Environmentally Sustainable Work Practices
Sustainability

Sustainability is the capacity to endure. In ecology, the word describes how biological systems remain diverse and productive over time. Long-lived and healthy wetlands and forests are examples of sustainable biological systems. For humans, sustainability is the potential for long-term maintenance of well being, which has environmental, economic, and social dimensions.

Healthy ecosystems and environments provide vital goods and services to humans and other organisms. There are two major ways of reducing negative human impact and enhancing ecosystem services. The first is environmental management; this approach is based largely on information gained from earth science, environmental science, and conservation biology. The second approach is management of human consumption of resources, which is based largely on information gained from economics.

Sustainability interfaces with economics through the social and ecological consequences of economic activity. Sustainability economics involves ecological economics where social, cultural, health-related and monetary/financial aspects are integrated. Moving towards sustainability is also a social challenge that entails international and national law, urban planning and transport, local and individual lifestyles and ethical consumerism. Ways of living more sustainably can take many forms from reorganising living conditions (e.g., ecovillages, eco-municipalities and sustainable cities), reappraising economic sectors (permaculture, green building, sustainable agriculture), or work practices (sustainable architecture), using science to develop new technologies (green technologies, renewable energy), to adjustments in individual lifestyles that conserve natural resources.
Sustainability

Definition

The word sustainability is derived from the Latin sustinere (tenere, to hold; sus, up). Dictionaries provide more than ten meanings for sustain, the main ones being to “maintain”, “support”, or “endure”. However, since the 1980s sustainability has been used more in the sense of human sustainability on planet Earth and this has resulted in the most widely quoted definition of sustainability and sustainable development, that of the Brundtland Commission of the United Nations on March 20, 1987: “sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

At the 2005 World Summit it was noted that this requires the reconciliation of environmental, social and economic demands - the "three pillars" of sustainability. This view has been expressed as an illustration using three overlapping ellipses indicating that the three pillars of sustainability are not mutually exclusive and can be mutually reinforcing.

The UN definition is not universally accepted and has undergone various interpretations. What sustainability is, what its goals should be, and how these goals are to be achieved are all open to interpretation. For many environmentalists the idea of sustainable development is an oxymoron as development seems to entail environmental degradation. Ecological economist Herman Daly has asked, "what use is a sawmill without a forest?" From this perspective, the economy is a subsystem of human society, which is itself a subsystem of the biosphere, and a gain in one sector is a loss from another. This can be illustrated as three concentric circles.

A universally accepted definition of sustainability is elusive because it is expected to achieve many things. On the one hand it needs to be factual and scientific, a clear statement of a specific “destination”. The simple definition "sustainability is improving the quality of human life while living within the carrying capacity of supporting eco-systems", though vague, conveys the idea of sustainability having quantifiable limits. But sustainability is also a call to action, a task in progress or “journey” and therefore a political process, so some definitions set out

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A representation of the relationship between the three pillars of sustainability suggesting that both economy and society are constrained by environmental limits

Scheme of sustainable development: at the confluence of three constituent parts.
common goals and values.\[17\] The Earth Charter\[18\] speaks of “a sustainable global society founded on respect for nature, universal human rights, economic justice, and a culture of peace.”

To add complication the word *sustainability* is applied not only to human sustainability on Earth, but to many situations and contexts over many scales of space and time, from small local ones to the global balance of production and consumption. It can also refer to a future intention: “sustainable agriculture” is not necessarily a current situation but a goal for the future, a prediction.\[19\] For all these reasons sustainability is perceived, at one extreme, as nothing more than a feel-good buzzword with little meaning or substance\[20\] \[21\] but, at the other, as an important but unfocused concept like "liberty" or "justice".\[22\] It has also been described as a "dialogue of values that defies consensual definition".\[23\]

Researchers and institutions have pointed out that these three dimensions are not enough to reflect the complexity of contemporary society and that culture must be included in this development model.\[24\]

**History**

The history of sustainability traces human-dominated ecological systems from the earliest civilizations to the present. This history is characterized by the increased regional success of a particular society, followed by crises that were either resolved, producing sustainability, or not, leading to decline.\[25\] \[26\]

In early human history, the use of fire and desire for specific foods may have altered the natural composition of plant and animal communities.\[27\] Between 8,000 and 10,000 years ago, Agrarian communities emerged which depended largely on their environment and the creation of a "structure of permanence."\[28\]

The Western industrial revolution of the 17th to 19th centuries tapped into the vast growth potential of the energy in fossil fuels. Coal was used to power ever more efficient engines and later to generate electricity. Modern sanitation systems and advances in medicine protected large populations from disease.\[29\] In the mid-20th century, a gathering environmental movement pointed out that there were environmental costs associated with the many material benefits that were now being enjoyed. In the late 20th century, environmental problems became global in scale.\[30\] \[31\] \[32\] \[33\] The 1973 and 1979 energy crises demonstrated the extent to which the global community had become dependent on non-renewable energy resources.

In the 21st century, there is increasing global awareness of the threat posed by the human-induced enhanced greenhouse effect, produced largely by forest clearing and the burning of fossil fuels.\[34\] \[35\]

**Principles and concepts**

The philosophical and analytic framework of sustainability draws on and connects with many different disciplines and fields; in recent years an area that has come to be called sustainability science has emerged. Sustainability science is not yet an autonomous field or discipline of its own, and has tended to be problem-driven and oriented towards guiding decision-making.\[36\]

**Scale and context**

Sustainability is studied and managed over many scales (levels or frames of reference) of time and space and in many contexts of environmental, social and economic organization. The focus ranges from the total carrying capacity (sustainability) of planet Earth to the sustainability of economic sectors, ecosystems, countries, municipalities, neighbourhoods, home gardens, individual lives, individual goods and services, occupations, lifestyles, behaviour patterns and so on. In short, it can entail the full compass of biological and human activity or any part of it.\[37\] As Daniel Botkin, author and environmentalist, has stated: "We see a landscape that is always in flux, changing over many scales of time and space."\[38\]
Consumption — population, technology, resources

The overall driver of human impact on Earth systems is the destruction of biophysical resources, and especially, the Earth's ecosystems. The total environmental impact of a community or of humankind as a whole depends both on population and impact per person, which in turn depends in complex ways on what resources are being used, whether or not those resources are renewable, and the scale of the human activity relative to the carrying capacity of the ecosystems involved. Careful resource management can be applied at many scales, from economic sectors like agriculture, manufacturing and industry, to work organizations, the consumption patterns of households and individuals and to the resource demands of individual goods and services.\(^{[39]}\)\(^{[40]}\)

One of the initial attempts to express human impact mathematically was developed in the 1970s and is called the I PAT formula. This formulation attempts to explain human consumption in terms of three components: population numbers, levels of consumption (which it terms "affluence", although the usage is different), and impact per unit of resource use (which is termed "technology", because this impact depends on the technology used). The equation is expressed:

\[ I = P \times A \times T \]

Where: \( I \) = Environmental impact, \( P \) = Population, \( A \) = Affluence, \( T \) = Technology\(^{[41]}\)

Measurement

Sustainability measurement is a term that denotes the measurements used as the quantitative basis for the informed management of sustainability.\(^{[42]}\) The metrics used for the measurement of sustainability (involving the sustainability of environmental, social and economic domains, both individually and in various combinations) are still evolving: they include indicators, benchmarks, audits, indexes and accounting, as well as assessment, appraisal\(^{[43]}\) and other reporting systems. They are applied over a wide range of spatial and temporal scales.\(^{[44]}\)\(^{[45]}\)

Some of the best known and most widely used sustainability measures include corporate sustainability reporting, Triple Bottom Line accounting, and estimates of the quality of sustainability governance for individual countries using the Environmental Sustainability Index and Environmental Performance Index.

