TRANSFERRING KNOWLEDGE OF SUSTAINABILITY

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Contents

1. Introduction
1.1. Identifying the Challenge
1.2. Sustainability
2. Strategies for Sustainability
2.1. Alternative Paradigms of Sustainability
2.2. Changing Individual and Institutional Behavior
3. Transferring Knowledge of Sustainability
3.1. Schools, Colleges, and Universities
3.2. Nongovernmental Organizations
3.3. Governments
3.4. Corporations
3.5. Media
4. Conclusions
Glossary
Bibliography
Biographical Sketch

Summary

Many of our activities today clearly do not meet the basic criterion of sustainability that the present generation meets its needs while assuring that future generations will be able to meet theirs. In order to meet that goal, it will be necessary to use energy and resources more efficiently, and to manage actively their stocks and flows to assure that the capacity of the natural world is not impaired.

To meet the growing needs of expanding populations will necessitate combining the elements of alternative paradigms of sustainability, and require us to assure that the next industrial revolution enhances rather than degrades the capacity of the planet to supply ecosystem goods and services.

Transferring knowledge of the technologies and the motivations and incentives needed to meet the goals of sustainability requires changes in education and improvements in communication among the multiple producers and conveyors of knowledge. The Internet will become an ever more important means of transferring knowledge about sustainability as more members of civil society, business, and government search for opportunities and strategies.

1. Introduction

1.1. Identifying the Challenge

Creating effective social change is always a major challenge. In shifting to an economic and social system that is sustainable, one must address an exceptionally high degree of social inertia, economic self-interest, and technological lock-in. To alter the current state of the economic and social system a more sustainable one will require a four-stage effort.

(a) First, create awareness of the need for change and the new value system that is required.
(b) Second, identify the actions, technologies, and measures needed to effect that change.
(c) Third, transfer that knowledge to the government and civil society.
(d) Finally, implement changes through effective government policies, efficient markets, and a knowledgeable public.

Knowledge about sustainability and the means of achieving sustainability may be discovered or invented by many sectors of society. For example, research universities and institutes and corporate and government research laboratories have discovered many technologies and strategies for more sustainable energy and resource use. The rate of adoption of these new technologies and practices, however, has been disappointingly slow. Clearly, there needs to be more than the existence of a new technology for it to be adopted. This article will concentrate on the process of knowledge transfer, and how it can lead to implementation. The actors responsible for knowledge transfer may or may not be the knowledge creators. Knowledge transfer agents include educational institutions, nongovernmental organizations (NGOs), corporations, governments, and the media.

1.2. Sustainability

It is easier to identify non-sustainable practices than sustainable ones. A number of non-sustainable practices are listed below.

- Consumption of natural capital rather than utilizing the annual interest provided by ecosystem goods and services
- Release of toxic chemicals into the air, water, and land
- Release of biological pathogens and alien species into ecosystems and human communities
- Pollution of local and regional air (smog, acid rain, haze)
- Modification of the composition of the global atmosphere, climate change, and ozone depletion
- Loss of plant and animal species from land-use change and overexploitation
- Increase and spread of diseases and pests
- Land damage from minerals and energy exploitation
- Persistence of acute poverty and disease
- Human contribution to the damage from natural disasters

It is clear that each one of these examples violates the principles put forth by the Bruntland Commission that defined sustainable development as development that allows the current generation to meet its needs without compromising the ability of future generations to meet theirs. The problems identified in these examples are compounded by ever greater numbers of people meeting their needs and wants and the use of ever more powerful technologies.

People often describe the examples given above as “environmental problems.” However, they are not really “problems,” but rather “symptoms” of the mismatch between the way human society and individuals are meeting their needs and wants, and the autonomous functioning of planetary and local ecosystems.

The premise that the undesired consequences of economic and social activities can be addressed by treating symptoms is analogous to treating a brain tumor with aspirin and is equally ineffective. The essence of sustainable development is that societies work with rather than against the forces of the natural world, achieve greater rather than less equity within society, and engage all parties in making political and social decisions.

Technological choice is a critical element in society becoming more sustainable, and it is essential that the technologies that run our homes, industries, transportation, and electric power generation be transformed. As will be discussed below, this is as much about institutional change, attitudes, and values as it is about technology itself.

2. Strategies for Sustainability

2.1. Alternative Paradigms of Sustainability

Beginning in the 1950s, many people began to recognize that the industrialization and land-use paths along which we were traveling had severe adverse consequences both for the natural world and for human health and well-being. In 1972, the first global conference on the human environment was held in Stockholm Sweden. Around this time, national governments began enacting laws to reduce air and water pollution, and the spread of toxic waste in the United States, Europe, Australia, New Zealand, and Japan. New national parks were established in both developed and developing countries to protect land and species from development.

