COST MANAGEMENT TOOLS FOR THE ENVIRONMENTALLY SUSTAINABLE FIRM

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Over the past several years, the Environmental Sustainability Interest Group has developed tools and techniques to help companies understand and manage their environmental sustainability programs.

A variety of cost and performance management tools have emerged in recent years, including activity-based costing (ABC), activity-based management (ABM), benchmarking, business process re-engineering, target costing (TC), and value chain analysis, to name a few. These tools have improved the way companies do business - helping them operate more effectively and efficiently. As a thought leader in cost and performance management, the Consortium for Advanced Management-International (CAM-I) Environmental Sustainability Interest Group (ESIG) seeks to leverage existing best practices to help organizations manage the assets and liabilities associated with their environmental footprints. Over the past several years, the ESIG has developed tools and techniques to help companies understand and manage their environmental sustainability programs. The work of this group has been both developmental and observational. That is, we have developed tools we believe are innovative and new, while at the same time informing our efforts with observations of various approaches and practices across member firms. This article presents the recent work of the ESIG. [1]

Defining an environmentally sustainable organization

Our interest group, along with the CAM-I Performance Management Interest Group, has developed the following definition of the environmentally sustainable organization:

> An environmentally sustainable organization balances its strategic and financial objectives with long-term natural resource preservation and usage without compromising those of future generations. [2]

The purpose here is to promote that definition as one that is a desirable goal of any firm and to provide examples of tools that can be helpful in promoting that goal.

A preface from performance management

A fundamental question in developing an environmental sustainability program is: Why are we doing this? Understanding why an organization is motivated to undertake an environmental initiative can help gauge to what level the organization wants to invest resources and how closely it should evaluate performance. To gain perspective on this, we turn to another interest group operating within the CAM-I framework - the Performance Management Interest Group (PMIG). In another article in this issue, a contributor from the PMIG describes "enablers" of performance management, among which environmental management is included. In turn, the PMIG describes several categories in which a firm may assess the maturity of its level of environmental management. For example, "data" is listed as a category. Maturity of environmental management within that category is classified via a rubric where the first level (rudimentary) witnesses that "some related ad-hoc data is collected but does not drive business decisions." At the highest level in the rubric, level four (adaptive) data is described as being of a predictive nature and deployed to drive/support environmental management initiatives.

One purpose in developing an assortment of tools designed to identify environmentally resource-intensive activities is to assist an organization in its pursuit of higher levels of maturity in environmental sustainability. In the example just described, the product of sustainability-related TC and ABM tools can provide managers with data that allow more precise identification of environmental costs imposed by products and/or processes.

Even without any altruistic motives, and all else held constant, the purely profit-driven firm that has no interest in accounting for externalities (e.g., environmental costs not borne by the firm) should at least be neutral with respect to minimizing environmental impact. Given that there is a non-zero probability that future regulation will internalize those costs, a manager should be interested in collecting data pertaining to those costs in order to be prepared to respond should they be imposed on the firm. Furthermore, to the extent that not all environmental costs are external, a manager should be very interested in tools that may provide opportunities for lowering costs that may be associated with an environmental impact.

Managers may also wish to engage a proactive risk management strategy with respect to pursuing environmental programs. Malone and Mouritsen argue that even risk averse managers have a positive expected value in monitoring societal tastes and preferences for environmental issues and adjusting the firm's course correspondingly. [3]

Dollars and gigawatts - Measuring environmental costs

Another critical component of environmental management is ensuring that decisions related to managing an environmental sustainability initiative are evaluated in the same way as all other decisions across the organization. For most managers, that common language is dollars. A challenge for many environmental interests is communicating the environmental value in terms of dollars (i.e., the value of clean water is harder to quantify than the cost of producing a particular product).

The CAM-I ESIG's proposed management tools help to communicate environmental benefit and cost in terms of dollars. A closer look at the definition provided previously of the environmentally sustainable firm suggests that measures of environmental costs will necessarily be expressed both in financial and physical terms. Certainly, those familiar with TC or ABM will understand the use of financial measures of environmental resources. A unique dimension to the work of our interest group, however, involves the use of cost management tools to help identify resource consumption in physical terms. For example, in the methods we will discuss in this article, ABM and TC, a firm may identify resource consumption in physical terms (e.g., greenhouse gas emissions) relative to levels of activity. More specifically, in the case of TC, a firm can effectively target established emissions levels. One can see how this could be very useful in an environment of strict regulation.

