

Sustainability on Planet Earth

What it Means for You

January 15, 2014

Flourishing

- Aristotle
- Equipment
- Characteristics
- CommonI
- CommonII
- CommonIII
- CommonIV
- CommonV
- CommonVI

Sustainability

from Aristotle ...

Happiness then is the best, noblest, and most pleasant thing in the world, ...

Flourishing

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Sustainability

from Aristotle ...

Happiness then is the best, noblest, and most pleasant thing in the world, ...

Happiness is one translation of *Eudaimonia*, another is Human Flourishing.

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Sustainability

from Aristotle ...

Happiness then is the best, noblest, and most pleasant thing in the world, ...

Happiness is one translation of *Eudaimonia*, another is Human Flourishing.

*Where **Human Flourishing** involves the rational use of one's individual human potentialities, including talents, abilities, and virtues in the pursuit of his/her freely and rationally chosen values and goals.*

Flourishing

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Sustainability

from Aristotle ...

Happiness then is the best, noblest, and most pleasant thing in the world, ...

Yet evidently, as we said, it needs the external goods as well; **for it is impossible, or not easy, to do noble acts without the proper equipment (Nicomachean Ethics I:8).**

Proper Equipment

Flourishing

- Aristotle
- **Equipment**
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Sustainability

What is the proper equipment?

Proper Equipment

Flourishing

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Sustainability

What is the proper equipment?

... for the man who is very ugly in appearance or ill-born or solitary and childless is not very likely to be happy, and perhaps a man would be still less likely if he had thoroughly bad children or friends or had lost good children or friends by death (Nichomedean Ethics I:8).

Proper Equipment

Flourishing

- Aristotle
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Sustainability

What is the proper equipment?

Cars?

Proper Equipment

Flourishing

- Aristotle
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Sustainability

What is the proper equipment?

Welding robots?

Proper Equipment

Flourishing

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Sustainability

What is the proper equipment?

MRI machines?

Proper Equipment

Flourishing

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Sustainability

What is the proper equipment?

Coal?

Proper Equipment

Flourishing

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Sustainability

What is the proper equipment?

Clean air?

Proper Equipment

Flourishing

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Sustainability

What is the proper equipment?

The equipment, in a very anthropocentric sense, is the world or environment in which we live.

Proper Equipment

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Sustainability

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The equipment, in a very anthropocentric sense, is the world or environment in which we live.

As humans, we are part of a number of social-ecological systems (SES) — linked systems of people and nature.

Proper Equipment

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As humans, we are part of a number of social-ecological systems (SES) — linked systems of people and nature.

And human flourishing at the individual and aggregate level depends on the state of the system at a given time.

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As humans, we are part of a number of social-ecological systems (SES) — linked systems of people and nature.

And human flourishing at the individual and aggregate level depends on the state of the system at a given time.

Human flourishing also depends on other states of the system (world) and the likelihood that there will be movement from the current state.

Characteristics of Social-Ecological Systems

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Characteristics of Social-Ecological Systems

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Social systems are inextricably linked with the ecological systems in which they are embedded.

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Unfortunately, economists tend to model the economy, sociologists model social relations, ecologists model the environment, engineers model processes, and so on.

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Social systems are inextricably linked with the ecological systems in which they are embedded.

Social-ecological systems are complex adaptive systems.

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Social systems are inextricably linked with the ecological systems in which they are embedded.

Social-ecological systems are complex adaptive systems.

Complex adaptive systems have emergent behavior; that is, the emergent behavior of the system cannot be predicted by understanding the individual mechanics of its component parts or any pair of interactions.

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Emergence is the production of global patterns of behavior by agents in a complex system interacting according to their own local rules of behavior, without intending the global patterns of behavior that come about. In emergence, global patterns cannot be predicted from the local rules of behavior that produce them. To put it another way, global patterns cannot be reduced to individual behavior.

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Because of complex linkages and feedback, a social-ecological system is such that we can never predict with certainty what the exact response will be to any intervention in the system.

Characteristics of Social-Ecological Systems

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Social systems are inextricably linked with the ecological systems in which they are embedded.

Social-ecological systems are complex adaptive systems.

