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Sustainable principles: common values for achieving sustainability

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ABSTRACT

While there seems to be considerable consensus that a more sustainable society is in the best interest of everyone, opinions regarding what sustainability really means and how to achieve it are as diverse as the entities striving for it. With so many opinions and definitions circulating with respect to sustainability, the need exists for a set of core principles that can be applied evenly across all segments of society and disciplines. If we can establish universal principles associated with the development and implementation of a more sustainable society, it could help provide a consistent framework for human effectiveness in achieving sustainability. Three descriptions of such "sustainable principles" are described in this paper. These principles are rooted in the time-tested techniques associated with pollution prevention. They focus on developing and implementing better systems that reduce wastefulness through improved quality of products, processes and systems. By following these principles we can optimize resource utilization across all system components for the entire life cycle of the systems. In doing so, we will improve the sustainability of our ecosystems, production capabilities, community resources and human resources. Considerable educational resources already exist with respect to these principles. If we can apply them to sustainability issues, we can teach the skills and methods required for a more sustainable society.

1. Introduction

When the U.S. EPA was created in the early 1970s, their initial focus was on controlling and cleaning up the most immediate environmental problems. While these practices initially yielded major reductions in pollution, the traditional "end-of-pipe" approaches were expensive and, in some cases, ineffective as they transferred pollution from one medium to another. Subsequently, more effective approaches to environmental protection required focusing efforts "upstream" to prevent pollution from occurring in the first place. In addition to achieving superior environmental protection, pollution prevention offered important economic benefits, as pollution never created eliminated the need for expensive investments in waste management or cleanup. Additionally, efficiencies gained through better utilization of materials and energy also provided economic benefits while protecting the environment. The pollution prevention movement led the paradigm shift away from reactive environmental protection strategies that dealt with problems after their creation toward more proactive strategies that eliminated problems at their source through better designs, processes and systems. Consequently, today's sustainability movement is rooted to a great extent in the pollution prevention pioneering efforts from previous decades.

The worldwide movement toward a more sustainable society has caught fire in recent years with diverse constituencies, including communities, businesses, government, universities, and individuals. It seems that everyone is attempting to develop and implement methods, practices, curricula, and technologies that meet today's needs without jeopardizing the needs of future generations. Buzzwords such as "the triple bottom line" have now become commonplace in strategic planning sessions while organizations attempt to balance the needs of the environment, the economy and society. While there seems to be considerable consensus that a more sustainable society is in the best interest of everyone, opinions regarding what sustainability really means and how to achieve it are as diverse as the entities striving for it. Kirkby et al. (1995) noted that at least 70 different definitions of sustainable development appeared in the literature between 1974 and 1992. That number has certainly increased exponentially since then given that virtually all disciplines and organizations have a vested interest in the sustainability movement. The range in definitions is so varied that Lozano (2008) was able to separate them into 5 completely different categories. In their efforts to clarify ambiguity and classifying terms used in the sustainability field, Glavic and Lukman (2007) advocate that

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"sustainable development should be supported by a common, unambiguous terminology, applicable to real-world problems". With so many opinions and definitions circulating with respect to sustainability, the need exists for a set of core principles that can be applied evenly across all segments of society and disciplines. Principles are fundamental concepts that serve as a basis for actions, and as an essential framework for the establishment of a more complex system (Glavic and Lukman, 2007). The notion of establishing principles as a guide to sustainable development is not new. The "Natural Step" framework (Robert, 2000) was compiled by ten pioneering sustainability scientists focused on principles for sustainable development that, if accomplished, would achieve sustainability. The Natural Step principles state that "In a sustainable society, nature is not subject to systematically increasing:

1. concentrations of substances extracted from the Earth's crust;
2. concentrations of substances produced by society;
3. degradation by physical means, and, in that society, people are not subject to conditions that systematically undermine their capacity to meet their needs".