In the following sections of this article, we discuss two specific cost management tools that the CAM-I ESIG has considered, ABC/M and TC, both in the context of managing and measuring environmental costs toward the goal of environmental sustainability as previously defined.

ABM for environmental sustainability

Traditionally, ABC has been used to assign indirect costs to products on the basis of activity levels that drive those costs. In turn, ABM is the extension of that practice where indirect costs are managed - presumably minimized - over time. Under a traditional costing system, overhead costs are allocated on a basis (typically labor hours or machine hours) that may or may not reflect accurately the resource/cost intensity of a product mix over time. By more carefully tracing overhead costs to products on the basis of activities those products (and their related processes) consume, better long-term decisions may be made among alternative production resources that drive those indirect costs.

The same methodology can be applied to indirect environmental costs (both financial and physical). Consider that many processes in a firm result in environmental costs. Those costs can be divided into direct and indirect (i.e., environmental) costs that either can or cannot be traced directly to a product. In ABM, we are concerned only with indirect costs.

Accounting for greenhouse gas emissions (GHG) has become commonplace among large firms, in particular among industrial firms operating in densely populated areas. Many firms, therefore, have the basic data necessary to execute an ABM analysis, assuming that, in addition to output (e.g., GHG, kWh, etc., converted to metric tons per CO_2 equivalent (MTCO $_2$e)), the firm also has data on the levels of activity driving those outputs and can trace the outputs to the activities. For example, consider the budget information for three joint products in Exhibit 1.

Exhibit 1.

Three Joint Products

Indirect Costs	$	Environmental Usage (in $MTCO_2e$)	Cost Driver
Electricity for Manufacturing HVAC	20,000	5,000	Number of Units at Split-off*
Electricity for Machines (Products Prior to Split-off)	40,000	10,000	Number of Units at Split-off
Electricity for Servers	15,000	3,000	Design Time (in Hours)
Electricity for Lighting	45,000	2,000	Product Time in Facility
Natural Gas for Manufacturing	55,000	3,000	Product Time in Facility

	Product A	Product B	Product C
Number of Units at Split-off	1,500	3,000	3,000
Design Time (in Hours)	100	20	30
Product Time in Facility (in Product Hours)	15,000	40,000	25,000

*The split-off point is the point in the production process at which joint products become separately identifiable.

The predetermined environmental cost rates for each of the cost drivers would be calculated as follows.

$$\text{Units at Split-off} = \frac{\$60{,}000}{7{,}500 \text{ units}} = \$8 \text{ per unit}$$

$$\text{Design Time} = \frac{\$15{,}000}{150 \text{ hours}} = \$100 \text{ per hour}$$

$$\text{Product Time in Facility} = \frac{\$100{,}000}{80{,}000 \text{ hours}} = \$1.25 \text{ per hour}$$

Alternatively, predetermined rates can also be expressed in physical terms.

$$\text{Units at Split-off} = \frac{15{,}000\ MTCO_2e}{7{,}500\ units} = 2\ MTCO_2e \text{ per unit}$$

$$\text{Design Time} = \frac{3{,}000\ MTCO_2e}{150\ hours} = 20\ MTCO_2e \text{ per hour}$$

$$\text{Product Time in Facility} = \frac{5{,}000\ MTCO_2e}{80{,}000\ hours} = 0.0625\ MTCO_2e \text{ per hour}$$

Extending the example, the indirect environmental cost allocated to products A, B, and C by multiplying each product's activity levels by the predetermined rates for those activities yields the rates in Exhibit 2.

Exhibit 2.

