Climate and health public engagement

Leadership program

Topic area: Systems Thinking

Session title: Module 1 – Systems Thinking 101

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Funded by

Dalberg

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Agenda

01	Introduction	*(5 min)*
02	Stocks & Flows	*(15 min)*
03	Dynamics	*(15 min)*
04	Focusing Questions	*(15 min)*
05	Systemic Failure	*(20 min)*
06	Levels of Depth	*(15 min)*

a whistle-stop tour of systems concepts

01 **Introduction**

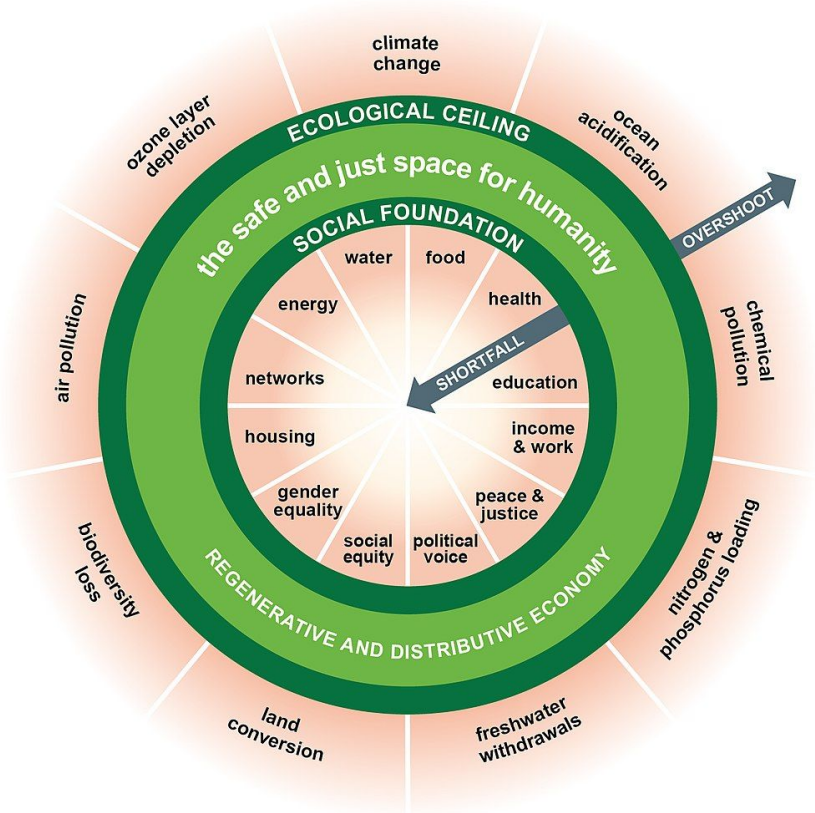
We live at the intersection of many complex and inter-dependent systems

Complex systems involve …

- … many components …
- … dynamically interacting …
- … giving rise to 'emergent' behaviors …
- … which form patterns that are common across types of systems, across scales, and across disciplines …
- … and which cannot be inferred from the behavior of their components alone.

Complex systems include …

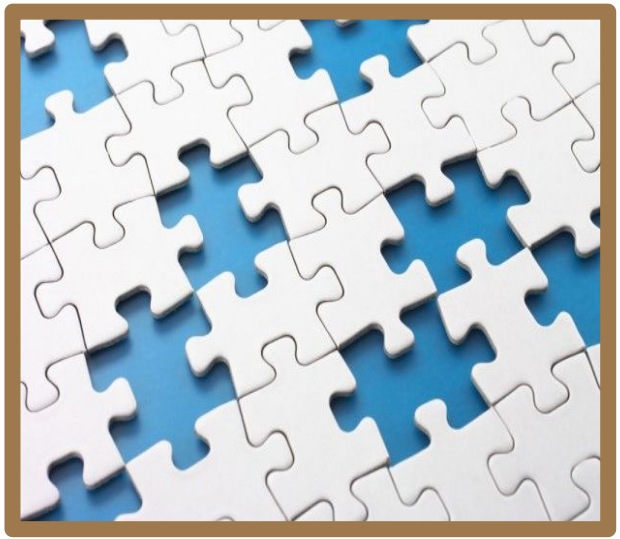
- … both material and non-material flows …
- … within and between sectors …
- … and the actors comprising those sectors …
- … including ourselves as individuals.



Source: Kate Raworth, "Doughnut Economics" (2017)

Systems thinking is about relationships

Conventional problem solving



Focus on component parts

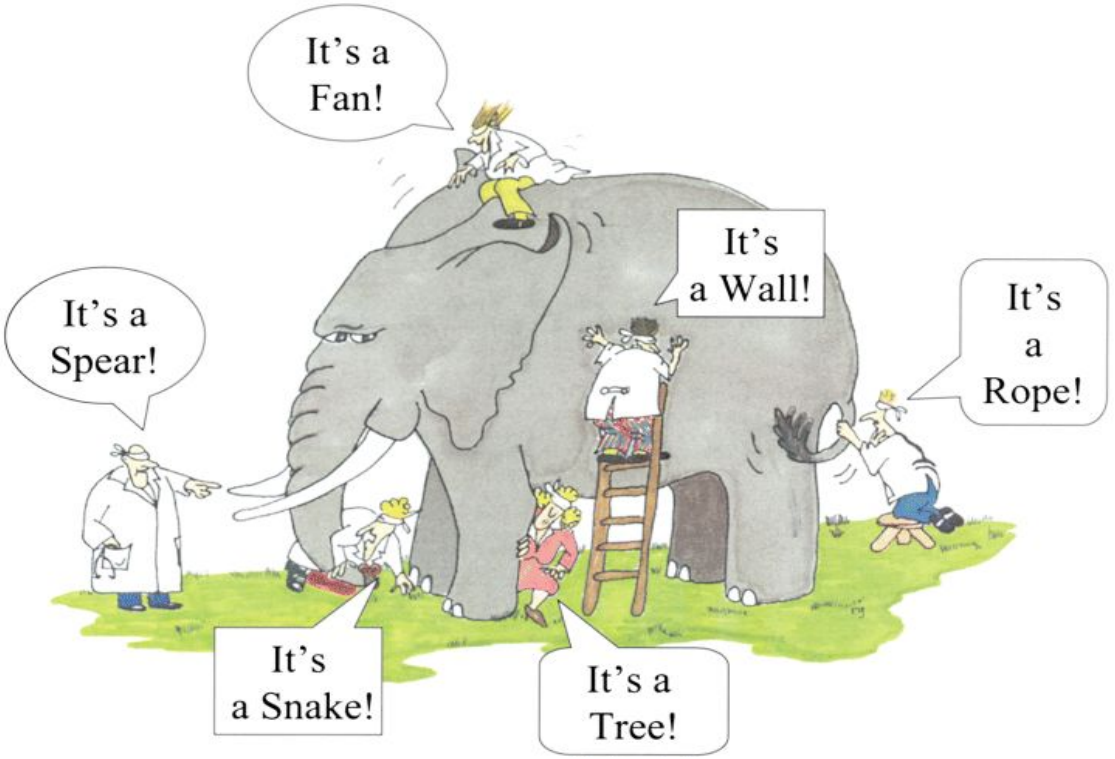
Systems thinking approach

Focus on relationships/whole

Systems thinking is useful when understanding the sum of a system's parts is not enough

"The key to success in the social problem-solving industry is being able to see the whole elephant."

--Nandan Nilekani



More specifically, systems thinking is useful when solving *problems that persist over time* despite efforts to address them

When is Systems Thinking most applicable?

