CHAPTER 4

Standards and Tools in Support of Sustainable Supply Chain Management

Our tools are better than we are, and grow faster than we do. They suffice to crack the atom, to command the tides. But they do not suffice for the oldest task in human history: to live on a piece of land without spoiling it.

Aldo Leopold

Living in a World of Standards

- Close to 2,000 companies used The GRI guidelines for reporting in the past year. The GRI produces a comprehensive Sustainability Reporting Framework that is widely used around the world to enable greater organizational transparency. The framework, including the reporting guidelines, sets out the principles and indicators organizations can use to measure and report their financial, environmental, and social performance. GRI is committed to continuously improving the guidelines, which are freely available to the public. www.globalreporting.org/
- The U.S. Securities and Exchange Commission (SEC) is drafting a new rule requiring companies to assess and report on their sourcing and chain of custody of certain "conflict minerals" as mandated by the Dodd-Frank Wall Street Reform and Consumer Protection Act.[1] These minerals—tin, tungsten, and gold—are typically mined illegally and in breach of human rights in the Democratic Republic of Congo and surrounding countries, and their sales are used to fund ongoing civil war. This is the SEC's latest venture into reporting

rules on social and environmental issues; earlier it adopted guidance on reporting climate change impacts and board diversity.

- Underwriters Laboratories, well known for establishing product safety standards and certification processes, issued a sustainability standard for manufacturing organizations, a certifiable standard framed around five topics: governance for sustainability, environment, workforce, customers and suppliers, and community engagement and human rights.[2]
- The decisions of companies such as GM and Ford to include sustainability as corporate goals have led to the realization amongst many suppliers that becoming ISO 14001 certified not only results in improvements in efficiency and profitability but that such certification also help suppliers retain their position in the Original Equipment Manufacturer supply chain. Furthermore, suppliers such as Texas Nameplate Co. (Dallas, TX) and Howard Plating Industries (Madison Heights, MI) have found ISO 14001 certification leads to a safer and healthier environment for their employees.
- Clorox launched its Green Works line in 2008. This line consists of all-purpose cleaners, cleaning wipes, glass cleaners, toilet bowl cleaners, dishwashing liquids, and laundry detergents. With over 5,000 new products being introduced every year that claimed to be green or natural, the challenge facing Clorox was that of how to convince the marketplace that their products were truly green. To overcome this challenge, Clorox partnered first with the Sierra Club to review the formula and to earn third-party certification. Next, it worked through the EPA's Design for the Environment (DfE) program in 2009. Finally, in 2010, it obtained the Natural Products Association Natural Home Care standard. The reason that Clorox focused on these standards was to secure trust from its customer base.

In all of these examples, we see sustainability being successfully pursued by companies and implications for supply chains. Yet, what we also see are some of the challenges encountered as these firms pursue sustainability.

For some, it was developing a system for sustainability; for the Big Three automotive firms, it was ensuring that sustainability was pursued effectively throughout their supply chain; for Clorox, it was securing the trust of its target customers and in demonstrating their commitment to sustainability. In each of these instances, the firms involved turned to sustainability standards for the solution. Standards, while important, are only one of the many tools that are available to managers who want to make their supply chains sustainable. Since we cannot cover all of them, we will focus our attention on three critical tools as our chapter objectives that every manager should consider and use.

Objectives

1. Review the sources and types of standards.
2. Highlight prominent standards supporting sustainability initiatives.
3. Understand how to apply problem-solving approaches and process tools to sustainability.

Standards—Providing Guidance and Structure

Simply put, a standard is a set of rules, guidelines, or characteristics for activities or systems. Typically set down in a formal document and established by a committee through consensus, the standard often provides metrics for assessing performance and offers a means for certification (formal recognition that the organization has satisfied certain minimum sets of requirements prescribed by the standard). In the case of certification, the process of certification is often done in one of two ways: (a) through self-reporting by the firm; and (b) through a formal certification process carried out by an impartial third party. It goes without saying that in most cases, the latter is often viewed as being more credible in the market place.

Standards are a common feature in today's business environment. In the United States today, there are over 100,000 standards at work. These standards come in many forms:

- ***Product-based*** standards (e.g., qualified products must deliver the features and performance demanded by consumers, in addition to increased energy efficiency).
- ***Performance-based*** standards (e.g., level of GHG emissions, grown using Fair Trade practices).
- ***Management system*** standards (e.g., ISO 14001 and the environmental management system).
- ***Personnel certification*** standards (e.g., a person who understands production and inventory management procedures because they are CPIM (Certified in Production and Inventory Management)—a professional certification standard developed and administered by APICS, the Association for Operations Management).
- ***Construction standards for buildings*** (e.g., Leadership in Energy and Environmental Design or LEED).

Standards can come from several different sources, the most important of which are the following:

- ***Governmental agencies*** (e.g., the United States Department of Agriculture with its Organic standards program, and Environmental Protection Agency's Energy Star Program).
- ***Non governmental organizations*** (e.g., ISO, headquartered in Geneva, Switzerland, or the GRI).
- ***Professional societies*** (e.g., APICS with its CPIM certification program).
- ***Consultants/Consulting organizations*** (e.g., the cradle-to-cradle design standard developed by the McDonough Braungart Design Chemistry (MBDC) consultants).
- ***Individual Organizations/Firms***. In some cases, such as with Abhold International's Utz Certified or Starbuck's and its C.A.F.E. program or Nespresso's AAA ecolaboration program, an individual company with sufficient market presence or power can successfully introduce a standard.

Standards also have different levels of "intensity":

- ***Mandatory***: You must conform to the standard or you are not allowed to sell your product or compete. Failure to be certified can also result in being fined or otherwise punished.
- ***Quasi-mandatory***: While certification is not legally required, it is so strongly encouraged that it is viewed as almost being mandatory. A good example is that of ISO 9000 (the quality process standard). Increasingly, to compete in many industries such as the auto or aerospace, or markets, you must first be ISO 9000 certified.
- ***Voluntary***: This is the least intense of the standards. Certification is requested but not necessary. An example of this type of standard is the C2C design standard. Often, these standards, while driven by important goals and considerations, are voluntary because they have not achieved a sufficiently high level of acceptance/use to become viewed as quasi mandatory. Within some industries, for example, office furniture, Steelcase has been able to differentiate its products with claims of having the most C2C certified products. This is particularly important when competing against Herman Miller—a company with a history of environmentally responsible design and awards.

