<center>CHAPTER 3</center>

Performance Measurement & Metrics-Enabling Transparency, Visibility, and Sustainability

Firms now holding entire supply chains are accountable for new performance metrics

In God we trust, all others bring data.

<div align="right">W. Edward Deming</div>

Performance measurement and metrics are changing; consider the following:

- Walmart announced a goal to eliminate 20 million metric tons of GHG emissions from its global supply chain by the end of 2015. This represents one-and-a-half times the company's estimated global carbon footprint growth for five years and is the equivalent of taking more than 3.8 million cars off the road for a year. The footprint of Walmart's global supply chain is many times larger than its operational footprint and represents a more impactful opportunity to reduce emissions.

- Puma released the world's first EP&L statement uncovering 145M EUR of environmental impacts. Only 8M EUR were attributed to Puma's own operations, the remaining 94% were within their tier-1 through tier-4 supply chain. The company says future developments for the EP&L initiative include expanding the accounting methodology to include the social value created by the firm.

- EPA SmartWay programs increase the availability and market penetration of fuel-efficient technologies and strategies that help

freight companies save money while also reducing adverse environmental impacts. Specifically, SmartWay Transport programs lower emissions of carbon dioxide, nitrogen oxides, and particulate matter. As of 2010, Smartway Partners report: saving 50 M barrels of fuel ($6.1 B in fuel costs saved); eliminating 16.5 M metric tons of CO_2—equivalent of taking over 3 M cars off the road; eliminating 235,000 of tons nitrogen oxides, and 9,000 tons of particulate matter.

The growing complexity and changing landscape of sustainability are causing many to wait to see what metrics and standards will become accepted by the leading firms within an industry. Since these firms don't know what they will be measured and graded on, they don't know where to invest—so they wait. Those same organizations choosing to wait will inevitably have to catch up to proactive firms. For those willing to measure now (rather than waiting), there awaits numerous hidden opportunities to better understand processes, align entire supply chains, and to differentiate products and firms. Innovative firms are already taking a strategic stance on how they want to measure and manage sustainability opportunities. These same early adopting firms provide insight from which others can learn and improve upon. To help support this process, there are many guidelines and standards to help the next wave of adopting firms.

Objectives

1. Understanding the basics of performance measurement, including benchmarking, and how and where to integrate sustainability.
2. Introducing programs, guidelines, and tools to measure and manage supply chains.
3. Reviewing key performance indicators providing insight for carriers and less-than-truck-load service providers.

Introduction

"One of the most powerful management disciplines, the one that keeps people focused and pulling in the same direction, is to make an

organization's purposes tangible. Managers do this by translating the organization's mission—what it, particularly, exists to do—into a set of goals and performance measures that make success concrete for everyone. This is the real bottom line for every organization—whether it's a manufacturer or a service provider. Its executives must answer the question, 'Given our mission, how is our performance going to be defined?'"[1]

Someone who has a lot to say about performance measurement, sustainability, and corporate performance (and whose views are in line with the quote that began this chapter) is Bob Willard. A review of Bob Willard's most recent work uncovers very tangible performance improvements of innovative firms aligning mission and sustainability performance metrics. Based on years of working with an array of companies, Willard suggests that if a typical company were to use best-practice sustainability approaches already used by real companies, it could improve its profit by at least 51% to 81% within three to five years, while avoiding a potential 16% to 36% erosion of profits if it did nothing.[2] This business case is organized around seven bottom-line benefits that align with current evidence regarding the most significant sustainability-related contributors to profit. For example, a large manufacturer can:

1. Increase revenue by 9%
2. Reduce energy expenses by 75%
3. Reduce waste expenses by 20%
4. Reduce materials and water expenses by 10%
5. Increase employee productivity by 2%
6. Reduce hiring and attrition expenses by 25%
7. Reduce strategic and operational risks by 36%

Given the evidence of improved performance, many managers are both excited and cautious as to where they should start and what should be measured. First things first, we must recognize that the lack of a widely accepted definition of sustainable supply chain management and the complexity of overlapping supply chains make the selection and use of metrics both difficult and increasingly important for strategic alignment. What is needed (and often overlooked) is a process that links the strategic imperative of sustainability to performance measurement and management and

then ultimately to corporate performance. This process must ensure that there is alignment (consistency) between the various components so that what is done at one level is consistent with and supportive of the actions carried out at the other levels. A good starting point is that of understanding how you and your organization define sustainability.

Most firms start with the Brundtland definition of "meeting the needs of a current generation without compromising the needs of future generations to meet their own needs," and then add to this, customizing the meaning and keywords so that it aligns with their business model and a triple bottom line. This broad definition is a starting place, but does not provide the necessary insight regarding how to measure and integrate sustainability within your company.

To better define what is important while also aligning mission and metrics, Bill Blackburn[3] suggests developing a model sustainability policy. This process starts with a statement combining the Brundtland definition with an integrated bottom line[4] and then adding a breakout of topics important to your firm. For example, a company commitment to sustainability could start with the vision: "It is in the interest of our company and society as a whole that our company moves along the path to sustainability. To that end, we will strive to achieve the following vision of performance." Anyone can customize this further to have three additional sub areas of the vision covering financial capital, natural capital, and social capital. Within each of these areas, ask yourself the questions below:

- Do our business activities promote sustainable economic health for the company and global community?
- Do we conduct our business in a manner that contributes to the well-being of our employees and the global community?
- Do we manage our operations in a way that is protective of the environment to ensure the earth can sustain future generations and the company's ability to meet future needs?

By answering these questions and then looking for behaviors that support each of the three areas of the vision, you can further develop a customized sustainability policy to help guide behavior and measurement. This is a starting point for signaling what is important and how you will

design performance metrics that influence behavior. Here is a sustainability policy created by MBA students at Duquesne University:

> Our vision of sustainable performance includes researching and developing business opportunities that are economically, environmentally, and socially beneficial.
>
> - The program's economic success will depend on brand strength, community prosperity, and return on investment.
> - Our social responsibility includes action-driven learning, working with corporations on the business case for sustainability, respect for stakeholders, systems thinking, and an ethical approach to decision making.
> - Environmental responsibilities include resource conservation, recycling, reduction of supply chain impacts, collaboration with communities, the pursuit of energy efficiency and renewable energy sources.

Corporate examples can be seen within FedEx's global citizens' report[5] and themes highlighting "delivering what tomorrow requires today," with goals to connect the world in responsible and resourceful ways tracking progress in economics and access; environment and efficiency; community and disaster relief; people and the workplace. Others, such as UPS, are vague as to how sustainability is defined, instead stating their mission as "increase the efficiency and reduce the environmental impact of global commerce by combining the shipping activities of customers into a single, highly efficient logistics network." UPS translates this expertise into convenient services with a wide range of price points and delivery speeds, including options tailored to specific industries and expansion of carbon-neutral services to 36 countries.[6]

The vignettes at the start of this chapter and the FedEx and UPS examples highlight a few important trends. First, manufacturers and logistics providers alike are innovating practices and processes to meet the changing needs of their key customers and a diverse set of stakeholders. Sustainability policies are a starting point for signaling intentions; metrics
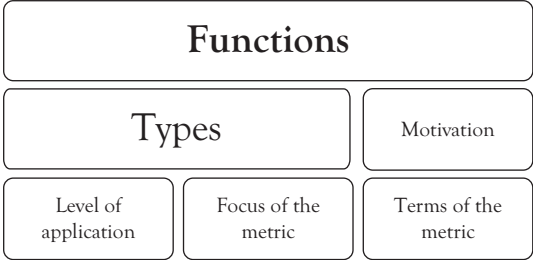
Functions

Types

Motivation

| Level of application | Focus of the metric | Terms of the metric |

Figure 3.1. The performance metric architecture.

signal what is important and what is not, both within the firm and its supply chain and to the market as a whole. Finally, that firms taking on the sustainability challenge are already experiencing gains in financial, natural, AND social capital, the foundations of sustainability, generating sustainable value added along with strategic competitive advantage.

In this chapter, we propose that single-firm metrics overlook the opportunity to measure and plan for multi-firm measures that are necessary to understand performance of a supply chain such as energy consumption, GHG emissions, and what is becoming a de facto measure within firms and across supply chains—CO_2. Next, we review a performance measurement architecture (Figure 3.1) and present evidence of the growth of sustainability performance metrics. We then go on to identify trends that will remain important to supply chain managers, and highlight the importance and differences of visibility and transparency now exposed within supply chains. By the end of the chapter, we review programs and tools available to help enable supply chain professionals facing sustainability supply chain management opportunities. Finally, we take a look at a less than truckload (LTL) company example using CO_2 to differentiate supply chain services before highlighting existing CO_2 reduction initiatives and available practices.