The Natural Step principles do a nice job of describing a vision of what a sustainable society would look like (Korhonen, 2007). However, they do not address the "how-to" aspect associated with getting there. This paper describes a small set of *sustainable principles* that have been observed from over thirty years experience associated with making all types of organizations more sustainable through implementation of pollution prevention and energy efficiency strategies. It is the author's hope that other change agents will be able to use these principles to stimulate sustainable development through merging the pollution prevention and sustainability strategies described below.

In his international best-selling book "The Seven Habits of Highly Effective People", Stephen Covey (1989) argues that "there are principles that govern human effectiveness – natural laws in the human dimension that are just as real, just as unchanging and arguably *there* as laws such as gravity are in the physical dimension". Covey focused on principles of personal growth and change, including fairness, integrity, honesty, dignity and service to name a few. It is difficult to argue against the value of these principles given their universal acceptance from moral and religious perspectives. Hence, these principles have stood the test of time and can be regarded as "sustainable" in their own right. One could argue that living sustainably is another example of a principle that should "govern human effectiveness" in and of itself. Likewise, if we can establish universal principles associated with the development and implementation of a more sustainable society, it could help provide a consistent framework for human effectiveness in achieving sustainability. Three descriptions of such "sustainable principles" are provided below. Considerable educational resources already exist with respect to these principles. If we can apply them to sustainability issues, we can teach the skills and methods required for a more sustainable society.

1.1. Principle #1: improved sustainability is achieved through reducing wastefulness

Over 30 years of experience with helping organizations of all types and sizes become more sustainable has produced one incontrovertible observation. That is "the less wasteful an individual, community, or country becomes, the more sustainable it becomes". Wastefulness can occur in multiple forms that impact, products, processes, and systems. It can deplete the availability of materials and energy and reduce the value and capabilities of agricultural, industrial, community, and natural resources. Finally, wastefulness can reduce the ability of current and future generations to reach their full potential. The focus of this paper is on wastefulness associated with "natural capital". The term 'natural capital' was coined by Schumacher (1973) to describe all of the ecosystem services that the earth provides to people.

Natural capital is wasted through two primary mechanisms, 1) consumption and 2) degradation. Consumption usually involves the use of raw materials such as water, metals, chemicals, paint, plastic, wood, etc. that go into products and leave the value chain when they end up as unusable waste. Consumption also includes using energy from non-renewable sources – after fossil fuels are consumed for their energy content, we have lost them forever. Degradation includes the resources that are tied up to store wastes (e.g., landfills) and the pollution that occurs as wastes are introduced into the environment. As pollutants build up in water, air, land, and living organisms, they reduce their quality and waste their full potential as important sources of natural capital. Society also wastes natural capital through degradation associated with neglect and overuse of the following:

- *Ecosystems* – Overuse of national parks and wilderness areas has resulted in considerable degradation of some of our most beloved resources – wasting their potential use by current and future generations.
- *Production capabilities* (factories, farms, etc.) – When the American industrial complex closes down a factory, the natural capital invested in those facilities is wasted. Unsustainable farming practices deplete topsoil and pollute bodies of water – wasting their potential for current and future generations.
- *Community resources* – Urban decay reduces the value of existing infrastructure and also wastes the natural capital that was invested in it.
- *Human resources* – Deteriorating ecosystems, production capabilities, and community resources, translate to reduced quality of life for current and future generations, thus wasting some of their potential for achievement. Extreme wastefulness can result in shortages of basic staples that ultimately causes social unrest and in some cases war. As Lozano (2008) noted: "When any individuals and societies have not filled their basic needs the long-term safeguarding of the environment becomes relatively unimportant, at least in the short-term".

This principle creates an important link between sustainability for the ecological system on the one hand, and sustainability for the social system on the other and is consistent with strategies advocated by Missimer et al. (2010). Reducing wastefulness through more efficient utilization of natural capital has to be at the core of any sustainability initiative. Consequently, it stands to reason that pollution prevention strategies that improve efficiency by eliminating waste at its source should also be a guiding strategy for sustainable development.