"Without a standard, there is no logical basis for making a decision or taking actions."

Joseph M. Juran

Types of Standards

In general, standards can derive from either an absolute goal or from a relative outcome. An *absolute standard* is based on some performance goal that is independent of the process being studied, or a process that is theoretically capable of being a "best practice." For example, the EPA mandates that certain manufacturing processes are only allowed a maximum number of pollution emissions per day. This mandate forms an absolute standard against which performance is compared. An example of the second type of absolute standard is given by a time and motion study, which

calculates the absolute minimum time required to perform a given set of tasks.

Relative standards derive from reference points given by the past performance of the process, or given by the performance of other similar processes. In general, there are three major types of relative standards: (a) internal standards; (b) group standards; and (c) benchmarks.

An *internal relative standard* is defined by the past performance of the person or process that is being measured. The current performance is compared with the past performance and the difference is noted. For example, a manufacturing plant's GHG emissions (a measure of waste) for a given month could be compared with its emission for the same month a year earlier. Such a standard is easy to implement; it is easy to understand; its goals and intentions are unambiguous. Yet, there are potential problems with this approach. First, it is often difficult to determine if differences in performance over time are due to changes within the process, or due to external factors outside the control of managers. For example, if our plant produced fewer emissions this year than it did last year at the same time, is it because we are more efficient, or are there other causes such as a reduced market share?

A *group relative standard* is based on the performance of other groups or processes that perform similar tasks as the ones we are interested in measuring. For example, we might compare energy conservation across different manufacturing plants within our plant network, or within our industry. We can also assess our supply base on dimensions of quality, environmental management systems, or human rights infractions. One use of this type of standard is to identify the best performer and to compare everyone else to this best performer. This approach deals with the limitations of internal relative standards, yet it has two shortcomings of its own. The first is the possibility that even the best performer in the comparison group is doing a poor job. The second and more troubling concern is how to determine what constitutes a comparable group. Few processes, people, or groups are completely comparable—differences exist. It is up to you, and/or the manager of a metric to attempt to identify and maintain a suitable group of comparable processes for comparison, recognizing that the group membership may change over time.

The ultimate form of relative standard is the *benchmark,* which is defined as a standard of performance representing the best in a given class of performers. In business, a benchmark is a widely accepted standard that denotes above average to "world-class" performance. Generally, there are three levels of benchmarks—best in firm (BIF), best in industry (BII), and best in class (BIC). The expected level of performance increases as we move from BIF to BIC benchmarks.

Establishing and using benchmarks can be costly. Consequently, benchmarking is usually reserved for strategically important processes. To appreciate the importance of benchmarking, consider the following story. A computer manufacturer operates its own division for supporting field service (repairs to computers). Inventory accuracy is important in this activity in order to ensure that needed parts are in stock to support field service personnel. After several years of hard work, this manufacturer had improved its inventory accuracy from about 75% to about 95%. Everyone in the division was proud, and others in the company were impressed, until at a conference one of the division managers learned that typical inventory accuracy levels in the pharmaceutical industry were 99%. Soon, the division managers sent a team to visit a drug company where they found that inventory accuracy was actually 99.99%. More important, the team learned many valuable lessons regarding how the drug company had achieved this high level of performance.

From this example, we can see that a benchmark is a standard of performance that represents the best or highest levels. How we define the "best" is a result of how we define the boundaries of the context in which we will search for benchmarks: within the firm, within the industry, or within all "comparable" operations. As another example of BIC benchmarking, consider that when a medical products manufacturer wanted to benchmark the integration of sustainability into the new product development process, they chose DuPont, a chemical company. Why a science-based chemical company? DuPont had created a sustainability index[3] that assesses products over 11 different criteria, these include: climate change (measured in GHG emissions generated throughout the life cycle of the product), energy use, pollution (both air and water created during product use), material use (and recycled content), waste, disposal, ecosystems and

biodiversity, water consumption, toxicological risk, use of non depletable resources, and cradle-to-gate environmental footprint. DuPont's ability to integrate dimensions of sustainability into a phased gate approach was known across industries. This process was "comparable" to the medical product's new product development requirements.

Standards: Pros and Cons

In most cases, becoming or requiring certification is a time consuming and often expensive process. It requires top management support; a champion from within the company to make a business case to both the firm's top management and to the rank and file that certification is both necessary and beneficial. It also entails marketing costs to explain the standards and its benefits/implications to key customers and/or stakeholders. Finally, it takes time to become certified—to learn about the standard; to do an initial audit with the goal of identifying those areas where the firm needs to do more work; to develop and implement a corrective action plan to address the issues uncovered in the audit; and, to then undergo final certification. Given the level of time and resources required, this raises a simple but important question—why become certified?

Standards are attractive because they offer management and stakeholders a number of advantages:

Standards are often based on codified "best practices." Ultimately, a standard reflects the "best practices" that have been found to work in other organizations. That is, when a standard such as ISO 14001 is created, the committee responsible for creating it reviews all of the practices that are associated with effective/successful examples. These practices are reviewed and the most important practices are then identified. These practices form the foundation on which the standard is built. The advantage of this approach is that we are drawing on practices that we know are important and that we know work (and work well). This process simplifies life for the organization being certified (since they do not have research and identify these practices).

Standards provide a template for organizations interested in developing new systems. A template can be regarded as a guide to help organizations implement a new system or activity. This guide takes two forms. First, there is a process guide. This guide tells the organizations what activities they must implement and in what order. The second is a content guide. That is, the standard tells the organization what activities must be present if the organization wants to implement a certain system. For example, if you are interested in having an environmental management system, ISO 14001 will identify the minimum set of components that you must have for that system to develop.

Standards have marketing value. As we saw in the case of Clorox (described in the opening vignettes), adoption of standards can have strong marketing value. The reason—the standards convey credibility. For certain markets and customers, knowing that the firms that they are working with are certified in certain standards has a real value—a value that can be manifested in one of two ways. First, the certified firms are given preference when it comes to purchases. Second, the buyers are willing to pay a price premium for their products.

