



BUSINESS ARCHITECTURE TOOL (BAT®)

SYSTEMS & COMPLEXITY EMBEDDED SOLUTION ARCHITECTURE

What is a system?

- Many definitions exist, a simple definition is: “**System means a grouping of parts that operate together for a common purpose.**” (Watson, 1994).
- A **system** is an ensemble, or combination of elements or parts forming a complex or unitary whole (e.g., a human body, a river, a transportation system, a business, an assembly of facts, a philosophy; a methodology, a system of marking, numbering, or measuring (Blanchard & Fabrychy, 1998)).

What is Thinking?

- When we receive data input (sensory perception), impressions & memory pictures emerge, this is not yet *thinking*. And when such pictures form a series, each member of which calls forth another, this too is not yet *thinking*. When, however, a certain picture turns up in many such series, then—precisely through such return—it becomes an ordering element for such series...Such an element becomes an instrument, a concept.

“I think the transition from free association of *dreaming* to thinking is characterized by the more or less dominating role which the *concept* plays in it” - Einstein, in Schilpp, 1949.

Connectedness

- Refers to the dynamic interplay of elements that comprise the system, impacting each other and having unpredictable influences across the whole. Thus to understand systems and system behaviour, can only be attained through the study of systems as a whole.
- “Cutting systems up into bits for study is likely to destroy the system’s connectedness, and hence the system itself.” (Sherwood, 2002)

Systems Theory

- General Systems Theory (1930s)
- Chaos Theory
- Quantum Theory
- Ecological Theory

Systems Principles

- Openness
- Purposefulness
- Multidimensionality
- Emergent property
- Counterintuitiveness

Systems Thinking

- Problem Solving Tool
- Pioneered By Biologists
- Looks At The Whole View
- Reduces Complexity
- Seeks to predict & influence System Behavior

Systems Thinking Methodologies

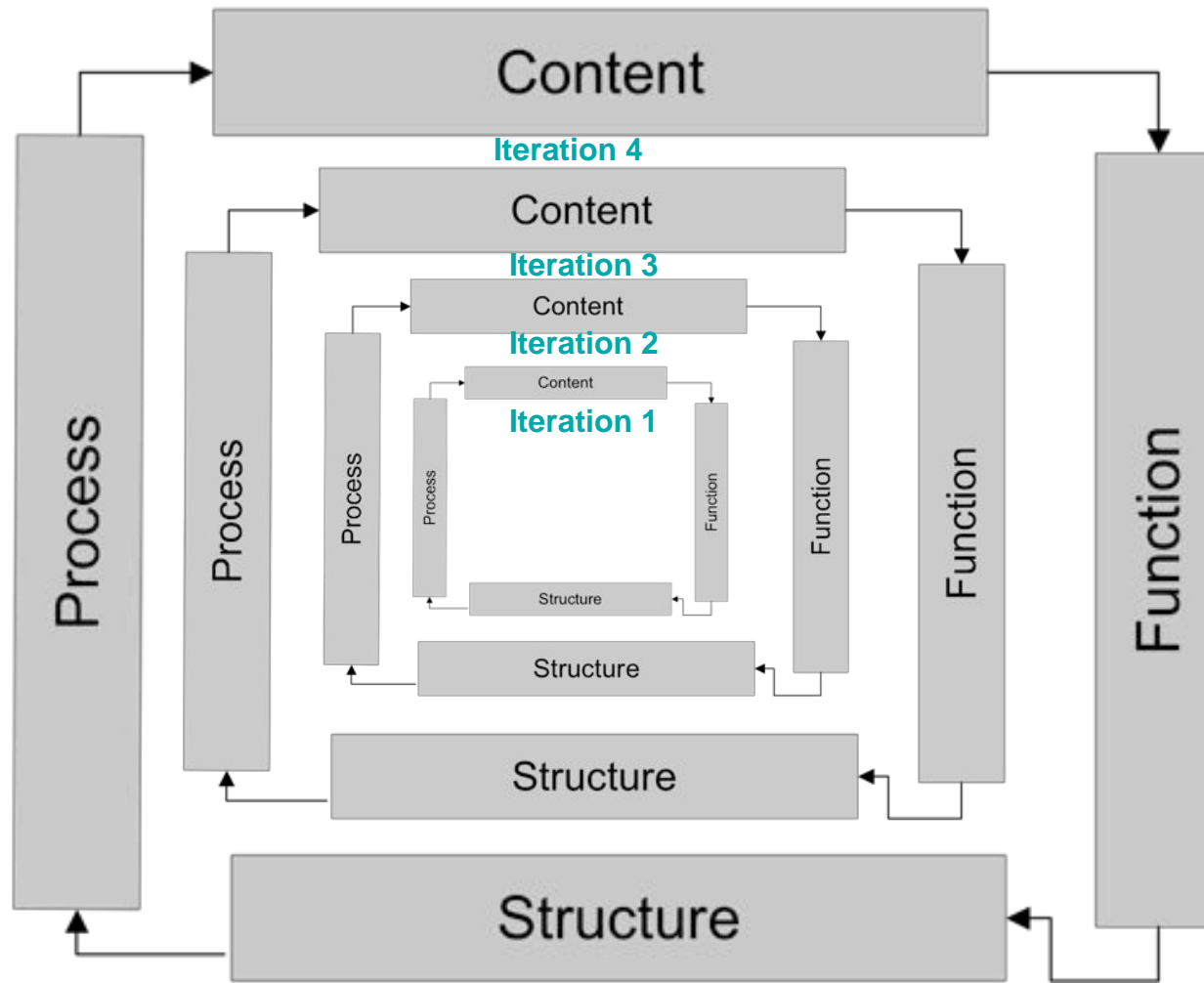
- Soft Systems Methodologies
- Hard Systems Thinking
- System-of-system (SoS)
- Critical systems thinking

Systems Thinking Tools & Models

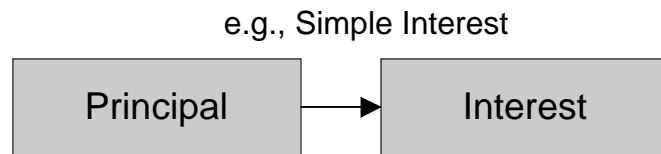
- Archetypes
- Causal Loop Diagrams
- Stocks and Flows
- Simple Structure Dynamics
- BAT®

