Sustainability Return on Investment: A Scenario-based Multicriteria Assessment Tool for Policy-Making

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Abstract

Policy makers use various tools to make decisions, looking at impacts to businesses, communities, and the environment. As systems become more complex, the trade-offs between different social and environmental impacts make a simple decision increasingly difficult. Many researchers have proposed Multicriteria Decision Analysis (MCDA) to assess the sustainability of decisions [1-3]. The methods proposed, however, often require academic involvement to analyze the alternatives against a set of complex weighting mechanisms. Even with a goal of transdiciplinarity, the methodologies often mask the process used to arrive at the conclusion.

Sustainability Return on Investment (S-ROI) originally developed as an industry MDCA tool, provides more transparency in how weights are defined and how they are applied. Like other MDCA tools, it allows for scenario development and associated probabilities. This methodology shows promise in its ability to assess the sustainability of policy from the perspective of the environment and groups affected by the decision.

Keywords: Sustainability Return on Investment, Total Cost Assessment, Multicriteria Decision Analysis, social impacts

1. Introduction

Today, most decisions require an assessment of multiple criteria: cost of implementation, operational and maintenance costs, impacts on the environment and the community, effect on employees, and even indirect effects on allied systems affected by the decision. Beyond the most fundamental criteria, "can we afford it?" organizations both private and public struggle with how to balance the other criteria to make the best decision. Recently, decisions tend to be made on a single non-cost criteria, such as greenhouse gas emissions, or no decision is made at all.

Within the area of sustainability, researchers have been exploring the use of multi-criteria decision analysis (MDCA) as a scientific means of making good decisions [1-3]. Most of these methods, especially the methods developed for supporting multiple decision makers, engage stakeholders in assessing the importance of different criteria in the decision. This engagement has led to vastly improved engagement of stakeholders affected by the decision, an effect called transdisciplinarity. In all cases, this transdisciplinarity is seen to improve the decision.

Most MCDA methods rely on asking stakeholders to rank a pre-defined set of criteria using one of several schemes. Researchers use stakeholder ranking to assign weights to the criteria which can then be used to rank the alternatives. While these approaches appear to have promise, they have not been widely adopted, perhaps due to drawbacks in the time and effort to achieve a reasonable result.

The Sustainability Return on Investment (S-ROI) methodology that has grown out of the Total Cost Assessment methodology codified by the AIChE is an MCDA method that has been successfully used by both governmental and corporate organizations. The methodology has a streamlined, step-by-step approach to identifying and weighting objectives/criteria that are important to each stakeholder. Weighting is done in context with a specific aspect of the decision. In addition, for public decisions the decision is assessed with respect to each stakeholder, creating an understanding of potential winners and losers with the associated opportunity of creating a win-win-win situation.

2. Current decision-making practice

Current decision-making, particularly for corporations and the US government, centers on greenhouse gas (GHG) emissions and energy use. Alternatively, organizations find themselves unable to make any decision, since to do so would require using value judgments. The US Energy Star program is a good example of the former, relying solely on energy use to determine which products are better than others. The Department of Energy currently uses lifetime GHG emissions in comparison with fossil fuels to determine whether or not to fund alternative energy development. This policy has led to significant corn-based ethanol development and use in the US, resulting in indirect land use change as soy production moved to Brazil, tortilla shortages in Mexico due to increased corn prices, and very little net benefit in fossil fuel use.

In other areas of the government we find the US EPA unwilling to consider damage assessment in Life Cycle Assessment, leading in many cases to an inability to discern between as many as ten strictly environmental criteria to choose the best alternative.

This lack of guidance in assessing trade-offs results in policy with no clear direction, or no policy at all.

3. Multi-criteria Decision Analysis strengths and weaknesses

In most MDCA methods, researchers will first identify criteria of interest through research of existing literature, discussion with experts, the decision-maker and/or surveys of known stakeholders. They will then create survey questions to elicit the preferences or values from stakeholders. These preferences and values are used to set the weights on each criteria.. Newer methodologies include uncertainty and variability in the model [1,4]. While originally recognized as important in agricultural systems due to the high variability of crop yields, an uncertain future can affect most multi-criteria decisions. For example, uncertainty in fuel prices, regulations, and consumer demands among others may change what would be considered a good decision.

Ranking of criteria is in most MDCA is done through advanced algorithms understandable only by those with a reasonable mathematics background. Stakeholders may see results in units that they do not recognize and which make no sense unless one knows whether 10 is good or bad. This lack of transparency can jeopardize the goodwill of stakeholders.

Many MDCA researchers, however, identify the benefits of stakeholder involvement in the decision-making process. The mutual understanding that takes place between researchers, decision makers and stakeholders helps move from entrenched ideas into a realm where give and take is possible. Called transdisciplinarity, this discussion between disciplines appears to be imperative in reaching mutually beneficial agreements.

Once stakeholders have assigned weights, these MDCA methodologies can then determine which alternative ranks the best for the most people. Some methodologies are focused only on the decisionmaker while others try to create win-win alternatives

Few methods have tools to identify weaknesses in the decision where there is an opportunity for optimization.

