

Creating Sustainable Organizations

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<http://www.seedsys.com/cso/cso01.html>

Meeting the Economic, Ecological, and Social Challenges of the 21st Century

"I set before you the blessing and the curse, therefore choose life." -Deuteronomy

There is a proverb that states: "If you don't change direction, you'll end up where you're headed." Today there are many voices, both inside and outside of business, warning that we are headed for ecological disasters – a massive breakdown in the Earth's natural systems on which our civilization depends. There are other voices that complacently assert that nothing at all is amiss, that in fact things have never been so good. And there is a smaller but growing chorus arguing that both of these perceptions are true, at least in part.

One way to reconcile these conflicting viewpoints is to think of ourselves as living in a time of great opportunity, in which we have a chance to build a new path to the next Industrial Revolution. This new age will be dramatically different from the 19th-century emergence of industry, and building a path toward it will require substantial learning on the part of individuals, companies, and society at large. Our current "know how" pales in comparison to the art of "find out how" that we must develop in order not only to survive but also to thrive into the next millenium. In fact, it will be a systems perspective and revolutionary processes of organizational learning, not coal or petroleum, that will fuel this next Industrial Age.

The bad news is that the problems with the Earth's ecosystems, both today and in the future, are enormous. Human enterprise has indeed dealt a huge blow to our planet. The good news is that the opportunities-especially for human enterprise-are immensely greater. To harvest those opportunities, we need to make major changes in the way we think, act, and do business.

Fortunately, a vision of new levels of prosperity-levels that can be sustained economically, ecologically, and socially- is drawing more and more people into its service. To fulfill that vision, we will need to take new risks, make stronger commitments, and put in some plain old hard work. In the pages that follow, the authors explore hard but necessary questions such as:

- How can we expand our perspective to see that our economic systems are embedded within and defined by the broader ecosystem, and how might that awareness inform our business strategies?
- How can we use the concepts, tools, and methods of systems thinking and organizational learning to expand our capacity for sustainable development in our businesses and communities?

- How can we align our technologies with scientific principles for sustainability as we create products and services that will benefit society in the long term?
- How can we develop a community of learners who are colleagues and collaborators in the pursuit of creating sustainable development processes, practices, and results in business?

What Next: Standing in Two Worlds

Achieving a new vision will not be easy. But it is a vision profoundly worth fulfilling, and a legacy that this society will be proud to pass on to the next. It is a legacy that can and will endure through the seventh generation and beyond.

Two Potential Futures'

Scenario 1: It is the year 2050. There are 10 billion people on the planet. Pollution of air, soil, and ground water has risen to levels high enough to damage the land's ability to yield crops. Governments have been forced increasingly to shift investments into agriculture simply to feed their populations. Famine runs rampant in developing nations. Physical capital such as roads, factories, and other infrastructure is deteriorating faster than it can be restored, particularly in older industrialized nations. Industrial productivity is in a tailspin. Since 2020, the use of nonrenewable resources such as petroleum and natural gas has doubled, depleting reserves and increasing emissions of carbon dioxide and other toxic compounds. Global temperatures and sea levels are at all-time highs. Renewable resources continue to be harvested at rates that exceed their ability to regenerate, and their capacity to restore themselves is eroding. All world fisheries have collapsed or are in decline. War has erupted between nations everywhere over increasingly scarce basic resources and displaced populations. Global population is plummeting as death rates soar.

Scenario 2. It is the year 2050. The world's human population has leveled off at 8 billion. The average standard of living equals that of Europe at the end of the 20th century. People routinely expect to live over 80 years. Technologies such as superinsulation, fuel cells, and hypercars ensure the efficient use of material and energy resources like metals, wood, and fuels. Waste streams such as carbon dioxide, mercury, and sulfur dioxide have decreased dramatically. Global temperatures are leveling off, and forests are thriving. Land erosion has been controlled and food production increased so that all human beings enjoy a sufficient, healthy diet. Use of nonrenewable resources such as petroleum has declined as markets reflect their true costs to society more accurately. Solar wind and hydroenergy sources are meeting people's energy needs. Most industries and nations are collaborating to increase efficiency and to practice conservation. The Earth's soil, water, and air are consistently regenerating themselves and are free of pollution. The world is at peace.

The Systems View of Business: Seeing Constraints as Opportunities

'A closed system like the Earth's cannot withstand a systematic increase of material

things, but it can support exponential increases of information and knowledge."

- Robert Shapiro, CEO,

Monsanto Company

Harvard Business Review, Jan.-Feb. 1997

As you read "Two Potential Futures" above, which scenario did you find yourself thinking will come true in the year 2050? To focus on this question, imagine that this is the last day of your life. Think about how well you have taken care of yourself and your natural surroundings, and the legacy that you have left to the children in your life. What were the purpose and message of your time on Earth? And what is the quality of life that you envision your successors inheriting? What have you done to ensure that humanity as a whole heads toward Scenario 2 above?

Your responses to these questions may reveal your own vision of a sustainable future.

According to the World Commission on Environment and Development, sustainability is defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." The root meaning of the word, sustain, means "to support from underneath." The opposite of sustainability, therefore, is collapse.

On Earth, we live in a closed system with respect to matter; there are certain physical limits that we must respect if all life on Earth is to thrive and prosper for generations to come. To describe the implications of this reality for business, Karl-Henrik Robert and his colleagues at The Natural Step introduced "the funnel" (see "The Funnel"). The concept behind the funnel is that while exponential population growth is causing increasing demand for products and services, the Earth's capacity to provide water, fisheries, arable land, food, forest cover, and waste absorption is declining. As time moves forward, the narrow portion of the "funnel" puts more and more pressure on business and industry, especially on efforts to establish prices, to compete, and to earn a profit.

Yet what would happen if we turned these constraints around and saw them not as challenges but as opportunities for innovation in business-- just as a skilled engineer or architect uses the constraints posed by his or her project as catalysts for designing creative, attractive, and valuable solutions? To see constraints through the lens of opportunity, organizations need to adopt a systems view, and see natural systems principles as strategic guidelines for product and service development. Companies that can develop strategies in alignment with sustainability principles will avoid getting squeezed by the walls of the funnel, and will hone their competitive edge in the marketplace.

Global Warming: Problem or Opportunity?