- ✔ **Challenges persist** over time, as opposed to one-time crises that call for one-time responses
- ✔ The **landscape is crowded** with other development actors/efforts who have tried to solve the problem (with little or no success)
- ✔ The problem has **many parts** that must be addressed altogether, with solutions that are integrated
- ✔ **Stakeholders are open** to novel and more catalytic solutions that could involve different domains, versus pre-disposed to particular working in particular domains

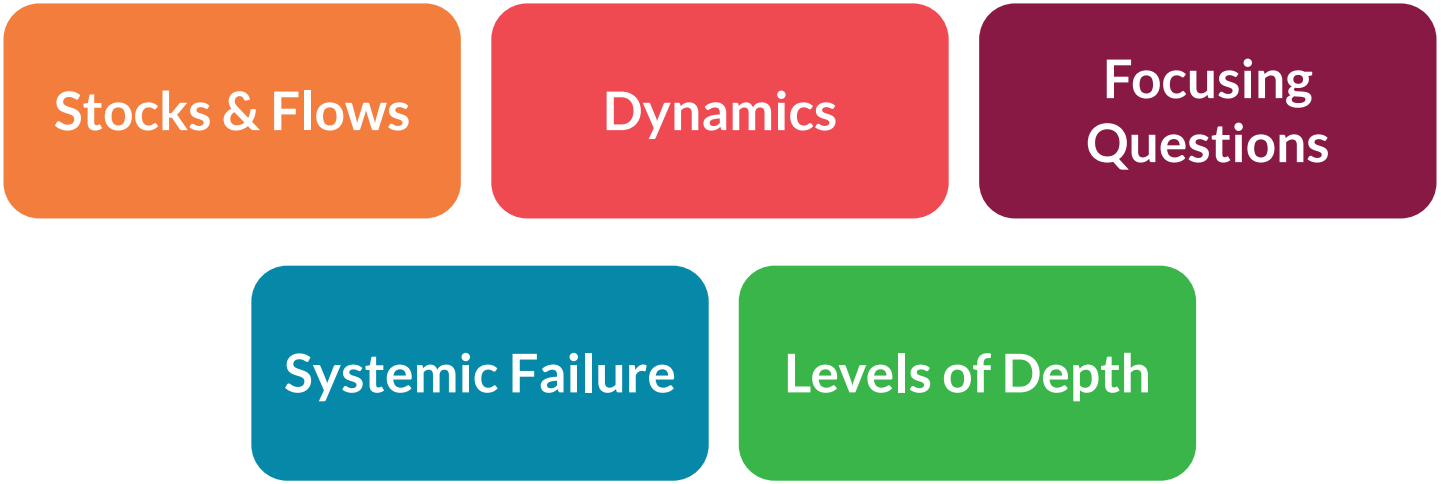
What are the benefits of Systems Thinking?

- ✔ Adopts a **more holistic view** and avoids bias of thinking in terms of traditional domain boundaries and domain-specific solutions
- ✔ Selectively **focuses on a few sustained and coordinated changes**, rather than many independent efforts to address each part of the problem
- ✔ Identifies **higher leverage** (and higher impact, albeit indirect) opportunities to deploy scarce resources
- ✔ Uncovers potential partners whose support makes solutions more likely to **scale and self-sustain**

What are risks in applying Systems Thinking?

- ▯ **Misuse of systems language and tools**, which can cause confusion
- ▯ **Defining the boundary of the system** too broadly or narrowly, and losing sight of the question
- ▯ Calibrating analysis at the **wrong level of aggregation**, leading to narrow or misleading insights
- ▯ **"Garbage in, garbage out"** (data); focusing on what is quantifiable, and missing what is important
- ▯ Findings can be **counter-intuitive, difficult to communicate**; e.g. people often struggle to understand accumulation (stocks vs. flows)

The remainder of this session unpacks five key concepts/tools for understanding systems and their behaviors over time



02 **Stocks & Flows**

What's a stock? What's a flow?

The concepts of stock and flow are crucial for understanding accumulation, i.e., repeated or continuous changes in something over time.

Stocks and flows can be distinguished by the way in which they are measured:

- **Stock** – A stock is something that is measured at a particular *point* in time, and represents a quantity existing at that instant, and that quantity may have accumulated in the past. The level of a stock varies as a function of its inflows and outflows.
- **Flow** – A flow is a *change* in something measured over an *interval* of time. Therefore, a flow is measured per unit of time (say, a year). In this sense, flow is roughly analogous to speed.

Can you distinguish which is a stock vs. flow?

Births?

GDP?

Debt?

Temperature?

Population?

Calories?

Heat?

Interest rate?

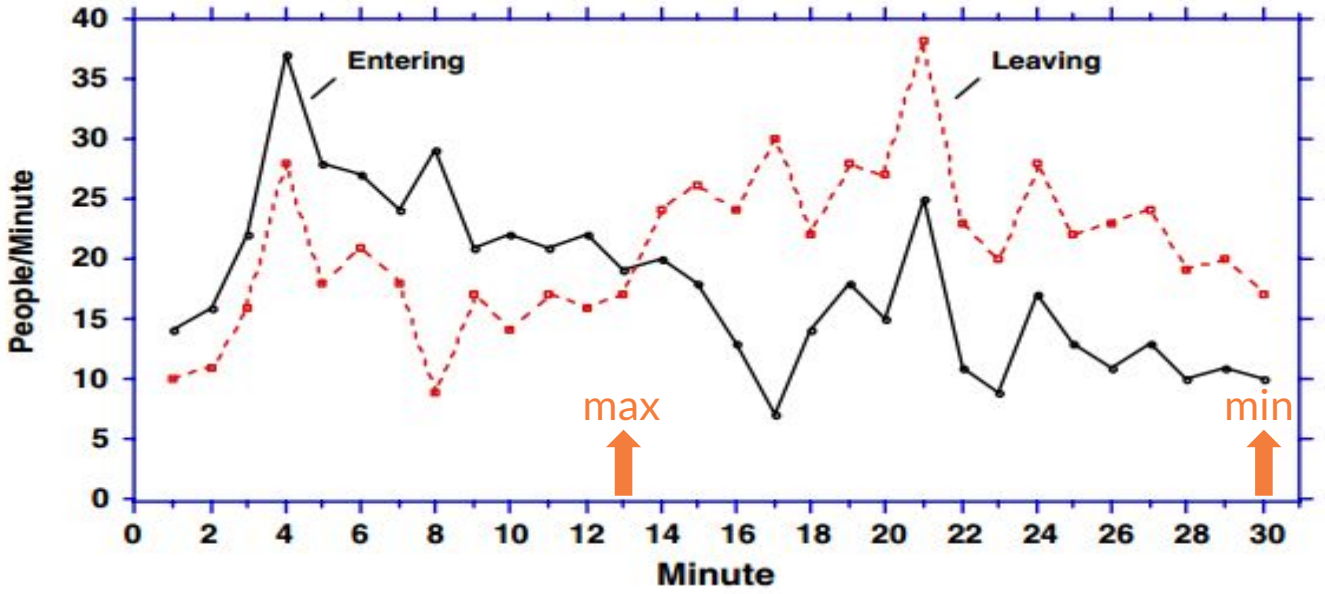
Morale?

Consumption?

Survey question given to n=134 educated adults

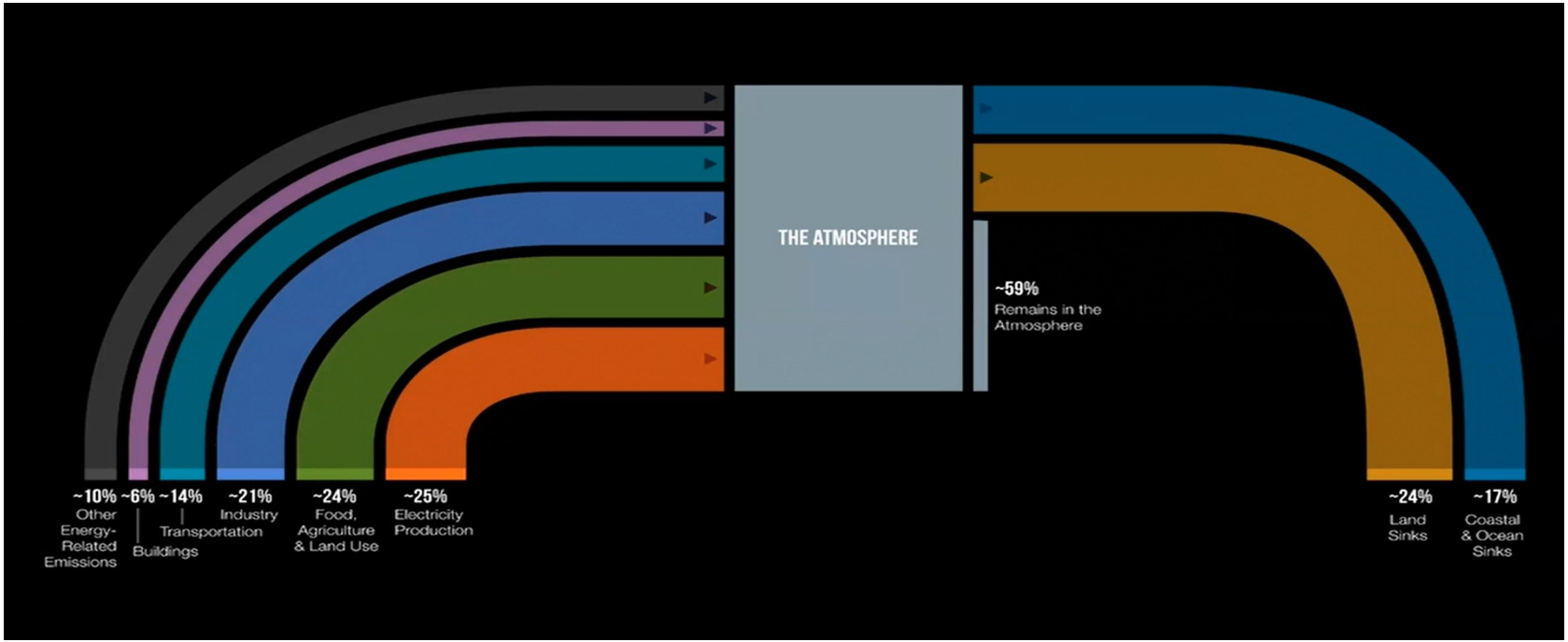
The graph below shows the number of people entering and leaving a department store each minute over a 30-minute period.

