System Theory

A **system** by definition is composed of interrelated parts or elements. This is true for all systems—mechanical, biological, and social.

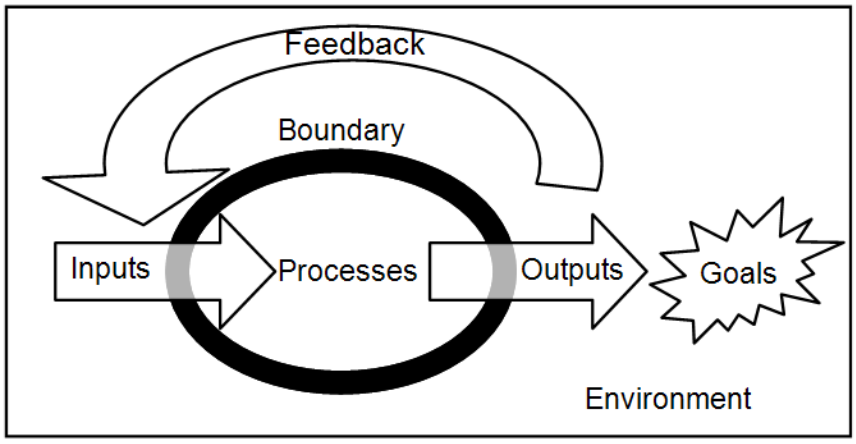
Boundaries- All systems have boundaries or barriers between the system and its surroundings (environement). Sometimes the system's barriers are difficult to recognize. Open systems have relatively porous boundaries through which useful feedback can be exchanged and understod. By contrast, closed systems have extremely closed boundaries in which very little information is exchanged.

Isolated systems- are closed systems that don't allow energy to flow into the system from its surroundings and therefore the amount **entropy** (amount of energy unavailable to do useful work) increases. **The tendency toward maximum entropy is a movement to disorder, complete lack of resource transformation, and death (decay).**

Closed System- a system which doesn't allow inputs of any matter, resources, ideas, or information from its surroundings, and isn't subject to any force whose source is external to the system. Closed systems contain limited energy/resources and as a result gains in one area of the system must be offset by a loss in another area of the system. In the absence of external inputs, evolution of closed systems is limited or missing.

Open System- a system which allows inputs of matter, resources, ideas, and information from its surroundings, and can be impacted by external forces to the system. Open systems, for this purposes, are not strictly limited to the resources found within its borders and therefore gains in one area of the system do not entail loss in another area of the same system.

Open systems continuously exchange **feedback** with their environments, analyze that feedback, adjust internal systems as needed to achieve the system's goal, and then transmit necessary information back to the environment. In short, open systems evolve.



For more detailed information read the next couple of pages.

Key Concepts of General Systems Theory – "Natural Laws"

and their

"Systems Dynamics" in Organizations

I. THE WHOLE SYSTEM

1. Holism, Synergism Organicism, and Gestalt

The whole is not just the sum of the parts; **the system itself can be explained only as a totality.**

Holism is the opposite of elementarism, which views the total as the sum of its individual parts.

2. Open Systems View

Systems can be considered in two ways: (1) closed, or (2) open. Open systems exchange information, energy, or material with their environment.

Biological and social systems are inherently open systems; mechanical systems may be open or closed. The concepts of open and closed systems are difficult to defend in the absolute.

We prefer to think of open-closed as a dimension; that is, **systems are relatively open or relatively closed.**

3. Systems Boundaries

It follows that systems have boundaries which separate them from their environments. The concept of boundaries helps us understand the distinction between open and closed systems. The relatively closed system has rigid, impenetrable boundaries; whereas the open system has permeable boundaries between itself and a broader suprasystem.

Boundaries are relatively easily defined in physical and biological systems, but are **very difficult to delineate in social systems, such as organizations.**

4. Input–Transformation–Output Model

The open system can be viewed as a transformation model.

In a dynamic relationship with its environment, it receives various inputs, transforms these inputs in some way, and exports outputs.

5. **Feedback**

The concept of feedback is important in understanding how a system maintains a steady state.

Information concerning the outputs or the process of the system is fed back as an input into the system, perhaps leading to changes in the transformation process and/or future outputs.

Feedback can be both positive and negative, although the field of cybernetics is based on negative feedback. Negative feedback is information input which indicates that the system is deviating from a prescribed course and should readjust to a new steady state.

6. **Multiple Goal-Seeking**
Biological and social systems appear to have multiple goals or purposes.

Social organizations seek multiple goals, if for no other reason than that they are composed of individuals and subunits with different values and objectives.

II. THE INNER WORKINGS

7. **Equifinality of Open Systems**

In mechanistic systems there is a direct cause and effect relationship between the initial conditions and the final state.**Biological and social systems operate differently.**

Equifinality suggests that certain results may be achieved with different initial conditions and in different ways.

This view suggests that social organizations can accomplish their objectives with diverse inputs and with varying internal activities (conversation processes).

8. **Entropy**

Closed, physical systems are subject to the force of entropy (increase in unusable energy) which increases until eventually the entire system fails.

The tendency toward maximum entropy is a movement to disorder, complete lack of resource transformation, and death (decay).

In a closed system, the change in entropy must always be positive; however, in open biological or social systems, entropy can be arrested and may even be transformed into negative entropy— a process of more complete organization and

ability to transform resources—**because the system imports resources from its environment.**

9. **Hierarchy**

   A basic concept in systems thinking is that of hierarchical relationships between systems.

   A system is composed of subsystems of a lower order and is also part of a suprasystem.

   Thus, there is a hierarchy of the components of the system.

10. **Subsystems or Components**

    A system by definition is composed of interrelated parts or elements. This is true for all systems— mechanical, biological, and social.

    Every system has at least two elements and these elements are interconnected.

11. **Steady State, Dynamic Equilibrium**

    The concept of steady state is closely related to that of negative entropy. A closed system eventually must attain an equilibrium state with maximum entropy—death or disorganization.

    However, an open system may attain a state where the system remains in dynamic equilibrium through the continuous inflow of materials, energy, and information.

12. **Internal Elaboration**

    Closed systems move toward entropy and disorganization.

    In contrast, open systems appear to move in the direction of greater differentiation, elaboration, and a higher level of organization.

Source: adapted from *Academy of Management Journal*, December 1972 by Stephen G. Haines