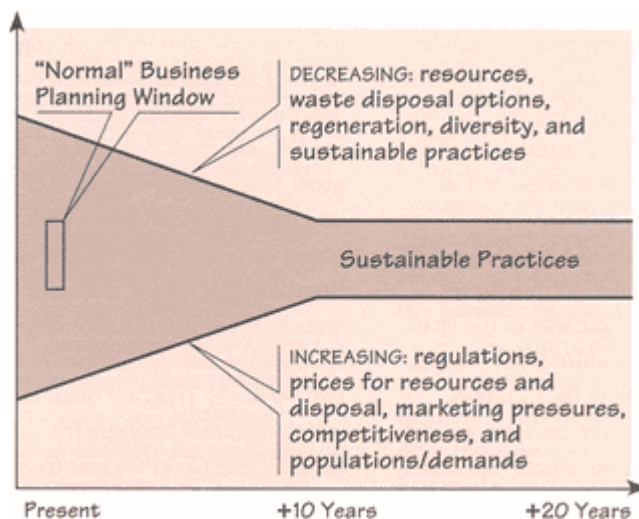
So how do organizations use sustainability principles to their advantage? The issue of global warming is one that has an impact on many industries. Global warming is a familiar and controversial subject in the media today. However, no one refutes the observable data: Average annual global temperatures have shown an upward trend overall, from about 14.5 degrees Celsius in 1866 to 15.4 degrees in 1995—the warmest year on record. Simultaneously, carbon dioxide concentrations in the atmosphere are 25-

30 percent higher than at any time in the last 160,000 years (State of the World, 1997, WorldWatch Institute). Carbon dioxide, a "greenhouse gas" that results in part from the burning of petroleum in combustion engines, is thought to contribute to the trapping of heat in the Earth's atmosphere and hence the phenomenon of global warming.

Indeed, in December 1997, 160 nations came together in Kyoto in an unprecedented global agreement restricting emissions of greenhouse gases, to be implemented over the next decade. GM chairman Jack Smith predicts that global warming will force a "phase-off of the internal combustion engine" (Time magazine, December 15, 1997). What fuel and power technologies will replace the internal combustion engine? These challenges create tremendous opportunities for innovations in business, as illustrated in the examples below.

In addition, regulatory pressures add compliance costs and create barriers to entry into certain markets. And, as losses mount due to wild weather swings, the cost of insuring our businesses increases. Crop failures and other disruptions in supply chains may also result. Global disruptions, no matter how distant, are rarely good for any business. And because we don't know just where our atmosphere's limits are, or how severe the consequences of exceeding them will be, or what the delays in the system might be, we are conducting a risky experiment on ourselves, our communities, and our economies worldwide. Global climate change is a powerful reminder to consider the systemic impacts of our actions, and to correct them ourselves before the system corrects them for us, at our expense.

Clearly, the problems that come from global warming and the atmospheric buildup of carbon dioxide suggest the need for controlling carbon dioxide emissions. It's also obvious that establishing such limits has enormous ramifications for many industries. But the idea of restricting carbon dioxide emissions also opens the door to some exciting new possibilities. Below are several examples of industries that have risen to the challenge of creating alternatives to greenhouse gas emissions.



The Automobile Industry

In the auto industry, reducing carbon dioxide emissions will require multifaceted solutions, including improving fuel economy further, reducing the number of cars on the road, and conceptualizing a totally new kind of transportation system.

Amory Lovins and his colleagues at the Rocky Mountain Institute have responded in a unique way to the challenge of rethinking automobile design. They began by asking the question, "Why not redesign the car from scratch, rethinking it from the wheels up, making it radically simpler?" They have developed a prototype for a new automobile called the hypercar. Thanks to its lightweight and strong, efficient design, the hypercar can cross the U.S. on just one tank of gasoline. According to Lovins, people will buy hypercars not because they save 80-95 percent on fuel and cut 90-99 percent of smog, but simply because they are superior cars—the same reason we now buy CDs instead of vinyl records.

The Logging and Power Industries

Like internal combustion engines, deforestation also increases concentrations of atmospheric carbon dioxide. Trees absorb carbon dioxide through the process of photosynthesis. As trees grow, they give off oxygen into the air and build up wood fibers, thus sequestering carbon in their trunks and branches. Decreasing the number of trees in the world through deforestation changes the natural balance in at least two ways: (1) Trees are often burned, which increases atmospheric carbon dioxide, and (2) as we lose trees, we decrease photosynthesis, thereby further increasing the amount of carbon dioxide in the atmosphere. If we think of atmospheric carbon dioxide as filling a kitchen sink, we can imagine it rising to overflow not only because we left the tap on (burning trees) but also because we've plugged the drain (reducing photosynthesis) (see "The Dynamics of Deforestation").

Total forest area on the Earth is now 23 percent smaller than it was in 1700 and declining at a whopping 11.3 million hectares, or 30 million acres, per year.

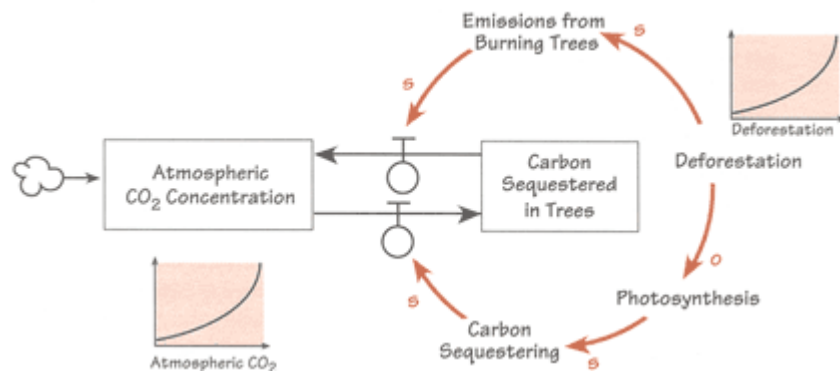
Deforestation also contributes to soil erosion, siltation in rivers, flooding, and drought. It is easy to see how, in the long run, uncontrolled logging can have dire consequences for our economies. Numerous logging towns in the U.S. have been wiped out by unsustainable logging policies.

As one example, Winton, Minnesota, a thriving American town of 3,000 people in the 1920s, has dwindled to a ghost town of 150. Only the liquor store and feed store remain as commercial establishments. Even the post office is gone.

Fortunately, some companies (Weyerhaeuser is one example) are starting to take the long view by implementing a concept popularized by economist Herman Daly: "Do not harvest a renewable resource at a rate faster than it can regenerate itself." In other words, respect the natural limits set by that resource and manage forestry accordingly.

Another innovative response to the issue of global warming has come from AES, an independent power producer with a large inventory of coal-fired, cogeneration plants. CEO Roger Sant decided to support a research effort at the company to find the least

expensive way to reduce AES's carbon dioxide emissions. The research indicated that something as simple as planting trees would be the most cost-effective solution! Accordingly, AES has launched a tree-planting effort.



Clearly, new business opportunities directly linked to the issue of global warming abound. Global warming has also catalyzed many stimulating questions about strategy, including, "What will the transportation system of the 21st century look like? How will billions of people living in densely populated areas of the world meet their transportation needs? What is the transportation vehicle of the next century?" Businesses involved in meeting human needs for food, agriculture, water, transportation, shelter, and air quality can benefit from exploring these kinds of questions.