Standards provide strong signals regarding the organization's intents. Closely associated with the preceding issue is the notion of signaling. Signaling is an approach whereby our actions are viewed as signals that we send to others. When we tell the market that we are actively pursuing a certain standard, we can be viewed as effectively sending the following signals: (a) the activity or system underlying the standard is important to our firm; (b) we are committed to this activity or system; and (c) we are willing to spend the time and resources to attain the necessary certification. In many cases, these are strong signals.

Standards are often supported by other organizations. Implementing a new standard is a major undertaking (as previously noted). What simplifies this process is that standards are often supported by an infrastructure consisting of consultants, educators, professional societies, and educational/training material. The consultants provide

specific assistance in terms of what the standards mean, how the organization can implement them, whether the organization is ready, and what it must do to be ready. Similarly, educators help collect and consolidate material about standards, thus helping to improve awareness and learning about them. Professional societies such as APICS (the Association for Operations Management), ISM (Institute for Supply Management), SCC (Supply Chain Council), CSCMP (Council for Supply Chain Management Professionals), ISSP (International Society of Sustainability Professionals), and the ASSD (Alliance for Strategic Sustainable Development) (to name a few) provide support in many ways to organizations interested in exploring and implementing specific standards and tools. These organizations provide information. Through meetings (either at the national/international level or the more local chapter level), they provide venues where the organizations can meet and talk with others who have gone through the process or who are currently going through the process of implementing the new standard. The societies also help keep organizations up to date on changes taking place in the standards or their implementation. Finally, the standards are often accompanied by educational material in the form of books (available either online or through actual books sold by outlets such as Amazon), magazine articles, and online postings. Again, this provides needed information and guidance to the organizations so that they know that they are not alone in this effort.

Standards are often accompanied by metrics. As previously pointed out in Chapter 3, a metric consists of three interrelated elements: a measure, a standard, and a consequence. What this means to the organizations pursuing the standard is that they now know *operationally* how the standard and the performance associated with the standard is measured. They also know what the minimum level of acceptable performance is, so that they can evaluate their own levels of performance. Finally, these metrics, since they are common, enable firms to compare their levels of performance with those reported by others.

Standards simplify evaluation and assessment. This last advantage is most relevant when dealing with supply chains. With supply chains, we have a large number of different firms involved as suppliers. Without standards, we would have to individually assess each firm, its systems, and its performance. This is a very time-consuming and resource-intensive effort. Standards greatly simplify this process. To assess the supply chain partners, we simply determine whether or not they have attained the necessary certification. If they have, then we have one strong indication that they are acceptable.

Against these advantages, you have to recognize the downsides created by standards:

Standards often lag real leading edge practices. It takes time for a practice to be recognized as "best." That is, the practice must be first implemented and its impact identified. Then, the practice must become known outside of the firm that first developed it. Next, the practice must show that it can persistently contribute to improved results. Then, it can become recognized as a best practice. What this means is that the practices that make up the basis of the standards may not reflect what is currently considered an innovative practice—there is always a lag.

Standards are not enough by themselves. Standards are often built around practices. These practices are generic in that they are intended to be applied to the largest number of organizations. Yet, for these practices to be truly effective, two conditions must be first met. First, they have to fit within the organization, its culture, and its past. If they don't fit, the practices will not be embraced and implemented. Second, they have to be extended. That is, the practices have to be taken, used, and built upon to create new forms of value. It is the ability to fit and extend that often differentiates the firms that are successful with the implementation and usage of standards from those that simply just do enough to be considered certified.

Being certified does not necessarily mean that the firm really embraces the systems or the activities. This concern follows from the preceding point. Just because an organization is certified does not necessarily mean that the firm has achieved the desired outcomes. It is one thing to do enough to become certified in any one of the sustainability standards (e.g., ISO 14001). To be certified, all that is often required is for the firm to hire a consultant who can help the firm walk through the process and meet the requirements of certification. It is quite another thing to embrace sustainability and rebuild systems around standards. Certification is a long-term undertaking that requires an understanding of sustainability and its goals, top management, and significant investments of time and resources. Consequently, it often makes sense to take a limited view of certification and sustainability. When a firm attains certification in a specific standard, such as ISO 14001, this should not mean that the firm has a system that is built around sustainability. Rather, it should be viewed as the firm being certified—nothing more and nothing less.

Standards may not be attractive to firms who have achieved the same outcomes by pursuing different approaches. Standards often identify one way or path of achieving a specific outcome or implementing a specific system. There are other approaches that are as effective in the end. The problem is that to be certified, some firms may see an additional cost—that of changing their existing systems simply to meet the certification requirements. The resulting benefits may not be viewed as sufficient to offset the costs. The authors encountered such a situation when they studied ISO 14001. They encountered a firm that had developed a highly effective system for sustainability. Initially, when they became aware of ISO 14001, management thought that it might be useful to become one of the first American firms to achieve this certification. However, when they looked at the requirements for ISO 14001 certification and compared these requirements with the existing system, management came to the conclusion that they would have to invest extensively to meet the certification requirements. These investments were not seen as having any impact on the ability of the firm to improve its level of sustainability performance. As one manager put it to the authors,

"this is an investment simply in paper and administration." Consequently, the firm decided NOT to pursue ISO 14001 certification.

Standards can discourage risk taking. Finally, standards identify desired objectives and appropriate approaches. As long as the firm pursues these objectives using approved approaches, it can expect to avoid problems. However, should the firm identify a new and potentially more attractive way of achieving these same objectives, then the firm assumes the costs of demonstrating that this cost is better. Consequently, firms may be discouraged for pursuing new and different approaches.

As can be seen from this discussion, standards are important. Yet, they are imperfect indicators of sustainability. Consequently, they should be leveraged with great care and alignment with your business model, that is, value proposition, capabilities, and key customers (Chapter 2). We next want to highlight some of the well-known sustainability standards. This list is not all inclusive, but instead a brief review and opportunity to get started in finding more information on standards that may be directly applied to your own organization.

Sustainability Standards

To this point, we have discussed the need for standards; we have also identified some different standards and certifications. In this section, we turn our attention to identifying the sustainability standards out there. The reality is that the number of standards related to sustainability is growing every day. Some of the more commonly cited sustainability standards are presented in Table 4.1. As can be seen from this table, these standards cover a wide range of sustainability-related issues.

What to Do with Standards and Certifications?