What was most remarkable were the large number of multilateral environmental agreements to protect endangered species, fish, and the oceans from oil spills, to limit trade in hazardous waste, and to protect the climate system and ozone layer. Most of the domestic laws and international treaties involve pollution control type strategies. Emphasis has largely been on controlling what comes out of the smokestack, sewer line, and tail pipe of industrial processes and vehicles.

Such an approach can be effective, but expensive, since one must pay for both the factory and car and in addition for the pollution control device. It is therefore not surprising that many developing countries have chosen to do relatively little to combat pollution, preferring to put all of their limited capital to work in industrialization.

A hierarchy of approaches has been developed to address the most obvious industrial problems. The strategies begin with pollution control of existing technology, which primarily treats symptoms and moves up the line to enhancing sustainability. A summary of these approaches follows.

- Pollution control: This reduces the pollutants as they leave the factory, vehicle, or farm. An example is the catalytic converter on vehicles that reduces tailpipe pollutants by 90%.
- Ecoefficiency (Factor 4 and Factor 10): This principle was embraced by many large multinational corporations at the United Nations (U.N.) Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992. It is based on pollution reduction goals (doing more with less) rather than advocating a particular strategy. Factor 4 was introduced as a goal to produce enough energy to meet a doubled world population twice as efficiently with one-quarter as much carbon dioxide released as in the late twentieth century. Factor 10 recognizes that if developing countries are to receive a share of energy proportional to their numbers industrial countries will need to meet their needs with one-tenth as much energy related emissions as occurred in the 1990s. There is a strong emphasis on technology, including genetic engineering of plants and animals to reduce chemical pollution and improve efficiency.
- Pollution prevention/waste minimization: This requires redesigning industrial processes or technology to prevent the production of pollutants in the first place. Many industrial examples have successfully reduced specific pollutants to zero. Replacing the internal combustion engine with a fuel cell releases only water to the environment. This strategy can also include genetic engineering.
- Lifecycle assessment: This is a matter of examining all of the energy and material used in a particular product or industrial product from the mine through production, use, and ultimate disposal. This information can then be used to limit environmental damage at its most economically efficient point.
- Industrial ecology: This involves attempts to compare industrial processes to ecosystem functions. Industrial ecology relies on life cycle assessment, but then uses that information to design industrial systems that mimic natural systems through recycling and reusing waste materials.
- Next industrial revolution: This approach addresses quality and quantity of flows; nonrenewable materials are continually recovered and recycled; and only biodegradable materials are released to the environment. It emphasizes services over goods to reduce resource use, and required buildings to rely on renewable resources to generate as much as or more energy than they use.
- Enhanced sustainability: Human activities usually decrease the opportunities for other organisms and interfere with the flows of energy and material cycles. It will become necessary to design industrial processes and products so that they reinforce natural systems, and operate so as to restore degraded ecosystems, bring energy and materials consumption within the natural rates of flow, and enhance existing natural materials cycles so as to support human needs in an equitable manner within and between generations. A shift to renewable energy resources from fossil fuels is an essential component of this approach, which uses analysis from life cycle assessment and industrial ecology as well as emphasizing social change to achieve goals.

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Biographical Sketch

Dr. William R. Moomaw is professor of international environmental policy at the Fletcher School of Law and Diplomacy, Tufts University, where he directs the International Environment and Resource Policy Program. He teaches courses on international and environmental policy and the use of multidisciplinary methods to develop sound solutions to problems of sustainability. He received his B.A. degree at Williams College in chemistry and his Ph.D. in physical chemistry from the Massachusetts Institute of Technology. After 25 years carrying out research in photochemistry and spectroscopy, Dr. Moomaw shifted his research and teaching to policy science, translating science and technology of national and global environmental issues into policy relevant terms. He was a coordinating lead author for the third Intergovernmental Panel on Climate Change in 2001 assessing the technological and economic potential for greenhouse gas reductions, and coauthored the Summary for Policy Makers. He was also a lead author for the industry chapters of the second assessment report in 1996, and recently chaired a long-range study of climate mitigation strategies for the Dutch government. In addition to his academic career, which includes his roles as Director of Environmental Studies at Williams College and of the Tufts Institute of the Environment, he also served as the first director of the Climate, Energy and Pollution Program at the World Resources Institute and a U.S. Congressional staff working on stratospheric ozone depletion. He helped to found Clean Air-Cool Planet to effect real reductions in greenhouse gas emissions by corporations, institutions, and other members of civil society. He also serves on the boards of Earthwatch, a science research and education organization in the service of conservation, and the Consensus Building Institute, an NGO devoted to finding sustainable, negotiated solutions.