Population

According to the 2008 Revision of the official United Nations population estimates and projections, the world population is projected to reach 7 billion early in 2012, up from the current 6.9 billion (May 2009), to exceed 9 billion people by 2050. Most of the increase will be in developing countries whose population is projected to rise from 5.6 billion in 2009 to 7.9 billion in 2050. This increase will be distributed among the population aged 15–59 (1.2 billion) and 60 or over (1.1 billion) because the number of children under age 15 in developing countries is predicted to decrease. In contrast, the population of the more developed regions is expected to undergo only slight increase from 1.23 billion to 1.28 billion, and this would have declined to 1.15 billion but for a projected net migration from developing to developed countries, which is expected to average 2.4 million persons annually from 2009 to 2050.\(^{[46]}\) Long-term estimates of global population suggest a peak at around 2070 of nine to ten billion people, and then a slow decrease to 8.4 billion by 2100.\(^{[47]}\)
Emerging economies like those of China and India aspire to the living standards of the Western world as does the non-industrialized world in general. It is the combination of population increase in the developing world and unsustainable consumption levels in the developed world that poses a stark challenge to sustainability.

**Carrying capacity**

More and more data are indicating that humans are not living within the carrying capacity of the planet. The Ecological footprint measures human consumption in terms of the biologically productive land needed to provide the resources, and absorb the wastes of the average global citizen. In 2008 it required 2.7 global hectares per person, 30% more than the natural biological capacity of 2.1 global hectares (assuming no provision for other organisms). The resulting ecological deficit must be met from unsustainable extra sources and these are obtained in three ways: embedded in the goods and services of world trade; taken from the past (e.g. fossil fuels); or borrowed from the future as unsustainable resource usage (e.g. by over exploiting forests and fisheries).

The figure (right) compares the sustainability of countries by contrasting their Ecological Footprint with their UN Human Development Index (a measure of standard of living). The graph shows what is necessary for countries to maintain an acceptable standard of living for their citizens while, at the same time, maintaining sustainable resource use. The general trend is for higher standards of living to become less sustainable. As always, population growth has a marked influence on levels of consumption and the efficiency of resource use. The sustainability goal is to raise the global standard of living without increasing the use of resources beyond globally sustainable levels; that is, to not exceed "one planet" consumption. Information generated by reports at the national, regional and city scales confirm the global trend towards societies that are becoming less sustainable over time.

**Global human impact on biodiversity**

At a fundamental level energy flow and biogeochemical cycling set an upper limit on the number and mass of organisms in any ecosystem. Human impacts on the Earth are demonstrated in a general way through detrimental changes in the global biogeochemical cycles of chemicals that are critical to life, most notably those of water, oxygen, carbon, nitrogen and phosphorus.

The *Millennium Ecosystem Assessment* is an international synthesis by over 1000 of the world's leading biological scientists that analyses the state of the Earth's ecosystems and provides summaries and guidelines for decision-makers. It concludes that human activity is having a significant and escalating impact on the biodiversity of world ecosystems, reducing both their resilience and biocapacity. The report refers to natural systems as humanity's "life-support system", providing essential "ecosystem services". The assessment measures 24 ecosystem services concluding that only four have shown improvement over the last 50 years, 15 are in serious decline, and five are in a precarious condition.
**Environmental dimension**

Healthy ecosystems provide vital goods and services to humans and other organisms. There are two major ways of reducing negative human impact and enhancing ecosystem services and the first of these is environmental management. This direct approach is based largely on information gained from earth science, environmental science and conservation biology. However, this is management at the end of a long series of indirect causal factors that are initiated by human consumption, so a second approach is through demand management of human resource use.

Management of human consumption of resources is an indirect approach based largely on information gained from economics. Herman Daly has suggested three broad criteria for ecological sustainability: renewable resources should provide a sustainable yield (the rate of harvest should not exceed the rate of regeneration); for non-renewable resources there should be equivalent development of renewable substitutes; waste generation should not exceed the assimilative capacity of the environment.[56]

**Environmental management**

At the global scale and in the broadest sense environmental management involves the oceans, freshwater systems, land and atmosphere, but following the sustainability principle of scale it can be equally applied to any ecosystem from a tropical rainforest to a home garden.[57][58]

**Atmosphere**

In March 2009 at a meeting of the Copenhagen Climate Council, 2,500 climate experts from 80 countries issued a keynote statement that there is now "no excuse" for failing to act on global warming and that without strong carbon reduction targets "abrupt or irreversible" shifts in climate may occur that "will be very difficult for contemporary societies to cope with".[59] Management of the global atmosphere now involves assessment of all aspects of the carbon cycle to identify opportunities to address human-induced climate change and this has become a major focus of scientific research because of the potential catastrophic effects on biodiversity and human communities (see Energy below).

Other human impacts on the atmosphere include the air pollution in cities, the pollutants including toxic chemicals like nitrogen oxides, sulphur oxides, volatile organic compounds and particulate matter that produce photochemical smog and acid rain, and the chlorofluorocarbons that degrade the ozone layer. Anthropogenic particulates such as sulphate aerosols in the atmosphere reduce the direct irradiance and reflectance (albedo) of the Earth's surface. Known as global dimming, the decrease is estimated to have been about 4% between 1960 and 1990 although the trend has subsequently reversed. Global dimming may have disturbed the global water cycle by reducing evaporation and rainfall in some areas. It also creates a cooling effect and this may have partially masked the effect of greenhouse gases on global warming.[61]

**Freshwater and Oceans**

Water covers 71% of the Earth's surface. Of this, 97.5% is the salty water of the oceans and only 2.5% freshwater, most of which is locked up in the Antarctic ice sheet. The remaining freshwater is found in glaciers, lakes, rivers, wetlands, the soil, aquifers and atmosphere. Due to the water cycle, fresh water supply is continually replenished by precipitation, however there is still a limited amount necessitating management of this resource. Awareness of the global importance of preserving water for ecosystem services has only recently emerged as, during the 20th century, more than half the world's wetlands have been lost along with their valuable environmental services. Increasing urbanization pollutes clean water supplies and much of the world still does not have access to clean, safe water.[62] Greater emphasis is now being placed on the improved management of blue (harvestable) and green (soil water available for plant use) water, and this applies at all scales of water management.[63]

Ocean circulation patterns have a strong influence on climate and weather and, in turn, the food supply of both humans and other organisms. Scientists have warned of the possibility, under the influence of climate change, of a
sudden alteration in circulation patterns of ocean currents that could drastically alter the climate in some regions of the globe.\cite{64} Ten per cent of the world’s population – about 600 million people – live in low-lying areas vulnerable to sea level rise.