As you can see, there have been numerous sustainability standards developed to address issues of social equity, environmental quality, and economic prosperity of global production and trade practices. Despite similarities in major goals and certification procedures, there are some significant

Table 4.1. Examples of Sustainability Standards/Initiatives

Program/Initiative	*Source*	*Summary*
Social Standards		
Accountability, Assurance and Stakeholder Engagement: AA1000 standards www.accountability.org/	Accountability	These standards help organizations address issues affecting governance, business models and organizational strategy, as well as provide operational guidance on sustainability assurance and stakeholder engagement. The AA1000 standards are designed for the integrated thinking required by the low-carbon and green economy, and support integrated reporting and assurance.
SA8000 www.sa-intl.org/	Social Accountability International (SAI)	This is a voluntary, universal standard for companies interested in auditing and certifying social performance. It is one of the world's first auditable social certification standards for decent workplaces, across all industrial sectors. It is based on conventions of the International Labor Organization, United Nations, and national laws. The SA8000 standard spans industry and corporate codes to create a common language for measuring social compliance.
Fair Trade www.fairtradeusa.org/ www.fairtrade.net/	Fair Trade USA Fair Trade International	Initially developed in the 1940s when a few small North American and European organizations reached out to help poor communities and supply chains sell their products to well-off markets. Today, fair trade is a global effort aimed at helping poor countries and areas by relieving exploitation and promoting environmental, economic, and social sustainability. Currently, Fair Trade USA, formerly a licensing agency for the Fair Trade International label, has broken from the system and is creating its own labeling scheme.
Human Rights www.ohchr.org/EN/HRBodies/HRC/Pages/HRCIndex.aspx	United Nations Human Rights Council	The Guiding Principles for Business and Human Rights' is an actionable set of processes and guidelines for global business designed to provide a global standard for preventing and addressing the risk of adverse impacts on human rights linked to business activity.

Organic Certification www.usda.gov/wps/portal/usda/usdahome	USDA	The USDA National Organic Program regulates the standards of any farm or organization that seeks to sell an agricultural product as organically produced. The National Organic Program and the Organic Foods Production Act are intended to assure consumers that the organic foods they purchase are produced, processed, and certified to be consistent with national organic standards.
Rainforest Alliance http://www.rainforest-alliance.org	Rainforest Alliance	Created in the late 1980s from a social movement, the Rainforest Alliance is committed to conserving biodiversity and ensuring sustainable livelihoods (especially for those living in rainforest areas). One key feature of the standard and the associated certification process is the requirement for a detailed plan for the development of a sustainable farm management system to protect and encourage wildlife conservation.
Responsible Care www.responsiblecare.org	Chemical Industry	Responsible Care is a voluntary initiative of the global chemical industry to safely handle products from inception in the research laboratory, through manufacture and distribution, to ultimate reuse, recycle, and disposal, and to involve the public in decision-making processes.
Sustainable Forest Products https://us.fsc.org/	Forest Stewardship Council (FSC)	FSC is an organization protecting forests for future generations while setting standards under which forests and company's products are certified. The organization provides independent labeling and certification of products.
UTZ Certified www.utzcertified.org	Utz Certified	This is a label and program for sustainable farming of agricultural products that was launched as a separate initiative in 2002. It currently claims to be the largest program for coffee in the world. Known formerly as Utz Kapeh (Mayan for "good coffee"), this program was first launched by the Dutch coffee roaster Ahold Coffee Company in 1997. This program aims to create an open and transparent marketplace for socially and environmentally responsible agricultural products.

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Table 4.1. Examples of Sustainability Standards/Initiatives (Continued)

Program/Initiative	*Source*	*Summary*
		Utz Certified is consistent with this book's view of sustainability since the 2009 Code of Conduct version focuses on three categories of performance: (1) good agricultural and business practices; (2) social criteria; and, (3) environmental criteria.
UL880 www.ul.com/global/eng/pages/offerings/businesses/environment/services/sq/enterprisestandards/UL880/index.jsp	Underwriters Laboratory and GreenBiz Group	UL Environment collaborated with GreenBiz Group, a leader in corporate sustainability media, corporate sustainability leadership and reporting, to develop UL 880: Sustainability for Manufacturing Organizations that includes governance, the environment, workforce, customers and suppliers, along with community engagement and human rights.
Environmental Standards		
Carbon Disclosure www.cdproject.net	CDP	An independent not-for-profit organization working to drive down GHG emissions and sustainable water use by businesses and cities. Based on the premise that the first step in managing greenhouse emissions and sustainable water usage is that of measurement. CDP holds the world's largest collection of self-reported climate change data.
Carbon Offsets www.co2offsetresearch.org/policy/VoluntaryStd.html	American Carbon Registry Social Carbon Climate Action Reserve The Clean Development Mechanism Gold Standard Verified Carbon Standard	There are over a dozen standards (with only six listed here) to verify the legitimacy of an offset provider by numerous combinations of metrics. An inclusive, complete, and credible carbon offset standard should include the following criteria: accounting standards; monitoring, verification and certification standards; and registration and enforcement systems.[4] The motivation for reporting GHG emissions and purchasing offsets includes corporate public relations and corporate social responsibility, a desire to go beyond what is mandated in terms of emission reductions, and to prepare for expected compliance action, for example, the introduction of a cap-and-trade system.

Conflict Minerals www.sec.gov/news/press/2012/2012-163.htm	Organization for Economic Cooperation & Development (OECD) Securities and Exchange Commission	The OECD published the guidance on conflict minerals supply chain traceability.[5] This guidance is gaining momentum as "the" standard within US policy. However, an analysis of the standard in comparison to existing US auditing standards under SEC highlighted a number of significant inconsistencies and conflict with relevant US standards.[6] Companies subject to the US law who implement the OECD Guidance without regard for the SEC auditing standards may face legal-compliance risks.
Cradle-to-Cradle Standard www.mbdc.com/c2c/	McDonough Braungart Design Chemistry	A set of standards intended to ensure that products are designed to make use of renewable resources and that the resulting products can be easily disassembled and the outputs converted back into inputs for future production (rather than being returned to the ground).
Electronic Product Environmental Assessment Tool (EPEAT) www.epeat.net	Green Electronics Council	A method for evaluating the environmental impact of computers and other electronic equipment. A seal to certify that electronic products are recyclable and designed to maximize energy efficiency and minimize environmental harm. EPEAT rating is becoming a requirement for purchases placed by the US government, state and city governments (e.g., San Francisco).
Energy Star www.energystar.gov/	EPA in partnership with the Department of Energy	Helping save money and protect the environment through the use of energy-efficient products and practices. This is more than just a label on a product as the EPA also provides an innovative energy performance rating system, which businesses have already used for more than 200,000 buildings across the country. EPA also recognizes top performing buildings with the ENERGY STAR program.
Greenhouse Gas Reduction www.theclimateregistry.org/	The Climate Registry	This nonprofit organization provides information to reduce GHG emissions. The Climate Registry establishes consistent, transparent standards throughout North America for businesses and governments to calculate, verify, and publicly report their carbon footprints in a single, unified registry