The Triple Bottom Line

To many people, the idea of the "bottom line" brings up images of the financial measurement or success of an organization. "Bottom line" means hard-core numbers: Did the company make a profit this year or didn't it? This volume expands on the common definition of the bottom line by introducing a broader concept: the triple bottom line of sustainable development. Attending to the triple bottom line means meeting the financial, ecological, and social needs of the present while maintaining the ability of future generations to meet their own needs.

Some key issues emerge when we consider organizational strategies and actions in light of the triple bottom line. Specifically, the concept prompts us to think about the financial benefits of practicing sustainable development, the impact of our operations on the natural systems that the company uses and depends on, and the ramifications that our business actions have for the surrounding community and society.

Companies that fail to tend to the financial bottom line obviously do not stay in business very long. This element of the triple bottom line, however, is probably one to which organizations pay the most attention. It's relatively easy for managers to ask, "How does this particular product, service, or action impact our business financially?" When managers make smart choices in this arena, their companies can gain a competitive advantage.

Failure to consider the ecological impacts of operations can also bring about devastating losses for companies. These losses may well extend beyond the costs of inefficiency and

environmental compliance to the destruction of wetlands, contamination of groundwater, and the health of entire communities. W. R. Grace is an example of what can happen if managers ignore the ecological bottom line. Grace spent over \$15 million in legal fees and penalties as a result of their part in poisoning the water supply of Woburn, Massachusetts. Likewise, Union Carbide and Exxon suffered tremendous financial losses as a direct result of deadly chemical and petroleum spills in Bhopal, India, and Alaska, respectively. Even business actions that are commonplace and legal now can create enormous liabilities in the future as public awareness of the price of those actions increases. To attend to the ecological bottom line, managers can ask, "How does this product, service, or action impact the natural systems that our business uses and relies on?"

Finally, companies need to think about broader social impacts of nonsystemic decision-making. Failure to consider this aspect of the triple bottom line may show up as increased health and unemployment costs in the larger society, as well as higher taxes for welfare, social services, and prisons. Attending to the community can create a motivated, skilled work force and greater good will. Managers can ask, "How does this product, service, or action impact the communities in which we do business?"

Keeping all three of these aspects in focus is challenging for business. And it is a challenge that markets, society, and governments are increasingly demanding from business. More and more, it is becoming an expectation and a price of admission to the "game". Attending to the triple bottom line reveals that you value sustainability, and gives you an opportunity to shape a business that is resilient to the ever-changing demands of the marketplace. The bottom line is: It's a better way to do business.

QUESTIONS FOR THE TRIPLE BOTTOM LINE

By carefully considering the triple bottom line in all our business decisions, we minimize risks for ourselves and everyone else. The questions below can help an organization maximize gains in the broadest sense.

1. How does this product/service/action impact our business financially?
2. How does this product/service/action impact the natural systems that our business uses and relies on?
3. How does this product/service/action impact the communities in which we do business?

Two Views of Sustainability

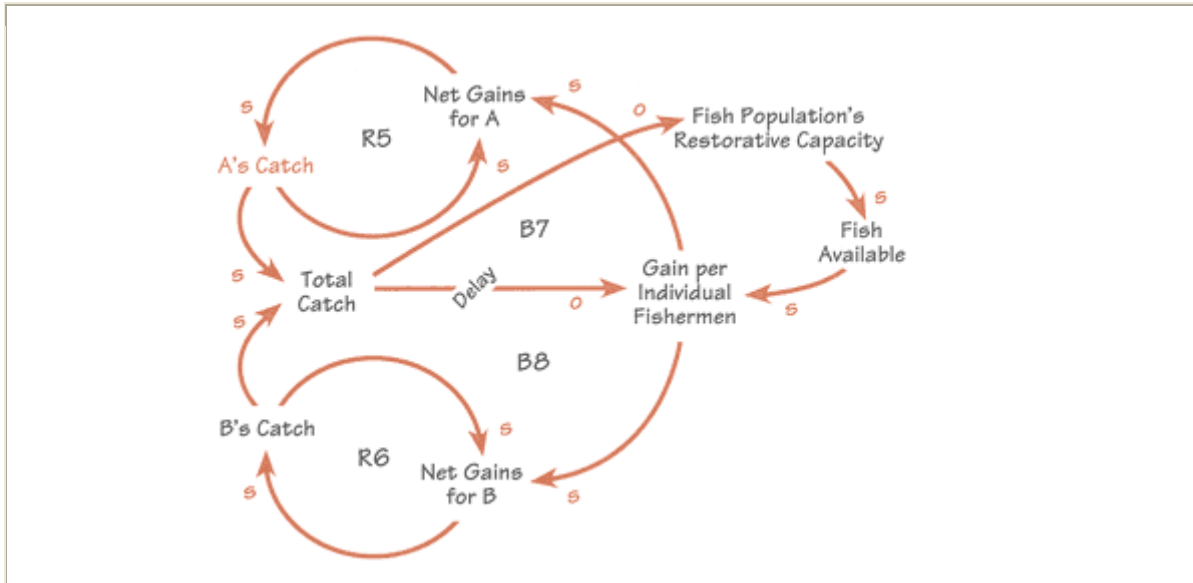
The Fishing Industry

To illustrate what can happen when we ignore the triple bottom line, let's turn to an example of a sustainability challenge that is close to home for those living near the coast of New England in the U.S. For generations, New England fisheries had flourished. Despite annual variances due primarily to weather patterns, the fish caught and the number of fishing boats increased year after year. In 1965 the waters off the coast of New England yielded 574,000 metric tons of fish. The Georges Bank fishery in the Northwest Atlantic was considered one of the most fertile and productive in the world. From 1966 to 1976, however, catches declined, despite new technologies and larger fleets. In 1976 the international waters limit was expanded to 200 miles, thus preserving those waters only for U.S. boats. Catches soared for about six years, then declined again.

Estimates of fish stocks sank to all-time lows by the early 1990s. In 1992 only 24,000 metric tons of fish were caught. The average size of spring cod caught dropped from 25-40 pounds to 5-8 pounds. New England fishermen to this day are having trouble paying their bills and staying in business, and the economies of entire towns are failing. What happened and why? What impact did this decline have on the fishermen and their families, the fishing industry, the coastal communities, and the Georges Bank fishery itself? The systemic process that precipitated this crisis comes to light in the computer-assisted board game *Fish Banks, Ltd.*, developed by system dynamicist Dennis Meadows of the University of New Hampshire. In the game, two to six teams of six or so players are each given control of a fishing company. Their goal is to maximize profits for their company. So each company goes about building and buying boats, catching and selling fish, and managing their little enterprises according to sound and accepted business principles. Profits and net worth grow as more and more fish are caught. But after a few years of healthy growth, something unexpected occurs. Catches (and profits) begin to decline, slowly at first, then more steeply, until the entire industry is plunged into a gut-wrenching decline and collapse. Profits evaporate and debts mount as the sea no longer yields its traditional bounty. Players scramble frantically to find productive fishing spots and sell their costly-to-maintain boats to anyone who will buy them. But the market is glutted with boats that no one can use profitably any more, and the economy grinds to a halt. Many if not most players end up bankrupt. Worse, most if not all of the fish are gone.