In which minutes did the store have the most and least people?



Source: Cronin, et al., "Why don't well-educated adults understand accumulation? A challenge …" Organizational Behavior and Human Decision Processes (2008)

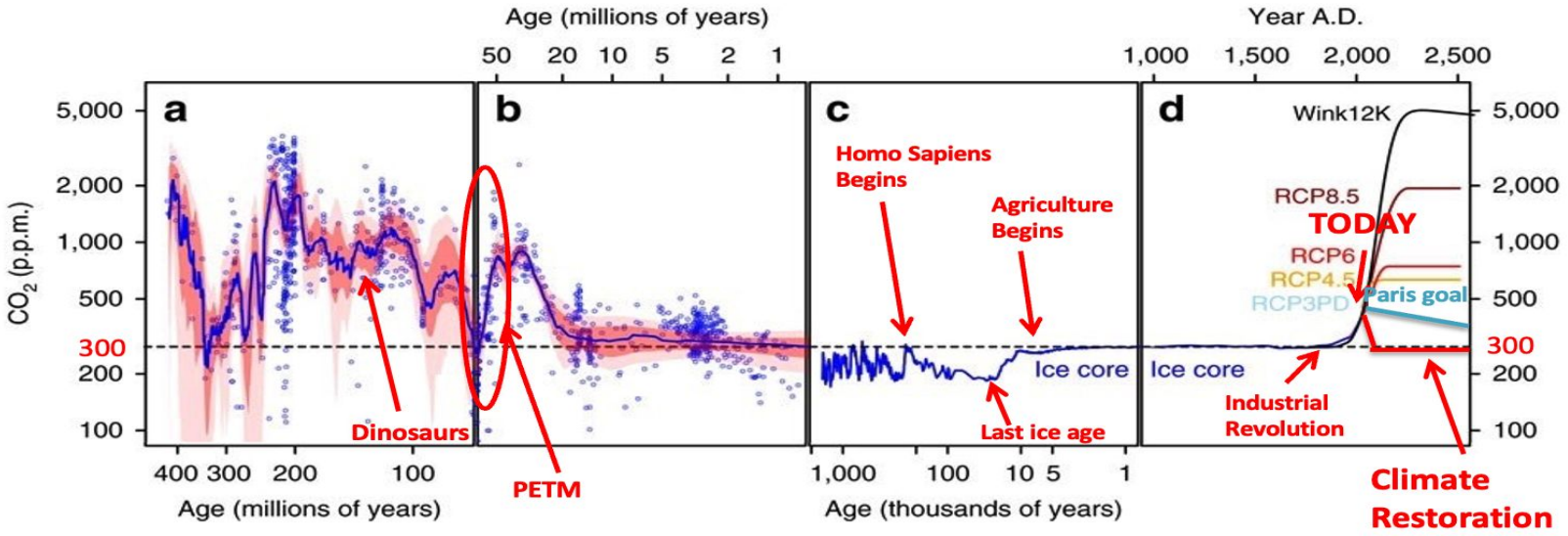
For example: “net-zero” is not enough …



Carbon sources → **Carbon stocks** → **Carbon sinks**

Source: Climate Leadership Initiative; Project Drawdown

… "drawdown" will be necessary for CO_2 concentrations to return to historical levels



- The "net-zero by 2050" Paris goal would result in CO_2 concentrations reaching levels dinosaurs survived, but not to historically familiar and sustainable CO_2 levels for humanity
- We would need to remove a trillion MT of CO_2 from the atmosphere in order to reach 300 ppm

Source: Foster, Royer, and Lunt. "Future climate forcing potentially without precedent in the last 420 million years." Nature Communications 8 (2017): 14845.

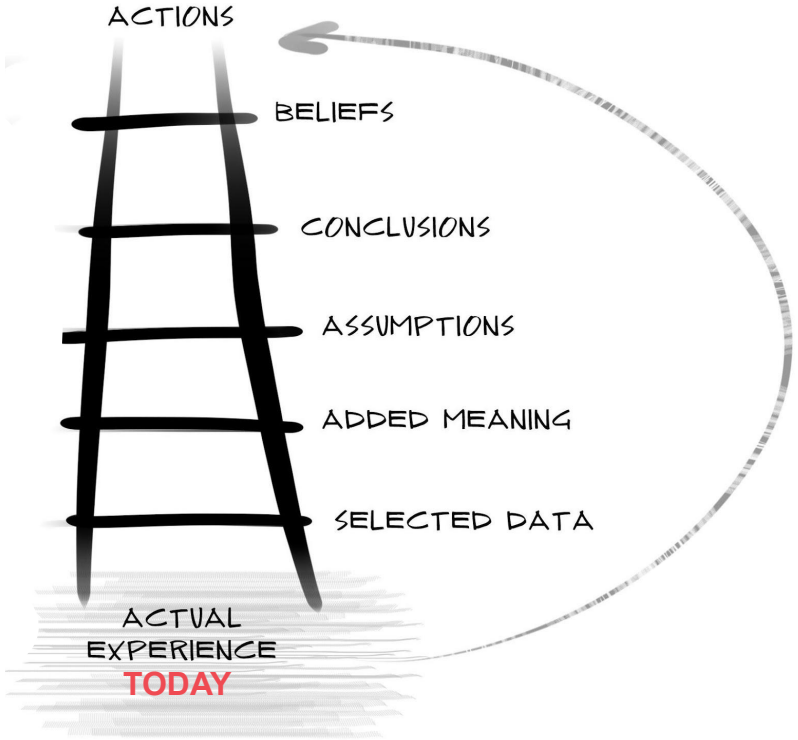
03 **Dynamics**

By definition, a snapshot in time sheds no light on a system's dynamics, and can lead people to make poor inferences

"More reason to believe global warming is a hoax"

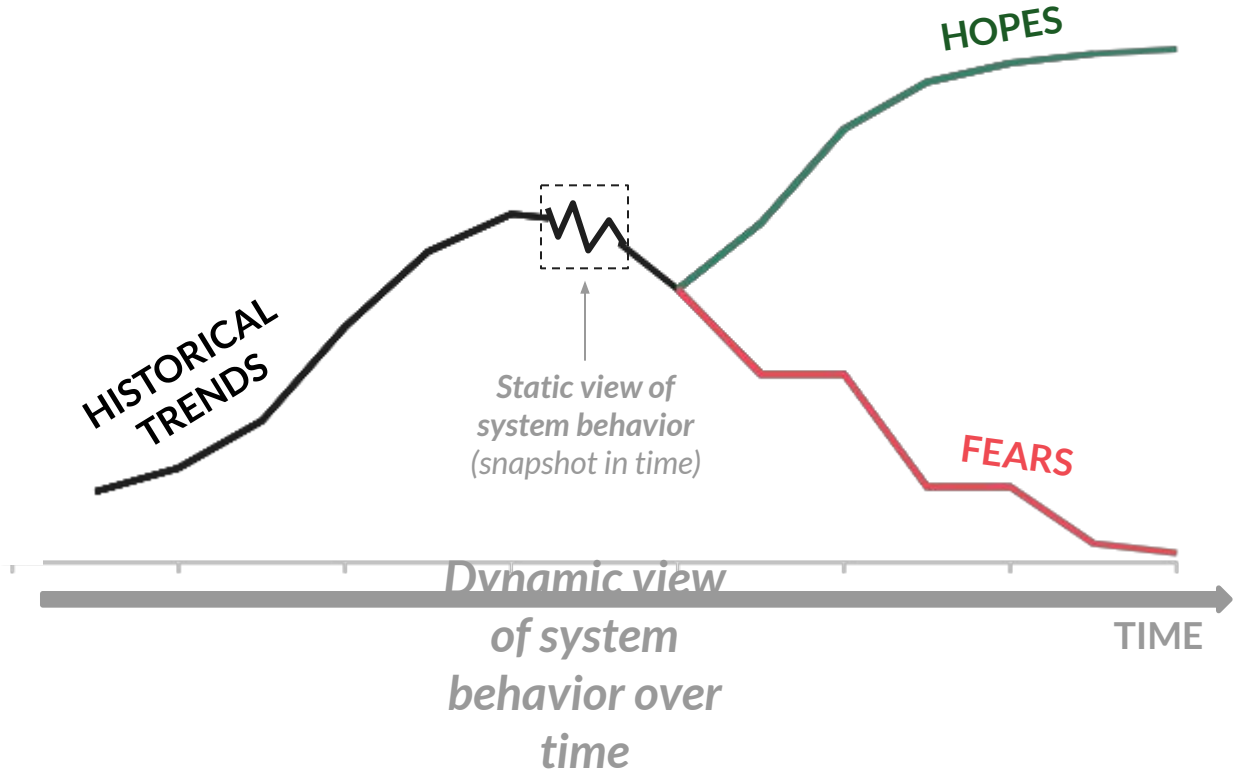
"The predictions were wrong"

