Systems thinking for communities - Telling your story in systems

What are systems?

Systems are all around us. A system is a set of interconnected elements interacting together. We live on the Earth, a wide system of rivers, oceans, forests, mountains, deserts. To this natural system, we have added a large human-based system of countries, governments, cities, and villages. We are also part of communities and family units. Every day, we take decisions based on the signals sent by our body's stomach, brain, heart, and feelings.

Mathare is a complex system including villages, diverse communities, a network of formal and informal supply of energy, many independent businesses, social hubs, and local leadership structures.

All systems follow objectives, like keeping our body healthy, developing a vibrant city, or developing our communities, and are composed subsystems that may follow their own individual objectives (e.g. the stomach wants to eat, governments wants to get re-elected, a business owner needs customers).

An energy system, for example, aims to provide energy to households and businesses. It is composed of sub-systems like infrastructure and equipment, the availability and adoption of different technologies, and the realities of different neighbourhood and communities. The energy system interconnects with national, regional and local authorities, and is influenced by social and economic factors and by the relations between actors, like between KPLC and local leaders.

What is the advantage?

The advantage to think in systems is to make sense of complexity.

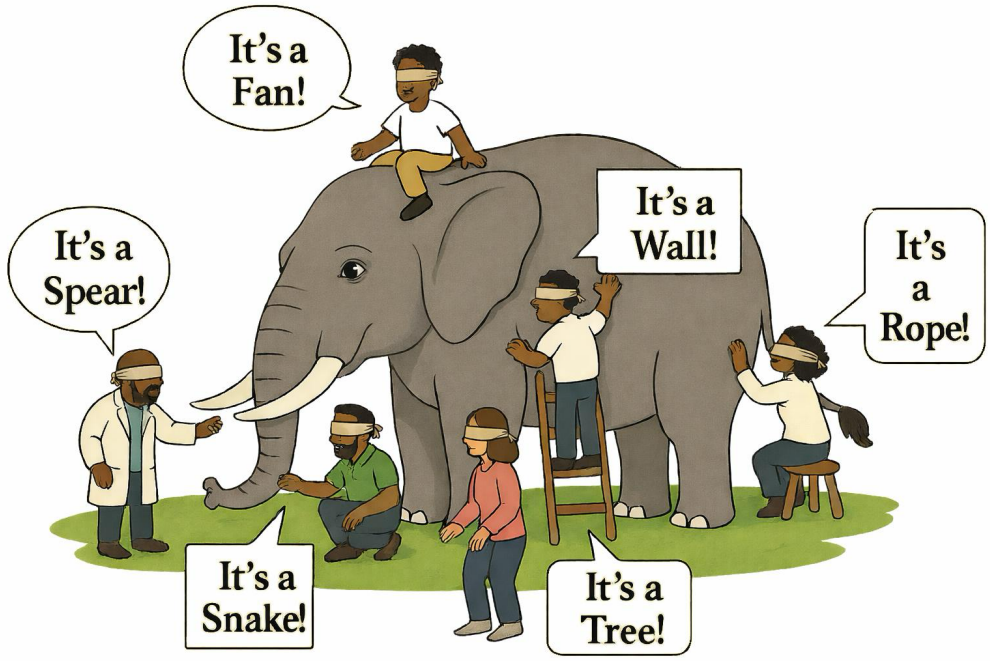
Sometimes a problem arises within a system, affecting some or all of the actors interacting in that system (for instance, environmental degradation, economic inequality, or lack of success in a business).

When something feels abstract, or when we feel a loss of control, it can feel overwhelming. Thinking in systems can provide more understanding of what we experience and why we experience it. We can see the interconnections at play, articulate our stories, and understand different perspectives. Understanding the roots of problems, why they persist, and how they could evolve, is an important objective of systems thinking.

This document presents some properties and concepts that help apply systems thinking to our everyday lives.

- "*Systems thinking isn't an inherently difficult subject. You don't need to be a math whiz or have a deep knowledge of a scientific discipline, but you do have to adjust how you look at the world." (Draper and Morgan Kauffman)*
- "*The basic rules of how systems work apply to all systems: social, political, economic, biological, technical. Once you understand these rules, you can tackle each new subject or problem by building on what you already know*."

SYSTEMS CONCEPT: MENTAL MODELS



Our life experience shapes our understanding of the world. Everyone has shared and individual experiences and the sum of these experiences influence how we perceive a problem and take decisions to resolve it. Our life experience influence how we predict the future, too. As a result, different individuals in a system will perceive the system differently. Understanding these differences and being aware of how our own perceptions shape our reality, can be useful. For instance, it can help understand the decisions of other people and potentially defuse tensions. It also helps to understand the system because these diverse viewpoints all contribute to shape the system. While a clash between different mental models can create conflict, being aware of it can help find shared objectives and opportunities for collaboration too.