Rates Yielded

	Product A		Product B		Product C	
	$	$MTCO_2e$	$	$MTCO_2e$	$	$MTCO_2e$
Units at Split-off	12,000	3,000	24,000	6,000	24,000	6,000
Design Time	10,000	2,000	2,000	400	3,000	600
Product Time in Facility	18,780	937.50	50,000	2,500	31,250	1,562.50
Totals	40,750	5,937.50	76,000	8,900	58,250	8,162.50

Several important observations may be made from these numbers. First, one must remember these are allocations of indirect costs. Decreasing production of any of these will not necessarily result in the reduction of short-term costs or emissions. Over time, redesign of products and/or processes may be informed by the relative resource intensity of these products; however, no short-term gains are likely to result from shifts in product mix, as allocations would simply shift among products, not be eliminated.

Second, in the long term, where resource shifts can be accomplished and environmental costs - both financial and physical - may be avoided, one must take into account the marginal product of the environmental resources being consumed. In Exhibit 2, no mention is made of the value being realized by the firm from the consumption of those resources.

Finally, the most significant contribution offered here is the application of ABM to allocating physical environmental costs to production processes and products. By examining the resource intensity with respect to indirect physical environmental costs, a firm can more effectively plan resource allocations, plan product mixes, and make design changes with a better understanding of the implications for changes in physical environmental resource consumption. Applying this methodology in the context of environmental sustainability provides the firm better information with which to plan strategic initiatives (e.g., appealing to consumers and other constituents with systematic decreases in environmental footprint) and responses to environmental demands (e.g., regulatory pressures).

TC for environmental sustainability

In a traditional target cost application, a market price is identified for a firm's product and given numerous parameters (e.g., safety requirements, product features and options, etc.) specified for that product. The product is then designed to a target cost taking into account a desired profit margin. Environmental issues insert themselves into the traditional target cost model due to regulatory issues, consumer demand, and shareholder/stakeholder demand that many products face. Those issues present themselves in many ways, most often specific to the nature of a firm's products and production processes. For example, in the auto industry, vehicles must be designed to the environmental standards that will be imposed in the jurisdictions in which those vehicles will be driven. Obviously TC becomes a competitive tool, as regulatory standards drive higher and higher expectations by the market regarding what is or is not acceptable in terms of fuel economy, emissions, and other similar competitive features sought in cars today.

A firm may, however, decide to be proactive in becoming more environmentally friendly or sustainable. Financially, the target process is the same. A firm simply adopts internally imposed standards that would have otherwise been imposed externally (e.g., either the regulatory requirement or competitive expectations as described previously). Still, TC is a very efficient tool in assisting a firm in meeting those goals.

CAM-I defines TC as:

> …a system of profit planning and cost reduction that manages costs before they are incurred, is committed to continual improvement in product and process designs, is externally focused on customers and competition, and systematically relates the complex web of value-chain and cross-functional relationships into a cohesive and integrated planning and execution system. [4]

There are six fundamental principles CAM-I endorses in executing a TC strategy. They are price-led costing, focus on customers, focus on design, cross-functional involvement, life-cycle orientation, and value-chain involvement. Sakurai described TC as a cost management tool used for "reducing the overall cost of a product over its entire life cycle with the help of the production, engineering, research and design, marketing, and accounting departments." [5] As suggested by these principles and broad perspectives, TC is a cost management tool that is much more comprehensive than its simple mathematical expression (i.e., Price - Desired Profit Margin = Target Cost) would suggest. In particular, the life cycle perspective and cross-functional nature of TC implies a very rich process of product/process transformation with the goal of achieving a derived target cost. Indeed, a firm must plan carefully as far in advance as possible due to the nature of committed costs, both financial and environmental. The further into the life cycle of a product a firm advances, the higher the costs of adjusting costs (again, both financial and environmental) in response to changing environmental conditions (e.g., regulatory).