**Land use**

Loss of biodiversity stems largely from the habitat loss and fragmentation produced by the human appropriation of land for development, forestry and agriculture as natural capital is progressively converted to man-made capital. Land use change is fundamental to the operations of the biosphere because alterations in the relative proportions of land dedicated to urbanisation, agriculture, forest, woodland, grassland and pasture have a marked effect on the global water, carbon and nitrogen biogeochemical cycles and this can impact negatively on both natural and human systems.\cite{65} At the local human scale, major sustainability benefits accrue from sustainable parks and gardens and green cities.\cite{66,67}

Since the Neolithic Revolution about 47% of the world’s forests have been lost to human use. Present-day forests occupy about a quarter of the world’s ice-free land with about half of these occurring in the tropics.\cite{68} In temperate and boreal regions forest area is gradually increasing (with the exception of Siberia), but deforestation in the tropics is of major concern.\cite{69}

Food is essential to life and feeding more than six billion human bodies takes a heavy toll on the Earth’s resources. This begins with the appropriation of about 38% of the Earth’s land surface\cite{70} and about 20% of its net primary productivity.\cite{71} Added to this are the resource-hungry activities of industrial agribusiness – everything from the crop need for irrigation water, synthetic fertilizers and pesticides to the resource costs of food packaging, transport (now a major part of global trade) and retail. Environmental problems associated with industrial agriculture and agribusiness are now being addressed through such movements as sustainable agriculture, organic farming and more sustainable business practices.\cite{72}

**Management of human consumption**

The underlying driver of direct human impacts on the environment is human consumption.\cite{73} This impact is reduced by not only consuming less but by also making the full cycle of production, use and disposal more sustainable. Consumption of goods and services can be analysed and managed at all scales through the chain of consumption, starting with the effects of individual lifestyle choices and spending patterns, through to the resource demands of specific goods and services, the impacts of economic sectors, through national economies to the global economy.\cite{74} Analysis of consumption patterns relates resource use to the environmental, social and economic impacts at the scale or context under investigation. The ideas of embodied resource use (the total resources needed to produce a product or service), resource intensity, and resource productivity are important tools for understanding the impacts of consumption. Key resource categories relating to human needs are food, energy, materials and water.
Energy

The Sun’s energy, stored by plants (primary producers) during photosynthesis, passes through the food chain to other organisms to ultimately power all living processes. Since the industrial revolution the concentrated energy of the Sun stored in fossilized plants as fossil fuels has been a major driver of technology which, in turn, has been the source of both economic and political power. In 2007 climate scientists of the IPCC concluded that there was at least a 90% probability that atmospheric increase in CO$_2$ was human-induced, mostly as a result of fossil fuel emissions but, to a lesser extent from changes in land use. Stabilizing the world’s climate will require high-income countries to reduce their emissions by 60–90% over 2006 levels by 2050 which should hold CO$_2$ levels at 450–650 ppm from current levels of about 380 ppm. Above this level, temperatures could rise by more than 2°C to produce “catastrophic” climate change. Reduction of current CO$_2$ levels must be achieved against a background of global population increase and developing countries aspiring to energy-intensive high consumption Western lifestyles.

Reducing greenhouse emissions, is being tackled at all scales, ranging from tracking the passage of carbon through the carbon cycle to the commercialization of renewable energy, developing less carbon-hungry technology and transport systems and attempts by individuals to lead carbon neutral lifestyles by monitoring the fossil fuel use embodied in all the goods and services they use.

Water

Water security and food security are inextricably linked. In the decade 1951–60 human water withdrawals were four times greater than the previous decade. This rapid increase resulted from scientific and technological developments impacting through the economy – especially the increase in irrigated land, growth in industrial and power sectors, and intensive dam construction on all continents. This altered the water cycle of rivers and lakes, affected their water quality and had a significant impact on the global water cycle. Currently towards 35% of human water use is unsustainable, drawing on diminishing aquifers and reducing the flows of major rivers: this percentage is likely to increase if climate change impacts become more severe, populations increase, aquifers become progressively depleted and supplies become polluted and unsanitary. From 1961 to 2001 water demand doubled - agricultural use increased by 75%, industrial use by more than 200%, and domestic use more than 400%. In the 1990s it was estimated that humans were using 40–50% of the globally available freshwater in the approximate proportion of 70% for agriculture, 22% for industry, and 8% for domestic purposes with total use progressively increasing. Water efficiency is being improved on a global scale by increased demand management, improved infrastructure, improved water productivity of agriculture, minimising the water intensity (embodied water) of goods and services, addressing shortages in the non-industrialised world, concentrating food production in areas of high productivity, and planning for climate change. At the local level, people are becoming more self-sufficient by harvesting rainwater and reducing use of mains water.
Food

The American Public Health Association (APHA) defines a "sustainable food system"[^84] [^85] as "one that provides healthy food to meet current food needs while maintaining healthy ecosystems that can also provide food for generations to come with minimal negative impact to the environment. A sustainable food system also encourages local production and distribution infrastructures and makes nutritious food available, accessible, and affordable to all. Further, it is humane and just, protecting farmers and other workers, consumers, and communities."[^86] Concerns about the environmental impacts of agribusiness and the stark contrast between the obesity problems of the Western world and the poverty and food insecurity of the developing world have generated a strong movement towards healthy, sustainable eating as a major component of overall ethical consumerism.[^87] The environmental effects of different dietary patterns depend on many factors, including the proportion of animal and plant foods consumed and the method of food production.[^88] [^89] [^90] [^91] The World Health Organization has published a Global Strategy on Diet, Physical Activity and Health report which was endorsed by the May 2004 World Health Assembly. It recommends the Mediterranean diet which is associated with health and longevity and is low in meat, rich in fruits and vegetables, low in added sugar and limited salt, and low in saturated fatty acids; the traditional source of fat in the Mediterranean is olive oil, rich in monounsaturated fat. The healthy rice-based Japanese diet is also high in carbohydrates and low in fat. Both diets are low in meat and saturated fats and high in legumes and other vegetables; they are associated with a low incidence of ailments and low environmental impact.[^92]

At the global level the environmental impact of agribusiness is being addressed through sustainable agriculture and organic farming. At the local level there are various movements working towards local food production, more productive use of urban wastelands and domestic gardens including permaculture, urban horticulture, local food, slow food, sustainable gardening, and organic gardening.[^93] [^94]

Materials, toxic substances, waste

As global population and affluence has increased, so has the use of various materials increased in volume, diversity and distance transported. Included here are raw materials, minerals, synthetic chemicals (including hazardous substances), manufactured products, food, living organisms and waste.[^95] Sustainable use of materials has targeted the idea of dematerialization, converting the linear path of materials (extraction, use, disposal in landfill) to a circular material flow that reuses materials as much as possible, much like the cycling and reuse of waste in nature.[^96] This approach is supported by product stewardship and the increasing use of material flow analysis at all levels, especially individual countries and the global economy.[^97]
Synthetic chemical production has escalated following the stimulus it received during the second World War. Chemical production includes everything from herbicides, pesticides and fertilizers to domestic chemicals and hazardous substances. Apart from the build-up of greenhouse gas emissions in the atmosphere, chemicals of particular concern include: heavy metals, nuclear waste, chlorofluorocarbons, persistent organic pollutants and all harmful chemicals capable of bioaccumulation. Although most synthetic chemicals are harmless there needs to be rigorous testing of new chemicals, in all countries, for adverse environmental and health effects. International legislation has been established to deal with the global distribution and management of dangerous goods.