Why do the well-reasoned actions of the individual participants end up spelling ruin for the larger system? We get a hint of the answer in the systems archetype "The Tragedy of the Commons" (see "The "Tragedy of the Commons" Systems Archetype"). In this archetype, the commons is any community- or globally shared resource. No single party owns it, and everyone can use it. As the individual players maximize their returns from the use of the commons, and their numbers grow,

"THE TRAGEDY OF THE COMMONS"
and The New England Fisheries



The overall story of the New England fisheries illustrates the importance of harvesting renewable resources at a rate within their restorative capacity. In Fish Banks, as in real life, overharvesting of stocks erodes a resource's ability to replenish itself. Competitive rather than collaborative efforts among fishermen, along with poor management of the "commons," combine to speed the decline of the fish stocks. Instead of continued prosperity, the end result is worsening poverty for everyone.

Notice that in the story of the New England fisheries, every aspect of the triple bottom line suffered. Financially, the fishing companies became poorer (those that survived at all); ecologically, the fish stocks were depleted, with unknown consequences to the entire marine ecosystem of which they are a part; and socially, the local communities and economies suffered. Everybody lost.

The Sustainability Challenge as "Limits to Success"

In addition to the "Tragedy of the Commons" systems archetype, the archetype "Limits to Success" can shed light on the issue of sustainability. In "Limits to Success," there is a growing action or reinforcing loop that is balanced by a slowing action (see "The 'Limits to Success' Systems Archetype"). As the system approaches its limit, the more you try to push the growing action or reinforcing loop, the more you activate the balancing side of the dynamic. As a result, greater and greater efforts to push growth yield diminishing returns.

In looking at sustainability through the lens of "Limits to Success" (see "'Limits to Success' and the Sustainability Challenge"), we can see that industrial productivity drives the reinforcing loop or growth engine (R11). Industrial productivity leads to economic growth, developed economies, and human health and prosperity, which generate investments for further industrial productivity. We could say that this dynamic describes the engine of industrial growth that has powered our economy over the last 150 years. Many people living in industrialized nations have benefited materially from the wealth generated by this dynamic.

Yet industrial productivity causes another effect, waste generation, which drives the balancing loop (B12) in this dynamic. Waste generation leads to dispersion of waste,

which over time leads to a build-up of toxicity in the air, soil, and water. We humans, as well as other forms of life, have a limited tolerance for such toxicity. When this limit is exceeded, despair, disease, and death may result, all of which decrease human health and prosperity. Other species suffer as well.

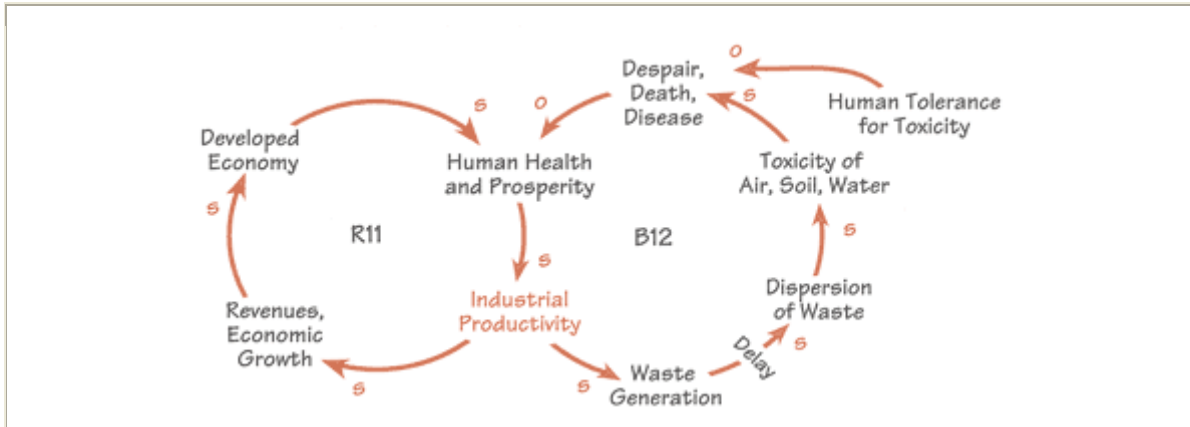
An industrial example of "Limits to Success" is the coal-based economy of London in the 1950s. Coal drove the industrial economy on the growth side of the equation. And, the particulate matter generated as a waste product led to air toxicity such that Londoners began dying from what they named the "black fog." Ultimately, a cleaner fuel source, petroleum, replaced coal.

When learning about "Limits to Success," managers are often told that the leverage for controlling this dynamic lies in "shifting the constraint." As Daniel Kim states, "The real leverage in a limits scenario... lies in finding and eliminating the factor(s) that are limiting success while you still have time and money to do so." With ecological sustainability, however, human tolerance for toxicity is a limit that cannot be removed, shifted, or delayed. We are the ultimate sinks, and there is a physical limit to the amount of toxins that we can tolerate. As Dana Meadows once said, "Choose your limit, or nature will choose it for you." We must look for leverage not in the elimination of the constraint, but elsewhere in the system. Once we accept the physical constraints in a system, we can use them as positive and powerful guidelines for effective action. There are no limits to our imagination and creativity in addressing these issues.

THE "LIMITS TO SUCCESS" SYSTEMS ARCHETYPE



"LIMITS TO SUCCESS" and The SUSTAINABILITY CHALLENGE



The Complexity of Sustainability Decisions

Making choices aimed at avoiding a "Tragedy of the Commons" or a "Limits to Success" situation can be quite complicated. Let's look at the example of the book-publishing industry, which uses huge quantities of paper. Some paper (called virgin stock) comes from trees that were logged. If that logging is done at a rate that exceeds the physical capacity of the forest to replenish itself, a commons—the soils, trees, and all the species that depend on them—may be destroyed. If, on the other hand, the logging is managed in a sustainable manner, so that the trees have the opportunity to replace themselves, we can use those trees to make paper without fear of destroying the commons (though making paper from virgin stock carries other costs and generates waste).