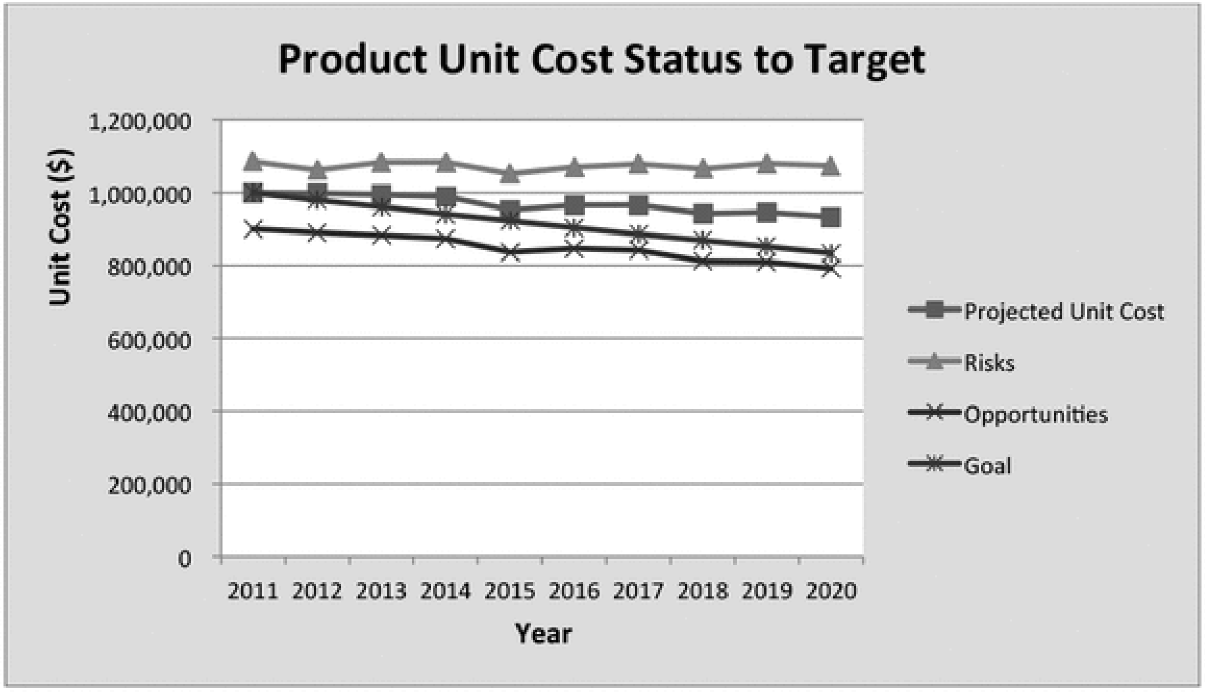
CAM-I, however, has taken TC one step further. Rather than focusing solely on financial improvements, we propose that targets can be set in physical terms with a TC methodology used to achieve those targets.

In order to subscribe to a life cycle perspective, TC requires monitoring costs over the life of the product and comparing them to predetermined objectives. Risks and opportunities that can cause the product cost to increase or decrease should be estimated. These factors produce a set of expected boundaries representing potential variability from original estimates. These boundaries are based on past experience with product life cycles, estimates of ranges by product developers, how dynamic the market is for technology, and potential disruptions in schedules, as well as interactions among any combination of factors that may influence deviations in costs over the product life cycle.

These estimates are then recorded in cost target tracking charts - a methodology adopted by CAM-I members - and used as a status mechanism for project management. An example is offered in Exhibit 3. [6]

Exhibit 3.

