= Sustainability =

In ecology , sustainability is the combination of the words sustain and ability . This concept makes reference to how biological systems remain diverse and productive indefinitely . Long @-@ lived and healthy wetlands and forests are examples of sustainable biological systems . In more general terms , sustainability is the endurance of systems and processes . The organizing principle for sustainability is sustainable development , which includes the four interconnected domains : ecology , economics , politics and culture . Sustainability science is the study of sustainable development and environmental science .

Sustainability can also be defined as a socio @-@ ecological process characterized by the pursuit of a common ideal . An ideal is by definition unattainable in a given time / space but endlessly approachable and it is this endless pursuit what builds in sustainability in the process (ibid) . Healthy ecosystems and environments are necessary to the survival of humans and other organisms . Ways of reducing negative human impact are environmentally @-@ friendly chemical engineering , environmental resources management and environmental protection . Information is gained from green chemistry , earth science , environmental science and conservation biology . Ecological economics studies the fields of academic research that aim to address human economies and natural ecosystems .

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 reorganizing 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 and sustainable fission and fusion power) , or designing systems in a flexible and reversible manner , and adjusting individual lifestyles that conserve natural resources .

Despite the increased popularity of the use of the term " sustainability " , the possibility that human societies will achieve environmental sustainability has been , and continues to be , questioned ? in light of environmental degradation , climate change , overconsumption , population growth and societies ' pursuit of indefinite economic growth in a closed system .

= = Etymology = =

The name sustainability is derived from the Latin sustinere (tenere , to hold ; sub , up) . Sustain can mean ? maintain " , " support " , or " endure ? . 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 as a part of the concept 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 . ?

= = Components = =

= = = Three pillars of sustainability = = =

The 2005 World Summit on Social Development identified sustainable development goals , such as economic development , social development and environmental protection . 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 . In fact , the three pillars are interdependent , and in the long run none can exist without the others . The three pillars have served as a common ground for numerous sustainability standards and certification systems in recent years , in particular in the food industry . Standards which today explicitly refer to the triple

bottom line include Rainforest Alliance , Fairtrade and UTZ Certified . Some sustainability experts and practitioners have illustrated four pillars of sustainability , or a quadruple bottom line . One such pillar is future generations , which emphasizes the long @-@ term thinking associated with sustainability .

Sustainable development consists of balancing local and global efforts to meet basic human needs without destroying or degrading the natural environment . The question then becomes how to represent the relationship between those needs and the environment .

A study from 2005 pointed out that environmental justice is as important as is sustainable development . Ecological economist Herman Daly 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 perspective led to the nested circles figure of ' economics ' inside ' society ' inside the ' environment ' .

The simple definition that sustainability is something that improves " 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 common goals and values . The Earth Charter speaks of ? a sustainable global society founded on respect for nature , universal human rights , economic justice , and a culture of peace . ? This suggested a more complex figure of sustainability , which included the importance of the domain of ' politics ' .

More than that , sustainability implies responsible and proactive decision @-@ making and innovation that minimizes negative impact and maintains balance between ecological resilience , economic prosperity , political justice and cultural vibrancy to ensure a desirable planet for all species now and in the future . Specific types of sustainability include , sustainable agriculture , sustainable architecture or ecological economics . Understanding sustainable development is important but without clear targets an unfocused term like " liberty " or " justice " . It has also been described as a " dialogue of values that challenge the sociology of development " .

= = = Circles of sustainability = = =

While the United Nations Millennium Declaration identified principles and treaties on sustainable development , including economic development , social development and environmental protection it continued using three domains : economics , environment and social sustainability . More recently , using a systematic domain model that responds to the debates over the last decade , the Circles of Sustainability approach distinguished four domains of economic , ecological , political and cultural sustainability . This in accord with the United Nations Agenda 21 , which specifies culture as the fourth domain of sustainable development . The model is now being used by organizations such as the United Nations Cities Programme. and Metropolis

= = = Shaping the future = = =

Integral elements of sustainability are research and innovation activities . A telling example is the European environmental research and innovation policy . It aims at defining and implementing a transformative agenda to greening the economy and the society as a whole so to make them sustainable . Research and innovation in Europe are financially supported by the programme Horizon 2020 , which is also open to participation worldwide .

= = Resiliency = =

Resiliency in ecology is the capacity of an ecosystem to absorb disturbance and still retain its basic structure and viability . Resilience @-@ thinking evolved from the need to manage interactions between human @-@ constructed systems and natural ecosystems in a sustainable way despite the fact that to policymakers a definition remains elusive . Resilience @-@ thinking addresses how much planetary ecological systems can withstand assault from human disturbances and still deliver

the services current and future generations need from them . It is also concerned with commitment from geopolitical policymakers to promote and manage essential planetary ecological resources in order to promote resilience and achieve sustainability of these essential resources for benefit of future generations of life ? The resiliency of an ecosystem , and thereby , its sustainability , can be reasonably measured at junctures or events where the combination of naturally occurring regenerative forces (solar energy , water , soil , atmosphere , vegetation , and biomass) interact with the energy released into the ecosystem from disturbances .

A practical view of sustainability is closed systems that maintain processes of productivity indefinitely by replacing resources used by actions of people with resources of equal or greater value by those same people without degrading or endangering natural biotic systems . In this way , sustainability can be concretely measured in human projects if there is a transparent accounting of the resources put back into the ecosystem to replace those displaced . In nature , the accounting occurs naturally through a process of adaptation as an ecosystem returns to viability from an external disturbance . The adaptation is a multi @-@ stage process that begins with the disturbance event (earthquake , volcanic eruption , hurricane , tornado , flood , or thunderstorm) , followed by absorption , utilization , or deflection of the energy or energies that the external forces created .

In analysing systems such as urban and national parks , dams , farms and gardens , theme parks , open @-@ pit mines , water catchments , one way to look at the relationship between sustainability and resiliency is to view the former with a long @-@ term vision and resiliency as the capacity of human engineers to respond to immediate environmental events .

= = History = =

The history of sustainability traces human @-@ dominated ecological systems from the earliest civilizations to the present time . 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 .

In early human history , the use of fire and desire for specific foods may have altered the natural composition of plant and animal communities . 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 . "

The Western industrial revolution of the 18th 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 . 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 . 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 greenhouse effect , produced largely by forest clearing and the burning of fossil fuels .

= = 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 .

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= = = 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 . 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 . "

The sheer size and complexity of the planetary ecosystem has proved problematic for the design of practical measures to reach global sustainability . To shed light on the big picture , explorer and sustainability campaigner Jason Lewis has drawn parallels to other , more tangible closed systems . For example , he likens human existence on Earth ? isolated as the planet is in space , whereby people cannot be evacuated to relieve population pressure and resources cannot be imported to prevent accelerated depletion of resources ? to life at sea on a small boat isolated by water . In both cases , he argues , exercising the precautionary principle is a key factor in survival .

= = = Consumption = = =

A major driver of human impact on Earth systems is the destruction of biophysical resources , and especially , the Earth 's ecosystems . The 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 .

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 :