SYSTEMS CONCEPT: THE ICEBERG MODEL AND LEVERAGE POINTS

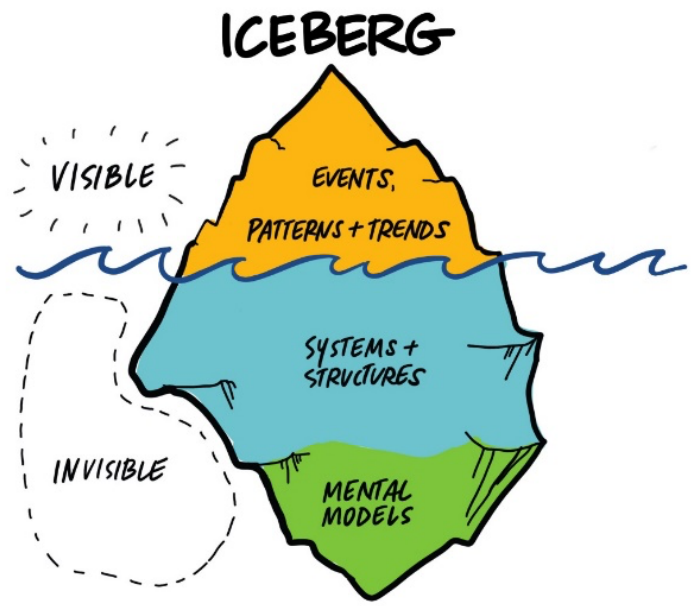
What we can see of an iceberg already looks very imposing, and yet most of its structure is hidden under the water.

Similarly, when a problem makes our life difficult, we often only experience the symptom of a larger, but hidden, system structure. The deeper we understand the system, the more we know what can influence long-term change. This is what Donella Meadows called the "leverage points": interventions to resolve a problem will be more efficient if they target deeper areas.

Often, policy interventions rely on interventions on the visible part of the system, like imposing new taxes, changing prices, or adopting punitive measures. While these interventions have value, they sometimes only consider short-term effects and don't consider long-term issues. Deeper interventions, for instance on the system structure,

its goal, or the mindset of stakeholders in the system, can provide longer term solutions.

Thinking of problems with the iceberg model allows to look for the root causes of social, economic and environmental issues that are being felt by many in their daily lives. For instance, complex challenges like climate change, poverty, or inequality, cannot be resolved with simple measures.



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Systems structures

Systems thinking encourages to think in a more “circular” way to explore the root causes of a problem. It includes considering how the consequences of a problem might influence the evolution of the same problem in the future. For instance, when a seller puts prices higher than other shops, customers may buy their products elsewhere, leading to a lack of customers to keep the business afloat. The seller’s response depends on several factors: maybe they cannot lower their prices because they operate on a tight budget, or maybe they have flexibility to lower it to attract more clients. In any case, the business owner analyses the effect of the price, then tries to adjust the price again. So, the price influences the future price. This is a **feedback loop**.

Another example on a larger scale, is the link between the causes and consequences of marginalisation. When communities experience marginalisation, they are more likely to be insufficiently considered in national planning (like energy access in urban informal settlements). This is because the situation is perceived as more difficult by planners, so they may be tempted to avoid it. However, this is a missed opportunity

for collaboration and knowledge exchange that impacts both sides by creating more distrust and tensions between people. Therefore, the effects of marginalisation tend to perpetuate or even reinforce the situation.

In general, if policies, rules and external interventions are not designed properly and inclusively, they may end up reinforcing systemic problems without realising it. This is called **unintended consequences**. Drawing a system structure can help see when and where unintended consequences might happen, to avoid them.

Delays influence a lot of consequences and causal relationships in systems. This may seem obvious for a physical and technical system, for instance the time to build a house, or a new product, before someone can use it. They are also essential in environmental systems, such as the time needed for a tree or for vegetables to grow, or the time after which a river might flood after heavy rain. These delays will influence delays in social systems too. Growing a community garden, or a social hub, will influence the time that people spend together and their ability to design future projects.