Recycling of paper offers another option for preserving the commons. This volume, for example, is printed on recycled paper, which costs a bit more than virgin stock but helps avoid overuse of forests. But recycling requires large quantities of energy and other materials, all of which carry a high price, and it generates its own kind of waste. So, is it more sustainable to make paper from trees logged from well-maintained forests, or to recycle paper and avoid logging altogether? Or some combination of the two? For any industry, it is clearly a difficult, complex task to measure and compare the full cost of all the alternative ways of doing business. Personal decisions about sustainability can prove just as complex. Many of the seemingly "simple" choices we make each day have complex implications. Think about your grocery-store clerk asking, "Good afternoon! Would you like paper or plastic?" Is it better to use recycled paper bags, which require lots of energy to create; paper bags made from virgin stock from sustainably managed forests; or plastic bags, which avoid logging altogether and require less energy to recycle than paper does, but which are made from petroleum? What about reusable cotton bags, and the pesticides and croplands required to grow the cotton?

We can struggle with lots of other questions as well. For example, is it better to put asphalt shingles on our roof and vinyl siding on our houses, or to use wood for those applications? Is an ice-cream company that uses all natural ingredients and supports important social causes really sustainable if they ship their product all over the country in refrigerated diesel trucks? One textile chemical manufacturer switched from chemical to natural dyes in their products-- until they visited a developing country whose vegetation was being stripped to supply them with their "natural" raw materials.

Obviously, there are no easy answers to these questions. However, a systems view gives

us a starting point for tackling these complex issues.

The Systems Conditions

In order to adopt and implement a systems view, we need a coherent framework and a set of shared mental models. To build such a framework, Karl-Henrik Robert and colleagues at The Natural Step asked, "What can we agree on?" They then looked for and articulated the basic principles that are applicable to all natural systems. Referred to as "The Four Systems Conditions," these principles provide a set of shared mental models that act like a compass in guiding dialogue and reflection on issues of sustainability and human beings' interaction with the rest of the natural world. The compass can be used at any scale and at any level of economic analysis—from the individual household, to the firm, to the community, to the nation, to the globe.

1. Substances from the Earth's crust must not systematically increase in the biosphere.

Fossil fuels, metals, and minerals must not be extracted at a faster pace than they can be redeposited into the Earth's crust. The reason for this is that wastes from these processes tend to spread and increase in the system beyond known limits 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 the biosphere.

Human-made substances must not be produced at a faster pace than they are broken down by natural processes. One reason for this is that, eventually, these compounds will 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 persistent, human-made compounds?" For example, Scandic Hotels stopped using bleach to clean guest towels and sheets, a decision that resulted in significant savings on bleach with no customer complaints.

3. The physical basis for the productivity and diversity of nature must not be systematically allowed to deteriorate.

The productive natural surfaces of the Earth should not be destroyed at a rate faster than they can regenerate. The reason for this is that we depend on the oxygen and the food that green plants produce: These plants are critical to our survival and are the source of many of our raw materials for commerce. 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?" Mountain Lumber Company in Ruckersville, Virginia, never cuts down a tree. They sell flooring and other specialty items made entirely from reclaimed wood. Meanwhile, lumber companies are facing a decade-long shortage of aspen, used to make chipboard, owing to over harvesting.

4. Resources should be used fairly and efficiently

Given the physical constraints of our biosystem (the planet Earth) as articulated in system conditions 1-3 above, the basic human needs of all people must be met with increasing efficiency and equity. 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, Malden Mills in Lawrence, Massachusetts, makes Polartec fleece fabric out of recycled plastic soda bottles, demonstrating a remarkable efficiency in its use of materials. The company has also earned much praise for its fairness, when it decided to

keep employees on payroll for a while after a recent, devastating fire.

To gain a concrete understanding of the four systems conditions, try the following exercise. Look around at your surroundings and focus on one object. Think about the resources that went into making that object. How does the manufacture of that object stack up with respect to the four systems conditions? For example, if you chose a drinking glass, note that glass comes from sand, a material found in abundance on the Earth's surface. The keyboard you may be typing on is made of Plastic, a petroleum derivative. Petroleum, mined from the Earth's crust, is problematic with respect to the first systems condition. Is there an alternative to petroleum? One scientist who was an employee at a major computer firm described the company's plastic-resource dilemma in this way. "We currently use 200 million pounds of plastics per year in production [for one product line]. In some product lines, we use almost the entire world supply of a particular plastic. We'd like to grow the company by 500 percent. Where are we going to get one billion pounds of plastics?"

New Mental Models for Sustainability

Honing our awareness of the systems conditions--whether on a community level or a personal level--requires a fresh look at our mental models. Mental models are those deeply ingrained assumptions and perspectives that

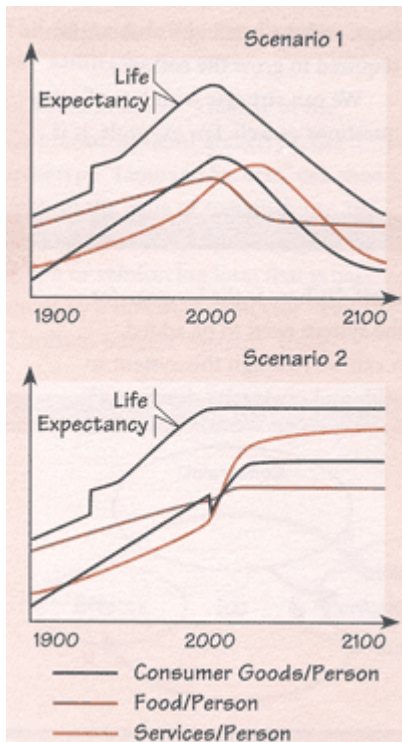
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The New England fisheries' predicament (p. 6) offers lots of lessons that can be applied to the larger world. One way to explore those lessons is to use computer modeling to examine systems behavior over time. The insights we can gain from this kind of modeling can help us understand the larger ecosystem within which commercial enterprises operate.

Dennis Meadows, Donella Meadows, and Jorgen Randers developed a computer simulation-- the World 3 model-- to address this wider perspective. World 3 was developed and used to support the conclusions of the books *Limits to Growth* and its sequel, *Beyond the Limits*. In these works, the World 3 model shows several possible scenarios for the impact of human activities on our global resource use, population growth, pollution concentrations, industrial and land productivity, and human prosperity. Two of those scenarios are shown below.

The World 3 model was programmed to simulate the activities of human society and the limits of the planet we live on. Given various inputs, the model shows how the state of the world and our material standard of living might progress over time, depending on what choices we make now. The simulation, in brief, makes the following assumptions:

- Growing populations and economies receive distorted and delayed systemic signals, and respond to these signals only after a delay. For example, a global response to the ozone situation took more than 13 years, and it will be a century or more before the situation can be fully corrected. Many global economic trends are well under way, if not over, by the time we fully recognize them. Because of the size of our populations and economies, it takes us time to disseminate, understand, and respond to information.