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Table 4.1. Examples of Sustainability Standards/Initiatives (Continued)

Program/Initiative	*Source*	*Summary*
Greenhouse Gas Reporting Program www.epa.gov/ghgreporting/	EPA (USA)	Implemented in 2008, requires the mandatory reporting of greenhouse gases of American firms. Comprehensive GHG data reported directly to EPA from across the country are now easily accessible to the public through EPA's GHG Reporting Program (GHGRP).
Greenhouse Gas Protocol www.ghgprotocol.org/	World Resources Institute World Business Council for Sustainable Development	The most widely used international accounting tool for government and business leaders to understand, quantify, and manage GHG emissions. They have worked with businesses, governments, and environmental groups around the world to build a new generation of credible and effective programs for tackling climate change. It provides the accounting framework for nearly every GHG standard and program in the world—from the ISO to The Climate Registry—as well as hundreds of GHG inventories prepared by individual companies.
Integrated Reporting www.sasb.org/	Sustainability Accounting Standards Board (SASB)	SASB is in the business of development and dissemination of industry-specific sustainability accounting standards. The goal is to establish an understanding of material sustainability issues facing industries and create sustainability accounting standards suitable for disclosure in standard filings such as the Form 10-K and 20-F. This organization addresses the unique needs of the U.S. market, establishing standards for integrated reporting that are concise, comparable within an industry, and relevant to all ~13,000 publicly listed companies in the U.S.
ISO 9001 Quality Management www.iso.org/iso/home/standards/management-standards/iso_9000.htm	ISO	The 9000 family of standards sets out the criteria for a quality management system (QMS) and this is the only standard in the family that can be certified (although this is not a requirement). This standard has been implemented by over one million companies and organizations in over 170 countries with total quality environmental management as a logical extension of a QMS.

ISO 14000 family of standards www.iso.org/iso/home/standards/management-standards/iso14000.htm	ISO	The family of standards gives the requirements for an environmental management and is one of more than 15,000 voluntary International Standards published by the ISO. It is primarily concerned with "environmental management." For the ISO, this means what the organization does to minimize harmful effects on the environment of its activities. It is not a product standard and does not give requirements for specific products or services; rather, it provides a set of generic requirements for what the organization must do to manage the processes influencing the impact of the organization's activities on the environment.
ISO 14001 Environmental Management Systems www.iso.org/iso/home.html www.epa.gov/ems	ISO	Sets out the criteria for an environmental management system and can be certified. It does not state requirements for environmental performance, but maps out a framework that a company or organization can follow to set up an effective environmental management system. It can be used by any organization regardless of its activity or sector. Using provides assurance to company management and employees as well as external stakeholders that environmental impact is being measured and improved.
ISO 14020—14024 Environmental Labeling www.iso.org/iso/home.html	ISO	Sets out the guidelines for environmental labeling covering three types of labeling schemes: Type I is a multi-attribute label developed by a third party; Type II is a single-attribute label developed by the producer; Type III is an eco label whose awarding is based on a full life-cycle assessment.
ISO 14040—14044 Life Cycle Assessment www.iso.org/iso/home.html http://www.epa.gov/nrmrl/std/lca/lca.html	ISO	Sets out the principles and framework for LCA including: definition of the goal and scope of the LCA, the life cycle inventory analysis (LCI) phase, the life cycle impact assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the assessment, the relationship between the LCA phases, and conditions for use of value choices and optional elements.

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Table 4.1. Examples of Sustainability Standards/Initiatives (Continued)

Program/Initiative	*Source*	*Summary*
ISO 14064 GHG Emission Quantification and Reporting www.iso.org/iso/home.html	ISO	Sets out the principles and requirements at the organization level for quantification and reporting of GHG emissions and removals. It includes requirements for the design, development, management, reporting, and verification of an organization's GHG inventory.
ISO 26000 Corporate Social Responsibility www.iso.org/iso/home.html	ISO	Sets out to provide guidance rather than requirements, so it cannot be certified unlike some other ISO standards. Instead, it helps clarify what social responsibility is, helps businesses and organizations translate principles into effective actions, and shares best practices relating to social responsibility, globally. It is aimed at all types of organizations regardless of their activity, size or location.
ISO 50001 Energy Management Systems www.iso.org/iso/home.html	ISO	Based on the management system model of continual improvement used for other standards, ISO 50001 makes it easier for organizations to integrate energy management into their overall efforts to improve quality and environmental management. This energy management standard provides a framework of requirements for organizations to: develop a policy for more efficient use of energy; fix targets and objectives to meet the policy; use data to better understand and make decisions about energy use; measure the results; review how well the policy works; and continually improve energy management.
LEED Certification Leadership in Energy and Environmental Design www.usgbc.org/**LEED**/	U.S. Green Building Council (USGBC)	LEED is intended to provide building owners and operators a concise framework for identifying and implementing practical and measurable high-performance building designs, and construction, operations and maintenance solutions. Certification can be at multiple levels; that is, silver, gold, and platinum.