"It's unusually cold today"



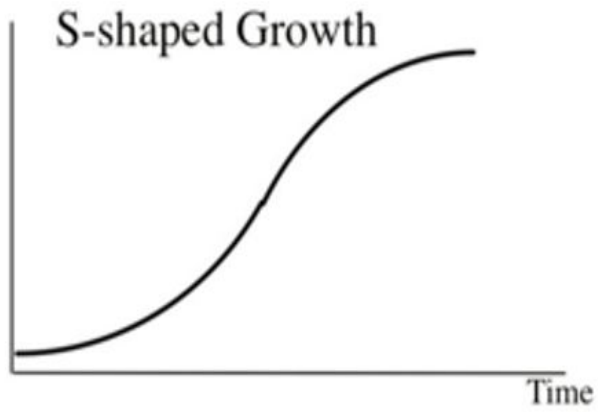
Source: Adapted from Chris Argyris and "The Fifth Discipline" by Peter Senge, et al.; drawing by Kelvy Bird (kelvybird.com/ladder-of-inference)

A dynamic view—of trends, hopes and fears—is essential for sensing what factors matter in a specific context



With observed behaviors of a system, we can develop and test mental models of a system's structure—i.e., its feedback loops

- Behavior over time can be depicted in terms of reinforcing and balancing feedback. For example:



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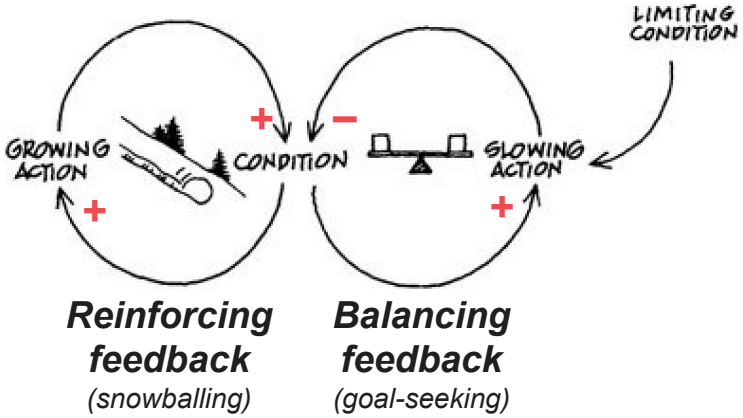


- A system's behaviors can change as the relative strengths of feedback loops shift, with one loop and then another dominating behavior
- A delay in a balancing feedback loop makes a system likely to oscillate
- Systems with similar feedback structures produce similar behaviors

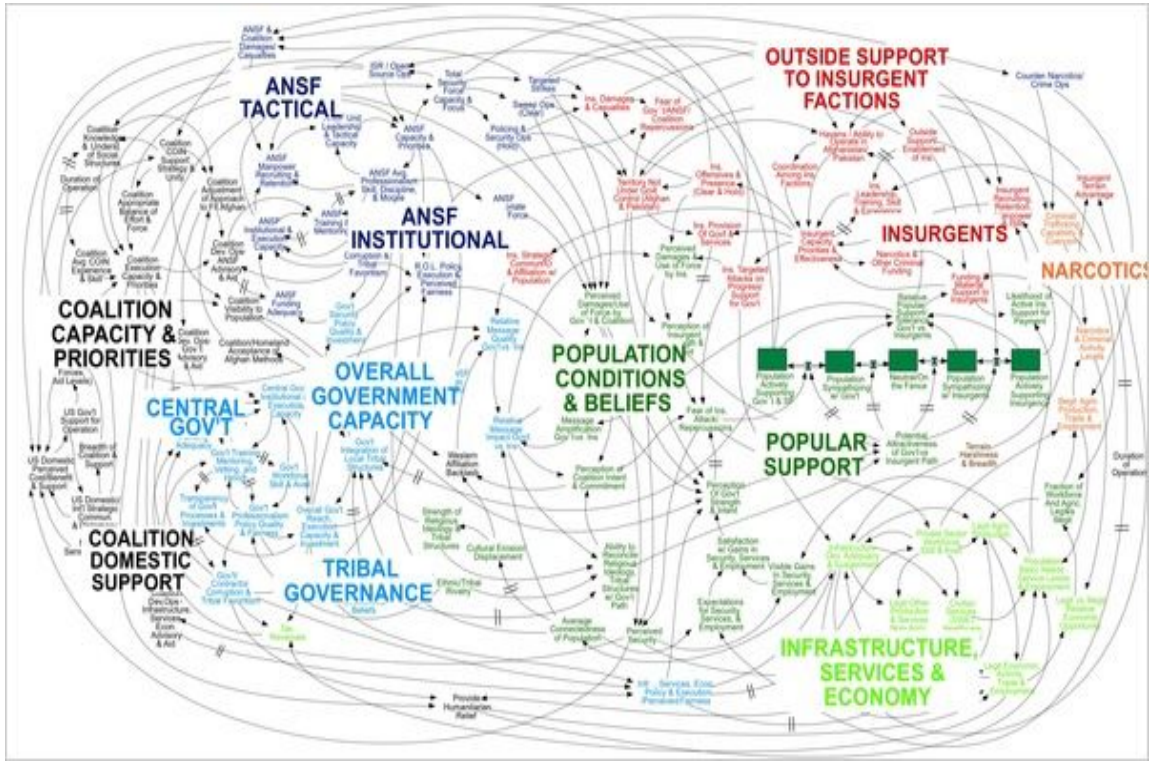
Source: Graph and casual loop diagram from "Thinking in Systems" by Donella Meadows

Mapping feedback loops is NOT about making spaghetti

"When we understand that slide, we'll have won the war."

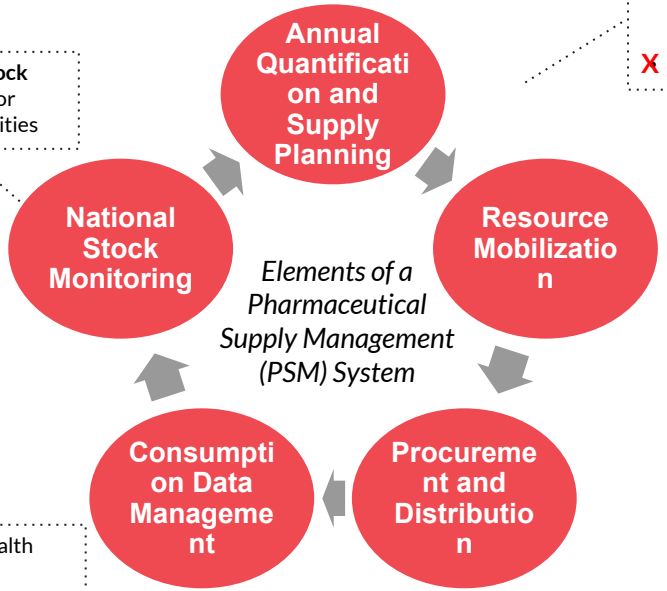
--U.S. General Stan McChrystal

Example – Systems map to portray the complex situation in Afghanistan (2010)



A "sub-systems map" can be a powerful substitute for spaghetti

FOR EXAMPLE – Inter-related challenges of inconsistent supply of child health commodities (Ethiopia)



X **Lack of a national stock monitoring system** for child health commodities

X CH Quantification is **morbidity-based and inconsistently conducted**, leading to significant over/under stock at various levels

X **Supply planning is not conducted**

X **Lack of funding coordination** among partners and with government for child health commodity procurement

