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THE SYSTEMS THINKER™
Building Shared Understanding

The Sustainability Challenge: Ecological and Economic Development

by Sara Schley and Joe Laur

Imagine picking up a newspaper and reading that the country's largest petroleum company has petitioned the government to *increase* the gasoline tax at the pumps. The company's motives, as explained in the article, are based on ecological as well as economic incentives. Could this ever happen?

In fact, such an event *did* occur in Sweden in 1992, when the OK Petroleum company successfully lobbied for an increase in the country's tax on leaded gasoline. This surprising action stemmed from OK's development of a high-octane (98) lead-free automobile fuel, which burned cleaner than other fuels while still maintaining high performance. The Swedish government agreed to the tax because it was in alignment with its own clean air policies and with international conventions that it supported. Since OK had the only lead-free product on the market, the gas tax gave the company a significant price advantage at the pumps. "The competition was forced to follow suit," explained OK's Per Wadstein, leading to cleaner air for all of Sweden.

Economy vs. Ecology

Economy and ecology are often pitted against each other in the "profitability versus environment" debate. There is a perception that companies can either prosper financially or take care of the earth, but not both. However, as OK Petroleum showed, these pursuits do not have to be mutually exclusive. In fact, *ecology* and *economy* derive from the same Greek root, *eco*, meaning *house*.

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(*Ecology* stands for "study of the house," and *economy* means "management of the house.") This etymology suggests that the two concepts are not contradictory, but actually part of the same larger idea. How, then, can we study and manage our "house" (the earth) in ways that benefit both industry and society over the long term?

The "Systems Thinking for a Sustainable Future" initiative, based at the MIT Center for Organizational Learning, provides a set of principles, practices, and processes that recognize and reinforce the synergistic link between long-term economic and ecological development. It seeks to provide industrial decision-makers with both a conceptual framework and practical tools for building financially healthy companies that are also ecologically sustainable. In addition, the initiative attempts to foster learning environments in which various stakeholders can grapple with the larger issues of the day. The hope is that within these settings, the participants will create presently unimaginable solutions to some of the world's most intractable problems.

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The Systems Thinker™ explores both the theory and practice of the learning organization, with particular emphasis on systems thinking as the cornerstone of the five disciplines (as outlined by Peter Senge in *The Fifth Discipline*). Articles by leading thinkers and practitioners articulate the challenges and issues involved in creating learning organizations. We encourage dialogue about systemic issues and strive to provide a forum for debating such issues. Unsolicited articles and stories are welcome.

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Sustainability

What do we mean by "sustainable"? A sustainable society is one that is self-perpetuating over the long term—meaning that it uses resources at a rate that does not exceed the rate at which they can be replenished, and that it produces waste materials at a pace that does not exceed the rate at which they can be reabsorbed by the environment. Within this framework, a sustainable organization can be described as a company that provides customers with goods and services for living a satisfying life, while maintaining both a healthy balance sheet *and* a healthy balance with the natural world.

Creating environmentally sustainable business practices used to be considered a choice for businesses—an optional activity for those companies that had the time, energy, and interest. But now it is becoming a more mainstream concern, due to several trends:

- The marketplace is demanding "greener" products that reflect environmentally responsible management. Supermarket aisles are filled with products that proclaim their eco-friendliness—from phosphate-free detergent and acid-free paper to recycled cardboard and "dolphin-safe" tuna.
- Material resources are becoming more scarce, resulting in a rise in production costs in many industries. For example, integrated steel producers virtually disappeared in the U.S. during the 1980s because the costs of mining iron ore grew financially prohibitive as the availability of that resource decreased.
- Regulatory compliance is becoming an increasingly costly concern. One petroleum company's environmental compliance costs topped $1 billion in 1994—a figure that exceeded the company's net profit for the year.

How can business managers think systemically about a sustainable future? How can they balance needs for economic prosperity and ecological survival? To address these challenges, companies need to expand their current strategic thinking to include economic and ecological concerns—creating what W. Edward Stead and Jean Garner Stead call "sustainability strategies."