Every economic activity produces material that can be classified as waste. To reduce waste industry, business and government are now mimicking nature by turning the waste produced by industrial metabolism into resource. Dematerialization is being encouraged through the ideas of industrial ecology, eodesign and ecolabelling. In addition to the well-established “reduce, reuse and recycle” shoppers are using their purchasing power for ethical consumerism.

**Economic dimension**

On one account, sustainability “concerns the specification of a set of actions to be taken by present persons that will not diminish the prospects of future persons to enjoy levels of consumption, wealth, utility, or welfare comparable to those enjoyed by present persons.” Sustainability interfaces with economics through the social and ecological consequences of economic activity. Sustainability economics represents: “... a broad interpretation of ecological economics where environmental and ecological variables and issues are basic but part of a multidimensional perspective. Social, cultural, health-related and monetary/financial aspects have to be integrated into the analysis.” However, the concept of sustainability is much broader than the concepts of sustained yield of welfare, resources, or profit margins. At present, the average per capita consumption of people in the developing world is sustainable but population numbers are increasing and individuals are aspiring to high-consumption Western lifestyles. The developed world population is only increasing slightly but consumption levels are unsustainable. The challenge for sustainability is to curb and manage Western consumption while raising the standard of living of the developing world without increasing its resource use and environmental impact. This must be done by using strategies and technology that break the link between, on the one hand, economic growth and on the other, environmental damage and resource depletion.

In addressing this issue several key areas have been targeted for economic analysis and reform: the environmental effects of unconstrained economic growth; the consequences of nature being treated as an economic externality; and the possibility of an economics that takes greater account of the social and environmental consequences of market behaviour.
Decoupling environmental degradation and economic growth

Historically there has been a close correlation between economic growth and environmental degradation: as communities grow, so the environment declines. This trend is clearly demonstrated on graphs of human population numbers, economic growth, and environmental indicators. Unsustainable economic growth has been starkly compared to the malignant growth of a cancer because it eats away at the Earth's ecosystem services which are its life-support system. There is concern that, unless resource use is checked, modern global civilization will follow the path of ancient civilizations that collapsed through overexploitation of their resource base. While conventional economics is concerned largely with economic growth and the efficient allocation of resources, ecological economics has the explicit goal of sustainable scale (rather than continual growth), fair distribution and efficient allocation, in that order. The World Business Council for Sustainable Development states that "business cannot succeed in societies that fail". Sustainability studies analyse ways to reduce (decouple) the amount of resource (e.g. water, energy, or materials) needed for the production, consumption and disposal of a unit of good or service whether this be achieved from improved economic management, product design, new technology etc. Ecological economics includes the study of societal metabolism, the throughput of resources that enter and exit the economic system in relation to environmental quality.

Nature as an economic externality

The economic importance of nature is indicated by the use of the expression ecosystem services to highlight the market relevance of an increasingly scarce natural world that can no longer be regarded as both unlimited and free. In general, as a commodity or service becomes more scarce the price increases and this acts as a restraint that encourages frugality, technical innovation and alternative products. However, this only applies when the product or service falls within the market system. As ecosystem services are generally treated as economic externalities they are unpriced and therefore overused and degraded, a situation sometimes referred to as the Tragedy of the Commons.

One approach to this dilemma has been the attempt to "internalise" these "externalities" by using market strategies like ecotaxes and incentives, tradeable permits for carbon, and the encouragement of payment for ecosystem services. Community currencies associated with Local Exchange Trading Systems (LETS), a gift economy and Time Banking have also been promoted as a way of supporting local economies and the environment. Green economics is another market-based attempt to address issues of equity and the environment. The global recession and a range of associated government policies are likely to bring the biggest annual fall in the world's carbon dioxide emissions in 40 years.
Economic opportunity

Treating the environment as an externality may generate short-term profit at the expense of sustainability. Sustainable business practices, on the other hand, integrate ecological concerns with social and economic ones (i.e., the triple bottom line). Growth that depletes ecosystem services is sometimes termed "uneconomic growth" as it leads to a decline in quality of life. Minimising such growth can provide opportunities for local businesses. For example, industrial waste can be treated as an "economic resource in the wrong place". The benefits of waste reduction include savings from disposal costs, fewer environmental penalties, and reduced liability insurance. This may lead to increased market share due to an improved public image. Energy efficiency can also increase profits by reducing costs. The idea of sustainability as a business opportunity has led to the formation of organizations such as the Sustainability Consortium of the Society for Organizational Learning, the Sustainable Business Institute, and the World Council for Sustainable Development. The expansion of sustainable business opportunities can contribute to job creation through the introduction of green-collar workers.

Social dimension

Sustainability issues are generally expressed in scientific and environmental terms, but implementing change is a social challenge that entails, among other things, international and national law, urban planning and transport, local and individual lifestyles and ethical consumerism. The relationship between human rights and human development, corporate power and environmental justice, global poverty and citizen action, suggest that responsible global citizenship is an inescapable element of what may at first glance seem to be simply matters of personal consumer and moral choice.

Peace, security, social justice

Social disruptions like war, crime and corruption divert resources from areas of greatest human need, damage the capacity of societies to plan for the future, and generally threaten human well-being and the environment. Broad-based strategies for more sustainable social systems include: improved education and the political empowerment of women, especially in developing countries; greater regard for social justice, notably equity between rich and poor both within and between countries; and intergenerational equity. Depletion of natural resources including fresh water increases the likelihood of "resource wars". This aspect of sustainability has been referred to as environmental security and creates a clear need for global environmental agreements to manage resources such as aquifers and rivers which span political boundaries, and to protect shared global systems including oceans and the atmosphere.