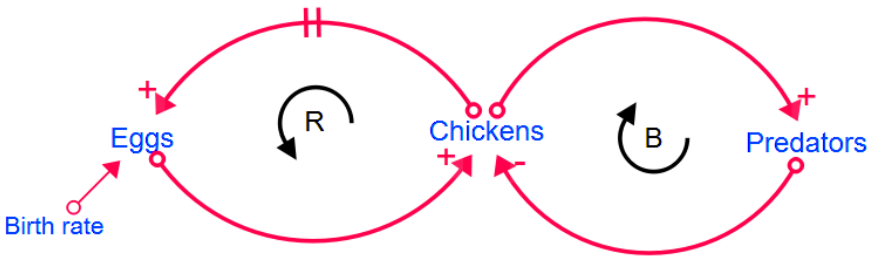
Delays have also a fundamental impact on safety and well-being and the time needed to rebound from difficult events (resilience).

Causal Loop Diagrams

The interconnections between system elements form a system structure. A system structure is composed of **causal relationships** (e.g. a higher cost of electricity leads to less adoption of electricity), **feedback loop** (e.g. marginalisation increases distrust and distrust increases marginalisation), and **delays** (e.g. the time to build infrastructures, the time for adopting new habits, the time to restore trust).

Causal loop diagrams are a way to draw the interconnections between elements to unveil the structure of a system.

Here is an example of how a causal loop diagram is drawn, showing some dynamics affecting a population of chicken.



The population of chickens is influenced by the number of eggs laid and by the number of predators chasing them.

The arrow going from chicken to eggs is called a positive causal relationship, because they go in the same direction: more chicken makes more eggs, and less chicken makes less eggs. This is noted “+” (or ”s” for “same”).

A positive relation does not necessarily mean an increase, simply that the element at the start of the arrow drives the element at the end of the arrow in the same direction. The relationship is also positive between eggs and chickens, as more eggs lead to more chickens and less eggs lead to less chickens. The loop that these causalities form is called a **reinforcing feedback loop (R)** because it reinforces the initial trend. If the chicken population is increasing it will continue to increase, and if it is already decreasing it will also continue to decrease. Other elements can of course influence this dynamic, including if the birth rate changes.

The other loop on the right-hand side illustrates that when they are more chicken they will attract more predators, also a positive link. However, if more predators kill chicken, then it leads to less chicken, so the link between predators and chicken is negative (noted “-“ or “o” for opposite). This loop contains one positive relationship and one negative relationship. Any loop which contains an odd number of negative relationships like this one is called a **balancing feedback loop (B)**. This is because the number of chicken and predators equilibrate, or balance, each other’s. The “//” sign on an arrow allows you to indicate where important delays occur. On the figure the delay for chickens to grow and make new eggs is marked.

Systems Archetypes

In all systems, similar systems structures can reoccur. They produce similar, albeit context and system-dependant results. For instance, patterns of “dependence” tend to happen in any system. In a human body it can occur as an addiction to coffee or alcohol. In a business system, it can occur when companies rely exclusively on other organisations for certain tasks. In a social system, it can occur in the form of dependence to certain services or flows of finance. The common issue in all these examples is that the dependence fixes something in the short term but gradually destroys the “internal” capability to find more long-term solutions.

Here is a list of some of the patterns that commonly create problems in systems (business, social, environmental).

Archetype	Example	Potential solutions
Fixes that fail *A short-term solution creates consequences that make the problem worse*	• Policy that excludes certain stakeholders	• Thinking of the possible side effects and consequences of an action • Finding common goals • Avoiding imposition
Eroding goals *When objectives are continuously lowered*	• Gradual degradation of environmental or social conditions	• Maintaining improvement objectives and high standards • Accepting the performance of today while acting towards a better situation in the future
Limits to success *Every growth and success is bound to reach its limits*	• Limits to the number of customers a business can attract • Limits to using a natural resource	• Identifying and anticipating limits that will arise from our actions
Dependence pattern *an external action provides short-term relief but erodes our internal capability to create meaningful change on our own*	• Addictions • Reliance on organisations in the community	• Confronting reality and restoring capacity, keep belief in one own's capacity to have an impact • For organisations: helping the system to help itself
Success to the successful *An individual or organisation achieves a dominant position which helps them remain dominant in the future*	• When some businesses are dominant • Issues of equity and justice, power relations between actors	• Defining success at higher levels • Less focus on competition
Escalation *Actions by one party are perceived as a threat by another party who reacts in similar ways*	• Competing actors trying to protect themselves of real or perceived threat • Can delay positive change and increase tensions	• Understanding the perception of others to defuse tensions • The same structure can be beneficial if it is used as a driver towards a common objective that will benefit all
Tragedy of the commons *Overuse of common resources, until they can't be used anymore*	• Risks to local environmental resources • Interconnected impacts increasing risks (erosion, floods)	• Awareness • Mutually agreed regulations • Understanding the delay the resource needs to regenerate, long before it starts to decline.