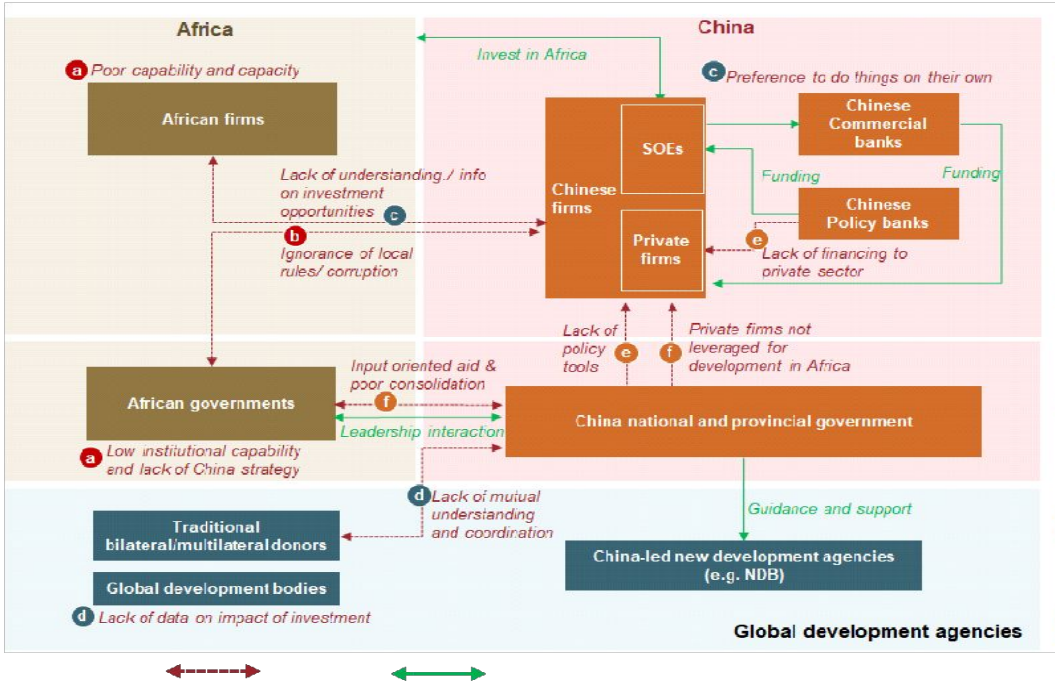
X **Lack of proactive budget allocation** and funding advocacy by Fed. Min. of Health (e.g., SDG Pool Fund, GFF and other funds are not utilized for child health commodities, resulting in emergency funding and procurement

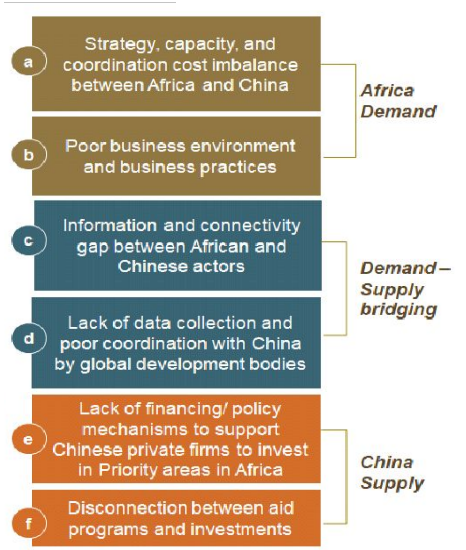
X **Push System**: child health commodities are not integrated into IPLS, resulting in lack of consumption data

X Many CH products are procured and distributed **outside of the national procurement agency's channels**

ANNEX – sub-systems map of Chinese investment in Africa

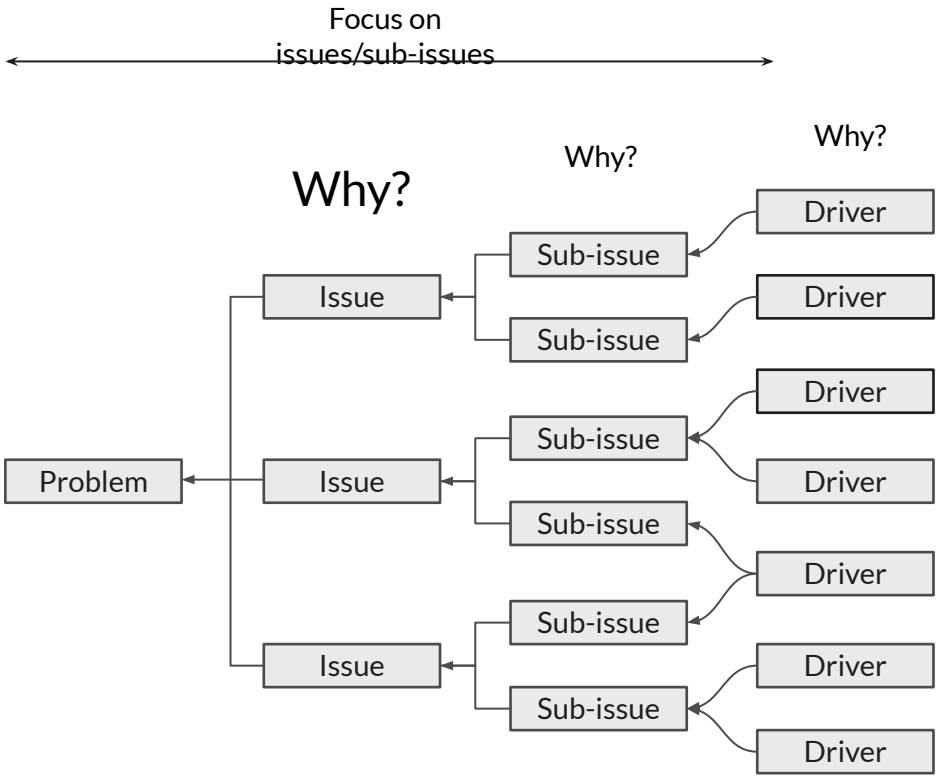
FOR EXAMPLE – sub-systems map produced by a global foundation aimed at accelerating Chinese investing in Africa