Sustainability and Poverty

A major hurdle to achieve sustainability is the alleviation of poverty. It has been widely acknowledged that poverty is one source of environmental degradation. Such acknowledgment has been made by the Brundtland Commission report Our Common Future and the Millennium Development Goals. According to the Brundtland report, "poverty is a major cause and effect of global environmental problems. It is therefore futile to attempt to deal with environmental problems without a broader perspective that encompasses the factors underlying world poverty and international inequality." Individuals living in poverty then to rely heavily on their local ecosystem as a source for basic needs (such as nutrition and medicine) and general well-being. As population growth continues to increase, increasing pressure is being placed on the local ecosystem to provide these basic essentials. According to the UN Population Fund, high fertility and poverty have been strongly correlated, and the world’s poorest countries also have the highest fertility and population growth rates.
Human relationship to nature

According to Murray Bookchin, the idea that humans must dominate nature is common in hierarchical societies. Bookchin contends that capitalism and market relationships, if unchecked, have the capacity to reduce the planet to a mere resource to be exploited. Nature is thus treated as a commodity: "The plundering of the human spirit by the market place is paralleled by the plundering of the earth by capital."[141] Still more basically, Bookchin argued that most of the activities that consume energy and destroy the environment are senseless because they contribute little to quality of life and well being. The function of work is to legitimize, even create, hierarchy. For this reason understanding the transformation of organic into hierarchical societies is crucial to finding a way forward.[142]

Social ecology, founded by Bookchin, is based on the conviction that nearly all of humanity's present ecological problems originate in, indeed are mere symptoms of, dysfunctional social arrangements. Whereas most authors proceed as if our ecological problems can be fixed by implementing recommendations which stem from physical, biological, economic etc., studies, Bookchin's claim is that these problems can only be resolved by understanding the underlying social processes and intervening in those processes by applying the concepts and methods of the social sciences.[143]

Deep ecology establishes principles for the well-being of all life on Earth and the richness and diversity of life forms. This is only compatible with a substantial decrease of the human population and the end of human interference with the nonhuman world. To achieve this, deep ecologists advocate policies for basic economic, technological, and ideological structures that will improve the *quality of life* rather than the *standard of living*. Those who subscribe to these principles are obliged to make the necessary change happen.[144]

Human settlements

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<th>Sustainability principles</th>
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<td>1. Reduce dependence upon fossil fuels, underground metals, and minerals</td>
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<td>2. Reduce dependence upon synthetic chemicals and other unnatural substances</td>
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<td>3. Reduce encroachment upon nature</td>
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<td>4. Meet human needs fairly &amp; efficiently[145]</td>
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One approach to sustainable living, exemplified by small-scale urban transition towns and rural ecovillages, seeks to create self-reliant communities based on principles of simple living, which maximise self-sufficiency particularly in food production. These principles, on a broader scale, underpin the concept of a bioregional economy.[146] Other approaches, loosely based around new urbanism, are successfully reducing environmental impacts by altering the built environment to create and preserve sustainable cities which support sustainable transport. Residents in compact urban neighbourhoods drive fewer miles, and have significantly lower environmental impacts across a range of measures, compared with those living in sprawling suburbs.[147]

Ultimately, the degree of human progress towards sustainability will depend on large scale social movements which influence both community choices and the built environment. Eco-municipalities may be one such movement.[148]

Eco-municipalities take a systems approach, based on sustainability principles. The eco-municipality movement is participatory, involving community members in a bottom-up approach. In Sweden, more than 70 cities and towns—25 per cent of all municipalities in the country—have adopted a common set of "Sustainability Principles" and implemented these systematically throughout their municipal operations. There are now twelve eco-municipalities in the United States and the American Planning Association has adopted sustainability objectives based on the same principles.[145]

There is a wealth of advice available to individuals wishing to reduce their personal impact on the environment through small, inexpensive and easily achievable steps.[149][150] But the transition required to reduce global human
consumption to within sustainable limits involves much larger changes, at all levels and contexts of society. The United Nations has recognised the central role of education, and have declared a decade of education for sustainable development, 2005–2014, which aims to "challenge us all to adopt new behaviours and practices to secure our future". The Worldwide Fund for Nature proposes a strategy for sustainability that goes beyond education to tackle underlying individualistic and materialistic societal values head-on and strengthen people's connections with the natural world.

### Notes


[112] Costanza et al. (2007). Ch. 1, pp. 1–4, Ch.3, p. 3.


[136] "Our Common Future, From One Earth to One World" (http://www.un-documents.net/oce-oiv.htm#1). UN Documents Gathering a body of global agreements.


[142] Bookchin (2005)


References


**Further reading**


**External links**

• Sustainability (http://www.dmoz.org/Science/Environment/Sustainability/) at the Open Directory Project
• Compilation of Fact Sheets (http://css.snre.umich.edu/facts/factsheets.html) published by the University of Michigan's Center for Sustainable Systems
• Elements of sustainability (http://www.stanford.edu/group/microdocs/elements.html) at Microdocs
• Sustainability (http://masonweb.wm.edu/sustainability/) at The College of William and Mary
Sustainable management

Sustainable management takes the concepts from sustainability and synthesizes them with the concepts of management. Sustainability has three branches: the environment, the needs of present and future generations, and the economy. Using these branches, it creates the ability to keep a system running indefinitely without depleting resources, maintaining economic viability, and also nourishing the needs of the present and future generations. From this definition, sustainable management has been created to be defined as the application of sustainable practices in the categories of businesses, agriculture, society, environment, and personal life by managing them in a way that will benefit current generations and future generations.

Sustainable management is needed because it is an important part of the ability to successfully maintain the quality of life on our planet. Sustainable management can be applied to all aspects of our lives. For example, the practices of a business should be sustainable if they wish to stay in businesses, because if the business is unsustainable, then by the definition of sustainability they will cease to be able to be in competition. Communities are in a need of sustainable management, because if the community is to prosper, then the management must be sustainable. Forest and natural resources need to have sustainable management if they are to be able to be continually used by our generation and future generations. Our personal lives also need to be managed sustainably. This can be by making decisions that will help sustain our immediate surroundings and environment, or it can be by managing our emotional and physical well-being. Sustainable management can be applied to many things, as it can be applied as a literal and an abstract concept. Meaning, depending on what they are applied to the meaning of what it is can change.

History

Managers' strategies reflect the mindset of the times. This being the case, it has been a problem for the evolution of sustainable management practices for two reasons. The first reason is that sustainable norms are continually changing. For example, things considered unthinkable a few years ago are now standard practices. And the second reason is that in order to practice sustainable management, one has to be forward thinking, not only in the short term, but also in the long term. Management behavior is a reflection of how accepted conceptions of behavior are defined. This means that forces and beliefs outside of the given program push along the management. The manager can take some credit for the cultural changes in his or her program, but overall the organization’s culture reflects dominant conceptions of the public at that time. This is exemplified through the managerial actions taken during the time periods that lead up to the present day. These examples are given below:

- Industrial environmentalism (1960-1970) [1]

This was a time period in which, even though there were outside concerns about the environment, the industries were able to resist pressures and make their own definitions and regulations. [1] Environmentalists were not viewed as credible sources of information during this time and usually discredited.