Renewable Fuel Standard Program www.epa.gov/otaq/fuels/renewablefuels/index.htm	EPA (USA)	Regulations designed to ensure that transportation fuel sold in the USA contains a minimum volume of renewable fuel.
SmartWay www.epa.gov/smartway/	EPA	The SmartWay Transport Partnership is a collaboration between EPA and the freight industry. This voluntary partnership program uses strong market-based incentives to challenge companies to improve the environmental performance of their freight operations. Through their collaboration with EPA, SmartWay Transport partners improve their energy efficiency, save money, reduce GHG emissions, and improve air quality.
Sustainable Supply Chains http://supply-chain.unglobalcompact.org/	United Nations Global Compact Sustainable Supply Chains: Resources & Practices	A compendium of information for businesses seeking information about supply chain sustainability. Information designed to assist business practitioners in embedding sustainability in supply chains including, initiatives, programs, codes, standards, and networks, resources and tools along with case study examples of company practices.

For more information on any standard, click on the URL hyperlink.

differences in terms of their development, target groups of adopters, geographical diffusion, use within supply chains, and emphasis on triple bottom-line performance. Using these standards and certification properly requires that management address the following questions:

- ***Why***? What is it that I am trying to achieve with the use of standards and certification? Am I interested in getting the standard because it is required for a contract or am I using the standard as a means to bring about significant change in the organization?
- ***What***? What aspect of sustainability is it that I am trying to focus attention on?
- ***How much***? How much time and what level of resources (money, personnel, expertise) do I need for this project?
- ***What standards***? What are the appropriate standards that are consistent with the information generated by the prior two questions?
- ***Which standard***? Of these various standards, which is the most appropriate one to use and how does it align with the business model of my organization (value proposition, capabilities, and key customers)?
- ***How to do it***? What is the process of achieving certification? Do I want to do it by myself or through a consultant? What intensity should I apply to this certification, that is, mandatory, quasi-mandatory, or voluntary?
- ***What resources are available***? What resources can I draw on to achieve this level of certification?
- ***What's next***? After I get certified, what am I going to do next? Certification can be viewed as part of an on going process. If so, then there should be a next step and continuous improvement.

We have provided you many questions, but you, the reader have the answers. The goals of sustainability standards are to provide a platform for insight as to what is important while leveraging best practices. Standards help to level the playing field for companies, as well as their customers, investors, employees, and others, in assessing what it means to be a sustainable business. Standards go a long way toward helping all stakeholders understand and assess a full spectrum of social and environmental issues of importance today.

The standards above are a starting place for the application of rules, guidelines, and structure for activities or the development of new systems. The resources provide the full documentation and metrics for assessing performance while also offering a means for certification (formal recognition that your organization has satisfied certain minimum sets of requirements prescribed by the standard). These standards by themselves are not enough. We have provided information on a diverse range of standards, including structure, sources, intensity, types, and use as benchmarks. These standards also need the support of a range of tools in order to better manage processes and outcomes that align with Sustainable Supply Chain Management.

Tools: Process Thinking and Process Flow Analysis

Sustainability can be viewed as an **output** that is the result of various processes. Some of these processes take place in design; others take place in production; still others take place in delivery, usage, disposal, or closed-loop systems. A supply chain can be regarded as simply a set of processes. Why is this focus on processes so important? Because it leads to a simple but important perspective: *if you don't like the outcome, change the processes*. In other words, if you are not getting the level and type of sustainability that you want in the supply chain, you have to identify the processes responsible for the problems, study them, and then change them. This perspective is more commonly referred to as **process thinking** and is a complement to both systems thinking and design thinking.

Process thinking is a way of viewing activities in an organization as a collection of processes (as opposed to departments or functional areas). This way of thinking focuses management's attention not only on the outputs but also on the processes responsible for these outcomes. At the heart of process thinking is **Juran's Law**. Joseph Juran (1904–2008) was one of the leading quality gurus of the 20th Century. He once observed that *15% of operational problems are the result of human error; the other 85% are due to systematic process errors.* Accordingly, if we are to pursue sustainability, we should focus our attention on processes.

Since processes are spread across many organizations that make up the supply chain, it is important for all managers at all levels and in all major departments to understand the basic operating principles of process thinking. One way of expressing these principles is through a management system known as the **Theory of Constraints (TOC)**.[7] The principles present in the TOC are universally applicable, whether the processes are located in a manufacturing plant, a service facility, a sales office, a hospital or in a financial planning office.

These principles simplify process management and process thinking by focusing management's attention on the important constraints that limit the performance of a process. There are five basic principles underlying the Theory of Constraints:

1. Every process has a constraint.
2. Every process contains variance that consumes capacity.
3. Every process must be managed as a system.
4. Performance measures are critical to the process's success.
5. Every process must continually improve.

Of these five, we will focus attention on the last. The reason is that this principle emphasizes the fact that we are living in a dynamic world. Technology is always changing; the competition is changing, and customers (and their expectations) are also changing. Consequently, processes (especially critical processes, as identified in Table 4.2) should also be changing. They must be evaluated and changed when the level of value that they provide is no longer acceptable to either to key customers or to management.

There are a number of specific tools that can be used to aid process improvement efforts, including process flow analysis, value stream, mapping, and Kaizen Events. While we identify some important references at the end of each of the following sections, we leave it to the reader to learn more about these additional procedures and tools.

Consider for a moment process flow analysis. This technique is used for documenting activities in a detailed, compact, and graphic form to help managers understand processes and highlight areas for potential improvements. The technique generates a process blueprint that supplies

Table 4.2. Six Types of Critical Processes

Process type	*Why critical*
Bottleneck	Limits output; increases lead time; adversely affects cost, quality, flexibility, increases risk, and ultimately impacts sustainability.
Visible to the customer	Affects how the customer views not only the process but also the firm's reputation and brand if supply chains contain human rights violations, lack social accountability, or have detrimental impacts on the environment.
Core capability	A process that incorporates a critical strategic skillset that is difficult for the competition to copy. Must be guarded, managed, and improved continuously because it is the major source of our firm's value. Every firm should be able to identify its core capabilities and align these with sustainability initiatives.
Feeder processes	A process that feeds a number of alternative processes coming out of it. A problem in this process (e.g., a delay or a quality problem) could affect the many resulting processes.
Greatest variance	Variances are amplified by sequential steps in processes. To reduce variances, managers should identify those steps that are sources of greatest variance and continuously work toward reducing it.
Most resources consumed	We focus on these processes because they offer the "biggest bang for the buck," and are directly tied to process waste, GHG emissions, carbon, and future risks while also containing opportunities for greater efficiency and effectiveness.

nearly all of the information needed to effectively assess a process, with the goal of answering the following critical question: *to what extent does the existing process make the desired outcome inevitable (and if not, what has to be done to create a process that makes the desired outcome inevitable)*.

