**Systems thinking is the process of understanding how things influence one another within a whole. In nature, systems thinking examples include ecosystems in which various elements such as air, water, movement, plants, and animals work together to survive or perish. In organizations, systems consist of people, structures, and processes that work together to make an organization healthy or unhealthy.**
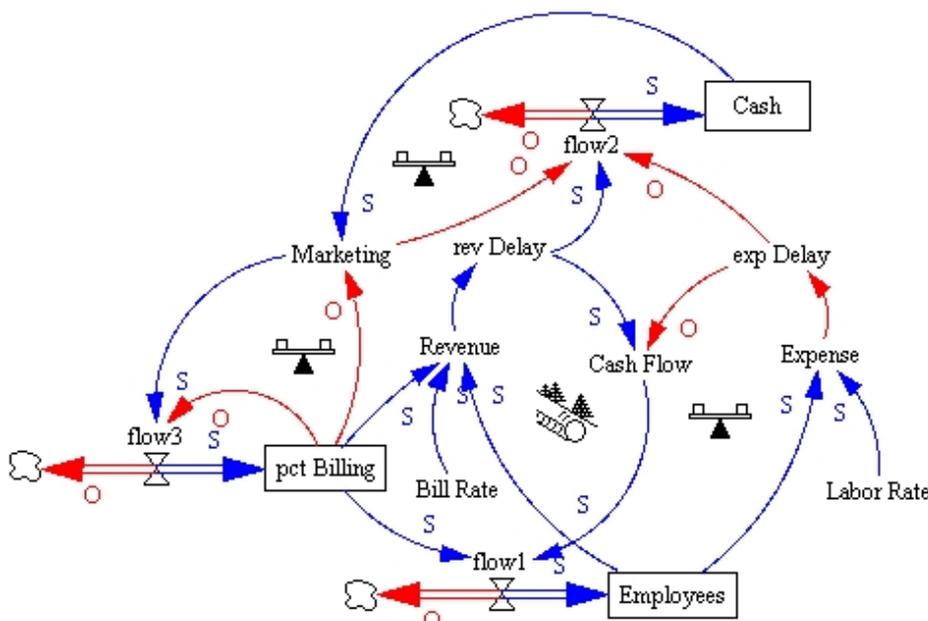
Systems Thinking has been defined as an approach to problem solving, by viewing "problems" as parts of an overall system, rather than reacting to specific part, outcomes or events and potentially contributing to further development of unintended consequences. Systems thinking is not one thing but a set of habits or practices [1] within a framework that is based on the belief that the component parts of a system can best be understood in the context of relationships with each other and with other systems, rather than in isolation. Systems thinking focuses on cyclical rather than linear cause and effect.

In science systems, it is argued that the only way to fully understand why a problem or element occurs and persists is to understand the parts in relation to the whole. [2] Standing in contrast to Descartes's scientific reductionism and
philosophical analysis
, it proposes to view systems in a
holistic
manner. Consistent with
systems philosophy
, systems thinking concerns an understanding of a system by examining the linkages and

interactions between the elements that compose the entirety of the system.

Science systems thinking attempts to illustrate that events are separated by distance and time and that small catalytic events can cause large changes in complex systems . Acknowledging that an improvement in one area of a system can adversely affect another area of the system, it promotes   organiz
 ational communication
at all levels in order to avoid the
 silo effect
. Systems thinking techniques may be used to study any kind of system — natural, scientific, engineered, human, or conceptual.

^{//} **The concept of a system**

Science systems thinkers consider that:

- a system is a dynamic and complex whole, interacting as a structured functional unit;
- energy, material and information flow among the different elements that compose the system;
- a system is a community situated within an environment;
- energy, material and information flow from and to the surrounding environment via semi-permeable membranes or boundaries;
- systems are often composed of entities seeking equilibrium but can exhibit oscillating, chaotic, or exponential behavior.

A holistic system is any set (group) of interdependent or temporally interacting parts. *Parts* are generally systems themselves and are composed of other parts, just as systems are generally parts or
holons
of other systems.

Science systems and the application of science systems thinking has been grouped into three categories based on the techniques used to tackle a system:

- Hard systems — involving simulations , often using computers and the techniques of op
 erations research

/management science. Useful for problems that can justifiably be quantified. However it cannot easily take into account unquantifiable variables (opinions, culture, politics, etc), and may treat people as being passive, rather than having complex motivations.