The norms or this period radically shifted with the creating of the U.S. Environmental Protection Agency (EPA) in 1970. The EPA became the mediator between the environmentalists and the industry, although the two sides never met. [1] During this period, the environment for the majority of industry and business management teams was only important in terms of compliance with law. [1] In 1974 a conference board survey found that the majority of companies still treated environmental management as a threat. [1] The survey noted a widespread tendency in most of industry to treat pollution control expenditures as non-recoverable investments. [1] According to the consensus environmental protection was considered at best a necessary evil, and at worst a temporary nuisance. [1]

- Environmentalism as social responsibility (1982-1988) [1]

By 1982, the EPA had lost its credibility, but at the same time activism became more influential, and there was an increase in the funding and memberships of major non-governmental organizations (NGOs). [1] Industry gradually
became more cooperative with government and new managerial structures were implemented to achieve compliances with regulations.\textsuperscript{[1]} Strategic environmentalism (1988-1993)\textsuperscript{[1]} During this period, industry progressed into a proactive stance on environmental protection.\textsuperscript{[1]} With this attitude, the issue became one in which they felt qualified to manage on their own. Although there was advancement in organizational power, the concern for the environment still kept being pushed down the hierarchy of important things to do.\textsuperscript{[1]}  
- Environmental management as an opportunity (1993-present)  
  In 1995 Harvard professor Michael Porter wrote in the Harvard Business Review that environmental protection was not a threat to the corporate enterprise but rather an opportunity, one that could increase competitive advantage in the marketplace.\textsuperscript{[1]} Before 2000, companies generally regarded green buildings as interesting experiments but unfeasible projects in the real business world.\textsuperscript{[2]} Since then several factors, including the ones listed below, have caused major shifts in thinking.\textsuperscript{[2]} The creation of reliable building rating and performance measurement systems for new construction and renovation has helped change corporate perceptions about green. In 2000 the US Green Building Council in DC launched its rigorous leadership in energy and environmental design (LEED) program.\textsuperscript{[2]} Hundreds of US and international studies have proven the financial advantages of going green: lower utility costs, higher employee productivity.\textsuperscript{[2]} Green building materials, mechanical systems, and furnishings have become more widely available, and prices have dropped considerably.\textsuperscript{[2]} As changes are made to the norms of what is acceptable from a management perspective, more and more it becomes apparent that sustainable management is the new norm of the future. Currently, there are many programs, organizations, communities, and businesses that follow sustainable management plans. These new entities are pressing forward with the help of changing social norms and management initiatives.  

**Management position**  
A manager is a person that is held responsible for the planning of things that will benefit the situation that they are controlling. To be a manager of sustainability, one needs to be a manager that can control issues and plan solutions that will be sustainable, so that what they put into place will be able to continue for future generations. The job of a sustainable manager is like other management positions, but additionally they have to manage systems so that they are able to support and sustain themselves. Whether it is a person that is a manager of groups, business, family, communities, organizations, agriculture, or the environment, they can all use sustainable management to improve their productivity, environment, and atmosphere, among other things. Some practical skills that are needed to be able to perform the job include:  
- Seeing problems/issues  
- Being able to set goals/agendas  
- Planning Skills  
- Creating new ways of doing things (thinking outside the box)  
- Taking action when it is needed  
- Organizational skills  
- Being able to teach, make aware, and train people  
- Ability to make tough decisions  
- Keeping tract of progress  
- Taking responsibility  
- Ability to project current issues/ideas/plans into the Future  
- Possessing whole systems thinking \textsuperscript{[3]}  

Recently, there has even been the addition of new programs in colleges and universities in order to be able to offer Bachelors of Science and Masters of Science in Sustainable management.
Business

In business, time and time again, environmentalists are seen facing off against industry, and there is usually very little "meeting in the middle" or compromises. When these two sides agree to disagree, the result is a more powerful message, and it becomes one that allows more people to understand and embrace.

Organizations need to face the fact that the boundaries of accountability are moving fast. The trend towards sustainable management means that organizations are beginning to implement a systems wide approach that links in the various parts of the business with the greater environment at large.

As sustainable management institutions adapt, it becomes imperative that they include an image of sustainable responsibility that is projected for the public to see. This is because firms are socially based organizations. But this can be a double edged sword, because sometimes they end up focusing too much on their image rather than actually focusing on implementing what they are trying to project to the public; this is called green washing. It is important that the execution of sustainable management practices is not put aside while the firm tries to appeal to the public with their sustainable management "practices."

Additionally, companies must make the connection between sustainability as a vision and sustainability as a practice. Managers need to think systematically and realistically about the application of traditional business principles to environmental problems. By melding the two concepts together, new ideas of business principles emerge and can enable some companies-those with the right industry structure, competitive position, and managerial skills- to deliver increased value to shareholders while making improvements in their environmental performance. [4]

Any corporation can become green on a standard budget. [2] By focusing on the big picture, a company can generate more savings and better performance. By using planning, design, and construction based on sustainable values, sustainable management strives to gain LEED points by reducing footprint of the facility by sustainably planning the site with focus on these three core ideas. [2] To complete a successful green building, or business, the management also applies cost benefit analysis in order to allocate funds appropriately.

Business economics

The economic system, like all systems, is subject to the laws of thermodynamics, which define the limit at which the Earth can successfully process energy and wastes. [5] Managers need to understand that their values are critical factors in their decisions. Many of current business values are based on unrealistic economic assumptions; adopting new economic models that take the Earth into account in the decision-making process is at the core of sustainable management. [5] This new management addresses the interrelatedness of the ecosystem and the economic system. [5]

The strategic vision that is based on core values of the firm guides the firm’s decision-making processes at all levels. Thus, the sustainable management requires finding out what business activities fit into the Earth’s carrying capacity, and also defining the optimal levels of those activities. [5] Sustainability values form the basis of the strategic management, process the costs and benefits of the firm’s operations, and are measured against the survival needs of the planets stakeholders. [5] Sustainability is the core value because it supports a strategic vision of firms in the long term by integrating economic profits with the responsibility to protect the environment. [5]

Service model

Changing industrial processes so that they actually replenish and magnify the stock of natural capital is another component of sustainable management. One way managers have figured out how to do this is by using a service model of business. [6] This focuses on building relationships with customers, instead of focusing on making and selling products. [6] This type of model represents a fundamental change in the way businesses behave. It allows for managers to be aware of the lifecycle of their products by leaving the responsibility up to the company to take care of the product throughout the life cycle. [6] The service model, because the product is the responsibility of the business, creates an avenue in which the managers can see ways in which they can reduce the use of resources
through recycling and product construction.

**Communities**

For communities to be able to improve, sustainable management needs to be in practice. If a community relies on the resources that are in the surrounding area, then they need to be used sustainable to insure the indefinite supply of the resources. A community needs to work together to be able to be productive, and when there is a need to get things done, management is needs to take the lead. If sustainable management is in practice in a community, then people will want to stay in that community, and other people will realize the success, and they will also want to live in a similar environment, as their own unsustainable towns fail. Part of a sustainable management system in a community is the education, the cooperation, and the responsiveness of the people that live in the community. [7]

There are new ideals to how a community can be sustainable. This can include urban planning, which allow people to move about a city that are more sustainable for the environment. If management plans a community that allows for people to move with out cars, it helps make a community sustainable by increasing mass transit or other modes of transportation. People would spend less time in traffic while improving the environment, and on an occasions exercise. [8]

Sustainable management provides plans that can improve multiple parts of people lives, environment, and future generations. If a community sets goals, then people are more likely to reduce energy, water, and waste, but a community cannot set goals unless they have the management in place to set goals. [9]

A part of sustainable management for a community is communicating the ideals and plans for an area to the people that will be carrying out the plan. It is important to note that sustainable management is not sustainable if the person that is managing a situation is not communicating what needs to be improved, how it should be improved, why it is important to them, and how they are involved it in the process.

