Systems Thinking

Key facts

- Analytic skill set, that allows to perform problem solving in complex systems
- Holistic approach that aims to "see the forest and see the trees"
- A system is more than its elements on their own, as each element is connected and behaves accordingly
- The individual elements as well as the whole systems need to be considered

What are Systems?

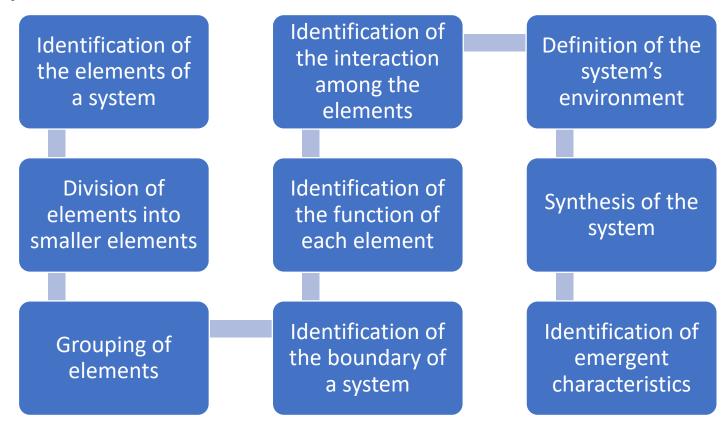
- Definition: Regularly interacting or interdependent group of items forming a unified whole
- Examples: (complex) supply chains, technological systems (GPS, power grid, internet), climate eg.







• 9 step approach:



- Elements of the system are depending on the type of system
- May consist for example of hardware, software, humans, processes, conceptual ideas or any combination of these.

Identification of the elements of a system

Division of elements into smaller elements

- Divide in hierarchical view
- Elements are sorted in a hierarchy to reduce the perception of complexity

- Elements are sorted into groups that are viewed as sub-systems
- Groups are identified by the function of the subsystem
- Subsystem can be analyzed separately to reduce complexity

Grouping of elements

- The boundary is essential for defining the system
- Allows the separation of the system from its environment
- Boarder is surface across which internal and external interactions take place

Identification of the boundary of a system

Identification of the function of each element

- Every element of a system has a function
- Some elements have multiple functions

 The system is shaped by the interaction between elements and sub-systems

Identification of the interaction among the elements

- Environments of interest: physical, cultural, economic, social, legal, political, and geographic environments
- Takes in account the dynamic context and all exchanges, influences and other factors

Definition of the system's environment

Synthesis of the System

- Construction of the entire system based on the steps before
- Iteration as a means of refinement and convergence

- A system is more then its elements by themselves
- Emergent characteristics are the properties that are not exclusively attributable to any of the interacting parts

Identification of emergent characteristics

Tools (Examples)

- Identifying the elements and environments:
 - Who: Desk research (single researcher), Brainstorming (Team)
 - How: SWOT-Analysis, Business Modell Canvas, Mind Maps
- Visual Representation of hierarchies and interdependencies
 - Who: Desk research (single researcher), Workshop (Team)
 - How: Graphs, Business Process Modelling (with for example BPMN), Software Systems Modelling (using eg. UML), Network diagrams

Applications

- (Understanding) Climate Change
- Business Model Innovation
- Social Science
- Systems engineering
- Operations management
- Supply chain planning
- Education (= Teaching students to apply systems thinking approach to find solutions)

Sources

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