1.2. Principle #2: improving quality improves sustainability

Reducing wastefulness is a common mantra for virtually every type of quality improvement program currently used in the business world. Waste is fundamentally the result of a defective product, process, or system. Consequently, eliminating defects and waste through quality improvement is a reasonable way to eliminate wasted natural capital as well and, therefore, improve sustainability.

From the time of the first industrial revolution until World War II, conventional business philosophy believed that quality and productivity were at odds with one another. That philosophy was proven specious when innovators such as Deming (1982) showed that quality and productivity could be improved simultaneously through the prevention of defects and wastes. Today's sustainability movement merely extends this train of thought incrementally. If we can simultaneously improve productivity and quality through the prevention of defects and wastes, we can also improve sustainability and quality of life through waste and pollution prevention.

Seven deadly wastes that can greatly reduce an organization's efficiency are frequently identified in quality assurance programs such as "LEAN" or "Six Sigma" (Womack and Jones, 2003). These include:

- Over-production
- Waiting
- Transport
- Processing
- Inventory
- Motion, and
- Repair/Rejects

Organizations such as Toyota have been able to improve their production, quality, and market share through reduction of these wastes. However, an excellent case can be made for adding natural capital to this list as an eighth waste in need of elimination. This would facilitate improving sustainability through existing quality assurance programs in thousands of organizations globally. Incorporating sustainability into existing quality management systems has been advocated by Azapagic (2003) who suggests that it can be utilized to make corporate sustainability an integral part of business instead of an "add on" approach.

As organizations continuously look for ways to reduce waste and improve competitiveness, they can also identify ways to reduce natural capital consumption and degradation and, in turn, improve sustainability. Kronenberg (2007) noted that "changing the properties of a product (e.g., increasing its durability)…. will lead to more sustainable consumption". Likewise, Hawken et al. (1999) predicted, "The first industrial revolution maximized the productivity of people. The next industrial revolution will maximize the productivity of resources".

One complicating factor associated with achieving sustainability through reducing wastefulness is the way markets value natural capital. Azapagic (2003) notes that "it is not always easy or possible to quantify direct financial benefits of corporate sustainability; and often, even if they are obvious, they may have longer-than-usual pay-back times". Some forms of natural capital such as energy, metals, wood, etc. are very well valued by the market. Consequently, efforts to reduce wastefulness associated with these items are often well justified in economic terms. However, other forms of natural capital such as water and air are not well valued in the market in spite of their irreplaceable contributions to life functions (if you think that the air you breathe isn't valuable because you pay nothing for it, try going 5 min without it).

Introducing mechanisms into the market place that ensure that natural capital is more accurately and equitably valued poses the greatest challenge to the sustainability movement. Waage (2008) suggests that "there is enormous potential for a government agency to address these issues through the creation of public databases with building block Life Cycle Analysis information and maintenance of these databases over time". However, as Bartelmus (1999) points out, "the value of the environment cannot be expressed in monetary terms. Equally, the value of societies and their individuals cannot be put in monetary terms. It is not possible to price the life of a human being, even if governments and corporations try to through compensation systems".

1.3. *Principle #3: sustainability is best achieved through implementing better systems*

It has long been understood that Mother Nature provides living, breathing and examples of the most efficient systems on the planet in the form of ecosystems. As shown below, energy is input directly from the cleanest of all sources, the sun, and is transformed and stored by producers (plants) for use by other organisms. Energy and materials continuously move from producers to consumers to decomposers with elegant efficiency that transforms products and by-products from each organism into usable forms for other organisms such that nothing is wasted. Regardless of the ecosystem in question (forest, desert, ocean, etc.) these systems function with perfect efficiency in terms of sustainability (Fig. 1).

