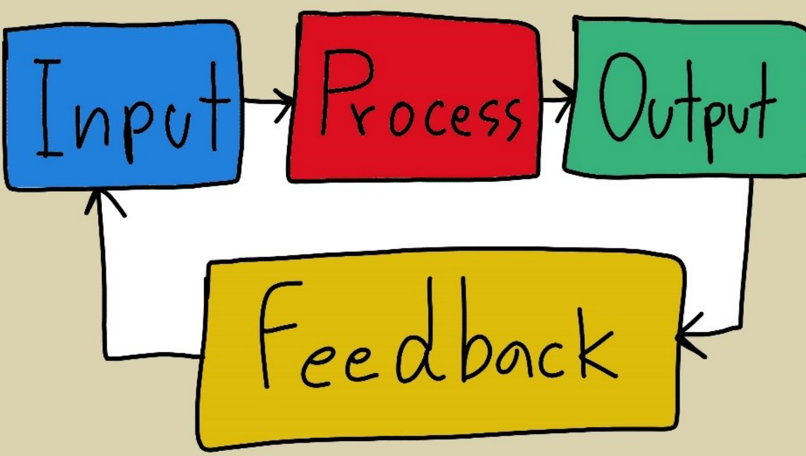
SYSTEM THINKING

PRINCIPLES



BIGROCKS THINKING

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Intro to System Thinking

Systems are ubiquitous. Humans impact and are influenced by several systems, ranging from the natural environment to family, companies, education, and health care. If we have a solid grasp of systems, we will be able to optimize our behavior and attain our goals more efficiently and proactively.

Consider the following: Suppose you operate a tiny firm. The company consists of you and three or four staff. Your targeted outcome is to deliver excellent community service and maintain a positive atmosphere for yourself and your staff. Each person in the company is vital to the company as a whole and contributes to the company's healthy culture through their work responsibilities. In this organization, each member relies on the others in order to achieve the shared purpose in harmony.

One day, two employees have a minor disagreement. It hinders their ability to communicate with one another. Their separate jobs are impacted by the absence of communication. Their ineffective performance impacts the other workers and the owner. This has a negative impact on the business's performance, generating challenges for the company's overall objective. In addition, this issue impacts the business's dealings with other members of the community.

This example reveals that this little business is a complete entity. Employees are a component of the whole. The products the firm acquires, the operations it executes, and the products it sells are other components. The people and procedures are subsystems of the small business system.

In addition, this tiny firm is a component of a bigger whole; it is a part of the larger business community. In this view, small businesses are subsystems inside the community of major businesses. When a small business acquires resources and sells its products, it interacts with other companies. The other firms are subsystems of the wider business community system.

As you can imagine systems are everywhere that is important to have at least a high-level understanding of how they work.

What is System Thinking

Systems thinking is a comprehensive approach to analysis that focuses on the interrelationships between a system's constituent pieces and how a system functions through time and in the context of bigger systems.

In order to understand how a system functions over time and in relation to other systems, it is helpful to take a more holistic, systems-level perspective. In contrast to conventional analysis, which examines systems by dissecting them into their component parts, the systems thinking method examines the whole. Medical, ecological, political, economic, human resource, and instructional studies are just some of the many fields that have benefited from the use of systems thinking.

Systems theory holds that the actions of reinforcing and balancing processes determine the behavior of a system. Some part of a system grows as a result of a process that reinforces its own existence. Unchecked reinforcement will lead to failure if not balanced by other processes. For a system to remain in a state of relative stability, it must undergo what is known as a balancing process.

System thinking is a form of critical thinking that involves analyzing the interrelationships between a system's components in order to comprehend a situation and make better decisions. In simpler terms, to understand a forest, one must examine a large number of trees, surrounding plants and animals, the weather, and how all of these factors interact.

System thinking is a radical shift from the traditional method of making decisions, which consisted of disassembling the system and analyzing each component separately. In our dynamic environment, where the reality of a situation is the result of countless interactions between the system's components, system thinking is paramount. If we investigate the interactions between the pieces of a system, we will observe bigger patterns, according to system thinking. By recognizing the patterns, we can start to comprehend how the system operates. If the pattern is beneficial, we can make decisions to reinforce it; if the pattern is detrimental, we can make decisions to alter it.

Defining A System

A system is a collection of components/pieces that interact and influence one another to form a larger, more complicated whole.

Several other definitions have been given during the years for example:

- "A system is a group of interacting interrelated interconnected interdependent elements (subsystems) that constitute a complex and integrated whole" (Anderson & Johnson, 1997).
- "A system is a group of essential parts or subsystems, that can "affect the behavior and properties of the whole system and none of which has an independent effect on it" (Ackoff, 1999).
- "A system is an interconnected group of elements (subsystems) coherently organized for a goal" (Meadows, 2008).

An example of a system is the very Earth where we live. Earth's many interconnected systems include not just the air we breathe and the water we drink, but also the mountains, plains, jungles, plants, insects, animals, humans, and the technological marvels we've created. While studying climate change, scientists often examine the interplay between a variety of different factors. These connections may reveal overarching patterns that can be used to explain the system and identify potential remedies by altering the way the various components interact.

If we use a business as an example instead. We'll start small and work our way up. A business is a system consisting of many parts: employees, management, capital, equipment, and products, among others. A group of companies comprises a system, which we may call an industry. Different industries – along with consumers, governments, and non-governmental organizations – make up our economic system.

