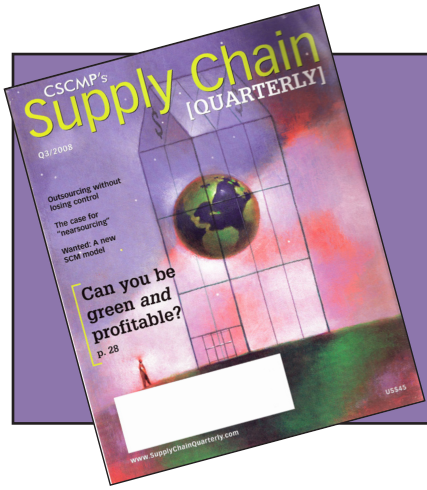

CSCMP's
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Can you be green *and* profitable?

Profitability and sustainability don't have to be mutually exclusive. By considering environmental issues when setting financial objectives for a supply chain network analysis, companies can successfully balance the trade-offs between them

By Alan Kosansky
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EVERYWHERE YOU LOOK, "GREEN" IS THE TOPIC OF THE DAY. There are "green" conferences, "green" articles in business journals, and almost daily news stories reminding us that we need to be "green." It is not just a matter for individual consumers, either. With concerns about climate change rising, the spotlight is also on the long-term effects of business practices on the environment.

The heightened awareness of the relationship between business and the environment has a direct impact on supply chain management. It has raised questions that many of us are now endeavoring to answer: How will we incorporate green sustainable practices into supply chain operations? How can we assess the trade-offs between sustainability and cost control? And how do we value long-term sustainability in the same equations as growth and profitability.

The path to those answers lies in a process that has already transformed businesses around the world: supply chain network analysis. By including sustainability stakeholders and their data when setting financial objectives for network analyses, companies can successfully balance these seemingly conflicting goals.

Conflicting agendas, competing priorities

Although sustainability has been added to the traditional corporate goals of growth and profitability at many companies across the globe, in practiced sustainability and profitability agendas often are at odds. They typically are managed as separate efforts by different line managers with separate organizations, budgets, and metrics. In many cases, sustainability initiatives are managed by staff organizations that report to high-level executives who are unfamiliar with the key production and distribution decision-making processes that influence both profitability and sustainability.

This lack of alignment can lead to situations in which decisions made by separate organizations conflict with or undermine each other. For instance, sustainability leaders might be aiming to reduce greenhouse gas (GHG) emissions through the use of new manufacturing technologies in the existing supply chain while the business leaders charged with increasing profitability are considering outsourcing manufacturing to a "low cost" country. The outsourcing option may reduce total delivered costs, but it will increase the number of miles the manufactured goods must travel, and thus will increase the GHG emissions in the distribution leg of the supply chain. What's more, depending on the type of energy sources supplying the outsourced manufacturer and the air quality regulations that are enforced at the manufacturing site, emissions from the outsourced operation may be significantly higher than those from the current operations, which have already been targeted for improvement.

Further complicating the picture for many companies is a lack of alignment among the internal organizations involved in their sustainability initiatives. Take the example of environmental health and safety (EHS) organizations, which understand how operational changes in the supply chain impact air and water emissions. These groups often function separately from organizations that manage product design and lifecycle assessment, which understand the effect of product and packaging design on disposal after a product has served its useful life, or from organizations that have stewardship of products and processes, which understand the products' risks and make sure they are processed, handled, and used safely.

In most companies, these constituencies are not included in mainstream, profit-oriented decision making because their charter has been viewed as simply ensuring compliance with environmental regulations. We are rapidly moving into an era in which this approach is no longer beneficial. Having different pieces of the sustainability agenda scattered across many parts of an enterprise makes it difficult to bring the right sustainability champions into the business decision-making process.

The good news is that these fractured, competing priorities are not unlike the separate constituencies and divergent goals that kept supply chains from achieving their full potential—and they likewise can be addressed and resolved. It was not long ago that manufacturing, logistics, sales, marketing, procurement, and finance all had separate organizations, agendas, and metrics. However, as companies have come to recognize the value of operating their supply chains as cross-functional business processes, many have aligned those separate factions around common goals and metrics. Especially in the top-performing companies, managers have been able to agree on methods for making trade-offs across disciplines, such as manufacturing costs against inventory, warehousing costs against freight costs, and customer service against the cost to serve. The supply chain literature is replete with examples of companies that have gathered the right people to focus on common goals, using powerful decision-support tools and data from enterprise resource planning (ERP) databases to change their supply chains in ways that lead to major increases in profitability.