Man-made systems are not perfect. As described by Deming (1982) and portrayed in the chart below, man-made systems are comprised of a combination of materials, energy, people, machines, methods, surroundings (environment, market conditions, political climate, etc.) and the way we manage them. Individual components of man-made systems tend to be optimized in isolation without regard to how they will affect other components of the system. System managers tend to only be concerned about wastefulness within their own organizations even though their decisions regularly affect both their supplier's and their customer's consumption of natural capital as well.

Waage (2008) notes that designers of products and systems have been "unclear about what sustainability principles, strategies approaches and tools to use at what points in time. At present, few companies publicly proclaim that their product design processes integrate either environmental or social aspects of sustainability thinking or take into account a systems-based view of sustainability". Additionally, life cycle impacts regarding natural capital consumption are often not considered properly. Decisions to go with the lowest bidder frequently offer short term benefits coupled with long-term commitments to waste natural capital excessively (e.g., an inexpensive appliance with low energy efficiency). Consequently, man-made systems tend to be un-balanced and generate considerable waste.

It would be ludicrous for an automaker to design and optimize individual components of an automobile (engine, transmission, steering, wheels, chassis, etc.) without consideration of the other components. To do so, would inevitably produce a vehicle that would not function well as a system. In fact, the notion is ridiculous

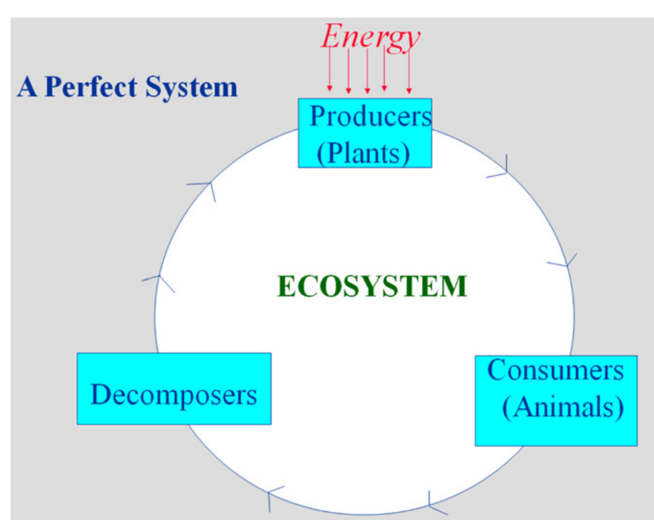

Fig. 1

because, in this example, an automotive company would be in control of all components of the system and would ensure that the components are designed and fabricated to mesh together and form an efficiently functioning system (Fig. 2).

Unfortunately, in most man-made systems, the design and management of the individual components is not controlled by a single entity. In these cases, the individual components tend to be optimized in isolation without regard to other components and do not function well together. For instance, an ethanol production facility is optimized to efficiently produce ethanol from corn without regard to how it will impact food supply (apologies to next generation biofuels developers who are well on their way to developing better systems).

Nowhere is the lack of balance in a man-made system more evident than in today's electronics industry. Electronic devices tend to be designed and manufactured without regard to how they can be collected, sorted, disassembled, refurbished, remanufactured or redistributed. Consequently, about two-thirds of the electronic devices removed from service are still in working order. However, only about 15% of this material is recycled while the vast majority is disposed in landfills (United States Environmental Protection Agency, 2008). The manufacturers of the devices do not own the waste – instead they count on their customers to become electronic waste management experts and deal with the waste appropriately. Consequently, the waste frequently ends up in developing countries where unregulated enterprises utilize primitive methods (e.g., burning) to recover metals without regard to impacts to human health and the environment. A better electronics management system would design and manufacture devices such that they could be easily refurbished and remanufactured. Business models would be reconfigured such that customers pay for performance of the devices and manufacturers would recover the equipment from customers and manage the remanufacturing of the used components. Such a system would not only be better for the environment, the economy and society; it would also be more conducive to a localized business model of service and flow that could bring substantial portions of this industry back to the United States.

