Anticipating STRAtegic Long-term challenges

Module 3. Section 6: Systems Mapping: Seeing the Bigger Picture

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Systems Mapping: Seeing the Bigger Picture

Systems mapping is a method in foresight practice for understanding complex, interconnected, and dynamic problems that shape long-term futures. It aids in thinking about feedback loops, emergent behaviors, and interactions/relations between actors in general. Actors in this context can be individuals, animals, organizations, nature, cities, forces, or any other thing that can have an impact on the system under study. For SMEs, systems mapping can support strategic anticipation by e.g. revealing how technological, social, economic, and environmental factors interact over time in their respective fields. This is especially important as the world has become increasingly interconnected and thinking only in one area, and solving the problems there, can have detrimental effects on another area. Long-term developments are seldom driven by single variables, and it is therefore imperative for doing Long-Term Future Foresighting (LTFF) that a systems thinking mindset is developed.

Conceptual Foundation

Before diving into the different techniques for mapping systems, a quick conceptual foundation is presented to gain an understanding of systems and how elements within them interact and get accustomed to the vocabulary.

"A system is an interconnected set of elements that is coherently organized in a way that achieves something." (Meadows, 2008, p. 11). Three things are mentioned that make up a system; 1) elements (all the parts that interact), 2) interconnections (relations between the elements), 3) and a function or purpose (the goal of the system). An example could be a large language model (LLM), the *elements* are its weights, the human interacting with it, the server it runs on, the internet... The human interacts with the LLM through writing prompts in a web application which gets send over the internet to the servers, where the LLM processes the prompt, and sends a response back to the human over the internet (*interconnections*). The goal of the system could be to provide help in writing a book about mecha dragons built by AI to hunt down the last remnants of humanity.

Constructing a System Map

To identify if the thing you are looking at is a system, the following questions can be used (inspired by Meadows, 2008, p. 13):

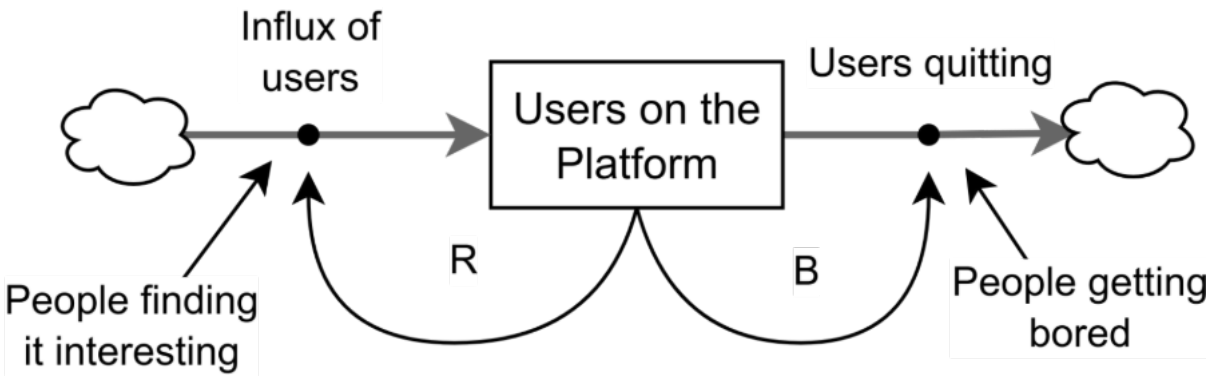
1. Can you identify elements?
    a. If yes, what are they?
2. Do the elements affect each other?
    a. If yes, how do they interact?
3. Do the elements together (the system) produce an effect on their surroundings that is different from the effect that each element can exert on its own?
4. Does the effect created by the system persist over time in several different circumstances?

By following these questions, and if the answers are "yes" to all, it is possible to map the system by connecting the elements with their interactions and stating the function and purpose of the system. If any of the answers to the questions are "no", then the thing you are looking at cannot be considered a system.

In system mapping, boxes represent a "stock". These are the elements of a system (the things you can, e.g. see, count, feel, or measure) and represent an accumulation of something such as material or information. From these stocks, inflows and outflows are connected. If the outflows are greater than the inflows, the stock will decrease. Stocks can act as a sort of time lag, as changes to the flows do not change the stock instantaneously.

The inflows and outflows can be affected by feedback loops, which can stabilize / balance or reinforce the flows. The balancing flows are indicated with a B, and reinforcing flows are indicated by an R.

An example could be the users on a given platform. This stock has an inflow of people who join it, e.g. because they find it interesting, and an outflow of users quitting, due to e.g. finding the platform boring after having explored it. The number of users is governed by a reinforcing loop of people joining resulting in more people knowing about it and inviting their friends to join, and a balancing loop of users quitting.



When to Apply Systems Mapping

Systems mapping should be applied if you want to:

- Gain a holistic and deep understanding of a specific area.
- See how changes could affect a specific area.
    - This is especially relevant if you want to see if the things you are doing could have negative consequences elsewhere.
- See why a solution you have designed works in unexpected ways.
- Identifying causal relationships and feedback loops and not just list factors.
- Support innovation.
    - Innovation rarely occurs in isolation, and Systems mapping can help SMEs understand how markets, technologies, and customer needs evolve over time and influence each other

Notes on Systems Mapping

- Systems Mapping is great at capturing complexity and interdependencies, but it can quickly become overly complex if boundaries are not set appropriately. Therefore, it is important to remember:
    - Start simple and iteratively refine the map .
    - Start with a focused problem or question (e.g., “How can we scale sustainably?”), while remaining open to expanding boundaries as new insights emerge.
    - The goal is insight, not completeness. Remember it is impossible to map the entire system.
- It aids in a shared understanding among stakeholders. Though this is also a drawback of the method, as diverse stakeholder engagement (e.g., employees, customers, partners) is needed to avoid blind spots and capture social and organizational dynamics. Therefore, Systems Mapping requires facilitation and stakeholder engagement skills, and the resources needed to gather the stakeholders for a workshop.

- Treat the Systems Map as a living tool and update it accordingly as new information is presented. Important instances to update the Systems Map is when:
    - Market conditions change
    - New technologies emerge
    - Strategic priorities evolve

Resources

Bender-Salazar, R., Dentoni, D., & Lubberink, R. (2023, March 13). *Systems mapping can facilitate the collective and shared understanding of complex problems*. Retrieved from World Economic Forum: https://www.weforum.org/stories/2023/03/systems-mapping-can-facilitate-the-collective-and-shared-understanding-of-complex-problems/?

Meadows, D. H. (2008). *Thinking in Systems - A Primer*. London: Earthscan.

SI Network. (2026). *What is Systems Mapping & Why is it Important*. Retrieved from Systemsinnovation.network: https://www.systemsinnovation.network/posts/articles-what-is-systems-mapping-why-is-it-important