Iterative Process of Enquiry

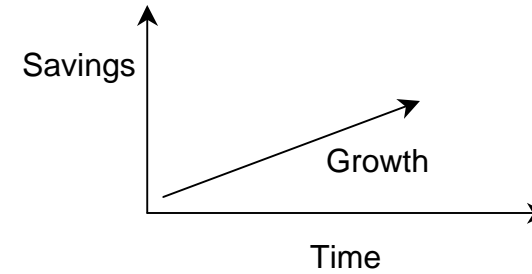
At each iteration, the key is to pause, reflect and put into the perspective of the whole



Closed and Open Loop Systems

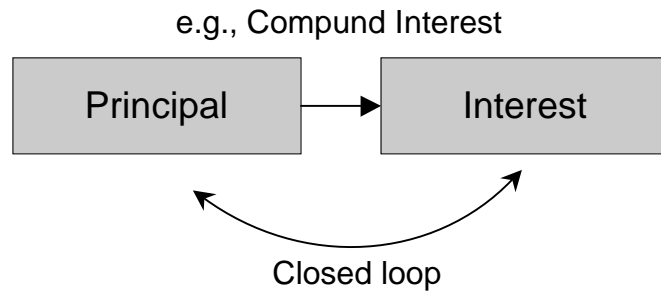


=

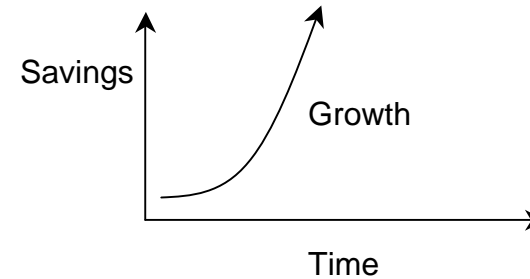


Closed System

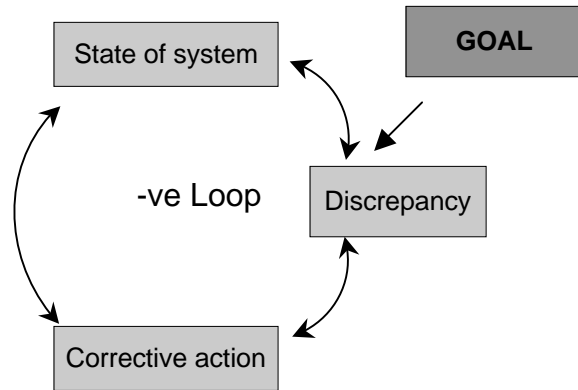
Open System



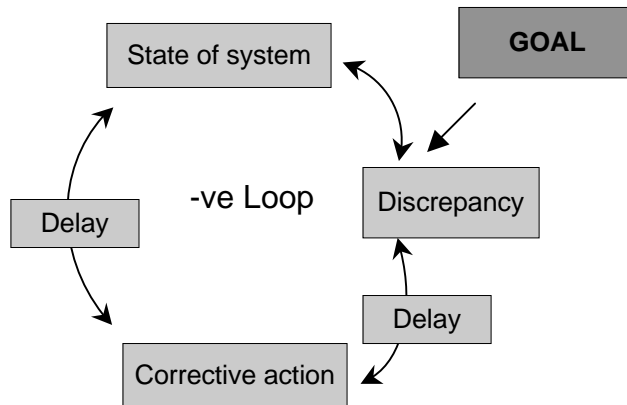
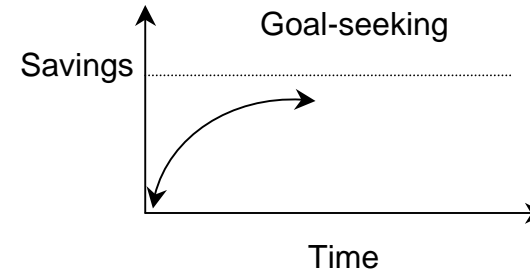
=