Another key component to the design and implementation of more sustainable systems is to consider the natural capital consumption of all the groups influenced by an organization. Initial focus tends to be on internal products, processes and systems for good reason. In-house opportunities for improving sustainability are easier to identify and change. However, opportunities associated with suppliers and customers should also be considered. When specifications are made regarding materials selection, processing methods, packaging, shipping, etc. we invariably impact the natural capital consumption of suppliers and customers.

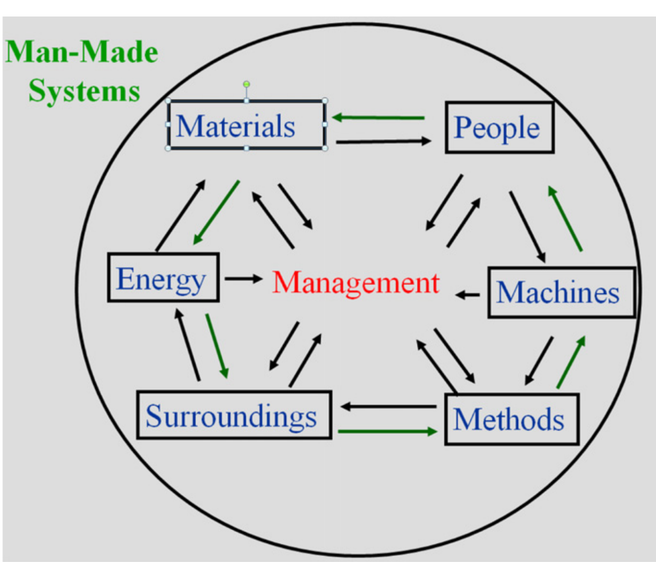

Fig. 2

Kronenberg (2007) noted the need to move from selling matter to selling function. He explains that "reducing material consumption does not lead to a decrease in well-being, as long as matter is replaced by non-material consumption". He further explains that "products only provide certain services and what is consumed is their function (or utility) and not their physical properties". Business models focused on selling performance instead of selling goods have become increasingly popular in recent years. Such models can greatly reduce inefficiency and waste because they align the interests of both supplier and customer. If a supplier is simply selling goods, the supplier is able to increase profits when the customer is more wasteful. However, if the supplier sells only the performance of their goods, then both entities benefit from reduced wastefulness. Several examples of performance based models that have become popular in recent years include:

- *Chemical Management* – Automotive, aerospace and other sectors no longer purchase chemicals (paints, lubricants, degreasers, etc.) from their suppliers. They pay only for the successful performance of the chemicals (i.e., cost per car) and the supplier makes more money by supplying less chemicals.
- *Waste Management* – Many organizations no longer pay for waste management services on a per container basis. They pay only for the service of managing wastes and by-products which encourage the waste manager to find recycling and alternative use opportunities.
- *Air Conditioning* – Some air conditioning suppliers now offer packages whereby their customers pay for comfort (an acceptable temperature range) instead of buying air conditioners. This encourages the supplier to optimize the entire building (caulk windows, etc.) instead of simply selling the largest unit they can justify.
- *Carpeting* – Some carpeting suppliers now offer programs whereby their customers do not purchase carpet. They simply pay to have their floors covered. The supplier comes in at night and replaces the worn carpet (typically 10%–20% of the total) thus reducing customer disruptions and overall material exchange.

The performance based programs described above share a common theme. The customer pays only for the performance they need – not the materials. These programs are inherently less wasteful, are more conducive to localized markets, and can improve domestic competitiveness.

1.4. Combining sustainable principles

Developing and implementing *better systems* that *reduce wastefulness* through *improved quality* of products, processes and systems is the key to a more sustainable society. Considerable educational resources already exist with respect to these principles. We need only to apply them to sustainability issues to teach the skills and methods required for a more sustainable society. By following these principles we can optimize natural capital utilization across all system components for the entire life cycle of the systems. In doing so, we will improve the sustainability of our ecosystems, production capabilities, community resources and human resources. But then again, we already knew that – mother nature has been showing us how to do it for thousands of years.

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