You Are What You Measure

Managers pursue multiple types of operations and supply chain metrics at different levels as a means to increase their visibility over aspects of the supply chain they do not control, yet they know will have impact on their own company's performance. Leveraging the Chapter 2 business model to align key customers, capabilities, and the value proposition provides any company an opportunity for process improvement. This improvement

will rely upon understanding and applying metrics that enable management to identify opportunities for improved profitability AND align sustainability objectives. The goal is to identify opportunities within an organization and across firms in a supply chain. We start with an understanding of the functions of performance measurement before transitioning to different types of metrics.

A metric is a verifiable measure assessed in either quantitative or qualitative terms and defined with respect to a reference point. This definition identifies several attributes of metrics.

- Metrics involve *measures* that capture data in numerical/quantitative form.
- Metrics are *verifiable*. Underlying the metric there should be a well-understood, documented process for converting data into the measure.
- Metrics require a *reference point*, otherwise known as a standard, providing a basis of comparison. Reference points are derived from previous performance, a computed or observed standard, or some ideal value (e.g., optimum value of performance).
- Metrics allow and encourage *comparisons* across processes, groups, time periods, and operating conditions.

Metrics exist because of, and to enable, people. They provide a language by which we can communicate specific information regarding the state or outcomes of a process. To understand their importance, consider the following functions provided by metrics:

- **Communication**. This is the most commonly identified function of metrics. Metrics report expectations and performance to process stakeholders (e.g., workers, managers, external agencies such as the GRI or Carbon Disclosure Project (CDP), and stockholders). Also, the selection of a given set of metrics communicates their importance to stakeholders. According to KPMG, Corporate Responsibility reporting has become the de facto law of business. Survey results show 95% of the Global 250 report corporate responsibility activities. What are you reporting/communicating?

- **Control**. Metrics enable managers to control and evaluate the performance of the people, processes, and business units. They also enable employees to control their own equipment and their own performance.
- **Expectations**. Metrics influence customers' expectations. For example, if we say that we will eliminate 20 million metric tons of GHGs by 2015, we have formed both an expectation and a metric (i.e., did we meet the amount propose by the deadline of 2015?).
- **Learning and Improvement**. Metrics identify gaps between outcomes and expectations. Learning occurs when workers try to understand the causes of and remedies for these gaps.
- **Transparency**. Corporate transparency reporting involves "the set of information items that relate to a firm's past, current and future environmental and social management activities and performance … [and their] financial implications."[7] Transparency is measured, managed, and reported by a firm and thus, the firm can control the message associated with its activities. Transparency is often revealed externally through corporate sustainability reports while following the GRI guidelines, and includes the submission of information to the CDP. Other innovative forms or transparency, enabled by technology, are helping firms to differentiate sustainability strategies. See for example trends in corporate responsibility reporting and the Dole farm locator program.

Within the organic agriculture and food industry, Dole's Organic Farm locator program allows consumers to see where their food comes from and the farm and farmer who grew the fruit. With the help of a smartphone or your computer, you can now see Dole's supply chains with more transparency than ever before.

By utilizing the Dole Organic Farm Locator, you can find the Don Pedro farm in La Guajira, Colombia. Consumers can see this banana farm has been certified since 2005, find photos of the farm, and certification Control Union Certification information from USDA – NOP Organic, ECC 834/2007 Organic, and GlobalGAP. Dole controls information and chain of custody communication to consumers knowing that organic credentials are important while providing access to all current and historical

Figure 3.2. Dole organic program farm #776.

organic farm certifications. This emerging form of transparency facilitates communication, sets expectations, and provides opportunities for consumers to learn more about the product and its supply chain. Consumers are now connected to supply chains and are more willing to be part of the value generation process.

- **Visibility.** Supply chain visibility is the ability of parts, components, or products in transit to be tracked from the manufacturer to their final destination. The goal of visibility is to improve and strengthen the supply chain by making data readily available to all stakeholders, including the customer. Supply chain visibility technology promotes quick response to change by allowing privileged users to take action and reshape demand or redirect supply. To take this a step further, organizations such as the United Nations Global Compact (UN GC) have a task force of industry partners to help identify common challenges of and solutions to tracing product and raw materials through complex global supply chains. This traceability is part of the UNGC's current supply chain sustainability efforts.

With the ever-increasing amount of data available through tools such as LCA, new mapping technologies now provide more visibility into supply chains. Take for example, Sourcemap.com. This freeware site allows users to post LCA maps of products. Right now, you and anyone else can go to this Web site and see where a laptop comes from. A drill down into the LCA information can now tell customers or consumers
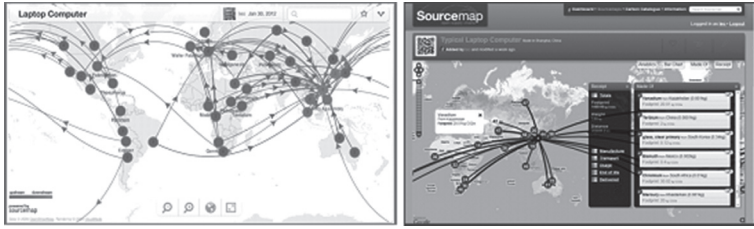
Figure 3.3. Sourcemap.com LCA laptop maps.

Source: Reproduced with permission from Sourcemap.com. Both maps added by Leo.[8]

what materials the product is made of, where these materials come from, and the amount of waste, for example, GHG emissions and CO_2 associated with manufacturing, transportation, use, and disposal or recycling of the product.

Managers can now use mapping and LCA information to identify the different entities and upstream and downstream linkages comprising the supply chain and value chain. In the example above, vanadium sourced from Kazakhstan contains 21.01kg CO_2 with other sources of materials highlighted consisting of terbium, glass, bismuth, chromium, and mercury. A further breakdown of this information reveals summaries of CO_2 contributions from manufacture, transport, usage, end of life, and the delivered product. After the initial focus on which supply chain members are delivering and moving what, attention can turn to waste elimination, and managing metrics with the greatest potential for increasing competitive advantage in terms of leveraging supply chain efficiency, product stewardship, innovation, and profitability.

Metrics play the critical role of translating an organization's strategy and business model into reality. They restate corporate objectives that are often broadly stated (e.g., reduce the impact of global commerce or increase market share) into actions that a person working in a given function (procurement, for example) can understand. For instance, suppose a manufacturer wants to implement a strategy based on differentiating products due to environmental attributes. One way to better define this goal for procurement is to measure the percentage of suppliers with third-party verification for their sustainability related practices and product attributes. Additionally, the supplier's ability to share information that now includes

attributes of sustainability will reduce the risk of supply chain disruption. In this way, metrics serve to define value and strategy in a business process. You can often get a better sense of a firm's value proposition by studying its metrics than you can be studying the corporate mission statement. Metrics and mission (the basis of the corporate value proposition) should be tightly linked to each other. As the adage goes, you are what you measure.

Supply chains provide a dynamic opportunity to better understand how we can leverage metrics within a systems thinking mindset to enable sustainability. Metrics serve as strong proponents or strong impediments to value creation. Many managers believe metrics are used only for control. In reality, metrics are used for communication and to report outcomes and, in doing so, they also motivate action. When the elements of product value (cost, quality, and timeliness) are identified, quantified, and stated in the form of meaningful metrics, then they become a powerful force for aligning organizational priorities, actions, and behaviors with strategic and value goals. If developed and implemented correctly, metrics form a critical link between value as it is strategically defined and the actions of various processes and people working within the operations management system. Metrics help to ensure that activities are consistent with what the firm wants to achieve in terms of value and how various employees will act.

Types of Metrics

Metrics are pervasive throughout different organizational levels and departments within a firm or supply chain. We will focus our attention on the different types of metrics found in most operations management systems (Table 3.1). These metrics can be categorized in four basic ways:

- Level of application: for what organizational levels are the metrics intended?
- Focus of the metrics: are the metrics oriented toward efficiency or effectiveness?
- Terms of the metrics: are the metrics stated in financial or operational terms?