A social-ecological system may have multiple stable states.

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One way to think of this to consider an ecosystem which has two alternative stable states, separated by an unstable equilibrium that marks the border between the “basins of attraction” of the states.

Characteristics of Social-Ecological Systems

Flourishing

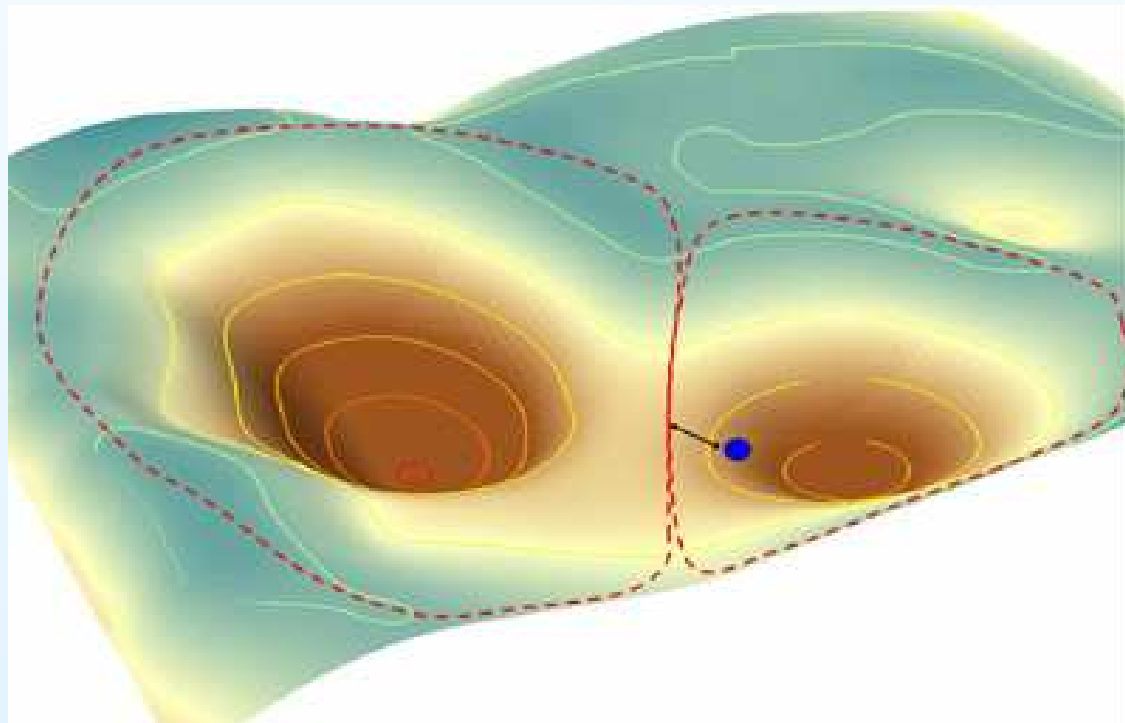
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Example of a Complex System

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- Common pool resources

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 - Common pool resources are rival in the sense that one person consuming the good prevents another person from consuming the good

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Or exclusion costs are very high

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- When no one owns a resource, users have no incentive to consider the foregone benefits to others or to conserve for the future

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- Examples

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- Examples
 - a. Picture a pasture open to all

Pasture



Example of a Complex System

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- When no one owns a resource, users have no incentive to consider the foregone benefits to others or to conserve for the future
- Examples
 - a. Picture a pasture open to all
 - b. Envision a water well

Well



Example of a Complex System

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 - Common pool resources are non-excludable
- When no one owns a resource, users have no incentive to consider the foregone benefits to others or to conserve for the future
- Examples
 - a. Picture a pasture open to all
 - b. Envision a water well
 - c. Envision the atmosphere

Global Warming



Sustainability ⇔ Human Flourishing?

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- Why the recent interest in sustainability?

Sustainability ⇔ Human Flourishing?

- Why the recent interest in sustainability?
- Is sustainability a more important topic than it was 100 years ago?

Sustainability ⇔ Human Flourishing?

- Why the recent interest in sustainability?
- Is sustainability a more important topic than it was 100 years ago?
- How important was sustainability in the Middle Ages or at the time of Aristotle?