Process flow analysis, itself, is based on a process consisting of six critical steps:

1. Determine the desired outcome for the entire process and the associated sustainability metrics needed to evaluate that process's performance.
2. Identify and bound the critical process.

3. Document the existing process (to determine the "current state" map).
4. Analyze the process and prioritize opportunities for improvement.
5. Recommend appropriate changes to the process (aimed at achieving the "future state" map).
6. Implement the changes and monitor improvements.

These six steps are as readily applicable to improving sustainability in the supply chain as they are to helping the firm reduce costs, improve quality, and reduce lead times.

In addition to process flow analysis, there is also *value stream mapping*. This technique is used to analyze the flow of material and information currently needed to bring a product to a customer. Value stream mapping is used to assess the extent to which the current process adds value (as a percentage of the total time) and to identify opportunities for reducing lead time and cost and attaining such outcomes as sustainability. It is more comprehensive ad complex when compared to process flow analysis.

Additional Resources for Process Thinking and Process Flow Analysis

- Madison (2005).
- Rother and Shook (2003).
- Smith and Finar (2006).
- Swink, Melnyk, Cooper, and Hartley (2013).

Quality Management Tools

Quality management tools have been a staple of most firms' systems since the mid-1980s when the importance of quality was forcefully introduced to American management by quality gurus such as Deming, Juran, Crosby, and Imai. That is when most firms were introduced to the concept of **Total Quality Management** (TQM). At that time, we were introduced to the importance of quality both as a tactical and strategic imperative (i.e., quality not only affected the dollars and cents, it also affected how the firm competed). We were also introduced to the tools and the process of problem solving under TQM. These tools and

processes are the same that today should be extended to sustainability and supply chain management.

The approach to problems taken by TQM formed a natural complement with the process-thinking orientation discussed in the preceding section. That is, quality problems are the results of processes. We can focus on correcting the problems as they are generated by the process, in which case we are perpetually engaged in continuous corrective action. AND, we can identify the underlying reasons for the problems, focus on the processes responsible for these root causes, and then take action to change the processes to bring about the desired outcomes. This approach, which is often referred to as **Quality at the Source**, or Q@S, argues that those who create the problem are responsible for preventing the problem. This approach ultimately seeks to prevent problems from occurring in the first place, rather than simply correcting them once they are created. This same approach (with its emphasis on process thinking and prevention rather than corrective) is also highly appropriate when dealing with the goals of social equity and minimizing environmental impacts in the supply chain.

Underlying this approach is the view that achieving an outcome such as improved sustainability or quality is a never-ending quest. Products, processes, and customer expectations are always changing. Consequently, we are always working on meeting these new, changing needs. To help us with surviving in this dynamic environment, we can draw on the overall problem-solving approaches of quality management as well as various quality management tools.

Additional Resources for Quality Management

- American Society for Quality: www.asq.org
- Foster (2013).
- Goetsch and Davis (2005).
- McCarthy, Jordan, and Probst (2011).

The Overall Problem-Solving Approach

While there are many problem-solving and project-development approaches, we will focus on two of the most well-known, the **Plan-Do-Check-Act**

Cycle (otherwise known as the Deming Wheel) and **DMAIC** (from Six-Sigma).

Deming's Plan-Do-Check-Act Cycle

This approach (also referred to as the PDCA cycle) was first developed by Dr. Deming. It emphasized the on going nature of problem solving by identifying four processes that are linked in an endless cycle:

1. **Plan**: The first step is to identify the problem by studying the current situation. Identify the nature of the gap that separates where we are from and where we want to be. Identify the reasons for this gap and the processes responsible for this gap. Once this is done, then formulate specific actions intended to close this gap.
2. **Do**: Having developed the plan, now implement it.
3. **Check**: Use metrics (previously developed in Chapter 3) to monitor the progress of the actions deployed in the preceding step. Determine if these actions are achieving the desired results. Also, determine if we are encountering any unplanned problems in the system—problems that were previously hidden.
4. **Act**: Review the information collected in the check step and take corrective actions to prevent reoccurrence of problems. Also, during this stage, institutionalize changes (through standards, revised procedures, and associated training). With the insights and information gained during this stage, you are ready to repeat the process by returning to the Plan step of a new PDCA cycle.

The major advantage and attraction of PDCA cycle is that it is simple. It gives all employees both within the firm and the supply chain a structure for attacking problems on a daily basis. By being simple, it can be easily taught to and readily understood by all employees within the system.

DMAIC

DMAIC, a key element of the Six Sigma process of TQM, can be viewed as a further refinement and extension of the PDCA cycle.

DMAIC is taken from the first letter of the five steps that make up this process:

- **Define**: The first step is to understand the task and problem facing the team. This requires generating a problem statement, identification of the key customers, flagging *critical to quality* (CTQ—the critical process outcomes), determining the critical processes, and then bounding these processes. The goal of this first step is to develop a thorough understanding of what is required.
- **Measure**: At the heart of this second step is data collection. Having identified the critical processes that influence CTQ, the team now collects data to better understand what is going on in these processes.
- **Analyze***:* The resulting data is then analyzed to determine the root causes of the resulting variance and problems.
- **Improve***:* The intent in this step is to generate solutions aimed at correcting and fixing the root causes previously identified.
- **Control***:* The final step is to put actions and tools in place necessary to keep the processes operating appropriately. This means updating process documents, business processes, and training records as needed.

DMAIC is a very data-driven process that makes extensive usage of a portfolio of quality management tools.

Quality Management Tools Supporting Sustainability

What TQM offers the manager interested in developing a sustainable supply chain is a rich, proven set of tools. It is important to recognize that these tools are not simply for quality problems. Rather, these tools should be viewed as management tools—tools that are useful for addressing any form of management problem and necessary decision making. Table 4.3 provides a summary of the major tools and their usage.

