to educate, a chance to reexamine premises and criteria, a chance to broaden the input into generating creative solutions, and a chance to assure more positive implementation of study findings.

**Use of New Tools and Techniques**

Inclusion of a broader range of stakeholders can also impact the tools and techniques used in a value study. We often assume that the alternatives generated will self-evidently improve or mitigate the problems under study, particularly if the costs are, at worst, only modestly increased. However, the environmental arena has taught us that the behavior of systems over time is not always intuitive—in fact it is frequently counterintuitive.

For example, speed bumps in a renewed downtown shopping area may solve the automobile/pedestrian conflict problem, but it may also increase the volume of automobile exhaust, slow traffic movement (including parking), increase noise, and eventually drive business out to the suburbs. The intentions may be laudable; the consequences far less so. Unintended consequences are a result of a failure to understand system behavior over time.

The tools exist, outside of the traditional value-analysis arsenal, for computer simulation and modeling of a wide variety of physical and social phenomena. Creation and validation of these models may be of enormous assistance in better understanding the consequences of value-study generated alternatives—and may also substantially assist in idea development, presentation, and implementation of study results.

Yet another emerging group of tools is geographic information systems (GIS). GIS is a computer-based technology that captures, stores, analyzes, and displays information about places on the earth’s surface: what’s on it; what’s under it; what the land is worth; where the natural resources, people, and utilities are located. More than 80 percent of all information used by local governments is geographically referenced. With GIS, the diverse facts and figures of local government operations can be combined into a common database and accessed according to the requirements of each individual or department. With GIS, any point on the map can become an index to cultural, economic, environmental, demographic, and political information about that location. Using geography as the common denominator, GIS ties data from many different sources into a single base map, incorporates changes as they are entered, and analyzes information to solve specific problems. The real power of GIS lies in analysis—linking layers of data and determining the impact of each layer upon another. GIS can be used to try out an idea first on the computer—to test it and see the potential results long before the idea becomes a costly reality. The results: fewer data inconsistencies, less costly and time-consuming redundancy of work efforts, reduced information search time, and improved efficiency and productivity.

**Better Use of Old Tools**

Function identification and FAST depiction do not consistently uncover the undesirable aspects of some project functions. This is an area where facilitators and teams alike may be challenged to focus on consequences more thoroughly and, with some of the newer tools mentioned above, identify (in the “When” direction) more comprehensively these additional functions.

**Broader Boundaries**

Traditional FAST is extremely useful to develop team consensus, improve team understanding of the problems, and to stimulate creativity. It also serves as a persistent graphic representation of the team consensus and understanding—and the boundaries of the problems under study (scope lines). Typically, teams are content to get one function beyond the scope lines to the left and right (higher order function and input function respectively) and quit-believing that their mission is restricted to
the matters within the scope lines. Further development of these functions, even though they may be temporarily outside the scope of the study, may have the beneficial effects of suggesting that the study needs to be broadened, that suggestions need to be made regarding these out-of-scope areas, or that additional subsequent or parallel studies are required. Environmental awareness has taught us the price of ignoring interconnectedness and putting on blinders.

Closely related to broadening scope is the scenario planning approach. Scenario planning does not seek to identify the course of future developments and predict the one future most likely to occur. It is more than contingency or flexible planning—as these concepts are typically interpreted into project planning. It is, rather, a systematic approach toward identifying multiple possible futures and the leading indicators that may suggest which of these possible futures is, in fact, developing. The goal is to incorporate into a project plan those proactive components that are responsive to the possible future developments regardless of which actually occurs. The importance of this approach is in the development of robust alternatives that surpass simple linear projection of the past into the future.

**FORMAL IMPLEMENTATION**

Implementation has always been the acid test for value studies. Without the implementation of findings, the bound and shelved final report is relatively useless, except perhaps as a historical document. Environmentally driven projects especially require a formal meeting of the stakeholders and those charged with implementation to determine how environmentally driven changes might affect the regulatory requirements, and to bring closure to the process. This includes decisions on implementation (yes or no and reasons for non-implementation), revisions to the developed ideas (if any), statements of probable savings and value enhancements (if these differ from those stated in the report of findings), and a preliminary schedule for implementation (along with assignments of implementation responsibilities).

Distribution of this documentation to all concerned will memorialize the decisions made and further assure the results that initially motivated the study.

**CONCLUSIONS**

Energizing the value methodology requires continuous improvement and an honest appraisal of its position among other value improving practices. The value methodology is far from static. In fact, the very subjects of value studies can be instructive in guiding adaptations to and augmentation of the traditional approaches, thus making the method even more responsive to an increasingly broad array of new and challenging problems in the future.