Table 3.1. Levels of Metrics[9]

Level	Examples	Orientation
Multi Firm	Sustainable Value Added (SVA), Economic Value Added (EVA),[10] risk of supply chain disruption, cradle-to-grave Life Cycle Assessment, Corporate Ecosystem Valuation (CEV),[11] Shared Value, Scope 3 GHG, normalized CO_2, Carbon Disclosure Project (CDP) supply chain member	Broad-based, strategic (long term) understanding of contribution from suppliers, own operations, to customers and end users; value, impact, and waste created in the system, includes traditionally overlooked externalities
Corporate or Business Unit	Sales, growth of sales, market share, stock prices, credit rating, performance on key strategic activities (e.g., on-time arrival and departure e.g., Southwest Airlines), high-performance buildings (Leadership in Energy and Environmental Design, LEED, or Energy Star), Scope 1 & 2 GHG, Environmental Profit & Loss statement, included in Dow Jones Sustainability Index, FTSE 4 Good	Broad-based, strategic (long term), aggregate units, many financial, includes recognition by external organizations
Product	Market share, contribution margin,[12] functionality, quality or reputation, repeat purchases, cost per unit (as compared to the budgeted cost), recommendations (by critical groups such as Consumer Reports®, or Good Guide), inventory level, % recycled content, free of xxx (where xxx could be an element such as BPA), Energy Star, qualifies for Green Seal or Ecologo, Design for Sustainability, Environmental Product Declaration (EPD), C2C certification	Broad-based, cross-functional, measure that can be measured at one location or across locations. Can be strategically oriented (e.g., market share, reputation, externally verified product attributes or labels, recyclability) or operational (e.g., inventory or design)
Process	On-time delivery rate, number of units produced, lead time, zero waste, carbon neutral, water neutral, Scope 1 GHG emissions, 100% renewable energy	More focused, tactically oriented, stated in terms appropriate and meaningful to the function or group
Individual/ Activity	Utilization, downtime, number of units produced per period; energy, water, or emissions per standard unit of production	Very focused, operational, emphasis on performance improvement, and normalized to unit of production

- Motivation for the metrics: are the metrics used in predictive or outcome-oriented manner?

Level of Application

Generally, metrics can be applied at different levels or units of analysis.

The set of metrics used by top management should be different from the set of metrics used by frontline workers. In some cases, however, the same metrics are applied at multiple levels. Metrics applied at higher organizational levels are often aggregates of metrics at lower levels.

Focus of Metrics: Effectiveness vs. Efficiency

Effectiveness-based metrics measure performance on dimensions that are of greatest interest to targeted customers. These metrics answer the critical question "What do I have to do well for the critical customer (and ultimately for the firm) to succeed?" Effectiveness-based metrics link customers, strategy, and activities together. In contrast, efficiency-based metrics focus more on resource utilization and costs. These measures are often formulated independent of customer considerations. Efficiency-based metrics answer the question "How well or efficiently did I or my department do this task?" Both effectiveness and efficiency metrics are needed in operations and supply chain management. However, truly value-driven operations tend to elevate the importance of effectiveness metrics over efficiency metrics.

Metrics Stated in Financial or Operational Terms

The metrics that management typically refers to as supply chain performance focus on attributes of transportation such as lead time, fill rate, or on-time delivery. Metrics are usually reported either in financial terms (e.g., return on investment, profitability, other monetary measures) or operational terms (e.g., lead times, units of inventory, number of defects).

Financial measures do not provide insight regarding how well business processes have performed, how effectively the supply chain has met the needs of critical customers, or how much waste can be attributed to supply chain processes. As was pointed out by Willard earlier in this

chapter, sustainability leads to financial gains through increased productivity and revenue, while also decreasing energy, materials, attrition, risk, and waste.

Waste is anything that does not add value to a product or service, that is, GHGs. Knowing this, supply chain managers are measuring performance outside the firm, evaluating tier 1 through 4 suppliers, responding to stakeholders, and relying on third-party providers to help in this process. Sustainability performance metrics such as GHGs are an opportunity for firms to realize a new level of waste measurement and associated costs as visibility increases within a supply chain. There are now new tools and standards enabling an understanding of where opportunities exist to decrease waste, while increasing competitiveness, customer value, and shareholder value[13] for firms across a supply chain.

Operational metrics are most useful to those people involved in carrying out a specific task or activity being measured, because operational metrics can be clearly linked to the sources of performance in the process. In contrast, financial metrics are most useful for people who evaluate and compare processes (e.g., managers, investors). By putting things in monetary terms, financial metrics allow "apple-to-apple" comparisons.

New operational metrics include but are not limited to water use, GHG emissions, land use, air pollution, and waste. The use of these new metrics helped to form the first EP&L statement by Puma in the Fall of 2010.

Puma is a sport-lifestyle company that designs and develops footwear, apparel, and accessories. Phase I of this three-phase process resulted in Puma, uncovering and valuing environmental impacts in excess of 145 M Euro (Table 3.2). This level of analysis included tier-1 through tier-4 suppliers revealing 94% of environmental impacts resulting from suppliers and not the direct operations of Puma. Here we see new operational terms used to help link processes and performance while new trends toward integrated financial and sustainability reporting reveal efforts to measure environmental impacts and social value of a firm.

Table 3.2. Puma EP&L statement (Phase I)

The environmental profit and loss							
EUR million	**Water use**	**GHGs**	**Land use**	**Other air pollution**	**Waste**	**Total**	**% of total**
	33%	33%	25%	7%	2%	100%	
Total	**47**	**47**	**37**	**11**	**3**	**145**	**100%**
PUMA operations	<1	7	<1	1	<1	8	6%
Tier 1	1	9	<1	1	2	13	9%
Tier 2	4	7	<1	2	1	14	9%
Tier 3	17	7	<1	3	<1	27	19%
Tier 4	25	17	37	4	<1	83	57%

Source: Puma EP&L Press Kit[14]

Motivation: Predictive and Outcome Metrics

Metrics can be used to both judge outcome performance and to predict future performance. An *outcome* metric supports evaluations of individuals and processes as a basis for rewards or for determining where attention is needed. For example, a manager's bonus might be tied to performance on a given set of metrics. In contrast, a *predictive* metric is aimed at increasing the chances of achieving a certain objective or goal in the future. Predictive metrics are associated with aspects of the process that are thought to affect the outcomes of interest. If our interest is in reducing lead time, then we might look at leading indicators of lead time such as the distance required to be traveled by an order, the current level of utilization in a process, and so on. If new supply chain initiatives involve increasing social and natural capital, then firms should put in place communication and training programs to leverage existing certifications, collaboration with NGOs, and use of a broad array of key performance indicators. Predictive metrics are appropriate when the interest is in preventing the occurrence of problems, rather than correcting them.

In many systems, the bulk of metrics are outcome oriented, rather than predictive (Table 3.3). For example, they measure on-time delivery

Table 3.3. Examples of Predictive and Outcome Metrics

Performance category	Outcome metrics	Predictive metrics
Lead times	Total order to delivery lead time	Bottleneck cycle time Setup time Throughput time for longest process Number of steps in a process Distance in a process Inventory in the system
Flexibility	Number of product variants Percentage of products that are made to order	Number of different job classes (fewer is better) Number of levels in the typical bill of material Setup time Percentage of cross-trained employees Percentage of parts/components that are common across product line
Quality	Parts-per-million defective (PPM)	Number of certified suppliers Process capability (Cp, Cpk)
Cost	Unit cost variance (between standard and actual) Direct labor cost variances Direct material cost variances Overhead costs variances	Costs to date Number of steps in the process Distance traveled by the order Number of changes processed Throughput time
Morale and Teamwork	Number of labor disputes Grievances filed Number of employee-requested terminations Level of absenteeism	Number of suggestions per employee Amount of training/ education time/employee Number of skills/person.
Social capital	Number of minority-owned suppliers No child labor Unhealthy work environment Executive and board diversity Non representation of women Transparency concern Corporate sustainability report Shared value	Level of diversity training Socially responsible supplier audits SA 8000 certification ISO 26000 certification Availability of OSHA training Diversity hiring and promotion practices Women and minorities have at least 4 seats on the board and >5% of subcontracting Measure wide range of social and environmental performance metrics[15]

(*Continued*)

Performance category	Outcome metrics	Predictive metrics
		Collaborate with NGOs (GRI, WBCSD,)
Natural Capital	Environmental fines (dollars) Pounds of pollution produced Percentage of waste recycled or reused TRI reporting Transport impacts of product and workforce Non monetary compliance sanctions Scope 1—3 GHG emissions Corporate Ecosystem Valuation	Process yield ISO 14000 & 50000 certifications Energy Star certifications Inventory of toxic materials on premises Percentage employees trained to handle toxic materials Floor space devoted to storage, processing, or disposal of toxic materials Investment in more efficient equipment Measure wide range of indicators, including materials, energy, water, biodiversity, and LCA of product and transportation

of products rather than looking measures that might predict on-time performance (e.g., inventory accuracy, setup time, and total lead time for a specific operation). As a result, the metrics system gives the managers little information that suggests means for improvement. More and more, firms are turning their attention to the development of predictive metrics. They recognize that such measures are far more useful. Some commonly used operational metrics include those in Table 3.3 above.