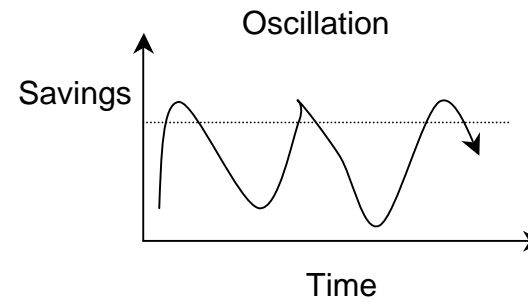
Negative Feedback loops



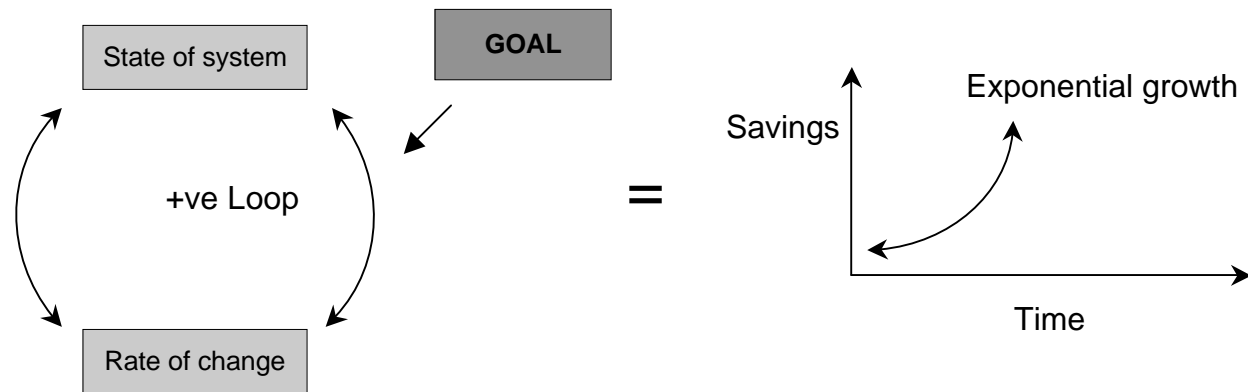
=



=

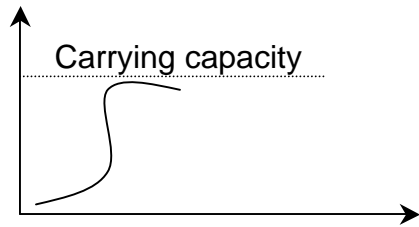


Positive Feedback loops

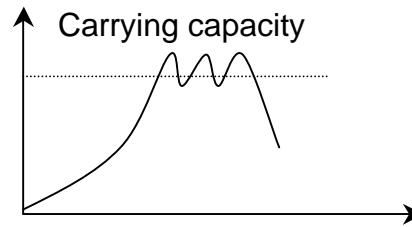


Carrying capacity of systems

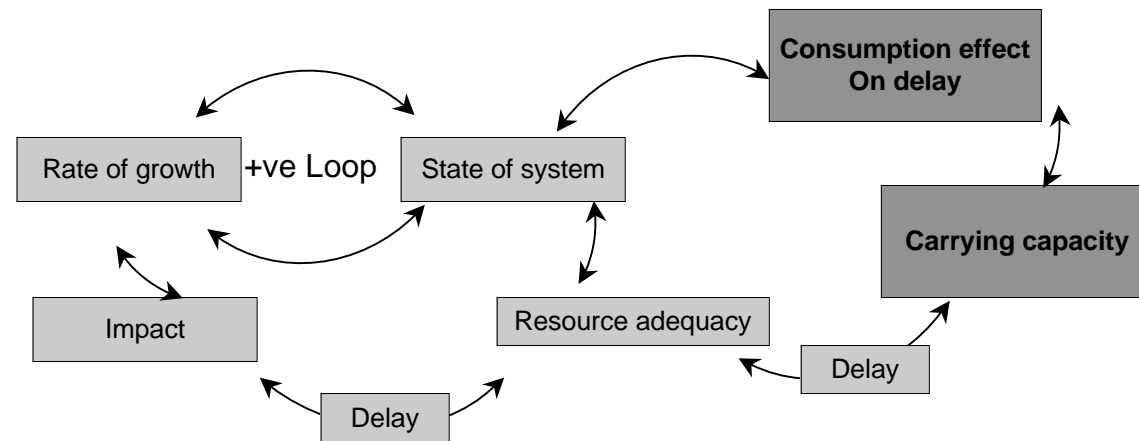
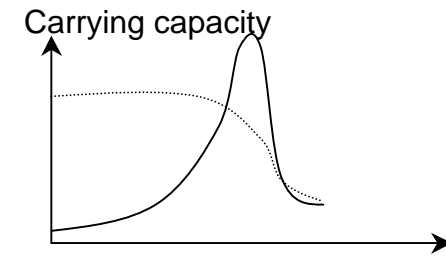
S-shaped growth