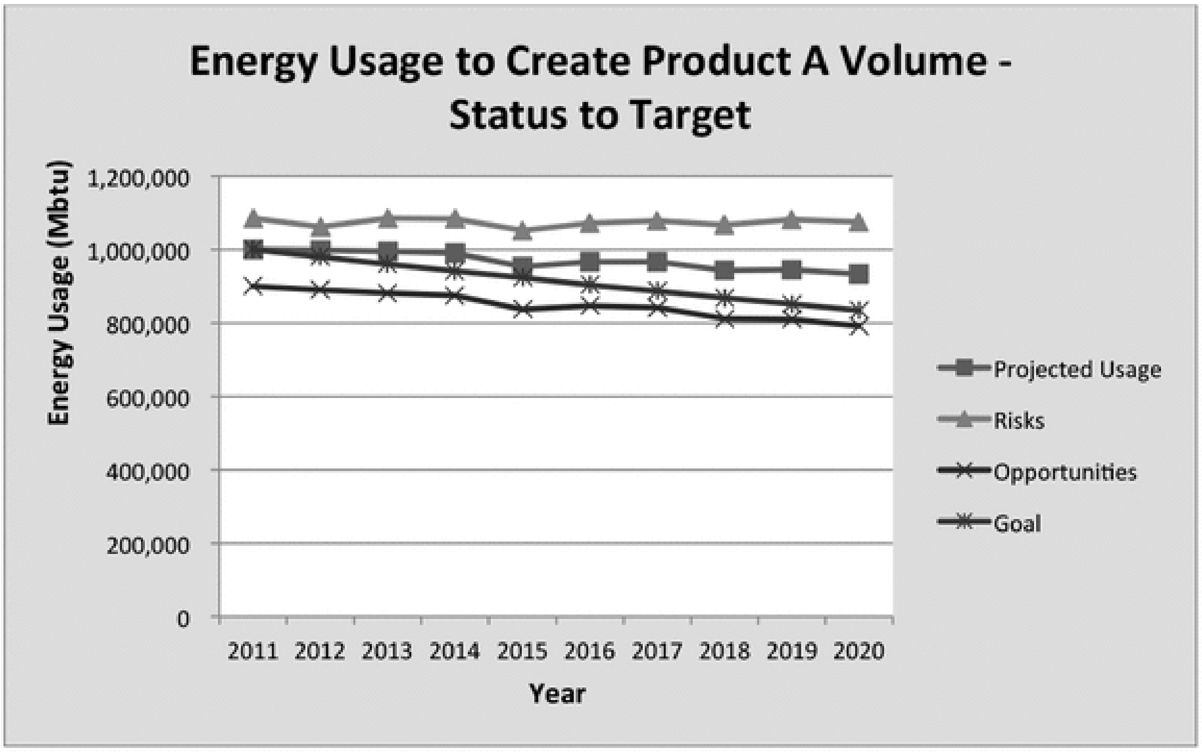
Typical Target Costing Status to Target Chart



These charts can also be adapted to use in applying a target cost methodology to environmental sustainability, tracking environment costs, both financial and physical. Exhibit 4 illustrates how TC techniques might be adapted using a measure of environmental impact (in this example, energy usage measured in Mbtu) in place of cost. **7** These charts can be used to track and manage environmental impact in the same way they can be used to assist in the management of costs.

Exhibit 4.

Sample Target Costing Status to Target Chart Applied to Environmental Sustainability



Using this data, managers can better assess whether they are following a path consistent with longer-term goals.

Conclusions

For a variety of reasons, a firm has an incentive to strategically consider the application of environmental sustainability initiatives in its operations. Whether the firm faces regulatory pressures, anticipates changes in regulatory or market conditions, is actively seeking inroads into corporate social responsibility (CSR) communities, wishes to be included among portfolios of CSR firms, or simply anticipates potential cost savings by incorporating what otherwise are cost-effective resources to its business processes, the environmentally sustainable choice is often the best one. This article has offered two cost management tools that can assist the firm in seeking to be environmentally sustainable while still operating cost effectively.

1 The ESIG has operated as an active CAM-I interest group since September 2009. Anthony Pember served as the chair of the interest group for the first five years of operation. Mark Lemon became the ESIG chair in September 2014. Key contributors to the interest group include Mr. Pember of Grant Thornton LLP, Mr. Lemon of Grant Thornton LLP, James Hendricks of the Boeing Company, Todd Scaletta of CPA Canada, and David Malone of Weber State University.

2 Pember, A. and Lemon, M., Measuring and managing environmental sustainability: Using activity-based costing/management (ABC/M) (2012) (CAM-I white paper).

3 Malone, D. and Mouritsen, M., Change management: Risk, transition, and strategy, *Cost Management* 28, no. 3 (2014): 6-13.

4 Ansari, S.L. and Bell, J.E., *Target Costing: The Next Frontier in Strategic Cost Management.* (New York: McGraw Hill, 1997).

5 Sakurai, M., Target costing and how to use it, *Journal of Cost Management* 3, no. 2 (1983): 39-50 .

6 Exhibit adapted from Hendricks, J.R., Managing Environmental Sustainability Using Target Costing Principles (2013) (CAM-I white paper).

7 *Ibid.*