What is the meaning of the word *Sustain*?

Flourishing

Sustainability

- Sustainability
- **SustainingI**
- SustainingII
- How
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- A singer

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- A singer
- Balloons

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- Bubble gum
- A trap shooter

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- An underground aquifer

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- A singer
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- A trap shooter
- A steam engine
- An underground aquifer
- An open access fishery

What is the meaning of sustain?

Flourishing

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1. Keep up, prolong

What is the meaning of sustain?

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1. Keep up, prolong
2. To supply with sustenance or nourish

What is the meaning of sustain?

Flourishing

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1. Keep up, prolong
2. To supply with sustenance or nourish
3. To support, hold, or bear up

What is the meaning of sustain?

Flourishing

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1. Keep up, prolong
2. To supply with sustenance or nourish
3. To support, hold, or bear up
4. To give support or relief to

What is the meaning of sustain?

Flourishing

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1. Keep up, prolong
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5. We usually say that a system is **sustainable** if it is more or less able to reproduce or maintain itself over time without significant external injections of resources.

What is the meaning of sustain?

Flourishing

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5. We usually say that a system is **sustainable** if it is more or less able to reproduce or maintain itself over time without significant external injections of resources.
6. A system is **resilient** if its functionality is maintained when it is perturbed, or the elements needed to renew or reorganize it can be maintained if a large perturbation radically alters its structure and function.

How do We Sustain Something?

How do We Sustain Something?



How do We Sustain Something?

Output

How do We Sustain Something?

Output

Or the thing we want to sustain

How do We Sustain Something?



Output

How do We Sustain Something?



How do We Sustain Something?