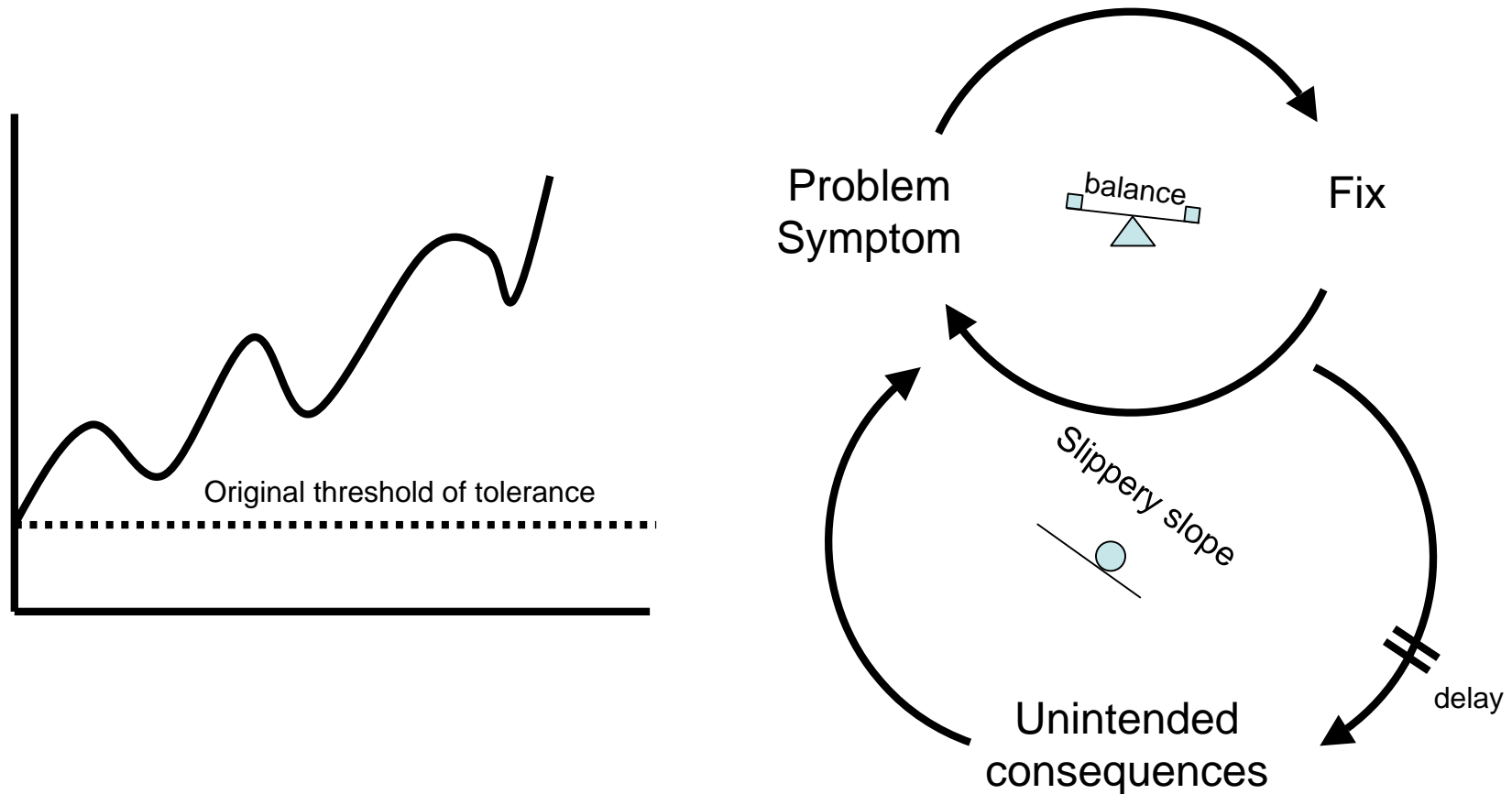
Growth & overshoot



Overshoot & Collapse

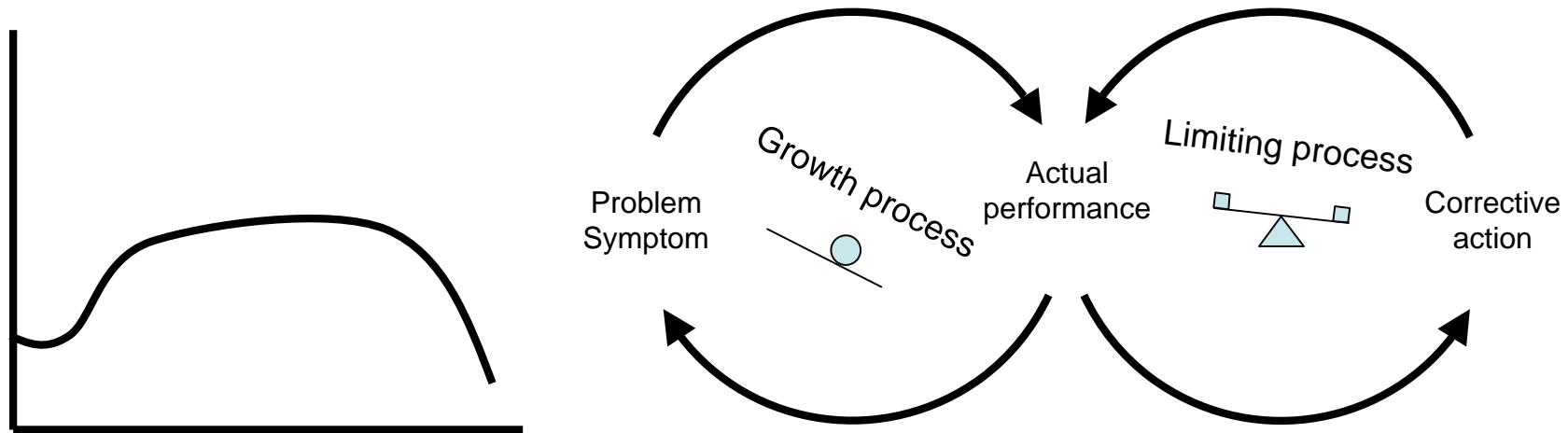


Archetype: Solutions that backfire



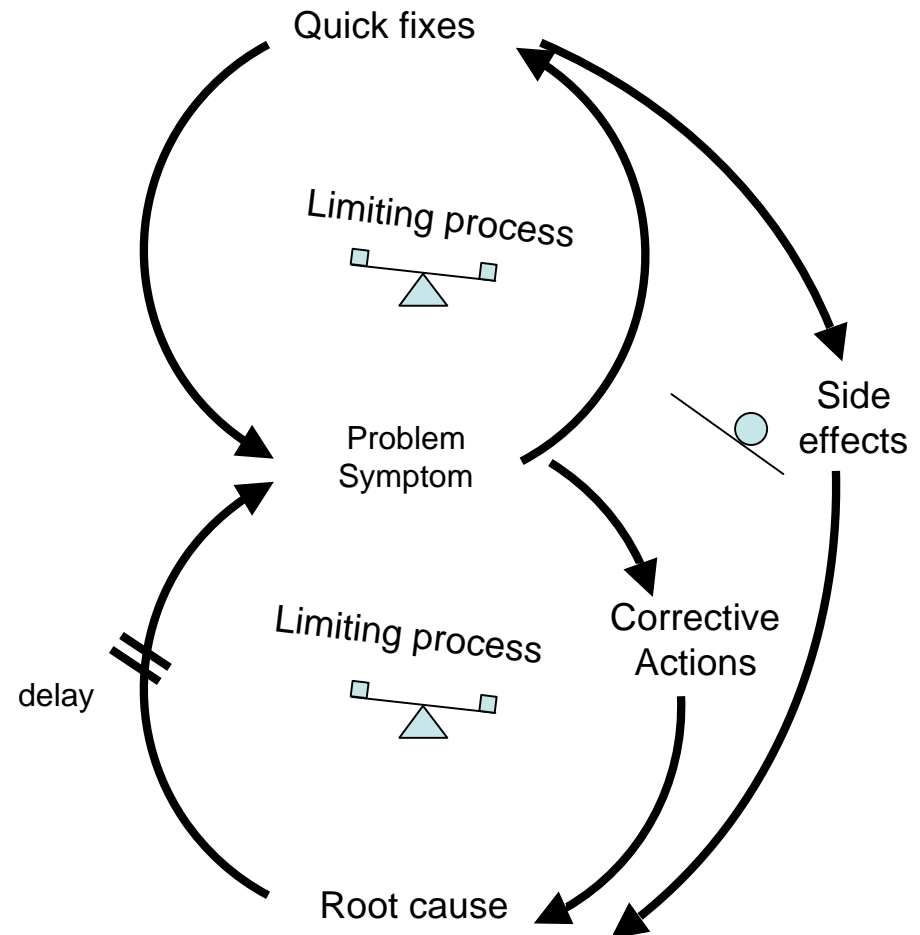
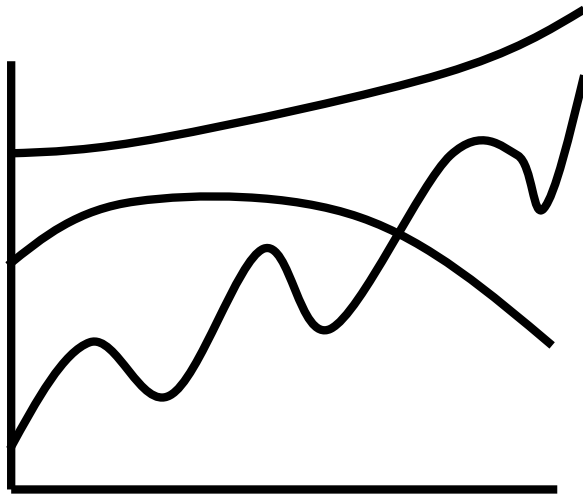
The problem symptom alternately improves. It goes down, then comes back up again and usually tending to worsen (Senge, 1994).