A Conceptual Framework

The Natural Step movement, which originated in Sweden, offers a clear conceptual framework for creating such sustainability strategies. Led by founder Dr. Karl-Henrik Robèrt, The Natural Step has proven to be one of the most effective sustainability movements in the world, aligning diverse social, business, and ecological interests around fundamental scientific principles of natural systems. The Natural Step process has been studied and practiced by corporate managers, urban community members, youth at risk, and schoolchildren; it has been shared via book, audiotape, board game, or CD-ROM with every household in Sweden. It is an approach that does not blame any one sector of society for our current problems, but rather encourages all of us to find ways to contribute to effective solutions.

The guiding principles of The Natural Step, known as the "four systems conditions," are derived from the basic laws of thermodynamics: matter cannot disappear, and matter tends to disperse (see "The Four Systems Conditions"). By using the four systems conditions to evaluate whether their products and services are economically and ecologically sustainable, some of Sweden's largest corporations have pro-

duced significant changes in their business strategies.

For example, the ICA supermarket chain in Sweden was asked frequently by its customers whether its refrigerators and freezers emitted CFCs, which are linked to ozone layer damage. After familiarizing themselves with the four systems conditions, ICA's leadership engaged in a conversation with Electrolux (Eureka in the U.S.), their primary vendor of refrigeration products. Aware that CFCs, a non-biodegradable, unnatural compound, violate systems condition 2, ICA's leaders asked Electrolux what it would cost to eliminate this compound from their existing inventory. After some technical hedging, Electrolux designers answered that it would take 1 billion Swedish crowns (approximately $140 million) to convert to soft freons—another persistent and unnatural compound, but one that is thought to be less damaging than CFCs. The CEO's response was, "You want me to invest 1 billion crowns in a product, of which the only thing I know for sure is that it is doomed to failure?! Please come up with a more suitable alternative."

Electrolux, which had not previously encountered The Natural Step, subsequently phoned Dr. Robèrt and asked him to come "talk about your damned systems conditions." A short time later, the Electrolux team announced the development of an interim compound that does not harm the ozone and that is now successfully being manufactured and marketed as a "green" refrigerant. The company is also well on its way to producing a refrigerant that is biologically harmless. As a result of its work with Dr. Robèrt and his colleagues, Electrolux has begun employing The Natural Step method throughout the company, and is now using the four systems conditions as a framework for its strategic planning process.

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The Four Systems Conditions

The guiding principles for sustainability of The Natural Step are known as the four systems conditions. The conditions, as we interpret them, are:

1) Substances extracted from the Earth's crust must not systematically increase in nature.
Fossil fuels, metals, and minerals must not be extracted at a faster pace than they can be redeposited into the Earth's crust. This is because wastes from these processes tend to spread and accumulate in the system beyond limits considered safe for human health. *Therefore, the strategic business question to ask is, "How can my organization take steps to decrease its dependence on underground resources?"*

For example, OK Petroleum of Sweden is working to develop an ethanol-based fuel derived from organic matter.

2) Substances produced by society must not systematically increase in nature.
Man-made substances must not be produced at a faster pace than they are broken down by natural processes of assimilation. In part, this is because these compounds will eventually spread and increase their concentration in the natural system beyond limits acceptable for human health. *Therefore, the strategic business question to ask is, "How can my company take steps to decrease its dependence on non-biodegradable, man-made compounds?"*

For example, Skandic Hotels stopped using bleach in its guest towels and sheets, a change that resulted in significant savings with no customer complaints.

3) The physical basis for the productivity and diversity of nature must not be systematically damaged.
The productive natural surfaces of the earth (such as oxygen-yielding forests) should not be destroyed at a rate faster than they can regenerate. We depend on the oxygen and the food that are produced by green plants in order to breathe and to eat; they are critical to our survival. *Therefore, the strategic business question to ask is, "How can my company take steps to decrease its dependence on activities that destroy productive natural systems?"*

For example, AMOCO replaced an old pipeline in a manner designed to create minimal disruption in the Indiana Prairie State Nature preserve. As a result of its efforts, the company won an award from a U.S. government organization.