> Measurement is the first step that leads to control and eventually to improvement. If you can't measure something, you can't understand it. If you can't understand it, you can't control it. If you can't control it, you can't improve it.
>
> H. James Harrington

What is the difference between predictive and outcome-based metrics? Experience (outcome-based metrics) is enlightening. It enables you to recognize a mistake when you make it again, and again, and again. Predictive metrics enable you to recognize a potential mistake before you make it. Of

critical importance to the successful integration of sustainability into any firm is the use of predictive metrics.

Sustainability: A Performance Measurement Evolution or Revolution?

We see the use of financial and operational metrics as a performance hierarchy (Figure 3.4), with a typical progress of management thinking and sustainability providing new opportunities to accelerate innovation. The ability to align sustainability as a strategic imperative across a supply chain means that you are simultaneously engaging multiple levels of the performance hierarchy from cost savings to value creation while using sustainability as a catalyst for the integration of new multifirm performance metrics.

With increased scrutiny of investors and customers, coupled with the ability of technology to quickly showcase supply chain problems, multi-firm metrics aligning sustainability provide insight for risk management. This level of thinking also enables both visibility and transparency through telling compelling stories of efficiency, stakeholder engagement, and innovation. Companies are now mapping and managing supply chains in new ways.

In order for management to understand the interrelationships between corporate and supply chain performance, more broad-based measures are required to move firms from efficiency and cost savings into opportunities for innovation, revenue generation, and new markets. Measures now
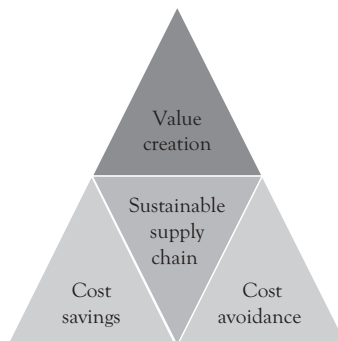

Figure 3.4. Performance hierarchy.

integrate financial and non financial performance. The complexity of the supply chain requires a different approach for understanding how and where sustainability will align with your business model and corporate performance. A number of factors contributing to the need for more comprehensive performance management include but are not limited to:

- The push for more visibility and transparency within supply chains
- The increasing complexity of supply chains
- The need to go beyond internal metrics to understand a supply chain perspective
- The need to understand interrelationships of corporate *and* supply chain performance
- The new availability of data from LCA and product development processes
- The use of new performance metrics for supply chain analysis and optimization
- The need for accountability of supply chain waste and SVA
- Differentiation and competitive advantage

Managers need to see into their supply chain by measuring and comparing the performance and activities of companies they do not directly control. Increased visibility and shared metrics assist management with the integration, synchronization, and optimization of processes cradle to grave (raw material extraction to landfill) or cradle to cradle (from raw materials to closed-loop systems recapturing raw materials as inputs). Implementing a supply chain strategy requires metrics that align performance with the objectives of other members of the supply chain. Supply chain and sustainability managers need to work collaboratively to generate the greatest mutual gains and resource efficiency. Aligned metrics help shift management's attention to making decisions that also align with the goals of the entire supply chain.

The overlay of sustainability within supply chin analysis and planning involves an understanding of how to approach creating sustainable value, and the application of emerging measurement tools and quantitative models that characterize various relationships and economic synergies in the supply chain. The field of supply chain analysis/optimization has made

significant strides in both theoretical and practical application of waste reduction. The application of a sustainability lens to analysis results in an unprecedented mixture of predictive and outcome models, global reporting, new visibility and transparency within supply chains, and like the Puma EP&L example, the ability to quantify full costs of operations, products, and supply chains. Next, we discuss how to get started, and the guidelines, tools, and models already available to leverage the integration of sustainability into supply chain management.

Models, Program, Guidelines, and Tools to Help Integrate Sustainability

So far in this chapter we have provided a foundation for understanding performance metrics, reviewed the performance metric architecture, levels of metrics, examples of predictive and outcome metrics, and foreshadowed sustainability as the driver of a performance revolution. We now introduce proven models, practices, and insight that help guide measurement and process improvement. The information presented here is a brief summary of models, programs, guidelines, and tools to help customize your own integration opportunities and processes.

The Supply Chain Operations Reference Model

For some, starting with a thorough understanding of your existing supply chain sets the foundation for then integrating sustainability initiatives. With the advent of supply chain management, managers have increasingly sought to coordinate activities spanning customer and supplier organizations. One of the challenges of this approach is finding new ways to communicate objectives and performance outcomes among supply chain partners. In the late 1990s, a group of industrialists from about 70 leading companies created an organization called the "Supply Chain Council." Working together, they developed the Supply Chain Operations Reference Model (commonly known as the SCOR model).[16] The model was originally conceived as a framework reference defining concepts and metrics that could be used by organizations in any industry segment to share information with supply chain partners.
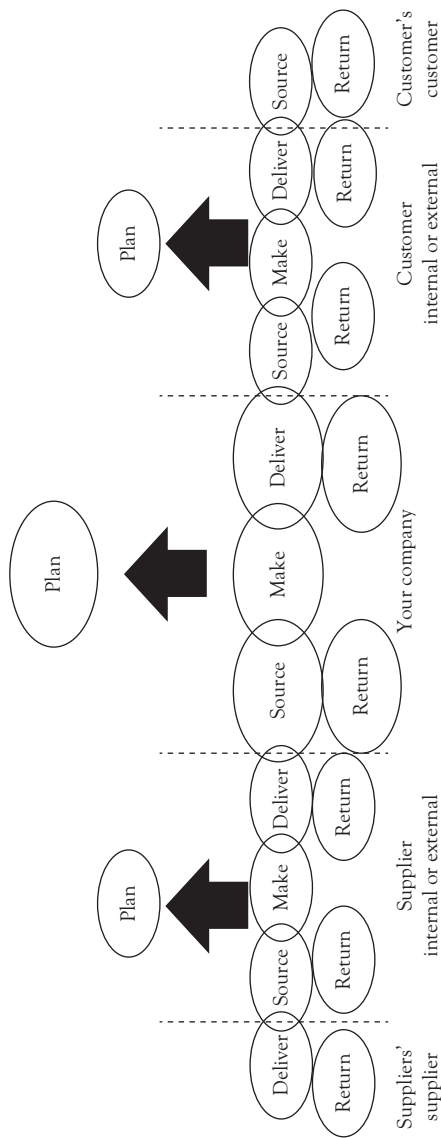
Figure 3.5. The SCOR model and its major components.

Source: Supply Chain Council's Supply Chain Operations Reference-model (SCOR)

The SCOR model includes more than just metrics; it illustrates tools for mapping and describing supply chain processes. It also describes supply chain management best practices and technology. SCOR best practices section now includes environmentally responsible supply chain management (called GreenSCOR). However, we will focus here on several dimensions and relative metrics of the model. The SCOR model identifies basic management practices at different levels of operation. For example, "level 1" processes include Plan, Source, Make, Deliver, and Return. One of the basic tenets of the SCOR model is that metrics should cascade hierarchically from one level to the next.

At each of the levels addressing the supply chain, SCOR addresses five basic dimensions of performance. They are:

- *Supply Chain Delivery Reliability*:
  - The performance of the supply chain in delivering the correct product, to the correct place, at the correct time, in the correct condition and packaging, in the correct quantity, with the correct documentation, and to the correct customer.
- *Supply Chain Responsiveness*:
  - The velocity at which a supply chain provides products to the customer.
- *Supply Chain Flexibility*:
  - The agility of a supply chain in responding to marketplace changes to gain or maintain competitive advantage.
- *Supply Chain Costs*:
  - The costs associated with operating the supply chain.
- *Supply Chain Asset Management Efficiency*:
  - The effectiveness of an organization in managing assets to support demand satisfaction. This includes the management of all assets: fixed and working capital.

