

Sustainability Concepts in Decision-Making: Tools and Approaches for the US Environmental Protection Agency

POPULATION GROWTH, CLIMATE CHANGE, AND DEPLETION of natural resources are just a few of the major challenges the US Environmental Protection Agency (EPA) faces in pursuing its mission to protect human health and the environment. The agency has increasingly embraced the use of sustainability tools and approaches for considering the potential social, environmental, and economic effects of agency decisions and actions. A review of recent case studies from EPA and elsewhere, as well as examples of successful public-private collaborations, reveal a number of opportunities for EPA to further incorporate sustainability tools and approaches.

In its 2014–2018 strategic plan, EPA describes a cross-agency strategy to “advance sustainable environmental outcomes and optimize economic and social outcomes through Agency decisions and actions.” The agency recognizes that traditional approaches to risk reduction and pollution control, without consideration of sustainability, cannot fully achieve many of its long-term and broad environmental-quality goals.

For EPA, incorporation of sustainability considerations will require a shift from a focus on single pollutants in an environmental medium (air, water or land) to a broader assessment of interactions among human, natural, and manufactured systems. For example, a sustainability assessment of drinking water resources would go beyond water quality and quantity to perhaps assess the efficiency of water use, influences on wetlands and other ecosystems, competing societal demands for water, sources of water contaminants, and climate change scenarios that impact supply and quality.

This report, produced at EPA’s request, evaluates case studies for applying sustainability tools, examines new methods in public-private partnerships for collaborating on research and development and problem solving, and assesses emerging issues that

EPA relies on the definition of **sustainability** provided in Executive Order 13514: “to create and maintain conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic, and other requirements of present and future generations.”



The three pillars of sustainability considerations are economic, environmental, and social. Credit: Stuart Monk/Shutterstock

create further opportunities for EPA to incorporate sustainability concepts and tools into its decision making process.

SUSTAINABILITY TOOLS AND APPROACHES

In its 2011 report, *Sustainability and the US EPA* (the “Green Book”) the National Research Council recommended that EPA develop a suite of tools for use in its Sustainability Assessment and Management (SAM) approach to assess options for optimizing environmental, social, and economic outcomes in EPA decisions. In a 2013 report (*Sustainability Analytics: Assessment Tools and Approaches*), EPA summarizes 22 tools and approaches it has used, categorized under the three pillars of sustainability: economic,

environmental, and social. Several of those tools are described in Box 1.

Some tools are supported by a long history of use and data (e.g. benefit-cost analysis, life cycle assessment, and risk assessment), while others are in the development stages or have been used only recently. Applying a consistent set of criteria across all of the tools would help EPA select the best tools for a particular activity. This report provides criteria for rating each of the 22 tools and approaches by qualitatively assessing documentation, accepted use, maturity, availability of software, suitability for screening-level analysis, adequacy of data, and extent of usage.

LEARNING FROM CASE STUDIES

The report examined five case studies where sustainability tools were used effectively:

EPA's Design for the Environment (DfE) program. In screening new chemicals under the DfE program, EPA has used a variety of tools, including collaborative problem-solving with manufacturers and chemical alternatives assessments. By doing so, the program has developed well-accepted approaches that help consumers, businesses, and institutional buyers to identify products that perform well, are cost-effective, and safer for the environment.

Meeting combined sewer overflow discharge limits. The use of collaborative problem-solving and environmental-justice analysis in Northeast Ohio enabled consideration of various green infrastructure options, in addition to gray infrastructure options (such as sewers and wastewater treatment plants) to help meet discharge limits and to provide other benefits, for example, improving low income areas. (see Box 2).

Site remediation decisions. In addressing soil and groundwater contamination at the Pitt-Consol and Fernald sites, the inclusion of life-cycle assessments for remedy selection, public involvement for land-use decisions, and visualization tools (such as design and planning workshops, also referred to as *charrettes*) are very helpful to remediation decision-making and could be more widely applied to other sites.