_Ginger R. Adams is executive vice president of Value Management Strategies, Inc., is a CVS, and is a past President and Fellow of SAVE International. Ginger is nationally recognized for her transportation and administrative process value studies and has twice been honored by the California Department of Transportation and the Federal Highways Administration for project studies she has facilitated. Her value analysis papers have been published in the United States, Japan, and Korea._

*M. S. Adams is an architect, planner, and CVS and is also vice president of Value Management Strategies, Inc. He holds B.A. and B.Arch. degrees from Rice University and an M.Sc. Arch degree from Columbia University. He is a trained arbitrator, mediator, and partnering facilitator. His value analysis papers have been published in the United States, Europe, and Japan. His research interests include conflict avoidance/resolution, a K-12 value analysis curriculum, and TRIZ.*
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INTRODUCTION

The politician faced the TV cameras and microphones, knowing he looked good and that this press conference would reach millions of people all over the state. The players were all in place, the research done, smiles projected around the room. At the signal from the director, the journalists began clamoring for attention, shouting their questions toward the politician, an incumbent running for re-election. Those whose voices were loudest, whose gestures were broad, who sat closest to the front, had the advantage. Quickly the routine was established and the question-and-answer process began. The politician felt good, because his answers were crisp, clear, and concise; his eye contact direct; his smile genuine.

After several minutes of hectic questioning, a young journalist standing toward the back of the room asked, "How do you feel about Proposition 106?" Quickly the politician verbalized the answer he believed the people wanted to hear, "I'm in complete agreement," he said. Viewers around the state didn't hear the words he spoke. The unspoken signal he gave spontaneously and subconsciously was the politician's head moving slightly, but distinctly from left to right.

NONVERBAL SIGNALS

Communicating without words is an ability we take for granted. Typically we don't realize the impact our nonverbal signals make on others, nor do we realize how spontaneously and subconsciously we communicate nonverbally. The politician's response is a classic example of a mixed message being sent, and rather than adding value to the communication process, both value and credibility were destroyed.

In his 1972 book Nonverbal Communication, Albert Mehrabian wrote that others pay more attention to body language (55 percent) and voice sounds and patterns (38 percent) than to the words we actually say (7 percent). Why is that so? Many of the explanations offered by researchers and scholars are valid, but perhaps one of the simpler reasons is that the conscious mind can only focus and concentrate on one thing at a time, while the subconscious mind can focus on a variety of things at once.

Remember when you first learned to drive? You were focused—both hands on the wheel, concentration on the road ahead, aware of the cars coming and going. However, as the motor skills associated with driving became assimilated into your behavior you were able to listen to the radio, wave to your friends, talk and laugh. Driving became a subconscious (or perhaps unconscious) activity, until you saw the flashing lights behind you, signaling you to pull over. Suddenly the focus changed. It's the same way in communication. What we do, our behavior and how we sound, get more attention than what we actually say. And our behavior is much more a subconscious activity, reflecting, perhaps, our true feelings, without our being aware of the possible incongruence between what we say and what we do. Unfortunately we forget that most of the time, which often results in miscommunication. We forget that we hear and listen not only with our ears, but also with our eyes.

Nonverbal behavior is a wordless system of communicating that is continuous. It is subconscious and spontaneous; culturally diverse and sensitive. It uses multiple channels simultaneously. It's the tilt of your head, the raising of your eyebrow, the clearing of your throat. We often forget that body language is more than just eye contact and hand and facial gestures. It's also about use of personal space, how you dress and wear your hair, how you smell, your posture, and your use of touch and space. Another thing we take for granted is OPE (other people's experience). Everyone comes to every encounter with their own set of experiences, prejudices, biases, beliefs, values and attitudes, based on everything they have experienced up to that moment. For instance, I know that if people have negative thoughts or experiences regarding short, Caucasian women with chemically dependent hair, I'm in trouble. Research tells me that I will have to talk to those with these negative biases for at least 5 minutes to change their minds even 50 percent.

COMMUNICATION CREDIBILITY

So, how can we communicate more effectively, adding value to our personal and professional relationships and honoring those with whom we communicate?

For our practical friends perhaps a formula will help:

\[ B + L + T = VA(CC) \]

Believability + Like-ability + Trust = Value Added (Communication Credibility)

The less analytical may agree with the late comedian Gilda Radner, who said, "To communicate is the most magic thing there is." For most of us, the real magic is in the mixture of attitude, nonverbal and verbal signals that help us think of communication as a brightly packaged gift, full of sparkle and promise.

Tom Peters in his book The Pursuit of WOW said "...even though we are overwhelmed by new technologies, new competitors, new everything, we hold the gift of human attention. ..." In the age of e-mail, supercomputer power, the Internet, and the raucous
global village, attentiveness—a token of human kindness—is the greatest gift we can give anyone.” After all, it is that attentiveness that provides the connection between hearts, minds and spirit.

How are you adding value in the communication process? Are your nonverbal signals congruent with the words you actually say? Whether you are practical and technical in your approach to communication, or whether you believe there’s an element of magic in your ability to connect, the best any of us can do is strive to communicate more effectively. We can accomplish that by being aware not only of what we say, but how we say and deliver our messages in order to connect.