Process

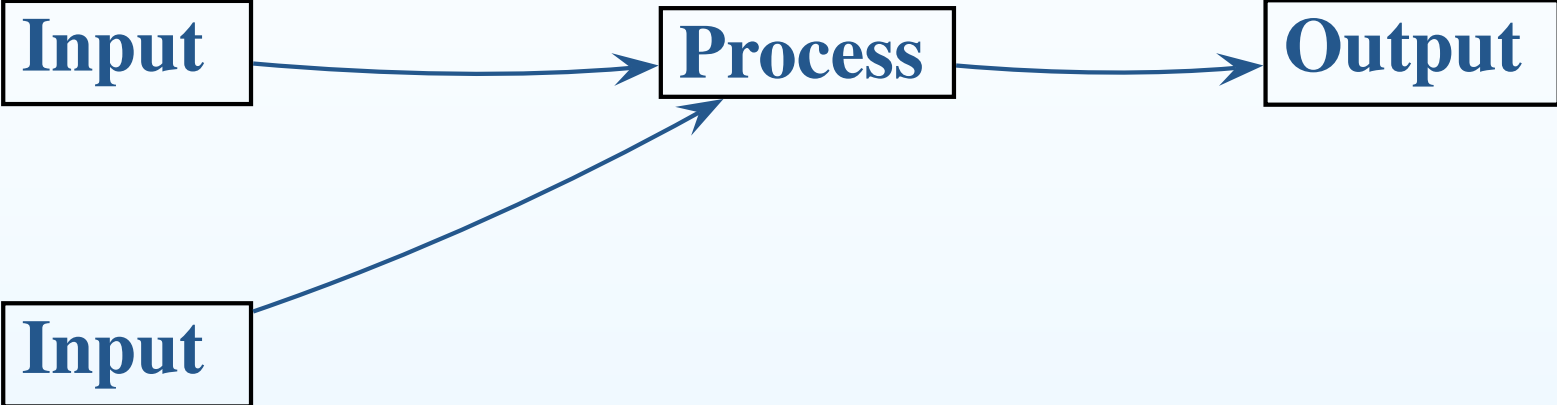


Output

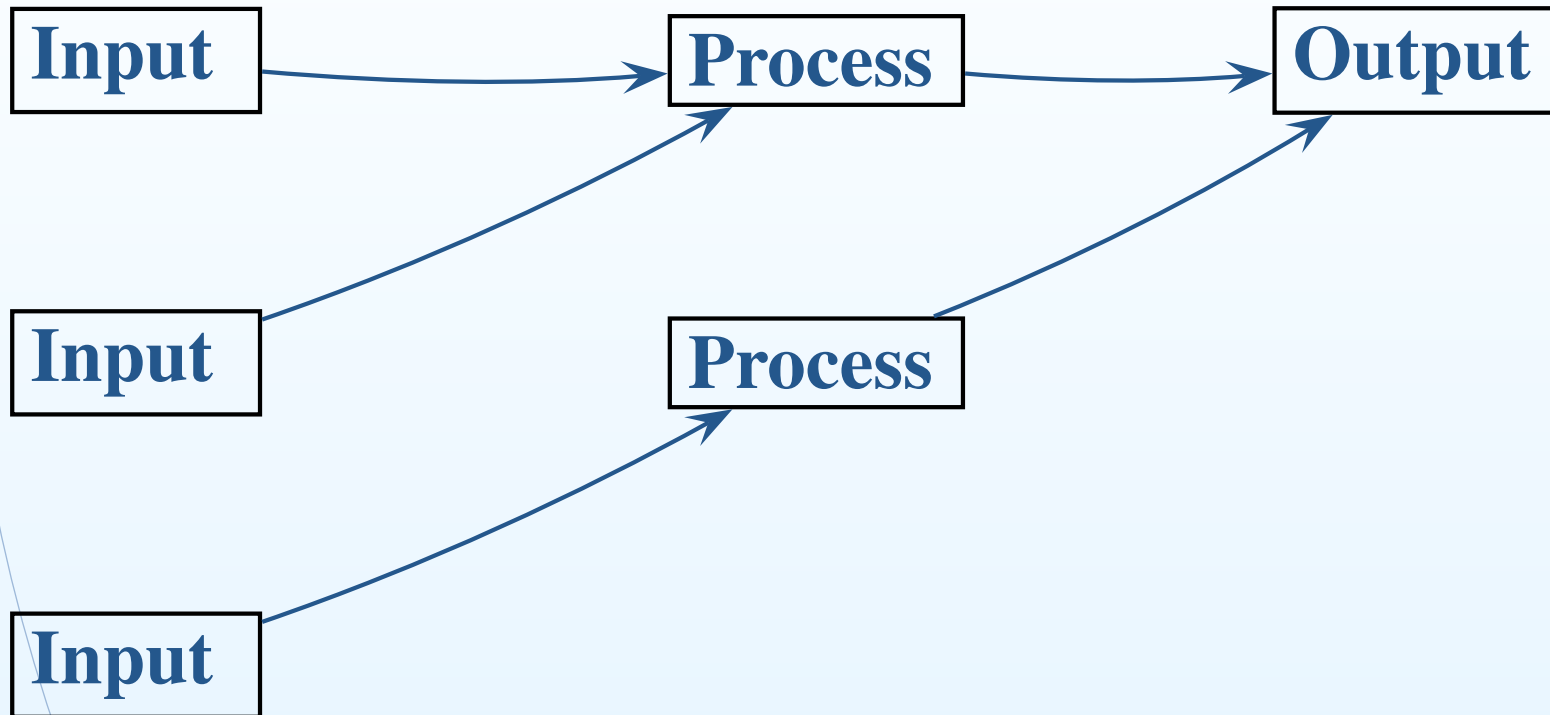