Archetype: Limits to Growth



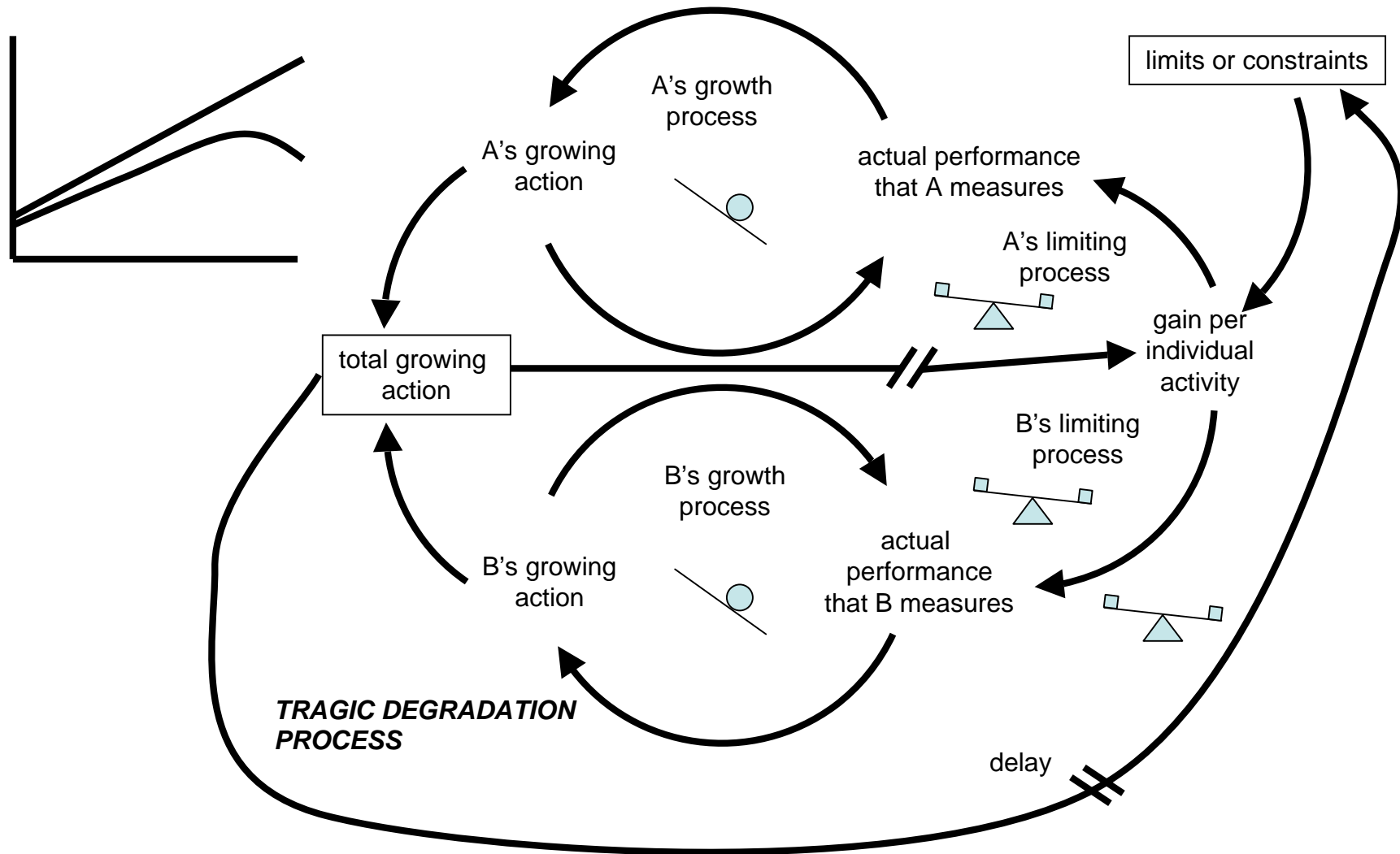
Growth occurs and levels off and/or falls into decline (Senge, 1994).