4) Resources should be used fairly and efficiently.
Given the physical constraints of our biosystem (the planet Earth and its atmosphere) as articulated in system conditions 1–3 above, the basic human needs of all people must be met with increasing efficiency. *Therefore, the strategic business question to ask is, "How can my company increase the efficiency with which it uses resources? How can we waste less?"*

For example, Wintergreen Clothing in northern Minnesota is making fleece coats, suitable for protection against winter's bitter cold, out of material derived from plastic soda bottles.

Source: Karl-Henrik Robèrt, "Simplicity Without Reduction," The Natural Step Environmental Institute Ltd. (Stockholm, Sweden), 1994.

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Integrating Sustainability Strategies and Organizational Learning

While the four systems conditions offer a basic conceptual framework for creating sustainable business strategies, they do not provide a specific process whereby those principles can be used to develop and implement such strategies. This is where the disciplines and tools of organizational learning can help. For example, the tools and methodology of systems thinking provide a means to test the long-term implications of policy decisions on the wider environmental system.

Systems thinking can also provide an overarching framework for understanding the industrial, governmental, and environmental interactions that play a role in sustainable development (see "The Sustainablility Challenge"). An overall increase in industrial productivity (such as the U.S. has experienced for most of the 20th century) leads to a reinforcing cycle of economic growth and profitability (R1), but it can also lead to an accumulation of industrial wastes in the environment. In the U.S., this has led to heightened regulatory pressures designed to reduced waste.

At the same time, increased consumer awareness of the environmental impact of production is leading to emerging new market opportunities in terms of "clean" technologies (B3), which, for those companies that invest in them, can lead to profitable alternatives to unsustainable production techniques (R4). However, the subsequent increase in regulatory compliance costs can constrain profits (B2), which can potentially limit industry's ability to invest in "clean" technologies (R4).

The disciplines of team learning and mental models also have much to offer in that they can help generate more informed, productive conversations. In the ecology/economy debate, dialogue skills of genuine inquiry, deep listening, displaying one's own line of reasoning, and respect for other viewpoints are critical, as are the ability to surface our mental models and to inquire into those of other people (see "The Power of Mental Models"). Through the use of dialogue and role-playing, we can gain deeper understanding of diverse points of view and bring out new ideas and solutions that a single point of view might not have produced.

In a recent learning laboratory at a petroleum company, for example, role-reversal, dialogue, and consensus-building tools were used to develop a new framework for environmental leadership. As part of the workshop, employees from the environmental engineering division took turns role-playing the traditional contestants in the environmental debate: "Government Bureaucrats," "Tree-Hugging Environmentalists," and "Big Bad Business." By humorously taking on their worst perceptions of each other, participants were able to see beyond the stereotypes that they had placed on their professional adversaries.

In the dialogue that followed, the engineers gained insights into the motivation, logic, and humanity of the various stakeholders, and were better able to understand the validity and utility of each point of view, even if the perspective challenged their own position. The engineers found that their subsequent meetings with EPA representatives on a difficult Clean Air Act

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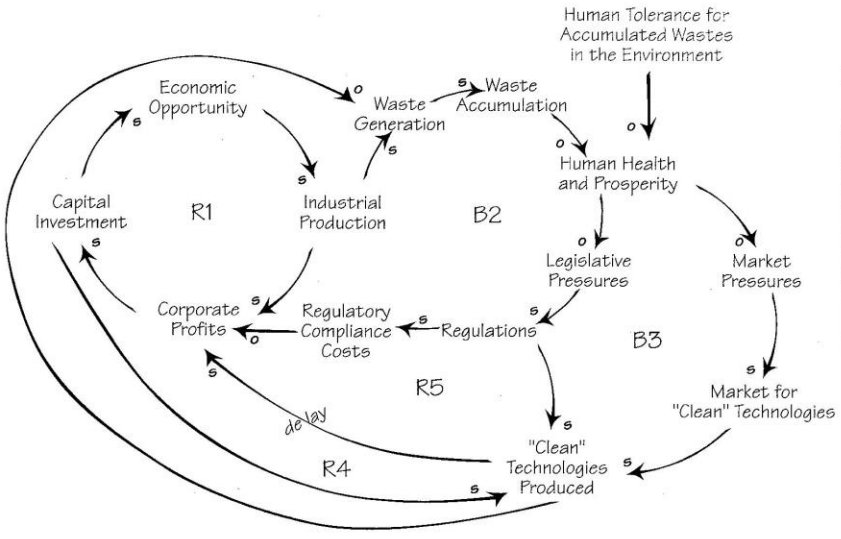

Heightened consumer awareness of accumulated industrial wastes has led to heightened regulatory pressures designed to reduce waste. However, the subsequent increase in regulatory compliance costs can constrain profits (B2) which can potentially limit industry's investment in "clean" technologies (R4).

project were significantly enhanced in terms of quality of communications, creativity of thinking, and efficacy of solution generated—all as a result of their experience in the workshop.