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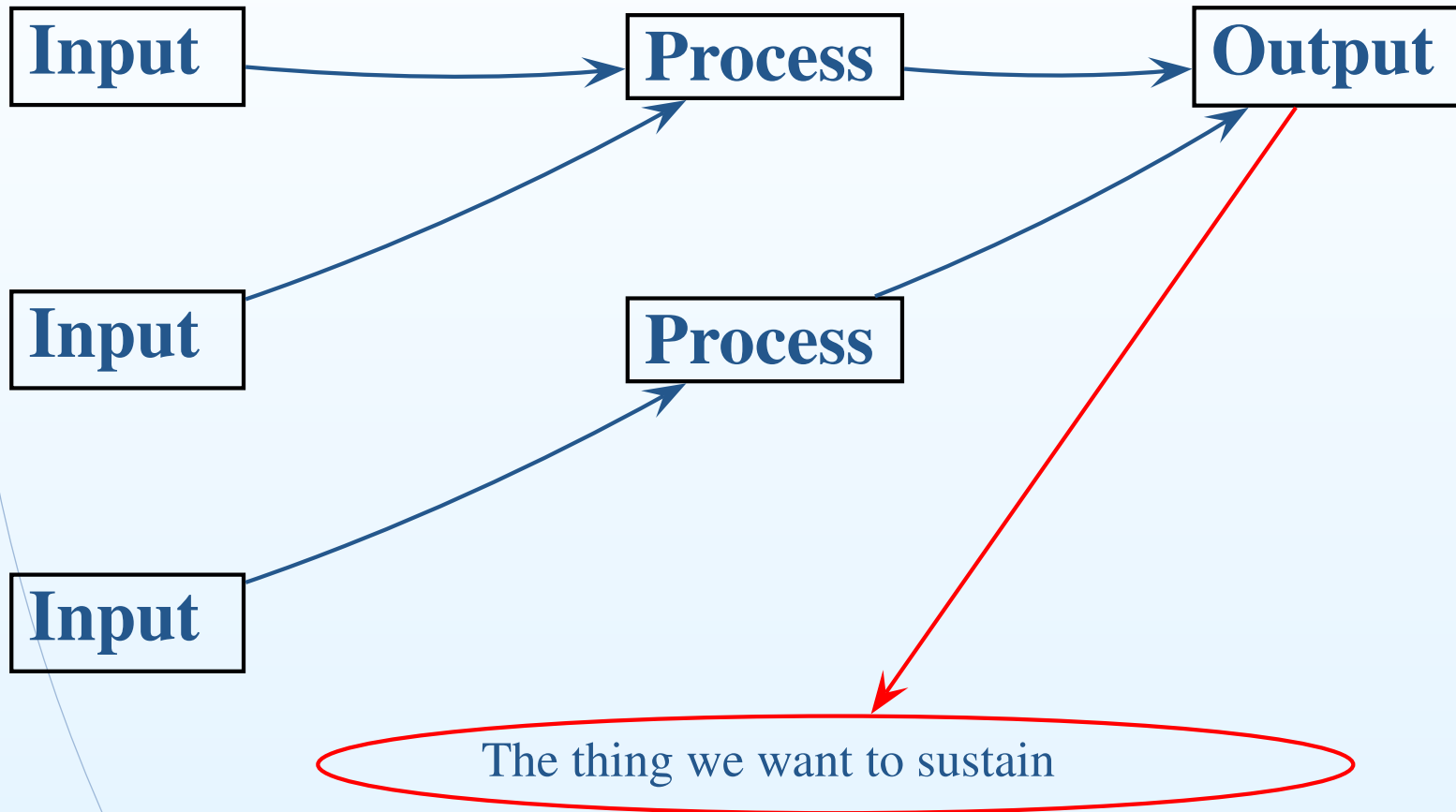
How do We Sustain Something?