Archetype: Shifting the Burden



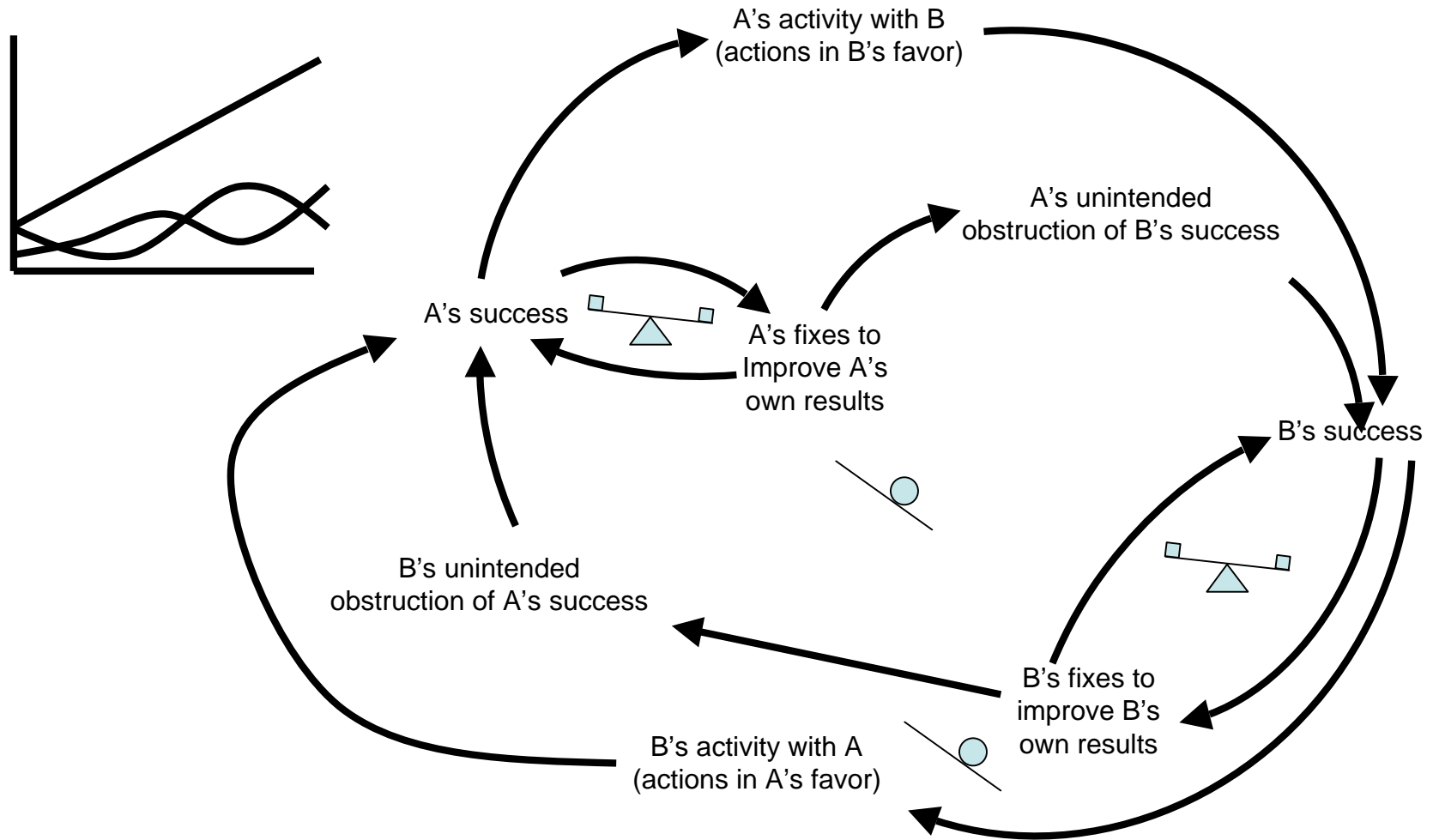
Three patterns exist side by side. The reliance on short-term fixes grows stronger, while efforts to fundamentally correct the real problems grow weaker, and the problem symptom alternately improves and deteriorates (Senge, 1994).

Archetype: Tragedy of Commons



Total activity grows, but the gains from individual activities are dropping off. Parts of the organisation are suffering for the whole (Senge, 1994).

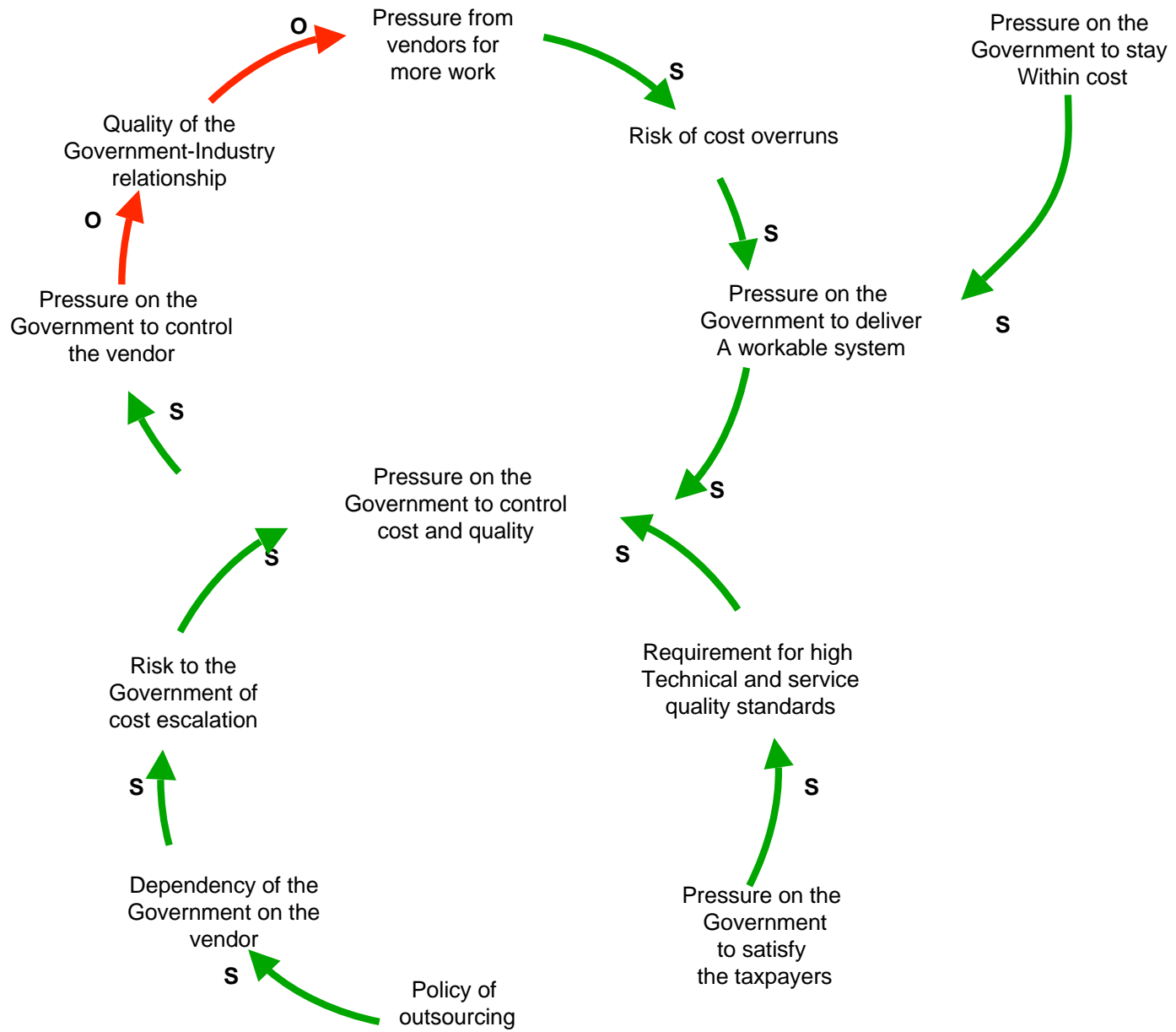
Archetype: Accidental Adversaries



Each sides performance either declines or stays level and low, while competitiveness increases over time (Senge, 1994).