- The Earth's ecosystem has finite limits, and is erodable when overstressed or overused.
- Growth is inherent to human value systems, and tends to be exponential when it occurs in populations and economies. This is evidenced by the exponential growth of populations and economies worldwide over the past century.
- There are physical limits to the sources of materials that sustain human populations and economies, and there are limits to the sinks (the soils, watersheds, and atmosphere) that absorb the waste products of human activity. Anything we "throw away" as waste goes into our soils, water, or air. There really is no "away".

Some people deny that any problem exists. ("The facts must be wrong. The projections are faulty. Something has been left out of the calculations.") Others respond with despair. ("I'm helpless. We're doomed.")

But there is a third alternative beyond denial and despair. It's called disciplined choice. The same World 3 simulation shows us that if we take immediate steps to reduce pollutants, enhance land fertility and yields, increase the productivity of our material use, and moderate the physical growth of economies and populations, we can-- by the same year, 2040-- achieve an economy and a planet that supports more people at a higher standard of living than ever before. And we can sustain that society indefinitely, as shown in Scenario 2.

WHAT'S AT STAKE: THE WORLD 3 MODEL

In your own choices as a householder or consumer, you can ask questions to determine how well your choice meets the four systems conditions. You can also reflect more deeply on your own connection to issues of sustainability. In order to work toward more sustainable business practices, we need to be able to sustain ourselves first. If we deplete our own energy and other resources, we'll have trouble contributing to the larger sustainability effort.

In addition, we must remember that each of us is part of the system that we are seeking to sustain. Therefore, we must ask ourselves what we can do differently in our own behaviors to align ourselves with natural systems of organization. Perhaps the greatest leverage lies within each of us. Or, as the lead character in the film *Mindwalk* says, "Healing the universe is an inside job." Following are four conditions for personal sustainability, which form a corollary to Karl-Henrik Robert's four systems conditions:

1. We must not systematically draw from our personal resources at a rate

faster than they can be replenished. Do you overcommit your time, deplete your physical reserves, and take on too many emotional challenges? Pursuing this path may cause your physical system to break down. Therefore, the strategic question to ask is, "Am I taking enough renewal time and energy to replenish my personal resources?"

2. We must not take stress and toxicity into our personal system at a rate faster than they can be processed.

Do you eat too much, drink too much, or endure too much physical or emotional stress? When we exceed the capacity of our bodies and minds to metabolize such stresses, our system breaks down. Heart and liver disease and psychological breakdown are some of the documented health consequences that can result from such patterns of behavior. Therefore, the strategic question to ask is, "Am I taking on more stressful situations and substances than my system can safely process?"

3. We must not systematically degrade or compromise our system's ability to replenish personal resources and to process waste.

Do you, through your behavior, destroy your system's natural capacity to restore itself by absorbing nourishment and eliminating wastes? Do you therefore compromise your psychological resiliency to handle life's complexity? Therefore, the strategic question to ask is, "Am I nurturing my natural ability to regenerate myself?"

4. We must use our personal resources in a respectful way that enhances our relationship to ourselves, each other, and the community at large. This means recognizing what Peter Senge and Fred Kofman have called "the community nature of the self." In order for us to be whole, healthy, and fulfilled, we must nurture productive relationships with the human community of which we are a part.

Practicing personal conditions 1-3 above gives us the store of energy necessary to do this well. Therefore, the strategic question to ask is, "Am I taking care of myself in a way that allows me to give energy back to my community?"

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products, made "faster, smarter, and cheaper," is on the rise, while many raw materials and energy that go into making those products are decreasing in availability and increasing in price. The four systems conditions therefore can become strategic design criteria, allowing the proactive leader to ask these critical business questions: "What is the goal of my product or service? Can I meet this goal in a way that reduces my dependency on materials mined from the Earth's crust? Can I meet this goal in a way that reduces my dependency on persistent compounds produced by society? Can I meet this goal in a way that maintains the physical basis for the productivity of the Earth's natural surfaces? Can I do more with less? In other words, can I meet this goal by increasing the efficiency of my production so that I can meet more human needs with fewer materials? If I can serve on hundred customers with the same amount of materials and energy that my competitor uses to serve twenty, I will win in the marketplace." The management team that asks these questions up front and designs its products and services with these criteria in mind will leap out ahead of the competition and see improvements at the financial bottom line. Following are some striking examples of businesses that have used such questions to generate creative, new solutions for meeting the sustainability challenge.

Pollution Prevention Reducing the significant waste and emission streams from current operations.

Quad Graphics is one of the largest privately held printers of magazines, catalogs, and commercial products in the U.S., with sales of more than 1 billion dollars and over 10,000 employees. In 1996 Quad recycled all of its production, office paper, and cardboard—more than 158,000 tons of it. In doing so, it saved over 220,780 cubic yards of landfill space and \$12.6 million in landfill fees. The company has reduced its ink waste by 60 percent while increasing production by 150 percent at cost savings of over \$342,000 annually. The company earned \$33,114 and avoided \$14,350 in landfill costs by recycling plastics, and saved \$21,000 by recycling metals. Wood reuse and recycling saved the company \$453,800 in landfill costs in 1995. Quad's solvent recovery system is 98 percent efficient, while the industry standard is 92 percent. Quad has devised a closed-loop inkjet system that captures 80-90 percent of methyl ethyl ketone (MEK) vapor and condenses it for reuse, instead of releasing it into the air. This system, when fully implemented, will save over \$550,000 annually and prevent the use of 7,000 gallons of ink and solvent. By eliminating the ventilation systems and production and transport of MEK, the system will also save an estimated 2.3 trillion BTUs of energy by the year 2010. Quad earned over \$1,165,000 from process improvements since 1988.

Product Stewardship Keeping the entire lifecycle of a product in mind when considering product design and development.

Hewlett-Packard's product stewardship program aims to minimize adverse environmental health and safety impacts throughout the lifecycle of their products. This effort includes consideration of the environmental impacts of design, manufacturing, distribution, use, take-back, disassembly, and ultimate disposal of parts, materials, and energy. An example is the Planet Partners program, where toner cartridges for laser jet printers are returned by customers in a "product take-back" program. Planet Partners is a worldwide program

covering 80 percent of market areas. Up to 95 percent by weight of the materials are recovered. Some of these are reused in the production process, while the majority is sold to secondary markets. To ease customer participation in the program, HP provides every toner cartridge sold in the U.S. with a prepaid UPS mailing label. In further designing their cartridges to be more environmentally responsible, HP has continued to improve the cartridge yield in terms of pages per cartridge, as well as to reduce both total parts and numbers of part types for ease of materials recycling. HP now offers a recycled paper, compatible with its products.