How do We Sustain Something?



How do We Sustain Something?



Moses



System Constraints

Flourishing

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1. Technology—Technology describes the processes that allow the conversion of inputs or resources (things we use) into outputs (things we want). Embedded in technologies are design attributes, physical laws and limits, costs, depreciation, and the extent of lock-in. Here lock-in is defined as the inability of a producer, a consumer or society to move from one solution/state to another without extremely large transition costs.

System Constraints

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1. Technology

2. Economics—Economics describes how individuals and societies choose to employ scarce resources that could have alternative uses to produce goods and services, and distribute them among various individuals and groups in society in such a way that the society maintains itself over time. Economic sustainability refers to the ability of an economic system to produce a constant or increasing standard of living over time.

System Constraints

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1. Technology
2. Economics
3. Paradigms—A paradigm is a set of practices that define a discipline, practice, or community of thought at any particular period of time. In a scientific community, paradigms “are the source of the methods, problem-field, and standards of solution accepted by any mature scientific community at any given time.” Paradigms are heavily influenced by attitudes and past practices. In many cases, received paradigms limit our ability to envision or design alternatives to current systems.

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1. Technology

2. Economics

3. Paradigms

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1. Sustainability is often defined as “meeting the needs of today without compromising the ability of future generations to meet their own needs (The Brundtland Commission, 1987).”

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1. Sustainability is often defined as “meeting the needs of today without compromising the ability of future generations to meet their own needs (The Brundtland Commission, 1987).”
2. Food, water, shelter, and clothing are “basic needs” on which there is universal agreement.

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3. Current discussions of sustainability also include items such as: a) a clean, healthy, and appealing environment,

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3. Current discussions of sustainability also include items such as: a) a clean, healthy, and appealing environment, b) meaningful and rewarding work, and c) full participation in a just and equitable society.

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1. Sustainability is often defined as “meeting the needs of today without compromising the ability of future generations to meet their own needs (The Brundtland Commission, 1987).”
2. Food, water, shelter, and clothing are “basic needs” on which there is universal agreement. There is also general agreement that all individuals should have access to proper sanitation, primary and secondary education, and basic healthcare.
3. Current discussions of sustainability also include items such as: a) a clean, healthy, and appealing environment, b) meaningful and rewarding work, and c) full participation in a just and equitable society.
4. Is item **3** one definition of human flourishing?

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Some have argued that the definition from the Brundtland Commission is too anthropocentric.

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Some have argued that the definition from the Brundtland Commission is too anthropocentric.

The Foundation for Global Sustainability, for example defines sustainability as follows.

Sustainable development is human development within the ecological means of our planet, while leaving a substantial share of the Earth's biosphere to species other than humans.

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In addition to this ecological framework, sustainable development requires a social regulatory framework which focuses on *improving* the quality of life for all, in current and future generations.

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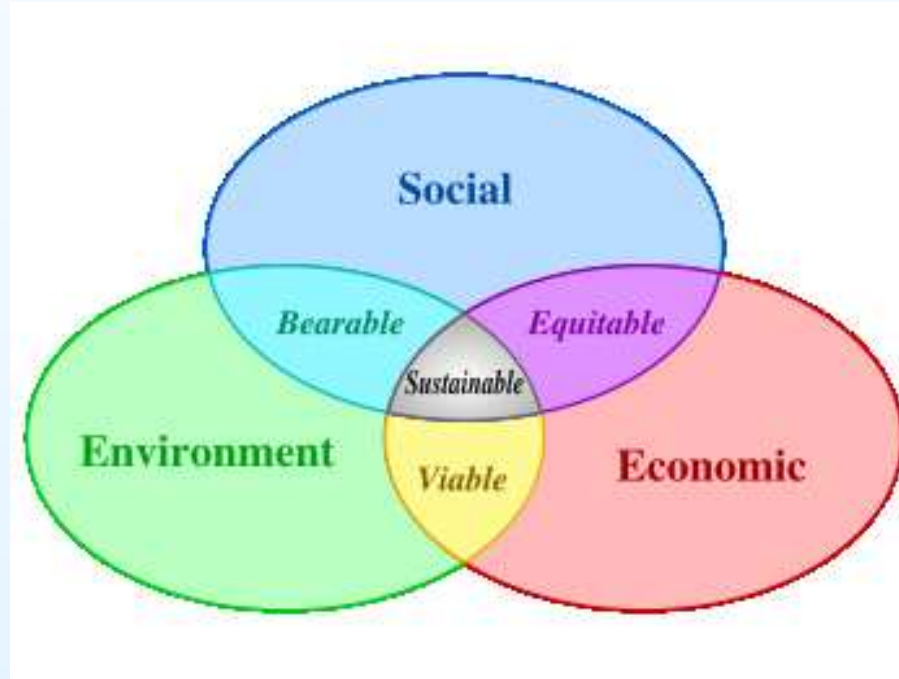
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Within those transparently set frameworks, a dynamic market economy can thrive.

Three Factor Model of Sustainability

Three Factor Model of Sustainability

Another common approach to sustainability was first proposed by Robert Goodland¹ in which he argues that sustainability is based on the interactions of three key realms: Environmental (or ecologic), Social, and Economic.