Causal Loop Diagrams

Government Cost Model Adapted From Sherwood's Causal Loop Diagrams

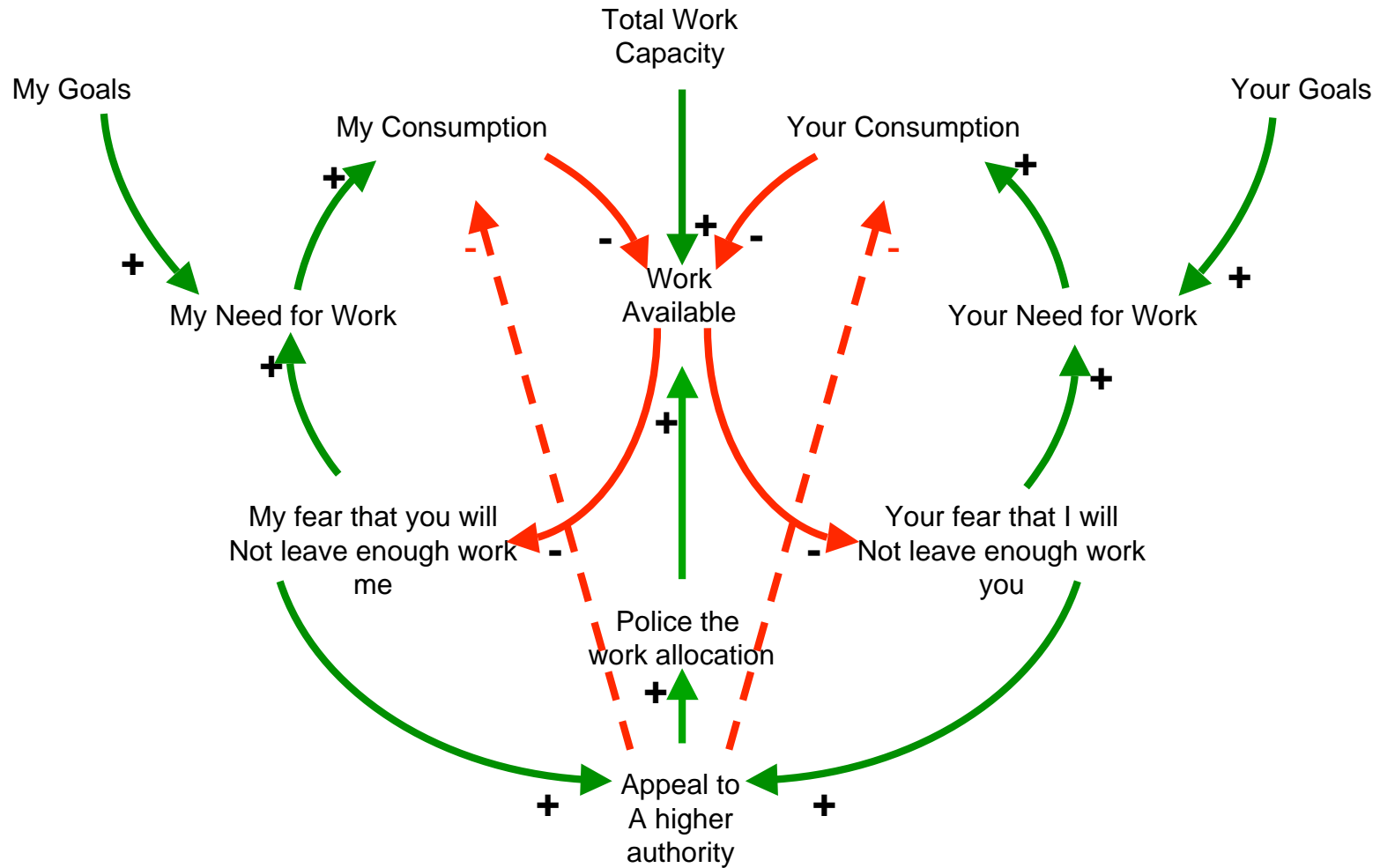


Causal Loop Diagram



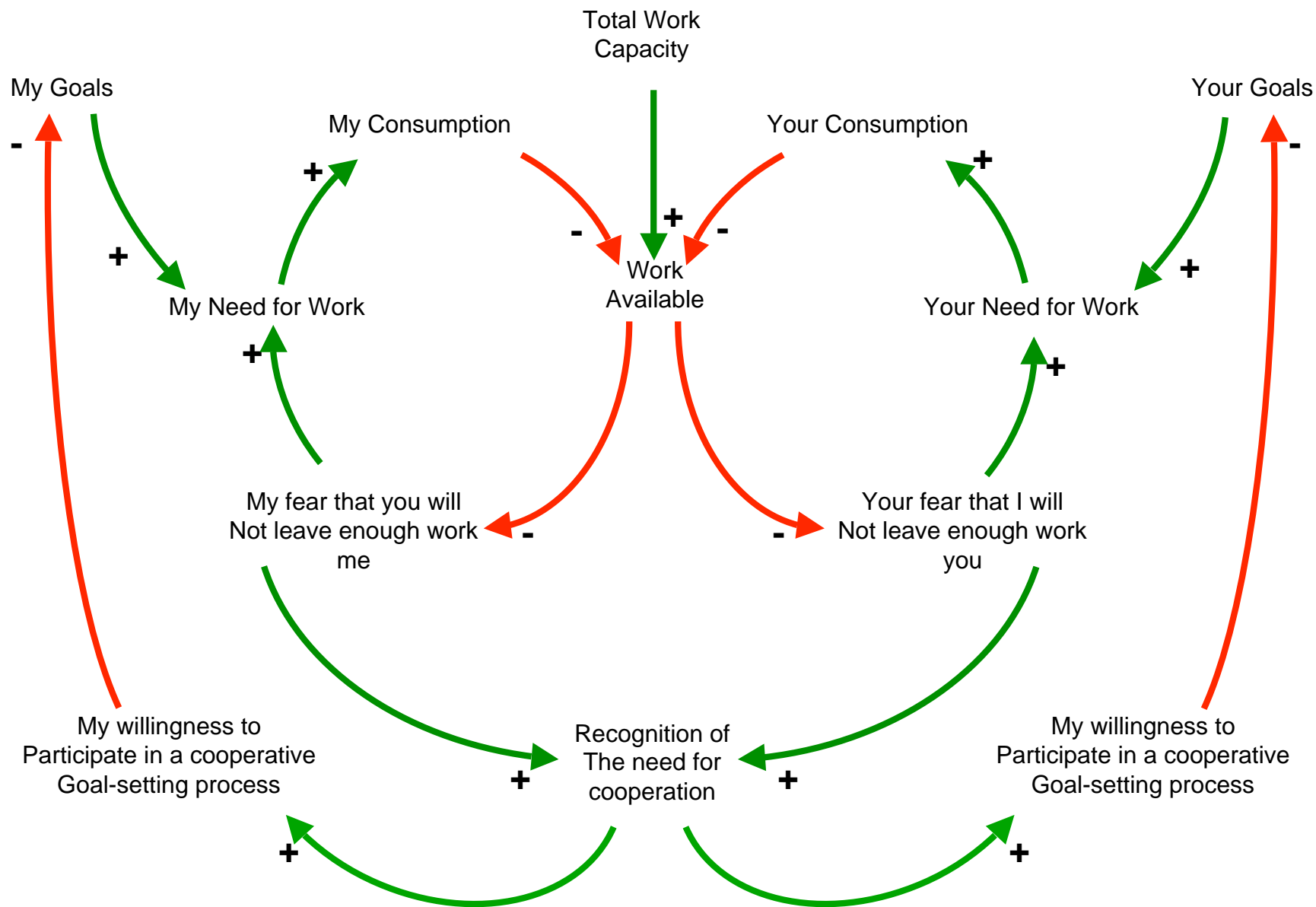