04 Focusing Questions

Like snapshots, parts of a problem shed no light on dynamics

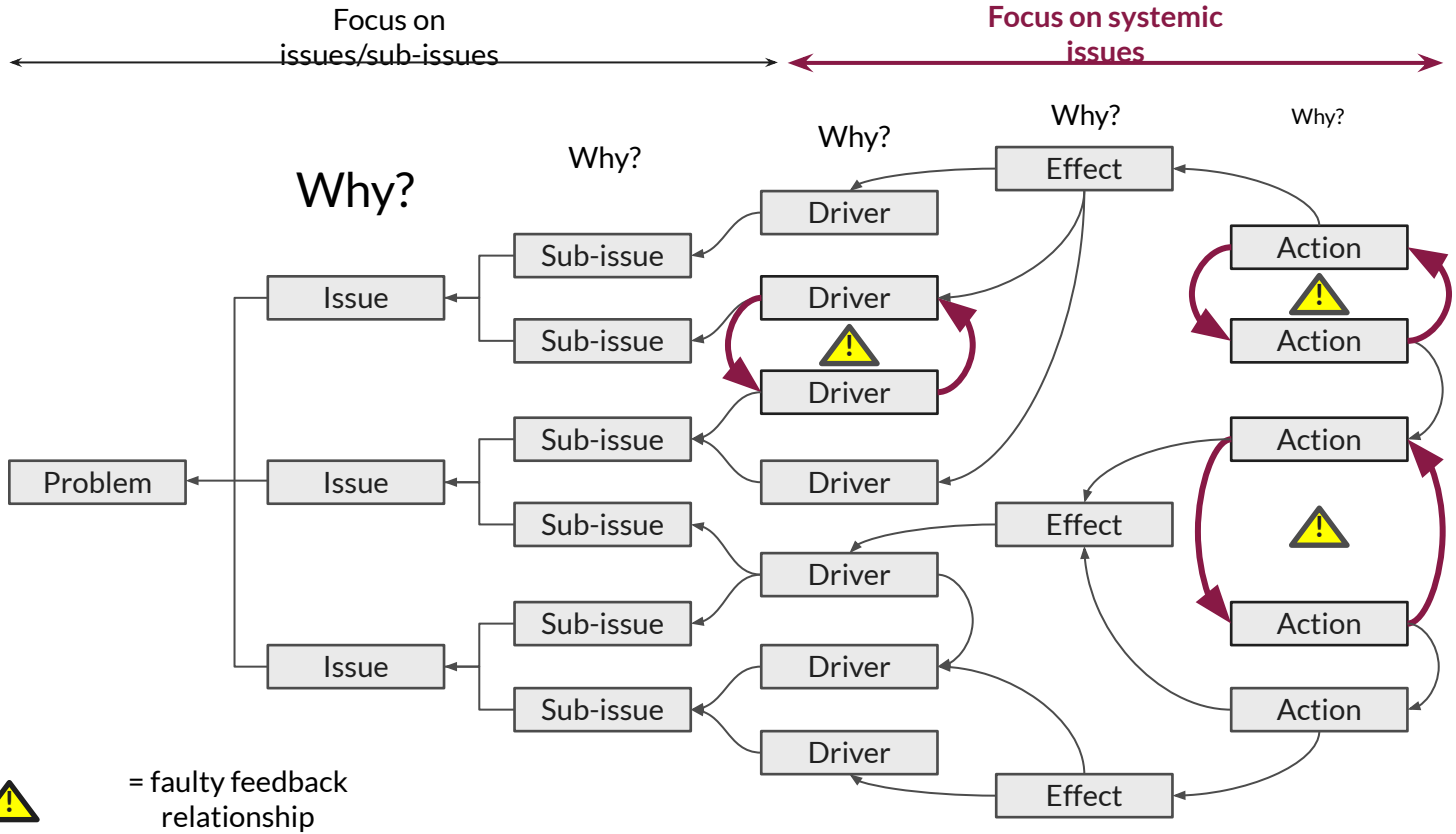


Conventional approaches to problem-solving typically break a problem down into its parts.

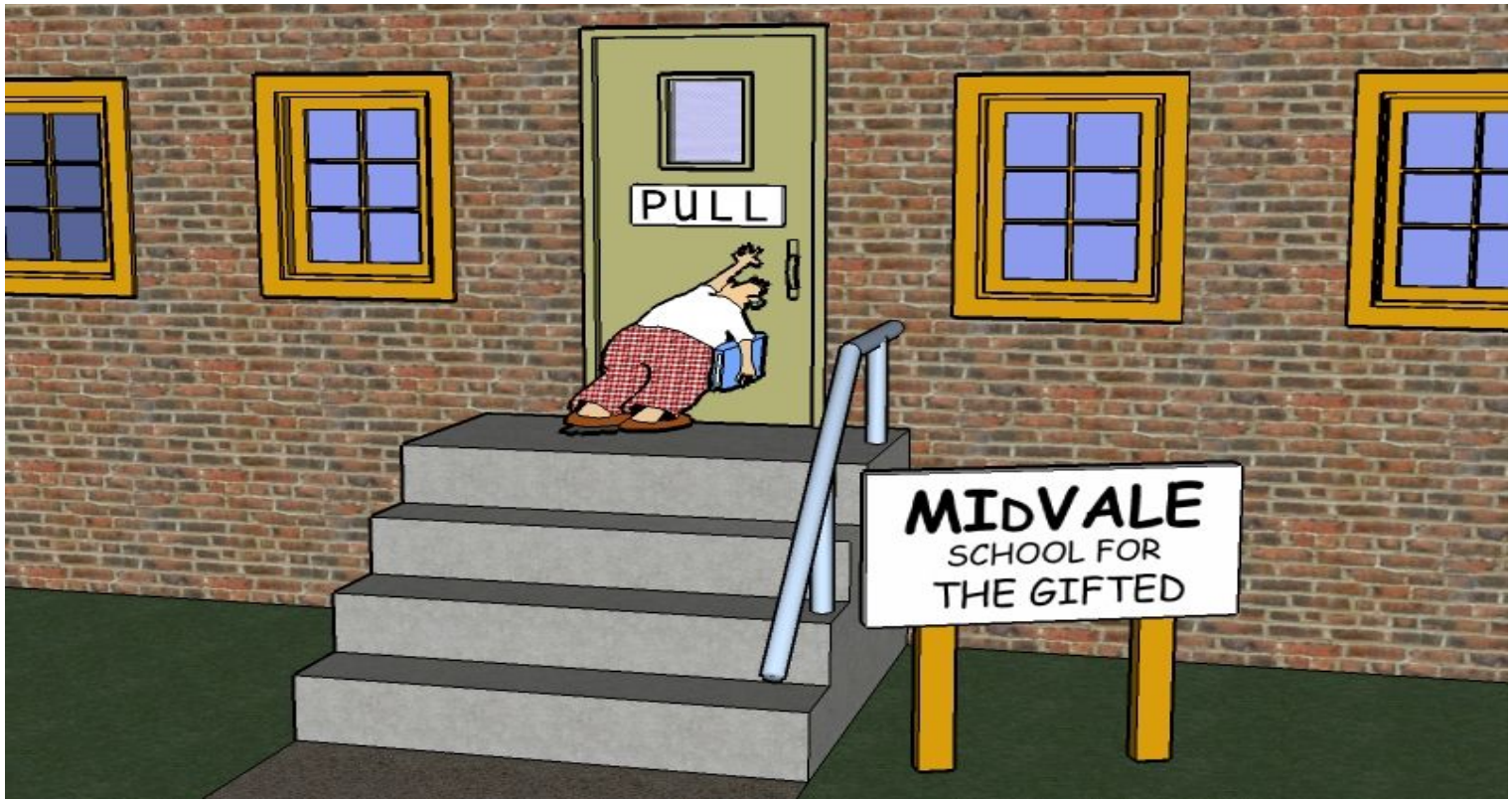
If a system is healthy, the presence of a problem should motivate actors to solve it.

However, if a problem persists over time, there are probably underlying reasons why (i.e., reasons for equilibrium)

How can we concentrate attention on deeper systemic issues?



e.g. at first glance, the door might seem to be the problem



Source: The Far Side comic strip by Gary Larson

A focusing question concentrates attention at a systems level

What seems to be causing the problem?

- ✗ *Answerable at a snapshot in time*
- ✗ *Seeks to understand the system by understanding its parts*
- ✗ *May reproduce past thinking that has not solved the problem*

VS

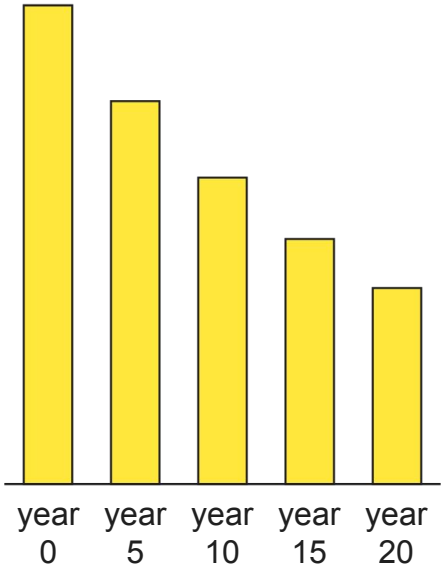
Why does the problem *persist over time*, despite the best efforts to solve it?

- ✔ *Considers chronic nature of problem*
- ✔ *Orients toward opportunities to solve many parts of the problem at once*
- ✔ *Frames the system and problem statement to include existing efforts*

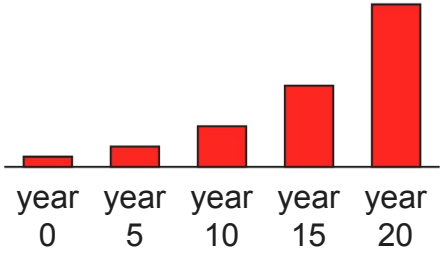
05 **Systemic Failure**

Why might destructive forest fires persist despite firefighting?