The SCOR model identifies performance metrics for each of these dimensions. One of the objectives of the model is to provide a framework for benchmarking and for translating strategy into practice. The following strategic environmental metrics allow the SCOR model to be used as a framework for environmental accounting:

- Carbon Emissions (Tons CO_2 Equivalent)
- Air Pollutant Emissions (Tons or kg)
- Liquid Waste Generated (Tons or kg)
- Solid Waste Generated (Tons or kg)
- Recycled Waste (Percent)

The SCOR framework ties emissions to the originating processes, providing a structure for measuring environmental performance and identifying where performance can be improved. The hierarchical nature of the model allows strategic environmental footprint goals to be translated to specific targets and activities.[17] The results of mapping a supply chain and benchmarking analysis provide the level of performance necessary to be on a par with the industry middle performers, as well as levels required to gain differential advantage. The benchmarking data can indicate the impact of improvement in a given outcome performance metric, either on revenues, costs, or investments. This type of analysis helps partners in a supply chain to plan and prioritize sustainability improvement initiatives in accordance with an overall business strategy.

The primary benefit cited by SCOR users includes process metrics and the benchmarks included in the SCOR guidelines. These guidelines help to show company executives a tangible picture of supply chain gap analysis and shortcomings. In doing so, the SCOR guidelines help direct supply chain performance plans.

Global Reporting Initiative (GRI)

The GRI (www.globalreporting.org/) is a multi-stakeholder non profit organization founded in the US in 1997 by the Coalition of Environmentally Responsible Economies (CERES). In 2002, GRI was formally inaugurated as a United Nations Environment Program (UNEP) collaborating organization and moved its central office to Amsterdam, where the Secretariat is currently located. GRI has regional "Focal Points" in Australia, Brazil, China, India and the USA, and S. Africa and a worldwide network of 30,000 people.

This organization produces a sustainability reporting framework that has become the de facto framework used around the world to enable

greater organizational transparency, and their guidelines are available to the public at no cost. GRI's reporting guidelines are used by over 1,500 companies in 60 different countries.[18] The GRI's mission is to mainstream the disclosure of environmental, social, and economic performance metrics for companies. The goal of GRI is to develop a standard practice for sustainability reporting that allows stakeholders to compare sustainability related data. These guidelines have been in use for over ten years as the original set of GRI reporting guidelines was released in 2000.

There are several options for reporting depending on the level of detail and amount of metrics a firm can measure and verify. After a company has decided to utilize the GRI reporting structure, the GRI metrics can be used as an audit template internally. The internal auditing and reporting process categorizes information for a general profile disclosure, management approach, an executive mission statement, and a strategy for executing sustainable initiatives. These initiatives are then linked to performance indicators as they relate to economic, environmental, and social metrics. The principles and guidelines help to make the report tailored to a company's specific industry and the sustainability challenges they face.

Primary benefits of GRI reporting include the use of existing performance metrics for environmental, social, and human rights, society, and product responsibility and the ability to have third-party verification of report contents. Thus, you do not have to reinvent the wheel when looking for relevant environmental and social metrics. Developing a GRI-based sustainability report can be beneficial undertaking for any company. The auditing and reporting process facilitates process level understanding of operations and supply chains and should be leveraged to inform management decisions, identify activities and benchmarks for cost reduction and avoidance, supply chain integration, brand reputation, and market differentiation. GRI guidelines and performance metrics are also leveraged for the assessment of corporate governance. In a recent survey of GRI report readers, 90% of those polled said that reading the sustainability reports resulted in them viewing the companies in a more positive light.[19]
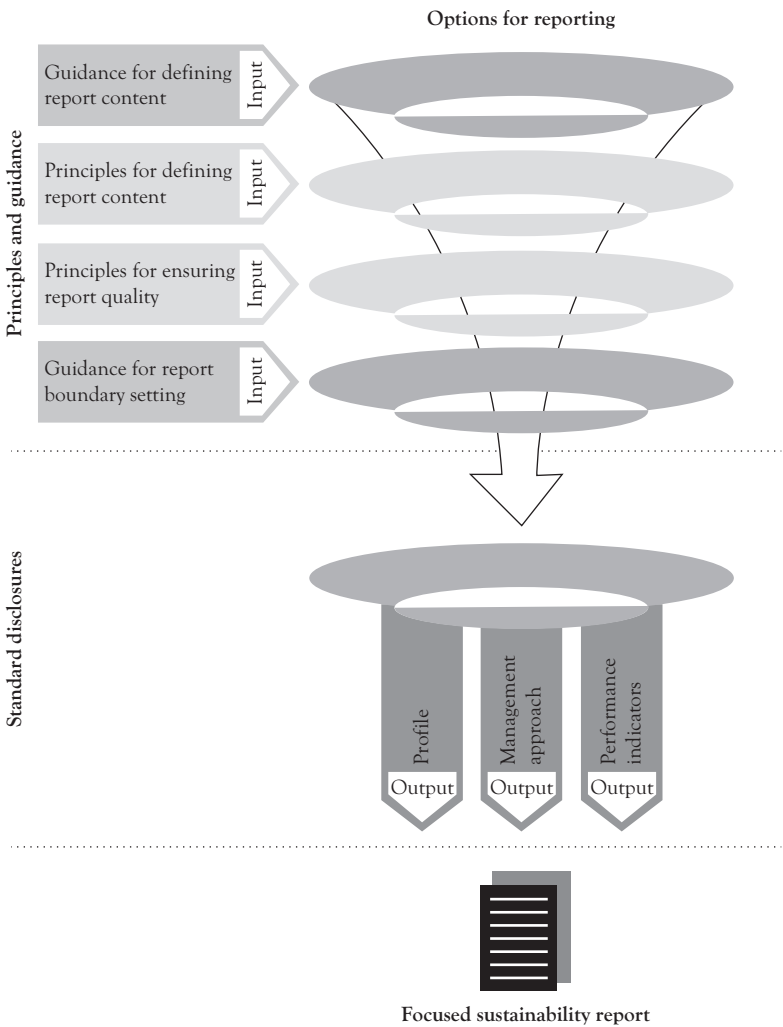
Carbon Disclosure Project (CDP)

In 2000, the CDP (www.cdp.net) was established to collect information from companies to "accelerate unified action on climate change."[20] Based in the United Kingdom, the CDP provides centralized accounts of corporations' climate-change and water-management policies and measures their direct impact on the environment through GHG emissions. Working with over 650 institutional investors holding over $78 T in assets, the CDP has an expansive worldwide presence, including offices in New York, Berlin, Sao Paulo, Beijing, and Tokyo.[21]

CDP reports a company's emissions based on scope, reduction from base year, and target year emissions. Like many sustainability programs, CDP believes in using base targets to set goals for reduction. In the Supply/Chain Public Procurement options, supplier companies' carbon information is requested in order to identify emissions through all parts of the production and distribution process. The Supply Chain Report, A New Era: Supply Chain Management in a Low-Carbon Economy is available as a free download highlighting survey results of CDP reporting organizations and suppliers.[22] Results of the survey show that 90% of CDP supply chain member organizations have a climate change strategy. Additionally, 62% reward suppliers for good carbon management practices with 39% soon to deselect suppliers that do not adopt such measures. The CDP also collects data outside of carbon management. Water-intensive companies report water usage and issues regarding coping with threats arising from water scarcity, pollution, and flooding. Cities report in order to prepare for effects of climate change, benchmark, and relate to the business communities.

To begin disclosing, a company submits an online questionnaire focusing on targets, emissions, risk management, scope, etc. This can be done individually or the CDP offers links to carbon calculator partners, consultancy partners, and third-party verification partners. The resulting reports allow you to calculate carbon footprint, identify areas for improvement, and benchmark against other groups.

There are a number of benefits associated with reporting emission data and water use data through the CDP. One key benefit is the opportunity to advertise successes, particularly in comparison to industry competitors.

Options for reporting

Principles and guidance

Guidance for defining report content — Input

Principles for defining report content — Input

Principles for ensuring report quality — Input

Guidance for report boundary setting — Input

Standard disclosures

Profile — Output

Management approach — Output

Performance indicators — Output

Focused sustainability report

The GRI structure—the major components.

The process of reporting this data can also help an organization identify areas for improvement in energy efficiency and cost savings. Organizations benefit by having a standardized response prepared for investor inquiries regarding emissions and water use. Additionally, participation in the CDP can be viewed as a favorable demonstration of transparency that can help set an organization apart from its competitors. This can be of particular value during times when investor confidence in the integrity of organizations is wavering.

Greenhouse Gas (GHG) Protocol

While climate change policy is still evolving, organizations are seizing the GHG space as a means of differentiation and waste reduction. To help in this process, the GHG Protocol Initiative (www.ghgprotocol.org) arose when World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD) recognized the need for an international standard for corporate GHG accounting and reporting. Together with multinational corporate partners such as British Petroleum and General Motors, WRI identified an agenda to address climate change, among which included the need for standardized measurement of GHG emissions. In the late 1990s, WRI and WBCSD convened a core steering group comprising members from environmental groups (WWF, Pew Center on Global Climate Change, The Energy Research Institute) and from industry (Norsk Hydro, Tokyo Electric, Shell) to engage in a multistakeholder standards development process.