We believe that a similar approach can integrate sustainability into supply chain optimization processes. It is not a simple task: Managers will need to initiate, manage, and deliver a project that will align the different constituencies charged with profitability and sustainability, evaluate the potential trade-offs among those constituencies' goals, and recommend supply chain solutions that achieve management's corporate goals and can be evaluated against current performance with agreed-upon metrics. We recommend the following six-phase process as a framework for achieving results:

1. **Assemble the right group of stakeholders to charter the effort.** This group will be responsible for creating a document that clearly states what is to be accomplished, how it will be measured, and the internal and external factors and assumptions that may affect the company's efforts.

Without the right people at the table, there is very little hope for success in this cross-functional effort. The team leader needs to collect goals, objectives, and key performance metrics across the groups that have a stake in the outcome. These stakeholders should include the traditional supply chain constituencies of manufacturing, planning, sales, marketing, logistics, procurement, and finance, as well as the constituencies tasked with environmental compliance, product and process design and stewardship, and corporate sustainability objectives, such as reducing the carbon footprint to reducing landfill waste.

Next, the group should identify areas of common purpose, areas of conflict, and areas that can "flex" to meet common goals. For example, an operations manager may have been given a single target manufacturing cost per unit for all of the company's manufacturing facilities. But the manager might be willing to agree to a green solution that resulted in some facilities having costs that exceeded that number, as long as the average per-unit manufacturing cost across all facilities met the target. Likewise, an environmental manager tasked with reducing greenhouse gas emissions at each facility by 30 percent may be willing to vary the percentage for individual facilities provided the total emissions for all of the facilities are reduced by 30 percent.

This would be an appropriate time to discuss how to value trade-offs among competing goals. ("I'd be willing to take a US $500,000-per-year hit on my income statement to get a 7-percent reduction in greenhouse gas emissions, but I don't think I'd be willing to take a US $1,000,000 hit.") This stage would also be a good time to agree on what is "good enough" in regard to meeting each of the stated goals. If there are mandated minimum achievements for any of the goals, they need to be brought up for discussion now.

Decisions that have already been made about the future direction of specific functions should be included in the baseline, or "do nothing," case. The team will need to decide how to resolve conflicts and remote barriers and when to go to a higher authority to break impasses. Additionally, it must agree on the metrics and definitions it will use to evaluate various scenarios' likelihood of success. For instance, a goal of reducing the supply chain's GHG footprint by 30 percent would require all involved to agree on where the supply chain starts, where it ends, which greenhouse gases are being targeted, and how these emissions will be measured in the network model.

This is also the time to identify aspects of the supply chain as well as external factors (such as the price of oil, customer demand, and the regulatory environment) that could drive the performance of the enterprise toward—or away from—the stakeholders' goals. In this step, the team members would determine the main "levers" in the supply chain that they would be using to accomplish those goals. Typical levers in this type of analysis include the opening or closing of distribution centers, the amount of raw material purchased from each supplier, the product mix and volume produced at each manufacturing facility, and the market segments the company may enter or exit, to name a few.

With regard to external factors, the team could ask itself such questions as: Should we assume the passage of legislation that implements a carbon tax or a "cap and trade" system? If so, what would be the monetary value of reducing greenhouse gas emissions by one ton? Alternatively, what is the projected range of prices for a barrel of oil over the planning period? What would be the corresponding costs for transportation, electricity, and raw materials at each price in that range? The team may choose to include contingent goals that would come into play if there are substantial changes to the assumptions.

2. **Gather the right data and create a baseline.** Once the key stakeholders have agreed upon the overall goals, the metrics they will use to measure the achievement of those goals, and the major assumptions governing the external environment, it is time to form a working team comprising representatives from each of the stakeholder groups. The first step for this new team is to assemble a baseline model. The working group will use this picture of the present as a starting point for the measurements specified by the chartering stakeholders.

The creation of the baseline allows all parties to see and, perhaps for the first time, understand how their goals and objectives fit together or conflict with other stakeholders' priorities in the current operating environment. This is an ideal opportunity, therefore, to identify areas of concern or opportunities for improvement that can be targeted in the subsequent analysis and modeling.