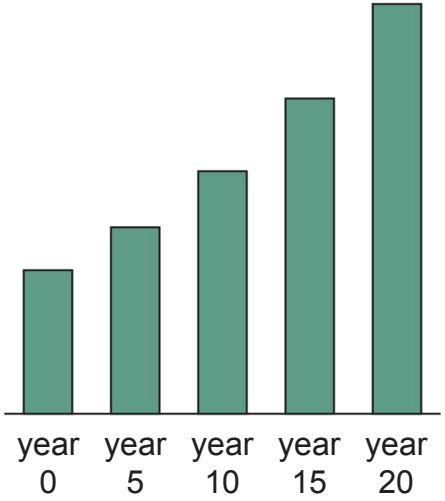
No. of forest fires per year



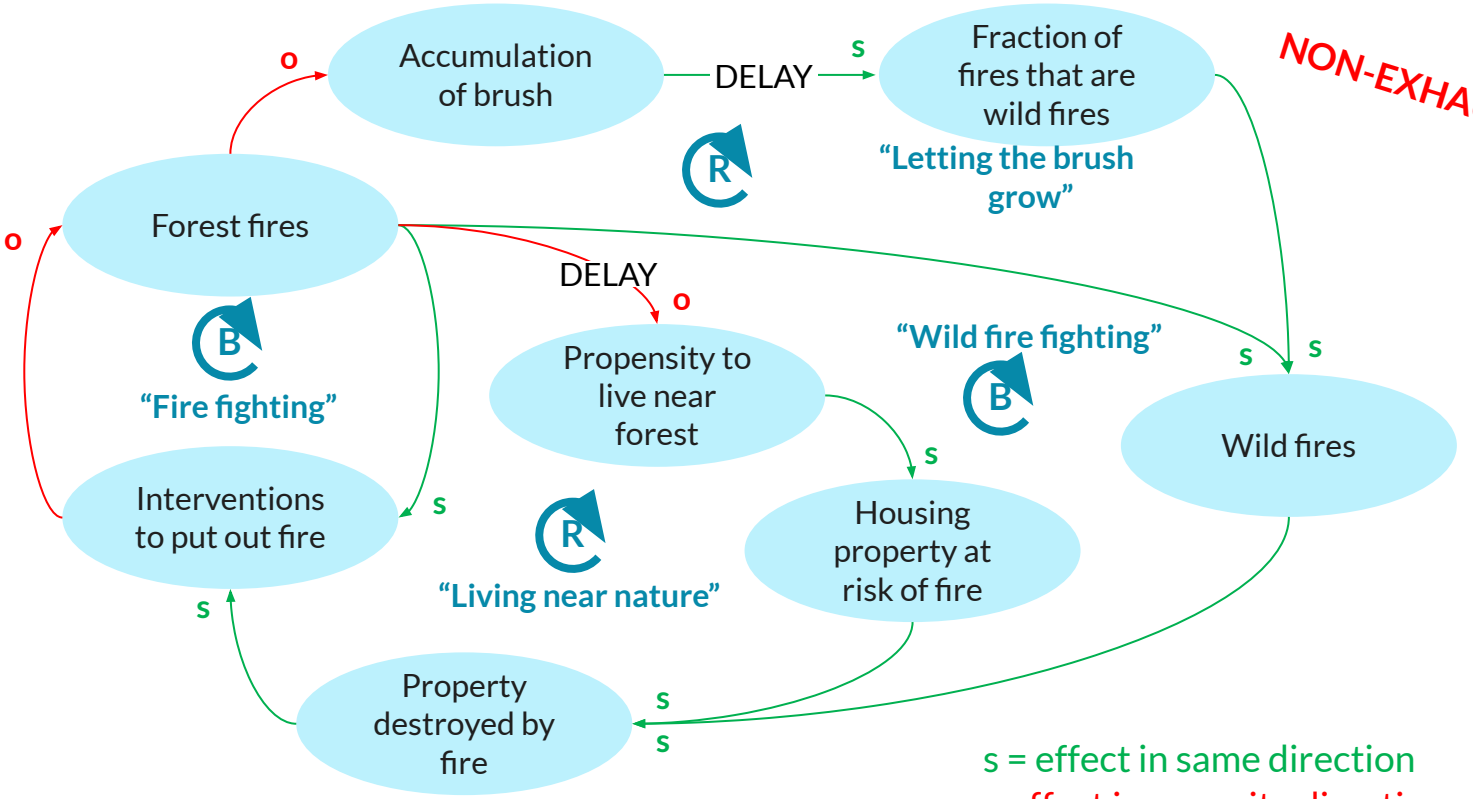
No. of uncontrollable forest fires (“wild fires”) per year



Property value destroyed in forest fire, in US$



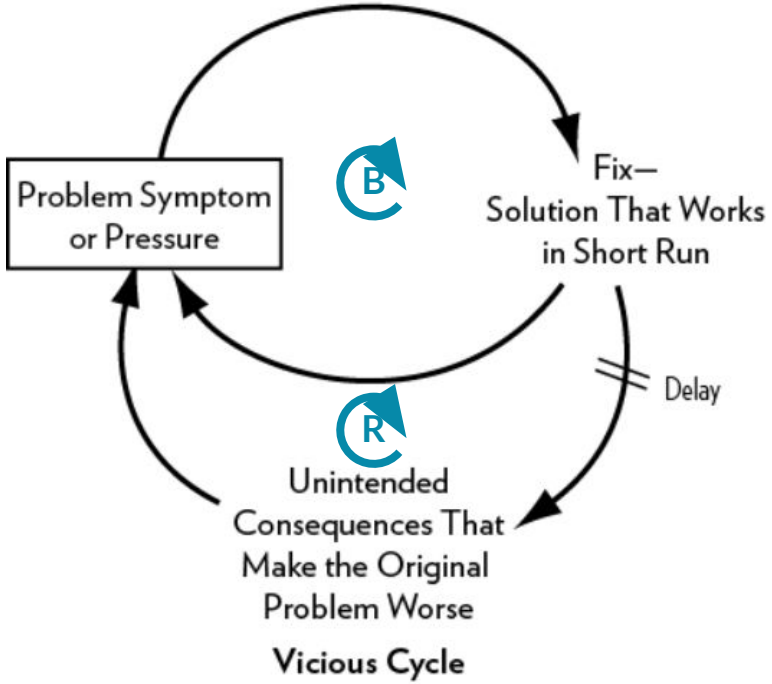
Can we map the feedback structure of this dynamic system?

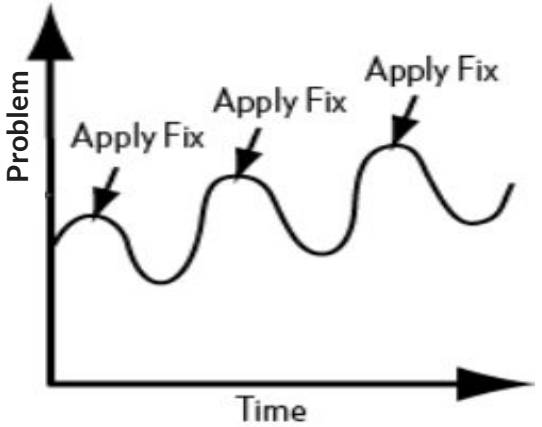


Note: R = reinforcing feedback loop, B = balancing feedback loop

This is a common archetype of system failure

"Fixes that fail"