- Soft systems — For systems that cannot easily be quantified, especially those involving people holding multiple and conflicting frames of reference. Useful for understanding motivations, viewpoints, and interactions and addressing qualitative as well as quantitative dimensions of problem situations. Soft systems are a field that utilizes foundation methodological work developed by Peter Checkland , Brian Wilson and their colleagues at Lancaster University.
Morphological analysis
is a complementary method for structuring and analysing non-quantifiable problem complexes.

- Evolutionary systems — Béla H. Bánáthy developed a methodology that is applicable to the design of complex social systems. This technique integrates critical systems inquiry with
soft systems methodologies
. Evolutionary systems, similar to
dynamic systems
are understood as open, complex systems, but with the capacity to evolve over time. Bánáthy uniquely integrated the
interdisciplinary
perspectives of systems research (including chaos, complexity, cybernetics), cultural anthropology, evolutionary theory, and others.

The systems approach

The systems thinking approach incorporates several tenets: [3]

- Interdependence of objects and their attributes - independent elements can never constitute a system
- Holism - emergent properties not possible to detect by analysis should be possible to define by a holistic approach
- Goal seeking - systemic interaction must result in some goal or final state
- Inputs and Outputs - in a closed system inputs are determined once and constant; in an open system
additional inputs are admitted from the environment

- Transformation of inputs into outputs - this is the process by which the goals are obtained

- Entropy - the amount of disorder or randomness present in any system
- Regulation - a method of feedback is necessary for the system to operate predictably
- Hierarchy - complex wholes are made up of smaller subsystems

- [Differentiation](#) - specialized units perform specialized functions
- [Equifinality](#) - alternative ways of attaining the same objectives (convergence)
- Multifinality - attaining alternative objectives from the same inputs (divergence)

Some examples:

- Rather than trying to improve the braking system on a car by looking in great detail at the material composition of the brake pads (reductionist), the *boundary* of the braking system may be extended to include the interactions between the:

- brake disks or drums
- brake pedal sensors
- hydraulics
- driver reaction time
- tires
- road conditions
- weather conditions
- time of day

- Using the tenet of "Multifinality", a supermarket could be considered to be:

- a "profit making system" from the perspective of management and owners
- a "distribution system" from the perspective of the suppliers
- an "employment system" from the perspective of employees
- a "materials supply system" from the perspective of customers
- an "entertainment system" from the perspective of loiterers
- a "social system" from the perspective of local residents
- a "dating system" from the perspective of single customers

As a result of such thinking, new insights may be gained into how the supermarket works, why it has problems, how it can be improved or how changes made to one component of the system may impact the other components.

Applications

Science systems thinking is increasingly being used to tackle a wide variety of subjects in fields such as computing, engineering, epidemiology, information science, health, manufacture, management, and the environment.

Some examples:

- [Organizational architecture](#)
- Job design
- Team Population and Work Unit Design
- Linear and Complex Process Design
- Supply Chain Design
- [Business continuity planning](#) with FMEA protocol
- Critical Infrastructure Protection via FBI Infragard
- [Delphi method](#) — developed by RAND for USAF
- Futures studies — [Thought leadership](#) mentoring
- The public sector including examples at The Systems Thinking Review [1]
- [Leadership development](#)
- Oceanography — forecasting complex systems behavior
- [Permaculture](#)
- [Quality function deployment](#) (QFD)
- [Quality management](#) — [Hoshin planning](#) methods
- [Quality storyboard](#) — [StoryTech](#) framework (LeapfrogU-EE)
- [Software quality](#)
- [Program management](#)
- [Project management](#)
- MECE - McKinsey Way
- [Sociocracy](#)
- Linear Thinking

See also

- [Boundary critique](#)
- [Crossdisciplinarity](#)
- [Holistic management](#)
- Information Flow Diagram
- Interdisciplinary
- Multidisciplinary
- [Negative feedback](#)
- [Soft systems methodology](#)
- [Synergetics (Fuller)](#)
- [System dynamics](#)

- Systematics - study of multi-term systems
- [Systemics](#)
- [Systems engineering](#)
- [Systems intelligence](#)
- [Systems philosophy](#)
- [Systems theory](#)
- [Systems science](#)
- [Systemography](#)
- Transdisciplinary
- Terms used in systems theory

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External links

- The Systems Thinker newsletter glossary
- Dancing With Systems from Project Worldview
- Systems-thinking.de : systems thinking links displayed as a network
- Systems Thinking Laboratory
- Systems Thinking
- Kaizen Training and Research Page - CSS Research and Training Center