**Personal life**

For a person to be responsible for their action is a part of managing, and that is part of being managed sustainable. To be able to manage oneself sustainable there are many factors to consider, because to be able to manage oneself a person need to be able to see what they are doing unsustainable, and how to become sustainable. Using plastic bags at a check out line is unsustainable because it creates pollutants, but using reusable biodegradable bags can resolve the problem. This is not only environmentally sustainable, but it also improves the physical and mental sustainability of the person that uses the reusable bags. It is physical improvement because people do not have to live with the countless plastic bags on the Earth and the pollution that comes with it. It is also an improvement to mental sustainability, because the person that uses the reusable bags has feeling of accomplishment that comes from doing the right thing. Deciding to buy local food to make the community stronger through community sustainable management, can also be emotionally, environmentally, and physically rewarding.

Figure 1[9] McKenzie shows how a person can look at a behavior that they are doing and determine if it is sustainable or not, and what they could replace the bad behavior with. Education of an individual would be the first step to deciding to take a step towards managing their lives sustainable. To manage a person life the benefits needs to be high and the barriers low. Good managing would come up with a competing behavior that has no barriers to it. To come up with a Competing behavior that does not have a barrier to it would involve good problem solving.
Figure 2[9] Mckenzie is an example of what a person might try to change in their life to make it more sustainable. Taking the bus instead of walking helps the environment, but it also loses time spent with family. The bus is in the middle of walking and taking a taxi, but another option that is not on the list is riding a bike. Good sustainable management would include all the options that are possible, and new options that were not available before. These figures are tools that can be used in helping people manage their lives sustainably, but there are other ways to think about their lives to become more sustainable.

<table>
<thead>
<tr>
<th>New Behavior</th>
<th>Competing Behavior 1</th>
<th>Competing Behavior 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Benefits</td>
<td>Helps the Environment</td>
<td>Time with Family</td>
</tr>
<tr>
<td>Perceived Barriers</td>
<td>Lose time with family</td>
<td>No alternative/Costly/Bad for the environment</td>
</tr>
</tbody>
</table>

**Forests**

There are very practical needs for sustainable management of forest. Since forests provide many resources to the people, and to the world, management of the forests are critical to keep those resources available. To be able to manage a forest, knowledge of how the natural systems work is needed. If a manager knows how the natural system works, then when manager of the forest makes plans how the resources are to remove from the forest, the manager will know how the resources can be removed with out damaging the forest. Since many forests are under management of the government that is in the region, the forest are not truly functioning how the ecosystem was naturally developed, and how it is meant to be. An example is the pine flatwoods in Florida. To be able to maintain that ecosystem frequent burnings of the forest needs to happen. Fires are a natural part of the ecosystem, but since wild fires can spread to communities near the forest, control of the wild fires is requested from the communities. To maintain flatwoods forest control burning or prescribe burning is part of the management to sustain the forest. [10]

**Farming/agriculture**

To have sustainable agriculture, sustainable management of the system that the farmer uses needs to be implemented. Management provides the tools, knowledge of the progress, the goals, and organization that sustainable agriculture needs to be sustainable. Keeping track of what the system is providing and consuming is important, so that the management can improve the sustainable efforts in the system. Sustainable management of agriculture means that the system that is being managed is sustainable in all respects. Production should be model after natural systems, instead of using human made systems that have been pushed on the Earth that are not sustainable.

In a natural system the Earth uses the waste of one system, and then turns it into the consuming part of another system. This is important to try to model in sustainable management of agriculture, because it would decrease in the amount of resources needed, and decrease the amount of money spent on removing and deposing of waste. Not only does an agriculture system need to protect the resources and environment, but it also needs to be able to compete in the market. Agriculture can model natural systems to provide a system that is competitive in the indefinite long run, instead of striping the land of its resources and making it unusable in the future. Agriculture that tries to produce its product at the maximum yield will strip soil resources until the land is void and unable to produce. This would be an
example of how sustainable management is not in practice, because the system will fail, and because it fails, it would have a negative impact on the people that rely on that product for work, food, and local economy. Sustainable management of agriculture should include the sustainable management of the people that work on the systems. Fair trade is an example of how the world is trying to produce sustainable management of local farmers in third world countries. Slow food is another movement that is trying to promote sustainable management by marketing the production of farms products to the people that live locally. Slow food provides fresher, cheaper, superior, and taster products, because they are sold directly to the public by the farmer. The farmer saves money by not spending it on shipping and transportation of their products.

Sustainable management of farms provide solutions to problems that are not sustainable in the areas of the people that buy the product, people that make the product, and the environment. [11]

References


Sustainable business

**Sustainable business**, or **green business**, is an enterprise that has no negative impact on the global or local environment, community, society, or economy—a business that strives to meet the triple bottom line. Often, sustainable businesses have progressive environmental and human rights policies. In general, business is described as green if it matches the following four criteria:

1. It incorporates principles of sustainability into each of its business decisions.[1]
2. It supplies environmentally friendly products or services that replaces demand for nongreen products and/or services.[1]
3. It is greener than traditional competition.[1]
4. It has made an enduring commitment to environmental principles in its business operations.[1]

A sustainable business is any organization that participates in environmentally friendly or green activities to ensure that all processes, products, and manufacturing activities adequately address current environmental concerns while maintaining a profit. In other words, it is a business that “meets the needs of the present world without compromising the ability of the future generations to meet their own needs.”[2] [3] It is the process of assessing how to design products that will take advantage of the current environmental situation and how well a company’s products perform with renewable resources.[4]

The Brundtland Report emphasized that sustainability is a three-legged stool of people, planet, and profit.[2] Sustainable businesses with the supply chain try to balance all three through the triple-bottom-line concept—using sustainable development and sustainable distribution to impact the environment, business growth, and the society.[5] [6]

Everyone affects the sustainability of the marketplace and the planet in some way. Sustainable development within a business can create value for customers, investors, and the environment. A sustainable business must meet customer needs while, at the same time, treating the environment well.[7]

**Environmental sphere**

A major initiative of sustainable businesses is to eliminate or decrease the impact made on the environment by harmful chemicals, materials, and waste generated by processes to manufacture products and services.[8] The impact of such human activities in terms of the amount of greenhouse gases produced can be measured in units of carbon dioxide and is referred to as the carbon footprint. The carbon footprint concept branched off from ecological footprint analysis, which examines the ecological capacity required to support the consumption of products.[9]

The *Gort Cloud* written by Richard Seireeni, (2009), documents the experiences of sustainable businesses in America and their reliance on the vast but invisible green community, referred to as the gort cloud, for support and a market.

One of the most common examples of sustainable business initiatives is the act of going paperless.[7] On a higher level, sustainable business practices can include reviewing processes in order to eliminate or recycle waste, making all products recyclable, and eliminating the use of nonrenewable resources via alternatives energies.