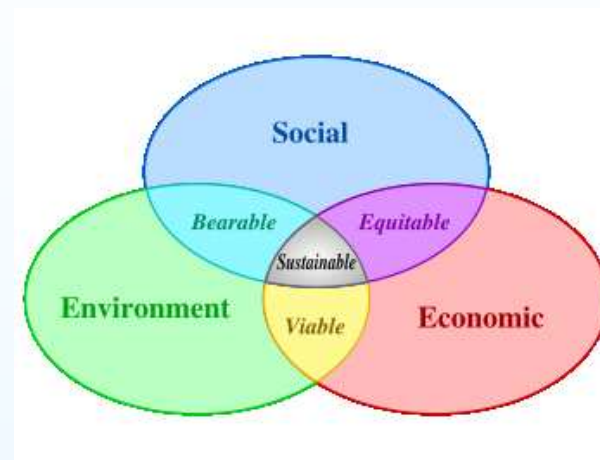
¹Goodland, Robert. 1995. "The Concept of Environmental Sustainability." Annual Review of Ecology and Systematics 26: 1-24.

Three Factor Model

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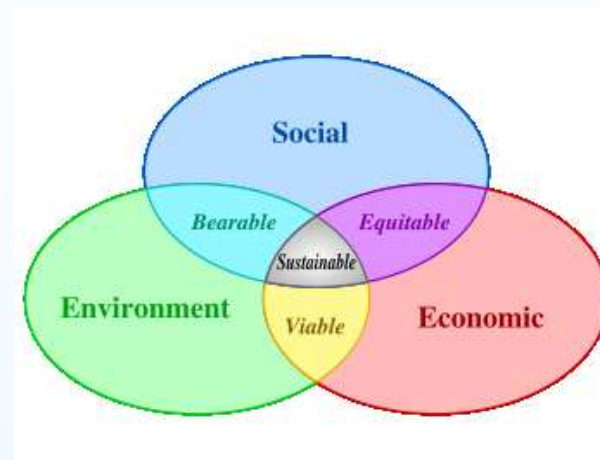


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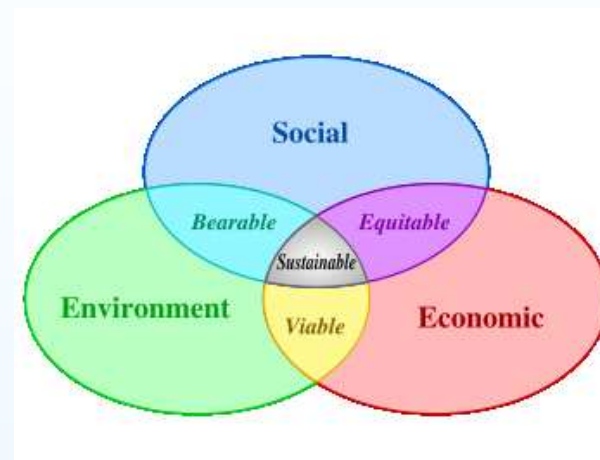
Upper class male in Britain in 1830

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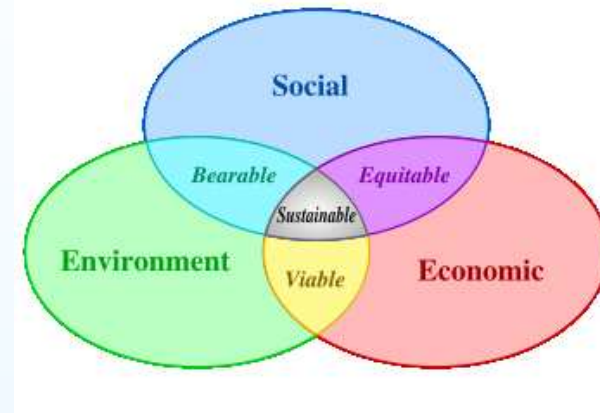
- Woman aged 28 with six children who lives in a rural village in southern India