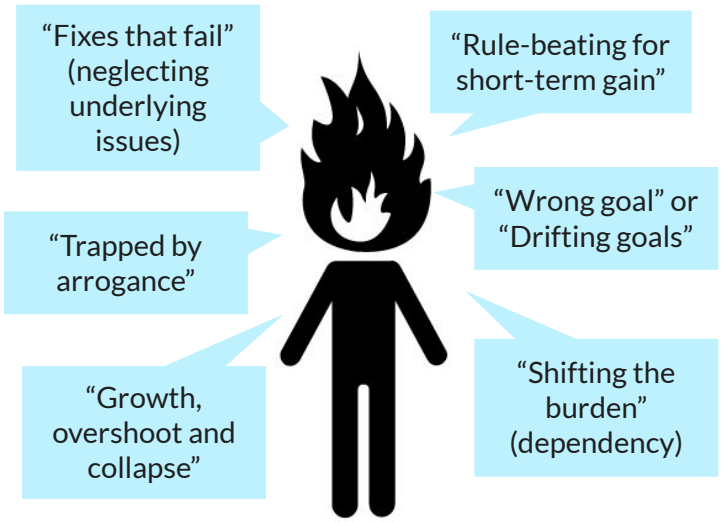




Source: "Systems Thinking for Social Change" by David Peter Stroh

Various archetypes describe patterns of failure to self-correct

Self-defeating feedback

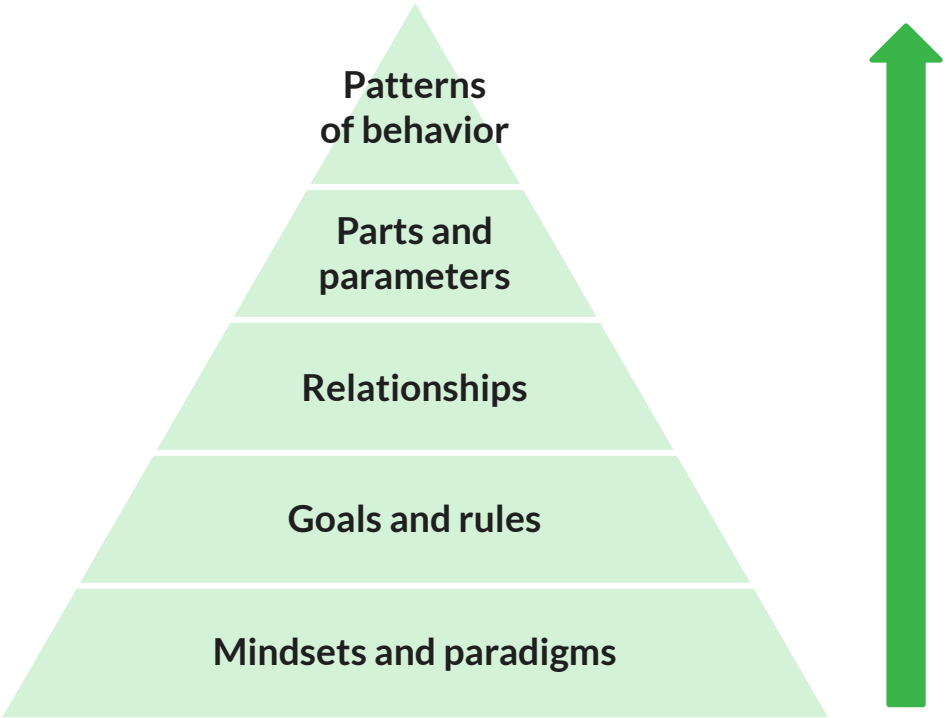


Mutually-defeating feedback

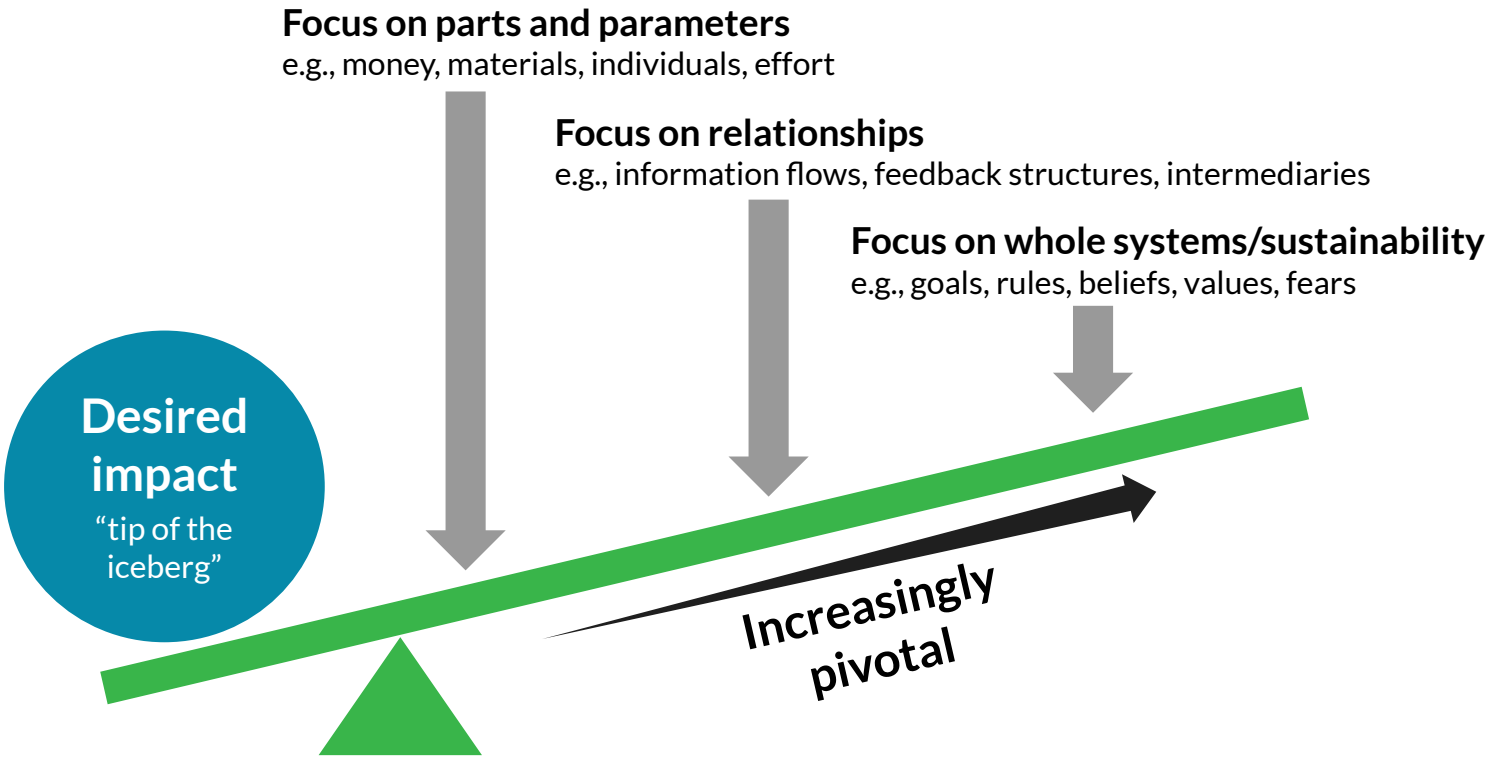
Source: "Thinking in Systems" by Donella Meadows; "Systems Thinking for Social Change" by David Peter Stroh; Dalberg Catalyst

06 **Levels of Depth**

Surface-level behaviors and patterns emerge from a system's underlying structure



Interventions at more systemic levels are increasingly pivotal



E.g., pivotal solutions for *self-defeating* systems

"Fixes that fail"

Dynamic: When a solution to a chronic issue reduces the symptoms without solving the underlying problem. Short-term improvements distract from the underlying problem, which persists or exacerbates over time.

Pivotal solutions: Invest in understanding underlying root causes or systemic failures that are giving rise to the symptoms of the problem. Apply a long-term view in developing and implementing solutions to the problem.

"Drifting goals"

Dynamic: Allowing performance standards to be influenced by past performance, especially if there is a negative bias in perceiving past performance, set up a reinforcing loop of eroding goals that sets a system driving toward low performance.

Pivotal solutions: Keep performance standards absolute or influenced more by best actual performances rather than worst actual performances.

"Limits to growth"

Dynamic: When a system faces capacity constraints whereby the system's increasing performance slows down (or collapses), due to depletion of a non-renewable resource or low replenishment of a renewable resource.

Pivotal solutions: Seek alternatives to non-renewable resources or, in the case of renewable resources, limit their utilization and/or invest early in their capacity.

"Dependency"

Dynamic: When an intervention to address a challenge reduces the symptoms without solving the underlying problem, and also either dulls one's perception of the problem and/or interferes with actions that could solve the real problem. The intervention becomes addictive.

Pivotal solutions: Avoid, if possible, or take focus off symptom-relieving policies or practices and focus instead on long-term restructuring or capacity building.

Source: "Thinking in Systems" by Donella Meadows; "Systems Thinking for Social Change" by David Peter Stroh; Dalberg Catalyst

E.g., pivotal solutions for *mutually-defeating* systems

"Zero-sum game"

Dynamic: When various actors try to pull a system state toward various goals; any new policy, especially if it's effective, just pulls the system state farther from the goals of other actors, with a result that no one likes but everyone expends considerable effort maintaining.

Pivotal solutions: Bring actors together and focus on mutually satisfactory ways all goals can be realized, or redefine goals to focus on bigger-picture issues.

"Tragedy of the commons"

Dynamic: When there is a commonly shared resource, every user benefits directly from its use, but also shares in the costs of its abuse else. Due to weak feedback between the condition of the resource and decisions of each user, the consequence is overuse of the resource.

Pivotal solutions: Educate the users and strengthen or restore the missing feedback, either by privatizing the resource or by regulating the access of all users.

"Race to the bottom"

Dynamic: When the state of one stock is determined by trying to surpass or undercut the state of another stock—and vice versa—then the feedback structures will carry the system into exponential growth or decline and will quickly lead to extremes.

Pivotal solutions: Avoid if possible or, if caught, then one can either unilaterally refuse to engage further or try to negotiate regulations to control the growth or decline.

"Success to the successful"

Dynamic: If winners of a competition are systematically rewarded with the means to win again, and if this is allowed to proceed uninhibited, then the winners will eventually take all, while the losers will be eliminated.

Pivotal solutions: Allow the losing actors to break away and play another game; strict limitations on how much any winner may win; policies whereby wins today do not bias the competition tomorrow.

Source: "Thinking in Systems" by Donella Meadows; "Systems Thinking for Social Change" by David Peter Stroh; Dalberg Catalyst

Agenda

- ✔ Introduction
- ✔ Stocks & Flows
- ✔ Dynamics
- ✔ Focusing Questions
- ✔ Systemic Failure
- ✔ Levels of Depth

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