Implementation of national ambient-air quality standards. Using benefit-cost analysis, formal analyses of future societal scenarios and their ramifications (referred to as *futures methods*), and other sustainability tools to broaden emission-control planning could result in multiple benefits, including improvements in addressing multiple pollutants simultaneously, and maximizing benefits while reducing pollutants.

Box 1 Examples of Sustainability Tools and Methods

Economic benefit-cost analysis organizes and evaluates information in a transparent way so that decision makers can understand the ramifications of their actions. Potential effects (economic and others) are clearly documented, whether or not they can be monetized.

Ecosystem-service valuation measures values associated with changes in an ecosystem, its components, and the services (such as flood protection) that it provides for human benefit.

Risk assessment evaluates the likelihood and magnitude of adverse consequences. It can estimate whether and to what extent public health or the environment will be affected if an action is taken.

Environmental-justice analysis evaluates disparities in exposure and risk and other factors for minority populations and low-income populations to inform equitable decision-making.

Life-cycle assessment considers all relevant aspects of a product, process, or system over its life cycle (from raw-material extraction through product manufacturing to end-of-life disposal, reuse, or recycling) to identify unanticipated effects anywhere in

the cycle as a result of an action. It does not address actual effects or risks.

Chemical-alternatives assessment evaluates hazards to human health and the environment that are attributable to the functional alternatives of a specific chemical to guide the selection of safer alternatives and to identify unintended effects.

Collaborative problem-solving involves the collaborative engagement of stakeholders to address a particular concern about sustainability considerations.

Design charrettes are a type of stakeholder engagement tool, involving the use of design and planning workshops, to develop a mutually agreed-on vision of future development, usually regarding land-use planning decisions.

Social-impact assessment evaluates possible social effects of an intervention or other action. It often relies on knowledge gained through collaborative efforts.

Futures methods include broad reviews of information, interview of experts, analysis of trends, and development of futures scenarios to anticipate conditions that may affect sustainability outcomes.

Meeting the Renewable Fuel Standard.

Augmenting life-cycle assessment with uncertainty analysis, rather than using single deterministic “point values,” is worthwhile not only from a sustainability perspective but also to better assess the likelihood that a given fuel could meet policy target threshold reductions compared to petroleum-based gasoline.

APPLYING SUSTAINABILITY APPROACHES TO EPA DECISION MAKING

EPA has many opportunities to incorporate sustainability considerations by applying tools and approaches across the spectrum of its activities, and it should do so as rapidly as is practicable. For every major decision, EPA should incorporate a strategy with the goal of assessing the three pillars of sustainability in an integrated manner. EPA should use selection criteria, such as the one described above, to select the best tools for the problem being addressed.

EPA can apply sustainability tools and approaches more fully by:

- Using sustainability concepts as an integrating principle for its strategic plan and implementation of its program responsibilities.

Box 2 Using Green Infrastructure in Northeast Ohio

EPA provides guidance to cities on meeting discharge limits of sewer overflow under the Clean Water Act. Municipalities and regulatory agencies have favored the use of “gray infrastructure”—sewer separation, storage tunnels, and additional treatment units—because they are considered to provide a high level of certainty to meet limits. However, EPA encourages municipalities to consider green-infrastructure approaches—such as constructed wetlands, rainwater harvesting, swales and green roofs. Green infrastructure can reduce capital expenditures, improve water quality, and improve low-income areas, for example, by transforming abandoned properties into recreational areas. The Northeast Ohio Regional Sewer District, which serves 62 communities in the greater Cleveland area, entered into a consent decree with EPA that required 98 percent capture and treatment of sewage (about 4 billion gallons annually) at an estimated cost of \$3 billion in capital expenditures over 25 years. Through the use of such tools as collaborative problem-solving and environmental-justice analysis, the parties agreed to a combination of cost-effective gray and green infrastructure that has brought new benefits to the region.

- Evaluating regulatory policies for public health and environmental protection.
- Managing and synthesizing data to aid the investment community in gathering public comment and to advise corporations on public-health and environmental issues.
- Convening collaborative efforts on system-level solutions.