The GHG Protocol is now the most widely used international accounting tool for government and business leaders to understand, quantify, and manage GHG emissions. As part of a decade-long partnership between the WRI and the WBCSD, the GHG Protocol is the result of work with businesses, governments, and environmental groups around the world to build a new generation of credible and effective programs for tackling climate change. It serves as the foundation for nearly every GHG standard and program in the world—from the International Standards Organization (ISO) to The Climate Registry—as well as hundreds of GHG inventories prepared by individual companies. The GHG Protocol also offers developing countries an internationally accepted management tool to help their businesses to compete in the global marketplace and their governments to make informed decisions about climate change.

The GHG Protocol Corporate Accounting and Reporting Standard (also called the Corporate Standard) was published in 2001. Since then, the GHG Protocol has built upon the Corporate Standard by developing a suite of calculation tools to assist companies in calculating their GHG emissions and additional guidance documents such as the GHG Protocol for Project Accounting. Additionally, WRI and WBCSD have

partnered with governments, businesses, and non government organizations in both developed and developing countries to promote the broad adoption of the GHG Protocol as the foundation for sound climate change strategies.

The primary benefits of using the GHG protocol include its acceptance as a global standard, understanding of process level performance metrics, and the scope and bounds of GHG measurement for organizations and supply chains. This information is important for understanding and determining who is responsible for GHG emissions, goal setting, and differentiating from others within an industry. Understanding starts with knowing the scope of GHG emissions and what you have direct control over.

GHG Protocol Emission Definitions

Scope 1: Direct GHG emissions—Direct GHG emissions occur from sources that are owned or controlled by the company (e.g., emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.) along with emissions from chemical production in owned or controlled process equipment.

Scope 2: Electricity-indirect GHG emissions Scope 2 accounts for GHG emissions from the generation of purchased electricity consumed by the company. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organizational boundary of the company. Scope 2 emissions physically occur at the facility where electricity is generated.

Scope 3: Other indirect GHG emissions Scope 3 is an optional reporting category that allows for the treatment of all other indirect emissions. Scope 3 emissions are a consequence of the activities of the company, but occur from sources not owned or controlled by the company. Some examples of Scope 3 activities are extraction and production of purchased materials; transportation of raw materials and finished goods; and use of sold products and services. For products such as consumer electronics, the use of the product will have the largest impact on GHG emissions.

In 2006, the International Organization for Standardization (ISO) adopted the Corporate Standard as the basis for its ISO 14064: Specification with Guidance at the Organization Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals. This milestone highlighted the role of the GHG Protocol's Corporate Standard as the international standard for corporate and organizational GHG accounting and reporting. ISO, WBCSD, and WRI signed a Memorandum of Understanding in 2007 to jointly promote both global standards.

The SCOR model, CDP, and GHG protocol provide vast amounts of information for global supply chain mapping, benchmarking, and performance metrics. These initiatives are broad based, providing organizations with proven guidelines and models for measuring, understanding and with the help of the GRI framework, reporting process level performance rolled up into organizational and supply chain performance. Two of the three initiatives are specifically focused on GHG and carbon measurement. What many supply chain service providers need at a more micro level includes incentives, policy, and technical solutions to optimize transportation networks in a company's supply chain. Thus, we next introduce programs within a US context for fuel efficiency and waste reduction.

SmartWay Program

As we found with the Puma EP&L example, many manufacturers have found a significant portion of their carbon footprint lies in the supply chain and distribution of products. To help reduce these impacts and better manage your supply base, you can leverage existing collaborative efforts from the SmartWay Program (http://www.epa.gov/smartway). This is the US Environmental Protection Agency's (EPA) program for improving fuel efficiency and reducing GHGs and air pollution from the transportation supply chain industry. The program includes four general areas of focus: transport partnership, tractors and trailers, finance, and technical assistance. Developed jointly in early 2003 by the EPA and Charter Partners represented by industry stakeholders, environmental groups, American Trucking Associations and Business for Social Responsibility, the program was launched in 2004. SmartWay comprises of partnerships,

financial incentives, policy and technical solutions, and research and evaluation projects that find new ways to optimize the transportation networks in a company's supply chain. To date, the partnership includes nearly 2,900 companies and associations committed to improving fuel efficiency. The SmartWay programs support the supply chain industries in the following ways:

- The SmartWay Partnership program is a government/ industry collaboration between EPA, freight shippers, carriers, logistics companies, and other stakeholders, to *voluntarily* achieve improved fuel efficiency and reduce environmental impacts from freight transport.
- Participating companies benchmark their current freight operations; identify technologies and strategies to reduce their carbon emissions, track emissions reductions, and project future improvement.
- SmartWay partners demonstrate to their customers, clients, and investors that they are taking responsibility for the emissions associated with goods movement, are committed to corporate social responsibility (CSR) and sustainable business practices, and are reducing their carbon footprint.
- SmartWay-endorsed tractors and trailers meet voluntary equipment specifications that can reduce fuel consumption by 10–20% for 2007 or newer long-haul tractors and trailers. Each qualified tractor/ trailer combination can save operators between 2,000 and 4,000 gallons of diesel per year while also reducing GHG emissions and air pollutants.
- To help with capital expenditures, programs include helping companies acquire fuel-efficient emission reduction technologies through easier access to financial mechanisms such as reduced-interest loans with flexible terms.
- To provide evidence-based solutions, the SmartWay assessment program tests and verifies emissions reductions and fuel savings from various available technologies, such as tractor and trailer aerodynamics, auxiliary power units, and wide-based tires. As a result, companies can compare the fuel efficiency and environmental performance of various technologies and make more informed purchases.

Benefits from becoming a SmartWay partner starts with the assessment of freight operations; calculating fuel consumption and carbon footprint; and tracking fuel-efficiency and emission reductions annually. In exchange for this upfront learning and resource expenditure, the EPA ranks and publicizes partner's performance on the SmartWay Partner List. Superior performers earn the SmartWay Partner logo and associated point value. Participation in SmartWay helps carriers to identify opportunities to improve efficiency; demonstrate efficiency to potential customers, and reduce fuel costs. Participation in SmartWay also helps shippers and logistics companies choose more efficient carriers; assess optimal mode choices; and reduce their transport carbon footprint.

The SmartWay programs provide a focused insight into fuel and pollution reduction that for many invokes an image of long haul tractors and trailers. It is also beneficial to drill down into more detail regarding a GHG focus within carriers and the LTL service providers. This insight reveals a number of existing practices with room for many in the industry to catch up to best practices. After reviewing activities within a regional context for logistic service providers, we next transition into information on how corporate sustainability professionals perceive successful sustainability initiatives and how these same professionals work with supply chain professionals to collaborate for success.

GHG Management Within Carriers and an LTL Company Context

Suppliers of both goods and services to leading edge sustainable organizations are seeing a shift from *optional* GHG improvement initiatives to *required* sustainability strategies to remain a viable supply chain partner. The first step in sustainable supply chain management for most organizations is to measure and control direct and indirect GHGs in house, or what is generally referred to as sources owned and controlled by the company (Scope 1 Direct emissions) and those from electricity consumed by a firm (Scope 2 Indirect emissions). However, for many manufacturers, a significant portion of their carbon footprint lies in the supply chain and distribution of products. More aggressive sustainability programs now expand their assessment and improvement requirements to Scope 3 partners.

PITT OHIO

Supply chain ▪ Ground ▪ LTL ▪ TL

PITT OHIO—Transportation solutions provider

Specifically, one of the largest contributors of CO_2 for many manufacturers' total carbon footprint comes from the logistics services required to properly position material and finished product in today's global supply chains. Despite the relatively large contribution of transportation to an overall carbon footprint, one of the major hurdles in tracking supply chain emissions is an understanding of how to develop scope 1 through 3 emissions reporting capabilities.

The leadership of some carriers such as PITT OHIO recognizes both the need and the potential benefit of gaining visibility and control over their carbon footprint as important to maintaining their competitive advantage in the industry into the future. This case example describes the elements of measuring CO_2, can provide the necessary link to current Activity-Based Costing (ABC) systems to permit viable CO_2 allocation to customers, and reveals best practices to assist any carrier in the development of a sustainable strategic plan.