At minimum, the baseline should show the key facilities in the supply chain, their operating cost, contribution to earnings, and relevant environmental footprint. This last would include such information as current carbon dioxide (CO_2) emissions, other airborne pollutants, water usage, wastewater discharge (especially toxics and organics), solid-waste discharge, and disposition to landfill or other treatment facilities. In addition, the baseline should show the major flows of material, from raw material through to delivery of finished product to customers as well as related costs, contribution to earnings, and environmental footprint.

For most companies, it is a significant effort to collect all of the cost and profitability data they need in order to characterize their current supply chains. However, for those that have determined where to mine the necessary data from ERP systems and how to aggregate it to best advantage, the effort has proved to be very worthwhile.

Calculating the supply chains' environmental footprint is likely to be especially time-consuming because it will require the use of different data sources as well as some estimation of factors that often are not directly measured. For example, the CO_2 emissions generated by the transportation of raw materials, intermediates, and finished goods are not directly measured. It is possible, however, to calculate the total CO_2 emissions related to goods movement with reasonable accuracy. This can be done by estimating the number of miles driven to move those goods and then, using publicly available information or information supplied by the carriers, multiplying those miles by the appropriate emissions factor.

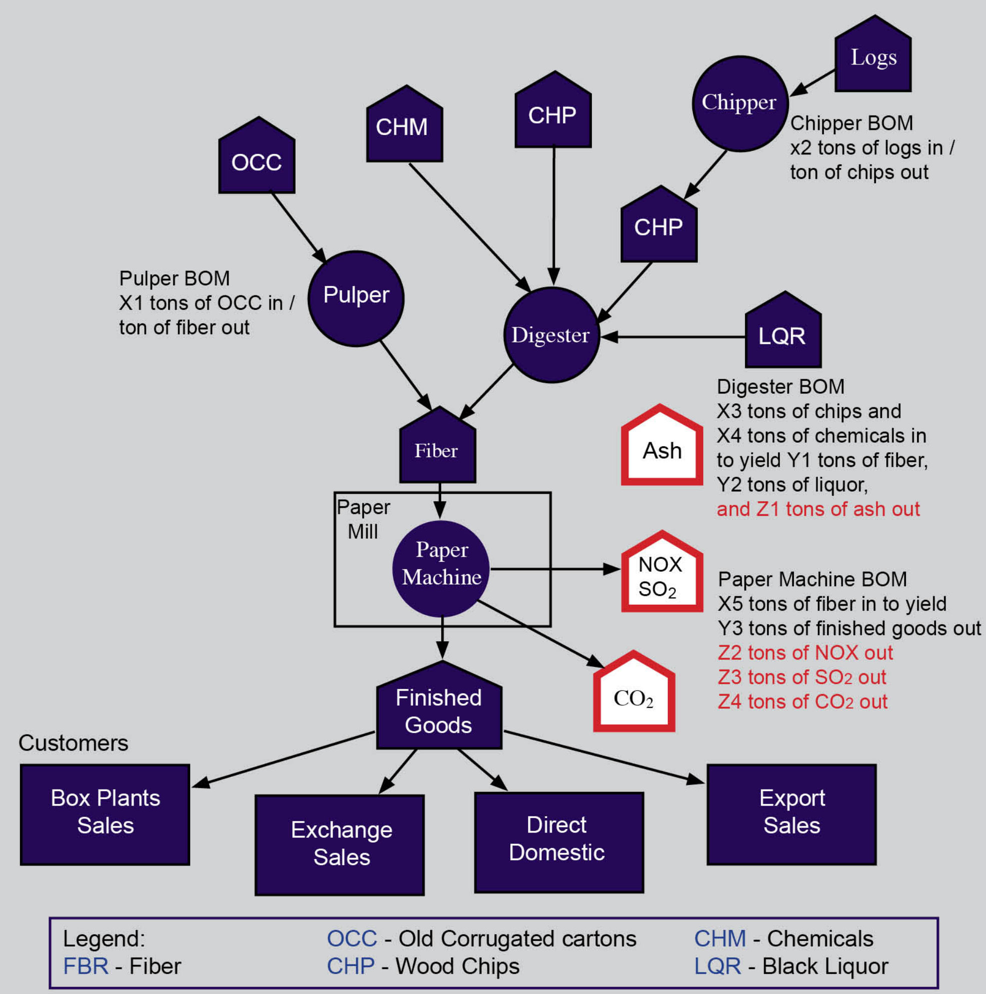
Another example: Existing operational compliance data can be used to generate bills of material to calculate the volume of wastewater produced, the amount of energy consumed, or the volume of landfill waste produced per unit of production. As shown in the sample bill of material for paper production in Figure 1, these elements can be entered into the model in the same ways that raw material or intermediates consumption are entered. Likewise, end-of-life recycling load or waste disposal can be entered based on data from product-lifecyle assessments.