In reviewing Table 4.3., it is important to note that we have flagged certain tools as more critical than others. This designation is based on the experience of the authors in this field. The tools in bold type are ones that

Table 4.3. Major Quality Management Tools

Quality tool	*Typical usage*
Cause and effect analysis	A critical tool (everyone who is engaged in the drive to a sustainable supply chain should have a working knowledge of this tool). Helps uncover possible factors contributing to an observed problem (as well as the possible structure). Encourages group brainstorming. Prevents the onset of **myopic management** (I know what the problem is; don't confuse me with facts).
Histogram	Helps uncover underlying patterns (range and frequency) in the observed data.
Check sheets	Helps identify the frequency and location of problem causes.
Pareto analysis	Another critical tool. Helps identify the most critical causes of observed problems. Becomes a prioritized list for action.
Scatter diagrams	Helps determine if two variables are related to each other (do the two variables move together in some predictable manner).
Process flow analysis	Another critical tool. Graphically displays and analyzes steps in a process.
Process capability analysis	Helps predict the conformance quality of a product by comparing its specification range to the range of its process variability.
Process control charts	Helps monitor process outputs and determine whether a process is operating within normally expected limits.
Taguchi method/design of experiments	Helps evaluate and understand the effects of different factors on process outputs.

it is important that management gain a good understanding and mastery before they proceed into any process improvement project. We next want to introduce a tool outside of the quality management domain, yet very useful to the application of decision making for emerging sustainability practices involving multiple criteria and multiple alternatives.

Multi-criterion Decision Analysis

Multi-criterion Decision Analysis (MCDA) methods have become increasingly popular in decision making for sustainable business practices because of the multi dimensionality of sustainability goals and the

complexity of social, environmental, and economic performance. We propose the use of the Analytic Hierarchy Process (AHP) as an MCDA tool for helping managers structure the problem of integrating social and environmental dimensions into process improvement projects, supplier evaluation and selection decisions, resolving trade-offs, and to better screen and assess supplier performance.[8] AHP is a simple yet powerful decision support tool that was first developed within the management science field over 30 years ago.[9] It was developed to help managers make more effective decisions by structuring and evaluating the relative attractiveness of competing options or alternatives. The AHP has been used successfully for structuring decision making in many areas of business management and planning.

To briefly describe this approach, AHP requires the decision maker to describe up to four different components: the objective, the relevant criteria, the relevant subcriteria if any, and the alternatives to be evaluated. One major advantage of AHP is that the construction of a hierarchy diagram forces the decision maker to structure the problem. Requiring the decision maker to explicitly define the objective and relevant criteria, and to assign numerical values for their relative importance forces the decision maker to consider trade offs in detail. Since managers typically rely on only a subset of information (e.g., heuristics), AHP helps managers make "more rational" decisions by structuring the decision as they see it and then fully considering all available information on the criteria and alternatives. In other words, the process of developing the AHP model provides value on its own, independent of the final ranked evaluation of the alternatives.

Building on What We Know

This chapter can be viewed as having a "bad news/good news" message. The bad news is that we have to draw on a large set of standards, tools, and procedures to help us in the challenge of making the supply chain efficient and sustainable. The good news is that many of these tools and procedures are already in place. If you or your firm has implemented systems such as Lean/JIT, or TQM or Six Sigma, then it is very likely that you already have in place the tools needed to help make the supply chain not only more efficient but also more sustainable. Add to this management toolkit

MCDA methods and decision makers can better assess the multidimensionality of existing and emerging sustainability opportunities. Consequently, this chapter argues that you should leverage your knowledge of these tools and apply them to the task of making your supply chain sustainable.

Leveraging existing standards and tools provides a good foundation for new initiatives and should be applied whenever possible because it builds on what you currently know and understand. We do not have to reinvent the wheel when it comes to sustainable practices. Instead, we can utilize known standards and tools as best practices to more quickly cross the chasm on a path to better social equity, less environmental impacts, AND improved economic performance. Leverage helps reduce confusion and training time. It also reduces the total time and cost needed to bring about the transformation.

Summary

This chapter has focused on those developments necessary if we are to begin implementing the sustainable supply chain. These developments include: (a) standards; (b) process thinking and process tools; and (c) quality management tools and processes. What we have presented in this chapter can be summarized as follows:

Standards play an important role in a sustainable supply chain and can be used to achieve a number of important outcomes. While standards are not perfect instruments; they should be leveraged for their alignment with a given business model and used carefully. There are a large (and ever-growing) number of standards appropriate to sustainability along with a process for the appropriate usage and implementation of standards.

The focus on standards is part of process thinking (where standards can be viewed as giving managers either process templates or standards for performance). Process thinking argues that every outcome or output (where sustainability is simply another form of outcome) is the result of a process. If you don't like the output, then you must identify the processes responsible for that output and focus your attention on them. Process thinking is enabled by tools such as process flow analysis, value stream

mapping, and frameworks such as the Theory of Constraints. You as a manager and others in your organization can also draw on the problem-solving frameworks developed in the quality management field (specifically the Plan-Do-Check-Act cycle and the DMAIC of Six Sigma). These frameworks are widely accepted and recognized to be effective for continuous improvement and as a foundation for the integration of sustainability into any organization. Furthermore, managers can draw on the well-developed tools of quality management—tools such as cause-and-effect analysis, pareto analysis, and histogram—to get a better idea of what is taking place within the system (what the nature of the problems are, where they are located, and factors contributing to these problems).

In most cases, the tools, frameworks, and procedures discussed in this chapter are not new to the firm. They have been implemented as a result of developments such as Total Quality Management, and Lean/Just-in-Time. What is needed is for the firm to leverage these elements and to reapply them with a focus of making a supply chain sustainable.

The sustainable supply chain can be achieved. We have the rationale for sustainability; we have the components; and, now, in this chapter, we have the standards, tools, and frameworks to make sustainability a reality. In Chapter 5, we will next review a design for sustainability, before reviewing integrated supply chain management in Chapter 6.

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

AI: What sustainability standards are used in your industry?

AI: What sustainability standards align with existing core capabilities and your business model?

AI: What process management tools are in use within your company?

AQ: What standards or certifications do your suppliers possess?

AQ: To what extent do management systems support process management?

AQ: To what extend does your company have a formal environmental management system in place and how long has it been in place?

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

Further Reading

McCarty, Jordan, & Probst (2011). *Six Sigma for sustainability*. McGraw Hill.

Visser (2009). *Landmarks for sustainability: Events and initiatives that have changed our world*. Greenleaf Publishing Limited.

Willard (2012). *The New Sustainability Advantage*. New Society Publishers.