4. Sustainability ROI strengths and weaknesses

Sustainability ROI differs from these methodologies in three major ways. First, stakeholders or their representatives are engaged in identifying the major risks and opportunities associated with the decision, as well as applying weights to the criteria in the context of specific risks and opportunities using ranges for both probability of risk and for the weights. Second, monetary cost or revenue is used as the weighting system. The last distinction is that the evaluation is made considering not just the manufacturing company or society as a whole, but considering effects to each stakeholder affected by the decision.

Educing opportunities and risks from stakeholders ensures that the decision takes into consideration changes that may affect the outcome: hurricanes or tsunamis, changes in regulation, or perhaps failure of a blow-out prevetion valve. The outcome can then be assessed for each stakeholder over a broad set of future circumstances. Since stakeholders are able to assign their own weighting (cost) value to criteria that affect them directly, they are able to use their own value system rather than the value system determined by society or an algorithm to asssess the decision.

Many researchers and corporate lawyers balk at the use of cost to assess impacts such as human health and ecosystem quality. Yet, we as a society do this type of assessment every day. Insurance companies have specific alllowances for what they will spend to save a disability adjusted life year. Almond growers pay bee-keepers to have thieir bees pollinate the trees. Corporations pay to remediate polluted land and waterways. Money is what we use to value nearly everything in our lives and is a unit that is famillar to all stakeholders.

The S-ROI methodology makes monetary valuation easier by encouraging the use of broad ranges. A value for a disabiliy adjusted life year that is a range between what the insurance companies use and what the World Health Organization uses encompases values that most stakeholders can agree upon. If the value still is not broad enough, zero can be used at the low end and nearly any value used at the high end.

While the most sophisticated S-ROI analyses take advantage of Monte Carlo analysis to determine the probability of different outcomes, the math used is traditional cost accounting. The discreet nature of Monte Carlo analysis makes it fairly easy to explain to even those without strong backgrounds in mathematics.

S-ROI, like other MDCA methodologies, takes advantage of transdisciplinarity. Stakeholders are able to discuss what is important to them in context, allowing others to find common ground in which to solve difficult issues. Like other MDCA methods, however, bringing stakeholders together in a room requires significant resources. Facilitation of the discussion also requires an experienced facilitator with knowledge of the types of issues that may affect the decision and how intangibles can be monetized.

4.1 Lessons from a case study on biomass utilization in Japan

A recent S-ROI study of sweet potato based ethanol illustrates many of the benefits of the method when multiple criteria are involved. The LCA showed the bioethanol project overall was better than traditional fuels in eight out of nine categories [5] and the traditional return on investment was positive for the ethanol plant. During the workshop, the stakeholders brought up a number of issues. The sweet potato farmers were not willing to accept a price for their potatoes that was less than they are currently receiving for starch and shoju production. The pig farmers indicated that their pigs could not eat the liquid effluent being proposed as feedstuff. Interestingly, both farmers wanted to find ways to make the project a success. By increasing the price paid for sweet potatoes, the ethanol facilitiy was still able to turn a profit. The pig farmers felt the feedstuff, if it could be made solid, would make a better quality meat. This discussion changed the premises for a number of stakeholders to create a better sollution.

All the participants were able to see the issues raised and the values that were most important. The transparancy of the process created a collaborative atmosphere with a lot of good dialog.

In the end, the project provided a positive net present value for all stakeholders except the sweet potato farmers who would not be able to reap sufficient profits to pay off their mortgages.

4.2 Recent developments

Traditionally, S-ROI has been conducted in a one- to two-day workshop setting. The workshop requires stakeholders or their representatives to travel to the workshop location and dedicate their time for the full period of the workshop. An experienced facilitator with knowledge of how intangibles might be costed is an added expense that is required to make the most of the workshop. This set up can be costly, both in terms of absolute dollars but also in terms of personnel availability.

To address these costs, a new software tool has been developed that includes a social networking component. Provided stakeholders and other participants have access to the Internet, discussions and debate can happen through webmeetings and the online dialog. All values used in the analysis become transparent to the participants and they are able to run their own analyses at any point during the process.

The need for experienced facilitation is lessened with the tool, as well. A template project has been developed that guides the user through both traditional costs associated with a corporate ROI and the risks and opportunities with associated costs and benefits that might be associated with other stakeholders. These include literature values for poor morale, brand value, disability adjusted life years, and a variety of pollutants among others. Users are provided with links to the original articles, enabling a careful evaluation of their applicability to a given situation.

5. Conclusions

Given the extreme complexity of many important decisions facing corporations and policy makers, a means of evaluating multiple criteria is imperative for good sustainable decisions. MCDA tools appear to be one way to evaluate these decisions, taking into account economic, environmental and social issues. In particular, S-ROI is an MDCA method that has been used successfully with both corporations and policy-makers with excellent acceptance of the outcomes by corporations and stakeholders alike. The methodology allows the evaluation of multiple criteria from multiple viewpoints over nearly any time period. The structured approach streamlines the assessment so that it can be accomplished within a few days time. The addition of social networking tools may spread the effort over a longer period of time, but allows participants to interact remotely and on their own time schedule. Finally, guidance within the tool enables project managers to facilitate the process with little knowledge of MCDA or weighting techniques.

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