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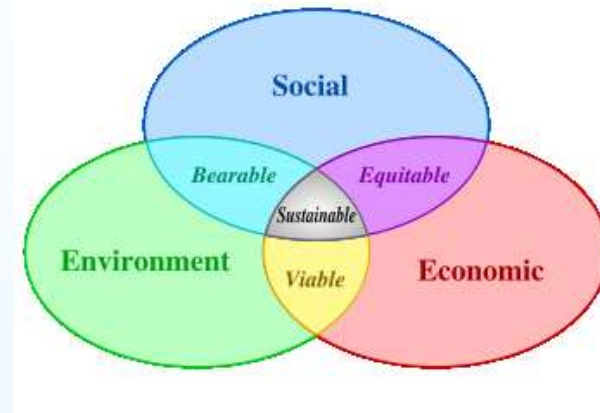
- Woman aged 28 with six children who lives in a rural village in southern India
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- Woman aged 28 with six children who lives in a rural village in southern India
- A Latino teenager who lives in LA whose father died when he was five and whose mother makes less than \$20,000 annually
- An eight year old girl who lives in Ramallah, Palestine whose father drives a taxi and whose mother works for a telecommunications firm

Environmental, Economic, and Social Sustainability

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- Sustainability is based on natural and social processes.

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- Sustainability is based on natural and social processes.
- Physical (sometimes more broadly called environmental or ecological) sustainability is the ability of a natural system to more or less reproduce itself over time without significant external injections of energy or increases in entropy.

Environmental, Economic, and Social Sustainability

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- Sustainability is based on natural and social processes.
- Physical (sometimes more broadly called environmental or ecological) sustainability is the ability of a natural system to more or less reproduce itself over time without significant external injections of energy or increases in entropy.
- Economic sustainability refers to the ability of an economic system to produce *a constant or increasing standard of living* over time.

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- Physical (sometimes more broadly called environmental or ecological) sustainability is the ability of a natural system to more or less reproduce itself over time without significant external injections of energy or increases in entropy.
- Economic sustainability refers to the ability of an economic system to produce *a constant or increasing standard of living* over time. Physical sustainability is a prerequisite for economic sustainability, though man-made improvements in technology may enhance the ability of both physical and economic systems to reproduce or grow.

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- Social sustainability considers how individuals, communities and societies live with each other, and societal provisions and expectations for

Environmental, Economic, and Social Sustainability

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- Social sustainability considers how individuals, communities and societies live with each other, and societal provisions and expectations for
 - a) individual autonomy and realization of personal potential,
 - b) participation in governance and rule making,
 - c) citizenship and service to others,
 - d) justice,
 - e) the propagation of knowledge,
 - f) and resource distributions that affect the ability of that society to flourish over time.

Sustainability is a Social Process

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Sustainability of human flourishing is inherently a social process. The natural, built, and cultural environment in which humans live and thrive is the outcome of generations of human interaction with the environment.

Sustainability is a Social Process

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Sustainability of human flourishing is inherently a social process. The natural, built, and cultural environment in which humans live and thrive is the outcome of generations of human interaction with the environment.

For example, norms that are used by any group to assign relative values to such things as technological change, scientific inquiry, economic activity including profits and costs, risk, the natural world, and human and nonhuman life dramatically affect the decisions those groups take and thereby the opportunities they allow to future generations.

Resilience

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Resilience is the capacity of a system to undergo change and still retain its basic function and structure.

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Resilience is the capacity of a system to undergo change and still retain its basic function and structure.

Psychological resilience refers to an individual's capacity to withstand stressors and not manifest psychology dysfunction.

Resilience

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Ecosystem resilience is the capacity of an ecosystem to tolerate disturbance without collapsing into a qualitatively different state that is controlled by a different set of processes.

Resilience

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A resilient social-ecological system has a greater capacity to avoid unwelcome surprises (regime shifts) in the face of external disturbances, and so has a greater capacity to provide the proper equipment necessary for human flourishing.

Holistic Nature of Sustainability and Resilience

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Sustainability and resilience are inherently holistic global concepts. Interactions between chemical and physical processes and the constraints they imply, between plants, animals and natural resources, between human beings and their local environment, and between industrial policies on different continents all affect natural and human flourishing on the planet.

Holistic Nature of Sustainability and Resilience

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From symbiosis between aphids and ants to trans-boundary movement of water, sustainability must consider the *competition and complementarity* between living organisms to understand the constraints and challenges of creating a sustainable future.