Eco-Quality for Environmental Sustainability

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Quality is a continually moving target. Managing for quality must break new ground in response to a changing environment in which customers and stakeholders demand sustainable and ecologically friendly products and services. Rather than simply maintain the status quo, businesses and society need to break through existing constraints and fundamentally shift to a new landscape—a new zone of quality—and design processes and products for sustained ecological quality from the start. This paper discusses what we believe is the next addition to the management of quality. We call it Eco-quality.

Quality and Sustainability

Organizations are being challenged to find and capitalize on opportunities to meet their strategic goals, while also meeting societal needs. More and more organizations are being encouraged to look at the entire landscape unfolding before them from the perspective of a balanced array of outcomes characterized by the new "triple bottom line" of people, planet, and profits (Savitz and Weber, 2006). As a result, successful organizations do not focus only on profits and their bottom line; they also take into consideration people and our planet. Quality Management has always taken people and profits into consideration; now, a third dimension has been added that encompasses environmental sustainability and stewardship. This partnership of quality and environmental sustainability is natural and, we believe, mutually beneficial over the long run. The performance excellence we strive for in a business environment extends to the larger, ecological environment in which businesses, customers, and stakeholders operate.

A number of years ago Dr. Juran coined the phrase "life behind the quality dikes" (Juran 1969). As explained by Dr. Juran, quality dikes are a way of securing benefits of technological advances, but living dangerously insofar as technology creates harmful byproducts held back by these quality dikes. Dr. Juran recognized that there are minor breaks in these quality dikes—occasional failures of goods and services. As he stated, these failures are annoying as well as costly. Some significant failures can be cited, such as the Chernobyl and Bhopal disasters. These are extreme examples, but pale in comparison with the potential impending tsunami of effects of climate change.

If it plays out as many believe, this approaching tsunami will spring more than just a few leaks in the dikes, posing instead a much more significant threat to our environment. This situation has slowly been gaining momentum for a number of years with much discussion regarding the effects of green house gases (GHG), in particular CO_2, on temperature and climate. Carbon dioxide, which is generated from various sources both man-made and natural, has physical and correlative properties that make it a prime suspect in global temperature fluctuations, i.e., global warming. Unlike the events at Chernobyl and Bhopal, which originated in point sources with effects confined to a general geographic area, global warming is by definition more far reaching: it is world-wide. Although technology-induced catastrophes (Chernobyl, Bhopal) plainly are different in many regards from the global warming issue, they have something very much in

common in that technology and people have the capacity to create change, for better and for worse.

Global Warming

Global warming is one of those topics that tends to divide people into two separate schools of thought. On one hand, there are those who believe that global temperature fluctuations reflect normal, common-cause variation, or perhaps represent part of a natural environmental or physical cycle the earth is now experiencing, and has experienced in our distant past. The other school of thought contends that humans are causing the earth's temperature to increase as a result of our technologies, specifically through increase of greenhouse gases (GHG). These gases are emitted primarily through natural sources and human (technological) activities, and contribute to the "greenhouse effect;" they include water vapor, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and carbon dioxide. Of these major contributors, CO_2 is judged to have the most far-reaching and consequential effects on our environment. In late 2009, the U.S. Environmental Protection Agency officially issued the finding that greenhouse gases contribute to air pollution that may endanger public health or welfare, thereby placing U.S. carbon emissions under the EPA's purview (EPA 2009). Atmospheric CO_2 levels are near record, highs, perhaps linking with rising sea levels, water shortages around the world, depletion of fisheries, extinction of species, shifting seasons and agricultural planting zones, and numerous other phenomena. As developing economies step onto the global stage, contributions to CO_2 emissions are expected to rise at increasing rates.

Whether the earth is simply experiencing another environmental cycle or humans directly are contributing to an increase in the earth's temperature perhaps is a moot point from a quality perspective. If there is something society can be doing to mitigate potentially damaging effects to the environment, then we as citizens of this planet have a responsibility to future generations to take action to preserve and sustain our environment. While formal steps are being taken, e.g., the talks in Copenhagen in winter, 2009, many believe that international cooperation is not keeping pace with the world's ever-growing interdependence and threats to the environment.