Characteristics of a System

1. A system's parts are not just a bunch of separate things; they are connected to each other and affect each other.

Example: Your dietician advices you to eat a breakfast bowl with 30 grams of almonds and 20 grams of walnuts in it. When you eat the cereal, the two nuts will allow your skin to shine.

You decide to leave out the almonds since you don't have any at home. The way the almonds and walnuts interact with each other to make the result (a shining face) will be changed, and the result won't be what you want.

2. All the parts of a system are put together in a certain way so that the system can reach its goal.

Example: You have to design a desk lamp and go through each phase of the design process. The result is a lamp that (a) meets the user's needs, (b) solves the problems that were identified, (c) was one of the numerous ideas, and (d) was tested to see how well it solved the problems that the user had identified. The person is pleased.

3. A system is always part of a larger system and has a role in a larger system.

For example, the forest ecosystem is part of the earth's ecosystem, the earth's ecosystem is part of the solar system and that is part of a galaxy system, and so on...

4. Systems have feedback.

Example: Your group has been asked to make software that helps people learn languages. After figuring out what the user wants and what the problem is, you and your team come up with different ways the software could work. A few people on the team are asked to look over the possible solutions to see if and how well each one solves the issues that were identified. They write down what they think and tell the team what they think. This feedback is then added to the process at the ideate stage.

Systems Thinking Components

There are several essential aspects of systems thinking that contribute to the structure of this mental model. They are as follows:

Interconnectedness: Some of the interacting components may be subsystems with their own elements. Because systems are interconnected, they are not just straight lines of cause and effect, but rather a web of interactions that affect the entire system.

Synthesis: The success of the entire system is dependent on the success of its constituent elements, and the failure of one piece can trigger the whole system to collapse. Understanding this synthesis necessitates studying the entire system as well as all of its component relationships at the same time.

Emergence: In systems thinking, it is crucial to consider how interactions within the system yield outcomes that are not anticipated when the individual pieces are examined. If you consider each component of the organization to be a part of the system, you can search for ways to enhance the system through the synergies of those components' effects.

Feedback loops: in systems, there are circular cause-and-effect linkages between system elements that can either strengthen or balance the system's behaviors. By identifying feedback loops, you might find areas where you might be able to influence the system's behavior.

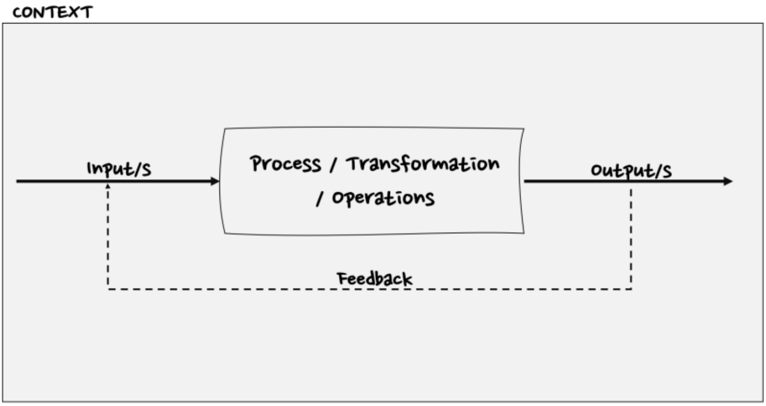
Causality: causality refers to how system components influence one another. The concept of causality underpins system element connections and can aid in the prediction of feedback loops.

Systems mapping: There are several approaches to mapping systems to help describe present causal linkages and feedback loops. Using simulations, these models can help you visualize the entire system at once and forecast future consequences.

System Modelling

A system can be modeled through 5 components:

1) Context
2) Input
3) Process/Transformation/Operations
4) Output
5) Feedback



During the operation of a system, different inputs interact with each other and change into outputs. Feedback about the outputs is gathered, and that information is then fed back into the operation. Inputs and outputs are dynamic, meaning they change as needed based on feedback and help make outputs work better.

Most of the time, when we control a system, we control the inputs and the transformation to get the output we want.

Good systems have the characteristic of self-balancing e.g. the output of a system is often the input of another system and they balance themselves. If we take Nature, for example, the sun warms up the seas, the water evaporates which forms clouds which in turn spread across the earth and reach even the driest areas. From the water that is spread through the clouds other living creatures benefit all around the globe. Each living being is supposedly in balance with its system and can constitute an input, a transformation, or an output in its subsystem and in the overall system. Water then comes back to the sea through rivers (feedback loop) and all restarts.

The process of making lessons for example is a system that needs to be guided. You gather your inputs, for example, information about the students, the context, the learner's goals, and content based on topics. During the planning process, you change this information into the desired outcome. But the story doesn't end there. During the testing phase, you will get feedback from the different actors (e.g. students, other instructors, etc.). This feedback will be used in other steps of the process, which will cause you to change your original concept. As a result, the program you create will better meet the needs of the audience and help you reach your goal.

You can think of many other examples e.g. the energy system, the human body system, a city system, the transport system, the water system, the economic system, the financial system, etc..

Systems Thinking Principles to Get You Started

- Think about the whole picture.
- Find a good balance between short-term and long-term goals
- Recognize that systems change, are complicated, and depend on each other.
- Think about how systems can be measured and how they can't.
- We are all part of the systems in which we work, and we all have an effect on those systems even as they have an effect on us.
- In order to understand a system draw the different element/component parts of the system, distinguish between context and higher level system/s, inputs, outputs, processes and feedback loops.

THE END