LTL Carbon Metrics

The GHG Protocol Corporate Standard provides an internationally accepted guidance for companies and other organizations preparing a GHG emissions inventory. It covers the accounting and reporting of the six GHGs covered by the Kyoto Protocol—carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6). While all six gases are not emitted from every industry, the guidance provides a structured approach to identifying Scope bounds for an emission inventory and methodology for summarizing an overall CO_2 equivalent. The protocol was designed with the following objectives for all firms including transportation providers:

- To help companies prepare a GHG inventory that represents a fair account of their emissions, through the use of standardized approaches and principles
- To simplify and reduce the costs of compiling a GHG inventory
- To provide business with information that can be used to build an effective strategy to manage and reduce GHG emissions
- To increase consistency and transparency in GHG accounting and reporting among various companies and GHG programs

The protocol builds on the experience and knowledge of over 350 leading experts drawn from businesses, NGOs, governments, and accounting associations. It has been road-tested by over 30 companies in nine countries. The GHG Protocol Initiative's vision is to harmonize GHG accounting and reporting standards internationally to ensure that different trading schemes and other climate-related initiatives adopt consistent approaches to GHG accounting.

Preparing an emission inventory has the potential to be straight forward in some environments where only direct emissions are calculated. The aggregation, transfer/sortation, line haul, and distribution nature of LTL and parcel transport add a level of complexity to CO_2 calculation and distribution not encountered in bulk transportation methods. Multiple types of equipment in various sizes, picking up and delivering shipments with a wide variety of sizes, weights, and distances traveled makes it a challenge to determine exactly how much carbon is generated within each step of a process, and even more challenging to calculate what portion of that carbon footprint belongs to each stakeholder involved.
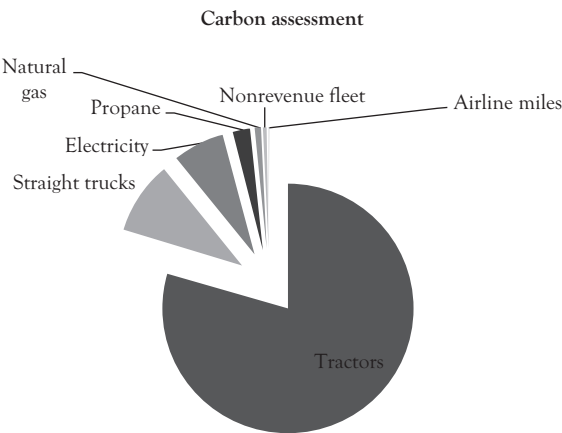
Carbon Assessment

With insight provided from PITT OHIO customers, a number of these companies are in the early stages of measuring supply chain CO_2 emissions, they have goals and performance metrics tied to CO_2, carrier selection is moving toward a carriers ability to reduce CO_2, and the three primary decision criteria for some customers is a combination of service, price, and sustainability, not necessarily in this same order.

One of the primary opportunities to get started is a baseline CO_2 assessment. After reviewing a number of publicly available carbon calculators, we find these approaches to be oversimplified by looking only at average burn rates and load factors, they aggregate all trucking for LTL and TL, or they do not produce the same numeric results and will make any assessment difficult to defend as the results will not be customized. A benchmarking of existing calculators reveals an opportunity for a customized assessment solution while leveraging existing internal data.

Enabling PITT OHIO's ability to draw from multiple sources of GHG emission data, coupled with the support of personnel, and based on best-in-class practices, a customized carbon calculator was created. When developing calculators, we propose taking a Scope 1 and Scope 2 assessment model based one calendar year of data. The bounds for this CO_2 assessment should include the electricity, natural gas, propane, and fuel oil used at the facility level. To give you an idea of the scale of this approach, this baseline assessment for PITT OHIO assessed over 20 terminals across nine states; using B-5 diesel fuel for over 700 tractors and over 400 straight trucks; gasoline consumption for 60 non revenue fleet vehicles; and all airline miles.

The insight gained during this assessment reveals over 125,000 metric tonnes of CO_2 associated with PITT OHIO operations. It's no surprise that tractors and straight trucks impacting 90% of the firm's CO_2

Carbon assessment

PITT OHIO—*Carbon assessment generated by its carbon calculator*

footprint. Electricity consumption at the terminals is the next largest contributor followed by propane and then natural gas. The process of collecting the location-level utility and fleet data is a good exercise in leveraging existing performance management and environmental management systems and this process will helps to uncover gaps in the data. Existing programs and efforts to reduce impacts at terminals have gone a long way toward resource efficiency for many common facilities initiatives throughout the industry such as electricity and water conservation. Existing programs to reduce fuel consumption within fleet vehicles is a step in the right direction, yet more attention can be put on tractors and straight trucks as a percentage reduction in fuel consumption will have proportionally larger CO_2 reductions.

As an LTL service provider, PITT OHIO is in the business of moving customer's goods with high service rates and competitive pricing. To drill deeper into the CO_2 assessment to look for understanding and opportunities for new services, any company will next want to look at the customer's portion of an LTL's CO_2 footprint.

Customer's Portion of LTL's Carbon Footprint

Utilizing the existing activity based costing system and insight from management; we collaboratively developed and assessed a CO_2 equivalent on a per-shipment basis for clients. Based on data, and several discussions with management, the agreed-upon best approach for the allocation of CO_2 to a customer can be based on distance, weight, and cube while utilizing a CO_2 emission coefficient for B-5 diesel fuel from soy-based and low-sulfur sources. Based on customer data, per-trip amounts of CO_2 can be generated and rolled up into a monthly amount of emissions in-line with what some customers are already asking for. Customer allocation also provides an opportunity for offering "carbon-neutral" options for shipments that other providers such as FedEx and UPS are already providing to customers.

The information and insight from a CO_2 inventory assessment project like this provide opportunities to better understand and leverage natural capital through outcome metrics while working toward predictive metrics, GRI reporting, and certifications. Key performance indicators

(KPIs) for assessing the impact of future sustainability initiatives typically start with natural capital and CO_2 and become more nuanced when assessing social capital. These opportunities for differentiation capture short-term positioning of information and analysis capabilities with the growing need for more transparency and better measurement of sustainability initiatives. We next summarized benchmarking regarding important sustainability factors in the LTL industry that align with natural capital, specifically looking at CO_2 emissions and resource efficiency.

Carrier and LTL Carbon Management Best Practices

Current commitment to managing and improving the carbon footprint of members of the supply chain's transportation segment varies significantly across the industry. Some LTL service providers show no evidence that they have taken any steps to track or manage their carbon footprint. Marketing material, web sites, and strategic plans rarely acknowledge the concept of sustainability as important to the industry or their customers providing a short-term window of opportunity for differentiation and possibly competitive advantage.

Most regional LTL carriers have some evidence of interest in impacting natural capital. Few reference membership in the EPA's Smartway Transport Partnership as an indicator of natural capital. In some cases, the Smartway logo on promotional material and websites is the only recognition given to natural capital. Other carries provided lists of environmental impact reduction initiatives most of which include; recycling, idle and speed controls, and low emission fuels.

A review of the LTL web landscape finds few LTL carriers presenting natural or social capital as a strategic initiative. Figure 3.6 provides a list of the various techniques and practices that LTL carriers are promoting as indicators of natural capital. The first section of this list identifies the most commonly identified CO_2 reduction initiatives. However, most, if not all, would also be considered good business decisions as they reduce costs AND improve service. Also listed are those CO_2 reduction practices of the more environmentally proactive carriers.

Common CO_2 initiatives

Facilities

- Electricity
  - Low-energy lighting, motion sensors, work hours, thermostats, energy star appliances
- Recycling
  - Refuse, pallets, lighting, metal, oil, plastic, paper, cardboard
- Resources
  - Auto towel dispensers, auto soap dispensers
- Water
  - Waterless toilets, auto flush toilets, auto faucets

Fleet

- Drivers
  - Shifting, idling, idle shutoffs, EZ pass, speed policies, minimize out-of-route miles
- Equipment
  - Speed governors, MPG monitors, recap tires, low-profile tires, bio diesel, air fairings, side fairings, routine maintenance, tire-pressure policies, aerodynamic mud flaps, trailer skirting, low idle RPM

Proactive/Strategic CO_2 initiatives

Facilities

- Electricity
  - Solar panels, wind, geo thermal
- Recycling
  - Ink cartridges, computers, refrigerant, fluorescents, LEDs Fleet
- Drivers
  - GPS routings, dispatch tools, poster programs
- Equipment
  - Electric delivery vehicles, natural gas vehicles, hybrid vehicles, intermodal, synthetic oil, synthetic lubes, fuel-sensing systems, LED lights, aluminum fuel tanks, efficient starters—brakes—engines, low drag paint, plural component paint spraying, green cleaning, aggressive equipment replacement plan, center fuse brake drums, wide-based tires, minimize tractor-trailer gap, single drive axle, trailer boattail, automated tire inflation, stationary fifth wheel

Operations

- Efficiency
  - Cube utilization tools, routing tools, physical distribution modeling, used pallet and corrugated dunnage, waste-reduction wash system, solvent cleaner/reuse system, propane fork truck conversion, University of Tennessee Simulation Center
- Administration
  - EDI/Web, paperless systems, driver document scanning, third-party CO_2 reduction verification

Figure 3.6. Actionable CO_2 reduction practices.