"We have not inherited the Earth from our fathers. We are borrowing it from our children." — Native American saying.

Societal Role and Responsibility

Social interactions among people in their everyday lives have expanded through technological advances and the capacity to impact others across distances. Historically, "society," in the sense of the general public, was defined functionally by the physical constraints of distance. An extended family was the only "society" of concern to an individual in prehistoric days, with subsequent expansion to tribes, villages, cities, and civilizations. Society in the sense of humanity always existed, but it had little practical impact to an individual that neither intermingled with nor directly depended on others that lived more than the next valley away. Societies were small, and so were perceived responsibilities.

Two factors, technology and the sheer number of people, have worked together to facilitate in mingling and interdependence. Technologies as simple as the wheel and as complex as the internet, allow people and ideas to move vast distances with relative ease. Populations once limited to local impact now are sufficiently large enough to affect many others. For instance, fishing in international waters or shipping of heavy metal-laden electronic components to other continents for recycling.

Once-separate societies have begun to band together ideologically on environmental issues. While no universal consensus exists on many aspects of the environmental impact of various human activities, governments, grass-roots organizations, and other assemblages are more vocally conversing and taking visible, concerted action to shore up the "quality dikes" that Dr. Juran so astutely saw decades ago. These efforts appear certain to result in widespread change in legislation controlling aspects of quality we long have taken for granted. Necessary, perhaps, to achieve emerging societal goals, but is control alone sufficient?

Consider what legislation, agreements, treaties and accords are intended to do. While they may incentivize, they act as constraints by setting out limits as to appropriate and inappropriate activity. This is the essence of control—to maintain performance within certain boundaries. Through continuous, incremental innovation and the elimination of sporadic, special causes of poor performance against environmental standards, the dikes gradually will be strengthened.

What else can be done? A good control plan eventually makes itself unnecessary. Once all the leaks have been plugged and the walls of the dikes strengthened, the dikes themselves become the limitation to quality improvement. In the same fashion, we need to think beyond mere control, to instead break through the self-imposed constraints and fundamentally shift to a new landscape—a new zone of quality—and to design processes and products for ecological quality from the start. We call this Eco-quality, which springs naturally from the Juran Trilogy's® universal processes of planning, controlling, and improving the quality of products and processes, thereby achieving sustainable performance breakthroughs. In stating his concerns about the environment and how it relates to quality management, Dr. Juran was well ahead of his time, nearly 30 years ago. Dr. Juran's concern for natural resources and the sustainability of the environment was based on a sincere desire to bring a better quality of life to not just his children and grandchildren, but all of humanity. Dr. Juran intuitively made the connection between quality and environmental sustainability, but did not give it a name. In recognition of his contribution, the Juran Institute refers to this as Eco-quality.

Corporate Role and Responsibility

What is the role of corporations in this context of Eco-quality? The global marketplace increasingly is focused on the environment, and customer needs now include social responsibility. As a part of this, organizations are beginning to invest in programs and initiatives to reduce the environmental impact associated with all life cycle stages of their products and processes. For example, U.S. Fortune 500 corporations and their global counterparts are beginning to recognize the importance of understanding and improving the environmental impact of internal technologies and business practices. With the belief that corporate sustainability

(including environmental dimensions) creates long-term shareholder value, Dow Jones established in 1999 the Sustainability Indexes, providing the first tracking of financial performance of leading sustainability-driven organizations worldwide. Another international program is the Carbon Disclosure Project (CDP). The CDP is a nonprofit organization with the mission to provide information to investors and stakeholders regarding the opportunities and risks to commercial operations presented by climate change. The CDP is a special project of the Rockefeller Philanthropy Advisors, and seeks to create long-lasting relationships between shareholders and corporations regarding the implications for shareholder value and commercial operations presented by climate change. Its primary goal is to facilitate a dialogue, supported by quality information concerning strategic risks, as well as opportunities and their implications to businesses, from which a rational response to climate change will emerge. From these and similar examples, we conclude that corporations have an implicit responsibility to manage their environmental impact, and increasingly explicit mandates to formally recognize and expand their role.