Finally, the team should factor into the model the capital costs for any expansions, energy-efficiency measures, or new pollution-control technology, along with the resultant increase in capacity or reduction in emissions. If the company is considering the closure or expansion of a plant or the addition or shutdown of a distribution center, the team must determine the impact these changes will have on both finances and sustainability. Decisions that have already been made but not yet implemented should be reconsidered here.

3. Optimize the current system and eliminate waste. The third step involves converting the baseline model into an optimization model that reflects both profitability and sustainability goals. Today, supply chain objectives make trade-offs between various cost components (transportation, inventory, manufacturing, and supply) and with a business's overall profitability and service targets. The supply chain objectives of the future will continue to trade off these elements against competing environmental goals.

At this point, it is likely that actions that improve profitability will also improve sustainability. For example, when a manufacturer of building products pried manufacturing sites and distribution centers with customer locations in order to reduce total delivered cost, the company also reduced its transportation-related CO_2 footprint by 9 percent.

(FIGURE 1) BILL OF MATERIAL (BOM) WITH ENVIRONMENTAL DATA



(SOURCE: DWIGHT COLLINS AND DAVID CLARE, "A CORPORATE MODELING TOOL TO ASSESS THE PROFIT-ENVIRONMENTAL FOOTPRINT LINKAGE WITHIN A LARGE COMPANY," SUSTAINABLE INNOVATION 06 CONFERENCE, OCT. 2006)

In this phase of the process, the team should target the elimination of unnecessary waste throughout the product lifecycle, from energy and raw material sourcing through packaging and reverse logistics. The group can minimize the number of miles traveled, revise operations or products that consume large amounts of energy (particularly if that energy is derived from a source that's targeted for reduction to meet sustainability goals), consider packaging alternatives, and so forth. The team will analyze all of these changes within the current business rules, or at least the set of future rules that has already been agreed upon. This will change in the next phase.

4. Evaluate the effect of existing business rules and assumptions on the metrics and achievement of goals. Every organization and process uses a set of business rules to help it achieve its goals. However, these rules are often established in functional or organizational silos and may actually create obstacles for other organizations or processes. By having the right people at the table with a model to evaluate trade-offs, these rules can be challenged and changed to achieve a more "global optimum" than each organization would be able to achieve on its own.

More than any other, this phase is likely to lead to some animated discussions. That's because each team member will question whether the company must continue to operate in a way that historically has created obstacles to achieving his or her organization's goals.

For example, someone may ask the customer service manager why it is important to continue to accept orders for same-day shipment after a certain time of day. Late cut-off times for same-day orders may mean more idling time for truck diesel engines (and thus more OC_2) emissions) because the warehouse was unable to pre-load a trailer for that order. Another costly "side-effect" of the late cut-off policy would be the need to have more personnel in the warehouse to handle last-minute orders. Likewise, someone might question minimum-stock requirements for consignment customers that are set so high that the customers never get close to stockout. Such a situation would require many more replenishment shipments than a more relaxed inventory target—again, increasing the amount of transportation-related emissions. The customer service representative might then ask whether the policy of minimizing the number of stocking locations to conserve inventory is really warranted if it results in more long-haul less-than-truckload (LTL) shipments, which have a much higher CO_2 footprint than full truckload shipments.

Other opportunities to challenge business rules may present themselves in the manufacturing arena. For instance, many manufacturing facilities contract for an electricity supply that would allow the plant to produce at maximum output at all times. On the one hand, that makes sense: The ability to ramp up production to maximum levels at any given moment reduces the amount of finished-goods inventory required in the supply chain. But on the other hand, this practice requires the utilities to operate at less than optimal efficiency. As a result, they end up generating more CO_2 per kilowatt-hour of electricity, just in case all of their customers require their peak load at the same time. If, however, the manufacturing plant limited its production (and thus its energy consumption) during periods of peak electricity load, then the utility could reduce its output of CO_2. The trade-off is that the plant would need additional finished–goods inventory to serve as a buffer against stock-outs.