CONGRUENT CONNECTIONS
The connections we make are important, whether they’re through cyberspace, by phone or fax, or face-to-face. Our businesses and professional relationships depend on them having an element of magic. Our ability to make them comes through sharing ourselves and our stories with others which allows us all to make a difference. Regardless of how we connect with others, the opportunities to connect are always there. It’s up to us to communicate congruently, making each connection positive, expecting to receive positive reinforcement in return.

Susan Luke is an international speaker who works across industry lines to help people create success through enhanced communication, leadership and team building skills. Her book, Log Cabin Logic, provides a unique philosophy and approach for working with others. She spoke at the 1999 SAVE International Conference in San Antonio, Texas.
### Annual Index

#### ARTICLES


Perceiving the Value of New Ideas (Editorial). Sperling, Roger B. Value World 22 (3): 1 (Fall 1999)


Value and the Domain of Value Engineering. Cook, H. E. Value World 22 (3): 10-13 (Fall 1999)


Value Engineering at the Virginia Department of Transportation. Garrett, Ron F., and Butts, Steven L. Value World 22 (2): 4-7 (Summer 1999).


Value Engineering Savings Prove Superior to Cost Reduction. Sperling, Roger B. Value World 22 (3): 2-24 (Fall 1999)


#### AUTHORS


Cook, H. E. Value and the Domain of Value Engineering. Value World 22 (3): 10-13 (Fall 1999)


Garrett, Ron F., and Butts, Steven L. Value Engineering at the Virginia Department of Transportation. Value World 22 (2): 4-7 (Summer 1999).


Lenzer, William F. Memories of the Past: The Transition Years (My Value Career). Value World 22 (3): 9 (Fall 1999)


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Learning Value Engineering from the Best

MY VALUE CAREER

J. Jerry Kaufman, CVS, FSAVE

Do the names Carlos Fallon, Admiral Mandlecorn, Chris Rand, Ed O'Connel, or Fred Sherwin mean anything to you? If so, we are of the same era — when value engineering made a career altering impression on me. The men mentioned were among the great people surrounding Larry Miles. They and others of that time helped shape my career in value management.

As a young mechanical engineer working for the Martin Co. in Baltimore, I had the occasion to meet them (and others) when Martin hosted an EIA committee meeting on value engineering. I must admit that I had many misgivings about value engineering. As a design engineer (DE), I rebelled against having a VE committee (task team) making design decisions for me. What struck me most that day was the intellectual level and dedication of the participants. As a neophyte, I asked questions (somewhat defensively) and was tremendously impressed when they listened, responded and treated me as an equal. They then asked my opinion on issues and again, gave me their undivided attention while I answered. I even received a “thank-you-gram” from Larry Miles for my contributions. At that point, I was hooked.

My concerns about a VE committee making design decisions were put to rest when I later learned that the DE’s decision prerogatives are still intact. In fact, the DE can make better quality decisions because the VE task team represents advisors who can predict the economic consequence of the DE’s decisions.

My career path took me to a program manager’s position (and value engineering) and department head (and value engineering) until Honeywell, in Florida, gave VE organizational recognition and I headed that department.

As my education and career in value engineering grew, Carlos Fallon, my mentor, took me under his wing. He taught me that value engineering’s natural roots are not in procurement, engineering or manufacturing, but in marketing. His reasoning was elegant. “It is the customer, not the producer,” Fallon said, “that determines the value of the products and services we produce.” I then learned about marketing and still use it as the spine, the vehicle for my value management offerings.

One day my boss lent me to the Honeywell Process Control Division in Philadelphia, to help organize a VE task team for a new oil process design. The project was very successful — too successful. A few weeks later I was informed that corporate was transferring me to Philadelphia to build a VE section. I went reluctantly, leaving a 12-year established position in my community. This was my first experience in the non-government related manufacturing market and I learned much. My biggest lesson was that “profit” is not a dirty word.

As I was growing professionally, my family situation was deteriorating. I had to get out of “snow country,” so after three years I accepted a position with Gardner, in Denver, working directly for the president as corporate director of value programs. This was an ideal position but it didn’t last long. After about 18 months Cooper Industries merged with (absorbed) Gardner. I was “requested” (as though I had a choice) to join Cooper corporate in Houston and join a small select group of interal consultants. As the corporate value specialist, my job was to help establish VE entities in our divisions and assist the SPU’s in meeting their business plans. That’s when I helped recruit Jimmie Carter to the position I vacated in Dallas.

During this period I served on the SAVE national board in a number of positions including president and CVS board chairman. Additionally, I attended every national SAVE conference since the first event at the Chain Bridge Marriot in Washington, DC.

The internal consultant group at Cooper was dissolved after five years and I was offered a line position with a small division. I declined and left to become a VE entrepreneur. After two years I asked Jimmie Carter to join me. This year marks 18 years of being in business and is the best part of my professional life. Jimmie and I were together for 16 wonderful years. I was indeed fortunate to know and work with him.

Most of my contemporaries are retired now. But I intend to remain active as long as I am physically able, or until the VE assignments are no longer challenging or fun.

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