HP also currently qualifies for the EPA's Energy Star program in 100 percent of its printer product lines. Energy Star qualification means that products will essentially "go to sleep" when not in use, powering down to a lower level and thereby saving energy. PCs, monitors, printers, faxes, and scanners also are part of the program.

Finally, HP is engaging its engineers in a "design for the environment" process, with the goal of designing products that are winners from both a business and an environmental perspective. As an industry leader, HP is setting the stage for competitors to take similar environmental responsibility.

Clean Technologies Realizing improvements in environmental performance and revenue generation through innovative new technologies.

DuPont CEO Edgar Woolard gave his scientists a challenge eight years ago: to reduce emissions by 60 percent. They exceeded that target. As a result of this leadership, many DuPont processes have become "cleaner," and new products and processes have been developed that are much safer environmentally. In their Chattanooga plant, engineers set a goal of zero waste. Approaching this, they went from 8 percent waste to 0.2 percent waste. This is saving \$250,000 in annual operating costs and \$20 million in avoiding upgrades of a waste disposal facility. DuPont is now leaving 200 million fewer pounds of chemicals in the landfill. This approach, says Woolard, is now "ingrained with out people: reducing pollution is a way to financial success."

DuPont has also reduced the application of chemicals to crops by 8 percent worldwide through the development of low use rate products, such as herbicides that are applied by thimbles per acre rather than pounds. In addition, these new processes save hundreds of millions of pounds of waste generation per year. The company has developed a biotechnological method, using renewable feedstock, to produce a key element of polyester. A chemical plant scheduled for opening in 1997 was designed and built from scratch to be a zero waste facility.

Finally, DuPont is partnering with Ford to paint cars for the automaker rather than to simply sell the paint. This financial arrangement is providing incentive for more efficient technologies, as DuPont is paid for the number of cars painted rather than the amount of paint produced and sold. DuPont and Ford are also partnering in manufacturing plastic auto parts from used carpeting.

Sustainability Vision Adopting a corporate vision that guides the development of new technologies, markets, products, and services aimed at meeting the triple bottom line of financial, ecological, and social performance.

Interface, Inc., the leading carpet tile manufacturer in the world with over \$1 billion in revenues, has committed to a sweeping environmental vision that aims to encompass all

aspects of strategy and operations. Their vision is "to make Interface the leading name in industrial ecology, worldwide, through substance, not words." To enact this vision, their policy is "to continuously improve the environmental, health and safety implications of operations and to protect the natural environment." This includes "striv[ing] for zero emissions operations."

Interface's sweeping sustainability vision translates into action at all operational levels. The company maps their industrial system with respect to multiple stakeholders—including suppliers, customers, market, the Earth, and the community—and then seeks to eliminate those links in their production process that do not contribute to sustainable commerce. Targets include eliminating waste, decreasing benign emissions, increasing renewable energy, attaining closed loop recycling, developing efficient transportation, and more. In the domain of "closed loop recycling," one idea in progress is the evergreen lease," in which Interface would retain ownership of the molecules that go into the manufacture of their carpets. In this way, Interface has reconceived itself as a service provider rather than a product supplier. As President Mike Bertolucci explains, customers want the service the carpet provides--"the comfort, look and feel of the carpet"—not the material carpet itself. With the "evergreen lease", customers will return old carpets to Interface rather than dumping them in a landfill. Interface will then redeem the molecules in those carpets for use as raw materials in producing new carpet. This idea represents a shift in mental models away from products and toward services. All manufacturers can ask themselves, "What service does my product provide?" and "Can I design a cost-effective way to retain physical ownership of the product while providing superior service to my customers?"

Interface realizes that these efforts will require a change in the organization's culture. Their experiential learning programs in teamwork and in The Natural Step aim to involve all 6,000 employees in the change effort. As part of Interface's commitment to be responsible to the community at large, CEO Ray Anderson serves as co-chair on the President's Council for Sustainable Development.

All of these efforts have led to a significant competitive advantage for Interface. The company enacted its sustainability vision in 1994 after experiencing four years of flat growth. By 1997, Interface showed \$45 million in savings and a 25-percent increase in revenues (from \$800 million to over \$1 billion in sales), and their stock price doubled.

A Closer Look at the Business Success Stories

The above cases suggest some interesting patterns. First, many companies begin their sustainability strategies with pollution prevention by improving efficiency, thus addressing systems condition 4. This is perhaps the most logical approach to seeing immediate returns to the bottom line. If a company buys raw materials at one end of it process and sees them go up the smokestack or down the drainpipe at the other, it's easy to conclude that a reduction in waste will save money. DuPont's reduction in emissions and waste, along with Quad Graphics' reduction in waste and use of paper, are apt examples of how pollution prevention can go straight to the bottom line. And it's not long before someone who is given the task of reducing waste at the back end of a process asks, "Why don't we design this thing in the first place so that it doesn't create so much waste?" Karl-Henrik Robert describes the evolution of a similar thinking process at McDonald's in Sweden. After exposure to the four systems conditions, the Swedish McDonald's took

on the considerable task of reducing packaging waste and composting food scraps. They succeeded, yielding significant savings for their company. After some time, the CEO of McDonald's Sweden asked the strategic question, "In a sustainable society, do we really need hamburgers?" Or, is there a better way to provide high-quality, low-cost food, fast? Chris Argyris has described this type of creative thinking as "double-loop learning," in which one steps out of a current mental model of how to do things and makes a quantum leap in thinking. Double-loop learning can help companies bridge the gap to a sustainable future, and often generates remarkably creative new ideas. Through this kind of learning, companies have begun by taking small steps toward sustainability, going for the proverbial "low-hanging fruit." If they take these steps in the context of a larger strategic framework with long-term sustainability objectives, they eventually can ask the questions that lead them to design products and services with the environment in mind. Total Quality Environmental Management (TQEM) and ISO 14000 efforts that build on companies' existing TQM and ISO 9000 structures provide another way to begin addressing issues of sustainability. When placed in the broader context of a total strategic sustainability program, these programs can yield initial short-term gains. These gains in turn give companies the confidence and the finances they need to invest in and design for the environment for the long term.