5. Evaluate structural changes needed in the supply chain in order to meet goals. By this point in the process, all of the easy solutions have been exhausted, and it is time to look at structural changes that will be more difficult to implement. For example, companies may be looking at "rightshoring" manufacturing or procurement activities—or determining which activities could be best performed locally and which abroad. They could also start incorporating variability into their measurements of total delivered cost and environmental impact. This would involve, for example, making sure these calculations include the historical or predicted number of expedited shipments, which both add to the delivered cost and increase the carbon footprint of the supply chain. Other changes might include making capital investments to reduce emissions and energy consumption; switching to a more sustainable form of energy; or exiting certain sites, businesses, or markets.

As they consider these significant structural changes, the group may find that sustainability goals are competing against profitability goals. In these cases, the group will need to consider the trade-offs and decide which supply chain scenario will yield the optimal balance between those competing interests. For all of these scenarios, determining the best solution is likely to require both qualitative and quantitative trade-offs. A good example of a company using both qualitative and quantitative "measures of goodness" in this type of process occurred a number of years ago in a chemical industry project in England. The project's goal was to reduce the cost of shipping raw material to the plant. The optimization model's findings clearly showed the cost advantage of supplying the plant by tank truck instead of repairing the plant's ocean jetty to allow for supply by tanker vessel. However, the plant manager had made a public commitment to reduce the number of trucks traveling through the adjacent town. When questioned about his commitment to this promise, the plant manager said he would be willing to pay a premium of UK £100,000 per year to repair the jetty and use tanker vessels if it would allow him to keep the trucks off the road and keep his promise to the town. However, if it would cost £250,000 per year to use tanker vessels instead of trucks, he would renegotiate his agreement with the town. Thus, the monetary value of that qualitative "measure of goodness" (reducing the number of trucks) had been effectively bracketed. This bracketing approach can be used successfully for many different types of evaluations.

6. Evaluate target scenarios over a wide range of future assumptions. By now, the team should be coalescing around a small number of potential solutions that will achieve, or come close to achieving, a healthy balance of goals. However, much of the analysis is dependent on assumptions of future conditions, such as product demand, currency exchange rates, labor costs, freight costs, and so forth. Yet predictions of the future inevitably are wrong. The questions are, "How wrong are they?" and "In which direction?" Therefore, the last phase involves evaluating each scenario in light of the many different situations that might exist in the future.

Evaluations should be considered for the following types of changes:

- Moderate and dramatic increases in energy costs;
- New legislation (carbon tax, or cap-and-trade mechanisms);
- Demographic changes in "low cost" countries inflating wages and other costs; and
- Demand sensitivities, both upward and downward for example, including a scenario where "greenness" really sells).

This is also the time to determine whether there are external "trigger points" that would cause the team to decide to change the supply chain's structure or operation. Team members could consider whether, for example, if the price for a barrel of oil reached a certain level, would it decide to:

- Open or close a new warehouse or manufacturing operation?
- Switch modes of transport or locations of manufacture for certain product lines?
- Phase out certain products?
- Phase in new energy sources and/or technologies?

A better balance

Leading companies have long been successful in trading off competing financial objectives to find optimal profitability using supply chain network analysis and design. Adding environmental footprint and product-lifecycle stakeholders and data into this proven approach in order to trade off sustainability targets with traditional financial targets will do two things: It will cut through the confusion about how to go "green", and it will enable companies to balance the twin objectives of profitability and sustainability.

Our expertise shows that a robust and proven infrastructure analysis or network-design process has all of the capabilities needed to meet this new objective. The key is to get the right people to share their goals, leverage the appropriate data, and develop an agreed-upon framework to assess the value and acceptability of a given scenario across all of the relevant functions. Once the right people, data, and tools are in place, companies can conduct "what if" planning to ensure that they not only remain profitable in the many possible future scenarios but also achieve the complementary objective of maintaining a more environmentally sustainable business.

We believe that now is the time to cut through all of the current hype about "green" in corporate boardrooms and in the press and take concrete steps that will make a real difference in the sustainability of our supply chins. We have the tools and we have the process—now we need to act.

Endnote:

1. The U.S. Environmental Protection Agency's Smartway Transport Partnership program (www.epa.gov/smartway) offers fleet-performance models that can be downloaded to provide carbon dioxide emissions per loaded freight-mile. Other useful information can be found at www.berr.gov.uk/energy and www.un.org/issues/m-susdev.

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