Product and Process Life Cycle Analysis

Earlier we introduced the concept of product or process **life cycle stages**. Here we will drill down to more fully develop this concept. The life cycle is important because it is necessary to analyze all aspects of products and supporting processes "cradle to grave" in order to arrive at a comprehensive profile of environmental impact (per the adage "you cannot manage what you do not measure"). This can only be achieved through a collaborative effort between commercial operations, supply and distribution chains. After a baseline profile is established, improvement can be achieved by instituting best practices that support the environmental sustainability of products and processes that support the end products. While this is straightforward in theory, currently there is no centralized or standardized set of data for the life cycle activities and processes to be included in quantifying product or process environmental impact. However, because of strong customer and stakeholder interest in CO_2 emissions, CO_2 is a reasonable currency that can act as a proxy for purpose of a life cycle analysis.

We can start by identifying five major phases of the life cycle of a product with its supporting processes that could be evaluated and analyzed. We can determine the probable range of CO_2 emissions generated by these various stages throughout the life cycle of the product and supporting processes. The five basic life cycle stages of a typical commercial operation are:

1. Product/process design
2. Manufacturing process
3. Production operations
4. Supply chain system
5. Final disposal (end-of-life)

Understandably, the initial focus of an organization in establishing its baseline carbon profile is on the manufacturing, production, and supply chain activities that are under the most direct control. With maturity, however, design and end of life contributions should be more fully

considered and addressed. Ultimately, the creation and development of an environmental sustainability process will benefit an organization's customers, shareholders, and society at large.

Eco-quality Defined

Eco-quality is not a replacement for designing a product or service that must be "fit for purpose." It is an extension on what "fit for purpose" will mean in the future. We believe that customers, of their own volition and through pressure from society and lobbyists, will create a new landscape for **quality and performance excellence**, a new zone of quality that incorporates the dimension of **environmental sustainability** in partnership with the **management of quality**. We now have the knowledge and experience to combine quality design, control, and improvement tools with best practices for environmental sustainability. Eco-quality is intended to enable clients across industries to respond to demands from customers, regulatory agencies, and shareholders for accountability in producing products and services fit for ecological use, focusing on understanding carbon profiles and reducing them to appropriate levels.

Eco-Quality and Performance Excellence

An effective performance excellence program in the future will include fulfillment of customer Eco-quality needs. This is in alignment with the Juran Trilogy®, encompassing the distinct processes of quality design, quality control, and quality improvement. Starting with a complete needs assessment of a client's products and supporting processes, a best fit methodology per the Trilogy is determined. The program core is quality improvement of processes, accomplished via a detailed accounting of carbon emissions and sources. The outcome is a baseline carbon footprint with corresponding recommendations to improve process efficiency, eliminate waste associated with CO_2, and control emissions over the long term through continuous improvement methods. The triple bottom line of people, planet, and profits goes from red to green by listening to the mounting voice of the customer, reducing negative impact to the environment, and providing a return on investment through improved efficiencies and cost reduction.

Methods and Tools for Eco-quality

A number of methods and tools are being used to move toward eco-friendly, eco-quality products including:

- **ISO 14000 Environmental Management System.** The ISO 14000 is a standard requiring organizations to establish an environmental management system. It is applicable to any business, regardless of size, location, or industry. The purpose of the standard is to reduce the environmental footprint of a business and to decrease the pollution and waste a business produces. The most recent version of ISO 14001 was released in 2004 by the International Organization for Standardization (ISO). An effective Environmental Management System meeting the requirements of ISO 14001:2004 is a management tool enabling an organization to:
  - Identify and control the environmental impact of its activities, products, or services

  - Improve its environmental performance continually
  - Implement a systematic approach to set environmental objectives and targets, to achieve these, and to demonstrate that they have been achieved

- **Life Cycle Assessments.** This is a "cradle-to-grave" analysis of the environmental impacts of a product or service caused or necessitated by its existence, from birth to death. Not limited to greenhouse gases (see carbon footprint below), it encompasses many forms of damage such as ozone depletion, desertification, and resource depletion. The objective of a life cycle analysis is to encourage informed and appropriate choices by providing fair comparison of products and services in terms of negative environmental impact. Consistent with this, the ISO 14000 environmental management standards define four phases of a life cycle assessment:

  1. Goal and Scope – description of the objectives, functional unit, system boundaries, method of assessment, and impact categories included in the assessment
  2. Life Cycle Inventory – detailed listing of inputs and outputs (e.g., materials, energy, water, chemicals, emissions, radiation) in terms of elementary flow to and from processes and the environment; relies heavily on software for data collection and modeling
  3. Life Cycle Impact Assessment – characterization of potential impacts, normalization to a common unit of measure, and weighting of impact categories
  4. Interpretation – sensitivity and overall analysis and conclusions regarding major contributing factors; assessment relative to the goal and scope

- **Carbon Footprinting.** A carbon footprint (or profile) is the combined total of all greenhouse gas emissions caused directly and indirectly by an individual, event, organization, or product (The Carbon Trust, 2009). Frequently this is reported as "CO_2 equivalent" with carbon dioxide used as a convenient, common currency; a carbon footprint therefore, need not be strictly confined to CO_2 alone. This is an expansive definition, and includes many sources over which an individual or organization has varying degrees of control. From a practical perspective, it is useful to classify the CO_2 equivalents according to the degree of control; common categories are:

  - Emissions from activities, products, and services under direct control
  - Emissions from activities, products, and services under indirect control
  - Emissions from electricity usage

  As already alluded, understanding an organization's carbon footprint is important for two reasons. First, customers, suppliers, shareholders, government agencies and various other third parties increasingly request this information from businesses. For example, organizations engaged in carbon neutrality "cap and trade" or those developing green marketing messages will need comprehensive, accurate, and verifiable reporting of GHG emissions, especially as this may become part of public record. Second, from the adage "you

cannot manage what you do not measure," measuring a carbon footprint is a necessary step towards reducing and controlling it, ultimately achieving gains in the triple bottom line.

- **Energy Audits.** An energy audit is an inspection and analysis of the energy flow through a building, process or system, carried out to improve energy efficiency and reduce overall consumption. While energy audits are not new (efficiency long has been an issue in corporate accounting offices), the "pollution" factor is gaining in prominence as a driver. A large proportion of energy typically comes from carbon-based fossil fuels, so carbon dioxide is a natural byproduct of energy use, and energy use therefore is a major contributor to a carbon footprint. An energy audit consists of the following types of information: building information (type of building, prior modifications, current conservation measures, occupancy profile), building characteristics (gross floor space, ceiling height, exterior wall area, number and placement of doors, insulation type and thickness, glass area, heating and cooling methods), electricity usage (metering method, demand patterns [including peak, average, and minimum], energy cost, service cost), non-electricity energy usage (other sources such as natural gas, liquefied petroleum, kerosene, coal, wood, steam), HVAC system (heating, ventilation and air conditioning units, sensors and controls, air flow and pressure), hot water (energy source, temperature at origin and point of use, distance from heater to point of use, insulation, re-circulation), lighting (area, lighting type [incandescent, fluorescent, mercury vapor, high pressure sodium, metal halide], wattage, output, operating hours, controls).

  Based on the audit results, opportunities are identified to eliminate energy waste, and reduce CO_2 emissions and operating costs. Many governments now sponsor programs to encourage "green building" and provide information to assist in energy audits, e.g., as part of the EPA's Energy Star program.

The End Game

Just as no single factor is implicated in climate change, no single player is driving the ball on social change. It is a collective effort. As organizations forge ahead and put together plans to meet the needs of their customers, it is easy to dismiss the once-solitary voices calling for change. This would be a mistake. Compelling expectations originate from multiple sources and perspectives:

- Customers – sensitive to the environmental impact of products and services they purchase
- Shareholders – demanding accountability, transparency, and favorable return on investment
- Legislators – pursuing legal incentives and constraints
- Scientific community – seeking evidence-based action
- Suppliers and Distributors – looking forward and back to manage their "cradle to grave" chain

Ignoring these will not make them go away. Rather, a real possibility exists that organizations failing to heed these influences will go away sooner. We are all faced with this environmental challenge in one way or another.

"The future belongs to those who are planning for it today" — African proverb.

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