STARTING A SUSTAINABILITY INITIATIVE

We can think of an ecologically and economically sustainable business as one that continuously increases shareholder value-- while simultaneously decreasing the energy and material density required by the products and services it provides. This is an ongoing journey. To begin a sustainability initiative, try the following:

- Develop a capacity for "find out how" in your business. That is, see your sustainability initiative as a learning journey during which people both imagine the company's future and create it.
- Develop a sustainability vision for yourself, your team,

- Increase your own "ecological literacy" by developing some personal mastery in this domain.
- Share new learning, visions, and attitudes with each other through formal and informal dialogue and conversation.
- Ask the strategic question, "What business am I in?" Answer this question from the perspective of what service your products provide. For example, Interface realized that they sell warmth, ambience, and aesthetics-- not carpet.
- Ask yourself, "How can my business deliver its products or services in a way that is aligned with the Earth's natural systems?" Here are just a few ideas:
 - Minimize throughput of

- rather than by consuming the "principal" that gives rise to those resources.
- Maximize operational diversity in your business to increase flexibility.
- Assess the current reality of your company's impact on the environment by measuring how much it "takes, makes, and wastes." That is, determine the total amounts of energy and materials that come into your business and the amounts that leave as products, as organic wastes, and as toxic wastes.
- Recognize that a sustainability strategy can focus on both the short and long term simultaneously. Short-term financial gains made from driving waste out

<p>and your business. What is the legacy that you want your company to leave future generations?</p> <p>- Challenge yourself and your colleagues to examine and shift mental models regarding your business and its relationship to natural resources.</p>	<p>energy and materials.</p> <p>- View all waste as "food" for some other natural or technical process.</p> <p>- Live on "interest income" from solar and other natural resources</p>	<p>of the business can fund longer term strategic investments in sustainable products and services designed to meet the demands of tomorrow's global markets.</p>
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What Next: Standing in Two Worlds

Like many people, you may find yourself experiencing the paradox of living in two worlds: the Industrial Era and the dawning Systems Age. In many ways, we are all still very much a product of the worldviews of the Industrial Era. Indeed, this paradigm shows up strongly in much of our commerce. We may also aspire to the more systemic, sustainable world that we've been exploring in this volume. And though we may see glimpses of this world in

the making, we do not yet experience it fully in our daily lives. Yet the disparity between these two paradigms can actually produce valuable, creative tension.

By continuing to articulate our visions of what is possible, we can inspire ourselves and others to move toward the desired future. Our simultaneous experience of current reality and holding of the vision are like the two poles of a battery: They are highly charged with potential energy for action.

THE CORPORATE WEB

Can one company, pursuing a vision of sustainability, act alone with success? To a degree, perhaps. But before long, that company will run into what we call the "corporate web." To envision this web, which we adapted from an exercise designed by Linda Booth Sweeney, try this activity. Gather a group of 15-20 people, and have everyone stand in a circle. Ask each person to represent a company from a different industry-- for example, auto, petroleum, utilities, telecommunications, paper, plastics, steel, computers, and so forth. Now take a ball of yarn and, beginning anywhere, ask one "company" to toss the ball to another "company" on which it depends as either

develop the fuels to run the new engine. If a carpet company seeks to produce carpets made from organic or reclaimed materials, it will need suppliers who can provide raw materials aligned with these goals. Pretty soon, we see the need for a new kind of corporate learning consortium, dedicated to strategic alliances aimed at sustainability objectives. The possibilities for innovative and fruitful partnerships are plentiful. To support such strategic corporate alliances, we also need "learning partnerships for sustainability." These will involve companies up and down the supply chain in product development who can learn from and work

supplier or customer.

Get the picture? Before long, you see that plastics are connected to petroleum, which are in turn connected to auto, which is connected to computers, connected to paper, and on and on. You see that your company is inextricably linked to other companies and industries on which you depend to do business. If one company were to step outside the web to pursue sustainability strategies, the entire web would be affected. For example, if a motorcycle company were to develop an alternative engine, it would need energy companies to

with each other in creating new products and services that are aligned with sustainability principles. For example, petroleum, auto, steel, plastics, computer, and carpet companies could work together to develop the transportation vehicle of the next century. Such learning partnerships would create forums for people to come together to share both technical breakthroughs and learning processes. Deep inquiry and dialogue to uncover current mental models that may be getting in the way of our seeing new possibilities will be important components of such gatherings.

To make the leap to a vision of sustainability, try this mental exercise: At our current rate of global population growth, as reported by the UN, we will have about 10 billion people on the planet by the year 2030. Think about how old the children in your life will be that year. How will 10 billion people have access to fresh drinking water? What will their system of transportation be? What will be the energy source that will power their basic needs? What beyond food, water, shelter, and community will all these human beings need? These and other issues that we cannot yet imagine will define a new era as transformative as the agricultural and industrial revolutions were. Those revolutions took place over centuries; this one will take place in just a generation. If ever a systems perspective was needed, it is now. If ever innovative ways of learning and thinking were called for, it is now. If ever a new spirit of cooperation and collaboration for the common good was essential for the future of human society, it is now.

Chief Seattle once said, "Whatever we do to the web [of life], we do to ourselves." This insight implies some good news: Every small action that each of us takes makes a difference to the whole web. It's up to each of us to look for the leverage points in our own companies and communities where we can make a difference. It's also up to each of us to hold our aspirations for a sustainable future alongside our experiences of current reality, and to develop the shared mental models that will let us work together to achieve those aspirations. As we stand on the threshold of a new era, we must look within ourselves and to each other to craft the learning partnerships that will make our vision real.

VISUALIZATION: 100 YEARS

Where is your personal leverage in moving toward a vision of sustainability? If "healing the universe is an

possible future you could imagine for these people, your heirs? Stand in that future. From that place, look back to

4. Now see yourself one year in the future. How are you living your life? What is your business life like? What are

inside job," then perhaps our greatest opportunity to play a role in this healing lies within each of us. To tap into your own aspirations in this domain, try this following exercise.

1. In your mind, go back in time 100 years. Picture the world of your great- or great-great-grandparents at that time. How did their lives and the actions they took shape your life today? How did the world, society, and commerce of that time build the world we live in today? What coaching would your great-grandparents have for you today?
2. Now go forward in time 100 years. It is the time of your great- or great-great-grandchildren: the world of future generations. What is the best

today. What would you say to yourself here in the present about how to create that future? Coach yourself from the wisdom of a century from now.

3. Now imagine yourself 10 years in the future. What is the best possible world you can imagine? How will that future shape the world of 100 years from now that you envisioned? Stand in that place, 10 years from now. What is your business life like? What are you doing? What has heart, meaning, and vitality for you? How would you coach yourself today, in the present, about how to build toward that future you envisioned 10 years away?

you doing? What has heart, meaning, and vitality for you? How is what you are doing building a path toward the world you envisioned for 10 years and 100 years from now? What would you say to yourself here today about how to move toward this same date next year? What thoughts and attitudes are you ready to shift? Coach yourself from the place of one year from today, as to where the leverage for action is for you.

5. Now, return to the present moment. Take a few minutes to jot down some of the insights that you gained from this journey through time. Where do you have the greatest energy and potential to take constructive action in building toward your aspirations?