Expanding the search to larger carrier groups and other modes uncovers a number of "Differentiating Strategic" sustainable practices. Most of the large transportation companies do not acknowledge the common activities listed above as part of their sustainability programs. It is implied that they are doing all of those things and they have moved on to more strategic initiatives. From Old Dominion's inclusion of electric, natural gas, and hybrid vehicles to UPS's carbon neutral program, most of the larger and multimodal carriers are going beyond basic efficiency improvements. Figure 3.7 identifies these differentiating CO_2 initiatives and the focus of some carriers on partnering with environmentally based organizations and NGOs.

Customer Focus

- Package design support
- Eco responsible packaging
- Shipment Scheduling
- Carbon Neutral Option Programs
- Carbon Calculators

Environmental key performance indicators

- CO_2 per ship unit
- CO_2 per $ sales
- Water (Gallons) per unit
- Environmental and Sustainability Affiliates
  - Forest Ethics
  - Dogwood Alliance
  - BSR
  - SGS in the USA
  - Global Resource Initiative
  - US Green Building Council
  - Trees for the Future
  - International Green Energy Council
  - Green Geeks
- Environmental Fines percentage of inspections

Business

- Carbon Exchanges
  - The Carbon Neutral Company
  - Carbon Fund
- Carbon Offsets
  - Gold Standard
  - Voluntary Carbon Standards (VCS)
  - Climate Action Reserve (CAR)
  - EU Allowance
  - Certified Emissions Reduction
  - ATA Sustainability Task Force
  - American Transportation Research Institute (ATRI)
- Promote Green
  - Strategic plan goal
  - President message
  - Sustainable Report
  - CO_2 goals (percentage reduction by 2020)
- Sustainability Index
  - Global Reporting Initiative (GRI)
  - Dow Jones

Figure 3.7. Best-in-class sustainability differentiating initiatives.

Larger carriers recognize the fact that the vast majority of the CO_2 from transportation is from fuel and therefore are focusing their efforts in this area. There are two primary approaches. The first involves alternative fuel options from higher concentrations of bio fuels, to electric, natural gas, or hybrid vehicles. This group of carriers is well past the basics of changing out tires and aerodynamic equipment, as next steps are more significant and expensive. The second focus is on improved utilization of equipment. By improving load factors in their operations and for their customers, more freight can be moved in the same CO_2 footprint. The use of enhanced packaging design tools, pallet loading, and trailer loading, internally and externally, CO_2 per shipment and per ton mile can be reduced. For those customers actively looking to reduce their Scope 3 CO_2 footprint, this proactive approach is effective while also understanding sustainable value maximization.

Other differentiating strategies found in the sustainability initiatives of the larger carrier groups involve the advanced practices of carbon offsets and carbon trading. For example, UPS offers a Carbon-Neutral Shipping option by which a freight premium is directed to one of the four global environmental projects that will reduce carbon as much or more than that generated by the shipment. While eliminating CO_2 is preferred to offsetting it, the continued dependence on fossil fuels for transportation in the foreseeable future requires other alternatives to neutralize the effect of transport CO_2.

One missing practice for a long-term sustainable relationship with nearly all LTL carriers is a formal strategic position on sustainability. While some LTL carriers such as PITT OHIO have a web page and literature about their "green" initiatives, a review of other service provider's strategic plans and value statements uncovers an absence of a formal statement of sustainability improvement as a corporate goal. Often any mention of sustainability programs by LTL providers is buried in web pages that require searches to locate, while the larger, more sustainably proactive carriers prominently display their sustainable programs, performance metrics, and their strategic commitment to sustainability.

The most visible difference between LTL sustainability programs and the large national LTL, TL, and multimode carriers is the existence, or lack of an annual sustainability report. While these reports in some case are very extensive (FedEx 47 pages and UPS 107 pages), the size is not as

important as making an open declaration of past sustainable accomplishments and future goals. Annual sustainability reports provide current and prospective customers with transparency into the organization's sustainability strategies and establish a level of accountability, providing customers an assurance that sustainability is a critical part of the carrier's future. By identifying both accomplishments and future plans, customers can understand a compelling story of the value placed on sustainability by the carrier, and how well the carrier's goals align with their own. For those shippers that are held accountable by offshore parent companies for improving their carbon footprint, alignment with strategically committed sustainable carriers is a positive step toward meeting parent company goals.

The LTL Carrier Context Summary

Our research suggests that any firm integrating sustainability should provide a compelling story to customers regarding the benefits of their previous carbon emission improvements and the development of a program for continued improvement. Industry trends point to the need for more visibility and transparency in reporting carbon reduction efforts, opportunities for providing lower carbon services, and the development of sustainability reports to position any firm relative to others in its industry.

Some firms such as PITT OHIO are already positioned to expand their competitive lead over LTL carriers due to proactive efforts toward environmental sustainability. By going beyond the basic steps of energy and CO_2 reduction to full carbon footprint accounting and customer-specific CO_2 allocation, some will outperform other LTL carriers and can offer sustainability conscious customers verifiable data on their scope 3 supply chain footprints.

As a result of measurement and reporting, transparent, publicly traded firms can be included in rankings such as Newsweek's Greenest Companies and within Socially Responsible Investing (SRI) indexes such as the Dow Jones Sustainability Index or FTSE 4 Good. The future reality of supply chain management is an integrated approach where supply chain professionals will leverage visibility within a supply chain to impact

financial performance, while simultaneously measuring, managing, and reporting natural AND social capital as enablers of transparency.

Summary

We wanted to place metrics early in this book to emphasize what operations and supply chain systems should be considered for measuring. This helps to avoid organizations typically looking at what they are good at and then institutionalizing only that. Instead, sustainable supply chain management provides an opportunity for a metrics evolution for some and a metrics revolution for others in changing the way management plans for and delivers process performance. Metrics are communication! They must emphasize the mission of the organization and in doing so become a critical element within an organization as they make programs and processes concrete. Mission and metrics define everything we need to know.

This chapter started by highlighting vignettes of a changing performance metrics landscape. Next, best practice highlights showed significant improvements in revenue, energy, waste, water, and materials expenses, along with improvements in employee productivity, attrition, and strategic as well as operational risks. With improved performance as a goal, information then followed discussing the functions, types, motivation, focus, and level of application of metrics. Within this context, trends regarding transparency and visibility showed more measurement and disclosure than at any time in prior history. This trend will only grow over time and to help align mission, metrics, and motivation, we focused on the use of predictive metrics to proactively avoid outcome-driven problems and cost savings, knowing that cost avoidance and revenue generation would allow firms to leapfrog others in their industry. After reviewing applicable models, protocols, and initiatives, a deep dive into the carrier and LTL industry demonstrates the ability to customize an organization's carbon footprint assessment and there is room for improvement as supply chains integrate sustainability and this metric evolution to innovate, reduce waste, and maximize sustainable value.

Applied Learning: Action Items (AIs) and Audit Questions (AQs)—Steps you can take to apply the learning from this chapter

AI: Run your business as if you did have to pay for carbon emissions, how would this change your approach to decision making, management, and supply chain integration?

AI: What existing groups and teams can be leveraged as champions of sustainability?

AI: How do you currently establish performance goals? Will this process be any different for natural or social capital?

AQ: Identify sustainability performance metrics that will align with your existing mission.

AQ: To what extent do you rely on output vs. predictive metrics?

AQ: What GHG emissions (Scopes 1–3) contribute the most to your carbon footprint?

For a more in-depth assessment, and to receive summary information of your AQs relative to others, you can access the Sustainable Supply Chain Assessment tool for this book at: www.duq.edu/sustainable-supply-chain-management

Further Reading

Porter & Kramer (2011). Creating shared value. *Harvard Business Review.*

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Eccles & Krzus, (2010). *One report-integrated reporting for a sustainable strategy.* Wiley.

Elkington (2012). *The zeronauts-breaking the sustainability barrier.* Earthscan.

Busch & Shrivastava (2011). *The global carbon crisis.* Greenleaf Publishing.

SECTION III

The Key Activities of a Sustainable Supply Chain