Organizational Learning for a Sustainable Future

Integrating sustainability strategies and organizational learning—one approach focused on content (where we need to go) and the other focused on process (how we'll get there)—may hold unprecedented potential for producing sustainable ecological and economic development. We have termed this synergy Sustainable Organizational Learning (SOL). Although the development of SOL is only in its initial stages, we can imagine a variety of learning practices through which SOL practitioners will work toward long-term economic and ecological sustainability:

- **Aligning industrial cycles and natural systems.** Conversations around strategy and future planning will include the question, "What business activities should we engage in that will be aligned with the systems conditions for sustainability?" The answers to this question will strongly influence investment decisions with respect to new products and services. In this way, SOL practitioners will begin to align their company's industrial cycles with natural systems.
- **Building cross-company consortiums.** By building consortiums of companies engaged in a similar inquiry, sustainable learning organizations will participate in company-to-company conversations that will enable them to learn from each other's challenges and successes in the pursuit of sustainability strategies.
- **Engaging in ongoing practice.** By studying and practicing the disciplines of SOL, practitioners will foster new learning in themselves, their compa-

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The Power of Mental Models

In the industrial culture of the 20th century, several mental models have prevailed that do not support a sustainable future. In order to create a different future reality, we must understand the impact of these beliefs on our current actions, and consider how these assumptions might be reshaped in order to contribute to global prosperity.

Mental Model: The economic system is the entire system.
The economic paradigm that has prevailed in business schools and executive boardrooms often suggests that the economic system is the entire system. This view forgets that economic benefits are derived from the overall natural system in which the firm operates. The social and environmental costs of doing business, such as consumption of natural resources and disposal of wastes, are often not included in the balance sheet. If the real costs to the natural system were reflected in accounting practices, some companies that are currently considered profitable would actually show a loss.

A more sustainable point of view recognizes the earth as the source of all profits. If I run an oil company, my profits are generated from petroleum extracted from the earth. If I run a lumber company, my profits are generated from the forests of the earth. Even if I work in the information industry, my profits are generated by providing knowledge or information to other companies that profit by producing goods from the earth. Ultimately, we must recognize that the economic system is a subsystem of the ecosystem.

Mental Model: Industrial processes are linear.
Most of us were taught in school that processes begin at point A and end at point B. This kind of thinking does not consider the systemic (cyclical) repercussions of our otherwise well-intentioned actions. We are therefore often surprised when our original actions produce dangerous consequences: the drums of chemicals that we buried "securely" beneath the earth 20 years ago leak into and contaminate the local water supply, or a product that made our firm tens of millions of dollars in profits costs us hundreds of millions in environmental cleanup a few years later.

A more sustainable view sees a cyclical process of design, production, and recovery of resources that can then be used again in the production process.

Mental Model: There are infinite resources for the production of goods. We can throw wastes away.
In the early days of the Industrial Era, when the world population was one-tenth of what it is today, the perception prevailed that physical resources were unlimited. Given an assumption of limitless goods and an infinite capacity of the system to absorb our wastes, there was no reason to focus on efficiency, reducing waste, or reusing goods. We could generate wastes and simply throw them away.

A more sustainable perspective recognizes that we do not have an unlimited supply of raw material to work with, so we must be more efficient in our use of materials. In addition, we must recognize that the earth is, indeed, a closed system. There is no "away" to throw our garbage—my "away" is someone else's backyard, water supply, or home. What waste we generate and are unable to reuse will become dispersed junk, which could have potentially devastating consequences for human survival and the survival of other inhabitants of the earth.