Sustainable businesses also look at inputs to determine what products are harmful to the environment and try to find green alternatives that can function at the same or a better level and, preferably, at a lower cost. Company leaders also take into account the life cycle costs for inputs of items purchased. Inputs costs must be considered in regards to regulations, energy use, storage, and disposal.[10]

A business’s green initiatives can include conserving materials through remanufacturing, converting harmful gases into clean energy, generating greener power, and improving fuel economy.[4] Designing for the environment (DFE) is also an element of sustainable business. This process enables users to consider the potential environmental impacts of a product and the process used to make that product.[10]
Henry Ford was a pioneer in the sustainable business realm, experimenting with soy-based materials and ethanol during the days of the Model T.\textsuperscript{[7]} Ford Motor Company also shipped the Model A truck in crates that later became the vehicle’s floorboard upon reaching its destination. This was a form of upcycling, a key element to DFE. Upcycling is the process of retaining high quality in a closed-loop industrial cycle.\textsuperscript{[10]}

Ford currently uses green fabrics and materials in the next generation of their vehicles—seat fabric made from 100 percent post-industrial materials, renewable soy foam seat bases, and the like. Ford executives recently appointed the company’s first senior vice president of sustainability, environment, and safety engineering. This position is responsible for establishing a long-range sustainability strategy and environmental policy. The person in this position will also help develop the products and processes necessary to satisfy both customers and society as a whole, while working toward energy independence.\textsuperscript{[4]}

In Korea, rice husks are used as a nontoxic packaging for stereo components and other electronics. The concept of waste is diminished because of inclusive shipping in freight costs the goods would already incur. The same material is later used to make bricks.\textsuperscript{[10]}

The green and sustainability trend has manifested in pressure from consumers, shareholders, employees, partners and governments (regulations) put upon companies to embrace more sustainable and green practices. Many companies resorted to greenwashing instead of actually creating green innovations by marketing their product in a way that suggests green practices. However, there are many companies that have taken the sustainability trend seriously and are doing so profitably.

**Social sphere**

Organizations that give back to the community, whether through employees volunteering their time or through charitable donations are often considered to be socially sustainable. Organizations also can encourage education in their communities by training their employees and offering internships to younger members of the community. Practices such as these increase the education level and quality of life in the community.

In order for a business to be truly sustainable, it must sustain not only the necessary environmental resources, but also its social resources, including employees, customers (the community), and its reputation.\textsuperscript{[11]}

**Organizations**

The European community’s Restriction of Hazardous Substances Directive restricts the use of certain hazardous materials in the production of various electronic and electrical products. Waste Electrical and Electronic Equipment (WEEE) directives provide collection, recycling, and recovery practices for electrical goods.\textsuperscript{[7]} The World Business Council for Sustainable Development and the World Resources Institute are two organizations working together to set a standard for reporting on corporate carbon footprints.\textsuperscript{[7]} Lester Brown’s Plan B 2.0 and Hunter Lovins’s Natural Capitalism provide information on sustainability initiatives.\textsuperscript{[12]}

**Standards**

Enormous economic and population growth worldwide in the second half of the twentieth century drove the impacts that threaten health and the world — ozone depletion, climate change, depletion, fouling of natural resources, and extensive loss of biodiversity and habitat. In the past, the standard approaches to environmental problems generated by business and industry have been regulatory-driven "end-of-the-pipe" remediation efforts. In the 1990s, efforts by governments, NGOs, corporations, and investors began to grow substantially to develop awareness and plans for investment in business sustainability.

One critical milestone was the establishment of the ISO 14000 standards whose development came as a result of the Rio Summit on the Environment held in 1992. ISO 14001 is the cornerstone standard of the ISO 14000 series. It specifies a framework of control for an Environmental Management System against which an organization can be
certified by a third party. Other ISO 14000 Series Standards are actually guidelines, many to help you achieve registration to ISO 14001. They include the following:

- ISO 14004 provides guidance on the development and implementation of environmental management systems
- ISO 14010 provides general principles of environmental auditing (now superseded by ISO 19011)
- ISO 14011 provides specific guidance on audit an environmental management system (now superseded by ISO 19011)
- ISO 14012 provides guidance on qualification criteria for environmental auditors and lead auditors (now superseded by ISO 19011)
- ISO 14013/5 provides audit program review and assessment material.
- ISO 14020+ labeling issues
- ISO 14030+ provides guidance on performance targets and monitoring within an Environmental Management System
- ISO 14040+ covers life cycle issues

**Six Essential Characteristics**

Dr. Tueth proposes that a mature and authentic sustainable business contains these six essentials. These essentials are rooted in many sustainability principals and are very dynamic. There is no reason in the future for essentials not to shift or adjust as we evolve our understanding of a sustainable business.

**1. Triple top-line value production**

"The TTL Establishes three simultaneous requirements of sustainable business activities - financial benefits for the company, natural world betterment, and social advantages for employees and members of the local community—with each of these three components recognized as equal in status." Though this is sometimes called the triple bottom line, triple top line stresses the importance of initial value rather than after the fact effects.

**2. Nature-based knowledge and technology**

"This biomimicry-based principal involves the conscious emulation of natural-world genius in terms of growing our food, harnessing our energy, constructing things, conducting business healing ourselves, processing information and designing our communities"

**3. Products of service to products of consumption**

"Products of service are durable goods routinely leased by the customer that are made of technical materials and are returned to the manufacturer and re-processed into a new generation of products when they are worn out.(These products are mostly non-toxic to human and environmental health but toxic materials that are used will be kept within a closed loop type system and not be able to escape into the environment). Products of consumption are shorter lived items made only of biodegradable materials. They are broken down by the detritus organisms after the products lose their usefulness.(These are also non-hazardous to human or environmental health). This principal requires that we manufacture only these two types of products and necessitates the gradual but continual reductions of products of service and their replacement with products of consumption as technological advancements allow." See Cradle to Cradle for other thoughts on Technical(Products of Service) and Biological(Products of consumption) nutrients.

**4. Solar, wind, geothermal and ocean energy**

"This principal advocates employing only sustainable energy technology—solar,wind, ocean and geothermal—that can meet our energy needs indefinitely without negative effects for life on earth."

**5. Local-based organizations and economies**

"This ingredient includes durable, beautiful and healthy communities with locally owned and operated businesses and locally managed non-profit organizations, along with regional corporations and shareholders working together in a dense web of partnerships and collaborations."
6. Continuous improvement process

"Operational processes inside successful organizations include provisions for constant advancements and upgrade as the company does its business. The continuous process of monitoring, analyzing, redesigning and implementing is used to intensify TTL value production as conditions change and new opportunities emerge."[13]

Notes


External links

- Erb Institute for Global Sustainable Enterprise at the University of Michigan (http://www.erb.umich.edu)
- Center for Sustainable Global Enterprise at Cornell University (http://www.johnson.cornell.edu/sge/)
- Coalition for Environmentally Responsible Economies (http://www.ceres.org)
- Green America (http://www.coopamerica.org)
- GenGreen Life (http://www.gengreenlife.com)
- Natural Resources Defense Council (http://www.nrdc.org)
- Network for Business Innovation and Sustainability (http://www.nbis.org)
- World Business Council for Sustainable Development (http://www.wbcsd.org)
- I Green Think (http://www.igreenthink.com)
- Conscious Manager - Balance in business and life. (http://conscious-manager.com) Online magazine
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