EPA should develop a set of guidelines for preparing a sustainability assessment that is analogous to its *Guidelines for Preparing Economic Analysis* and identify a home for maintaining and updating this guidance.

Importance of Systems Thinking

Environmental challenges and the growing interconnectivity of environmental problems across local, regional, and global scales are just two factors driving the need for systems thinking. Systems thinking, in EPA’s words, involves “a comprehensive understanding of the potential consequences of human intervention, such as how actions taken by industry and consumers affect the environment, how efforts to protect the environment impact industry and consumers, or how impacts on one system can affect others and the larger whole.” EPA should use concepts of sustainability to strengthen a systems-thinking approach to support agency decision-making.

Life Cycle and Value Chain Considerations

Considering the entire life cycle of a process—from the extraction of raw materials to the post-consumer fate of a product—can help identify potential environmental, social, and economic impacts that may not be revealed by focusing on individual sources of pollution. For example, the increasing use of natural gas instead of coal for electricity generation can reduce greenhouse gas emissions because the combustion of natural gas results in less greenhouse gas emissions than the combustion of coal. However, if methane, the primary component of natural gas and a potent greenhouse gas, leaks along the natural gas value chain, then much or all of the greenhouse gas advantage over the use of coal would be lost. EPA should use approaches that allow considerations of potential life-cycle effects along the entire value chain rather than focusing on individual or regional source categories.

A **value chain** consists of all the major business functions from extraction of raw materials to post-consumer fate of a product.

Private-Public Partnerships

Many private-sector companies have made significant progress in integrating sustainability concepts into day-to-day operations, strategy, and communications. A focus on sustainability can bolster brand image, giving firms a competitive edge that helps them access new markets, attract interest from socially responsible investors, and recruit top talent. Learning how successful firms have applied sustainability tools and approaches can help other companies and EPA do the same.

Collaboration is central to operationalizing sustainability. The first decade of the 21st century witnessed a dramatic expansion of collaborative relationships between NGOs and global companies. Examples include collaborations between the Environmental Defense Fund and other NGOs with Walmart to introduce sustainability strategies and practices into the company's global supply chain; between Coca-Cola and the World Wildlife Fund to develop a global water initiative to protect critical watersheds; between Marks and Spencer and Oxfam to develop a business process for recycling clothing to lower-income families; and between The Nature Conservancy and Dow Chemical to explore the value of ecosystems and natural capital.

EPA also has pioneered efforts to build collaborations for environmental protection; for example,

following enactment of the 1990 Clean Air Act amendments, EPA used its ability as a neutral convener to enlist the automotive and petroleum industries, state and local officials, NGOs and other stakeholders to design a regulatory framework for cleaner fuels. EPA should continue to use its convening ability and should seek to engage businesses that have not made as much progress in adopting sustainable practices.

LOOKING AHEAD

As the 21st century progresses, the United States will likely face rapid environmental, societal, and economic change, shortening the time to assess issues and devise strategies to address them. To prepare for such changes, EPA should

- Develop and automate screening tools to assess new issues rapidly to support the selection of appropriate sustainability tools and approaches.
- Leverage and enhance its advanced information-technology capabilities so that the outcomes of the combined use of tools and approaches can be simulated in a sustainability context in real time.
- Consider piloting “electronic jams” that reach out to the public in monitored on-line chat sessions to obtain public comment and identify new issues.

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The National Academies appointed the above committee of experts to address the specific task requested by the National Science Foundation. The members volunteered their time for this activity; their report is peer-reviewed and the final product signed off by both the committee members and the National Academies. This report brief was prepared by the National Research Council based on the committee's report.

For more information, contact the Board on Environmental Studies and Toxicology at (202) 334-2347 or visit <http://dels.nas.edu/best>. Copies of *Sustainability Concepts in Decision-Making: Tools and Approaches for the US Environmental Protection Agency* are available from the National Academies Press, 500 Fifth Street, NW, Washington, D.C. 20001; (800) 624-6242; www.nap.edu.

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