Option 1: Two reinforcing loops (Sherwood, 2002)

Causal Loop Diagram



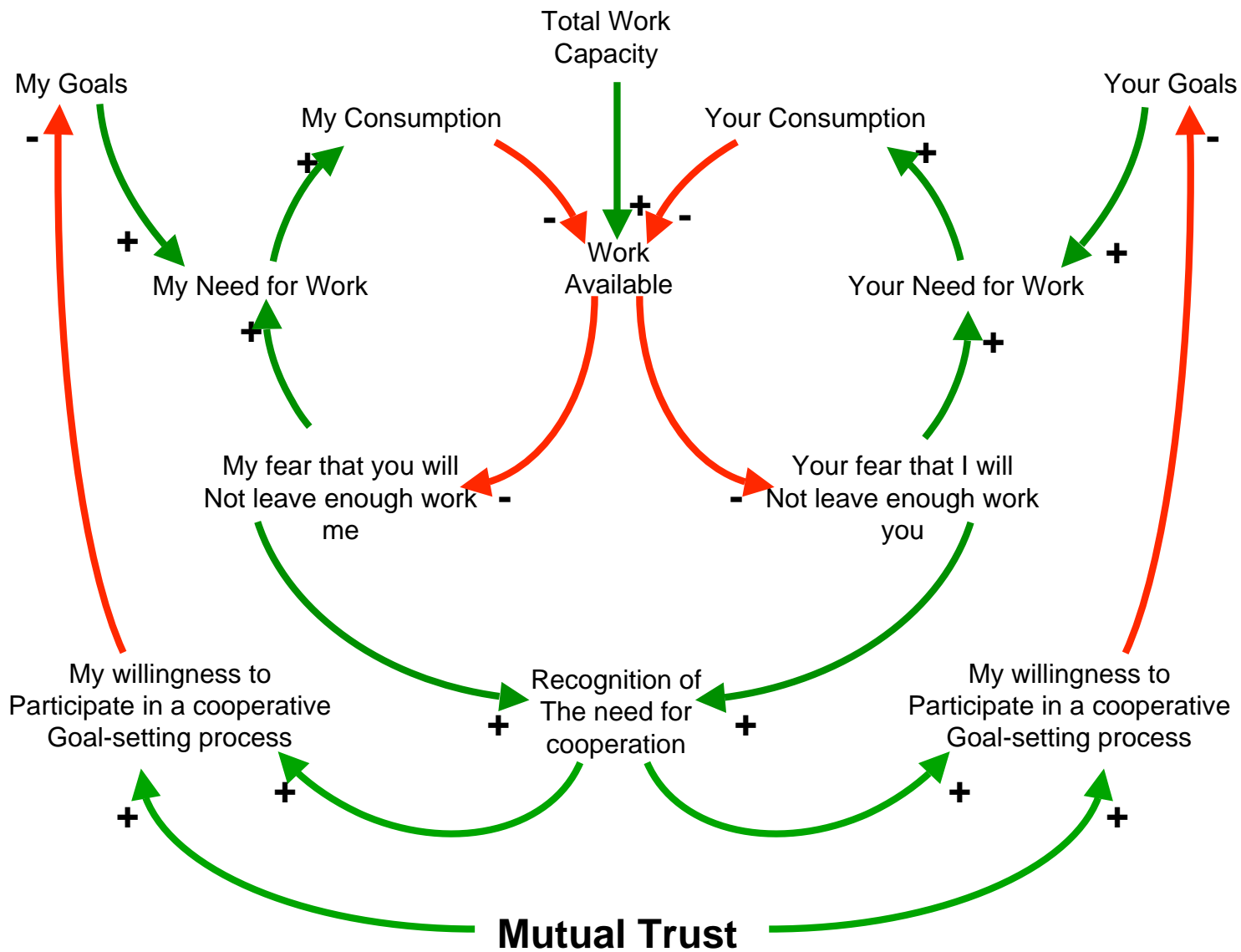
Option 2: Limit consumption—before turf war (Sherwood, 2002)

Causal Loop Diagram



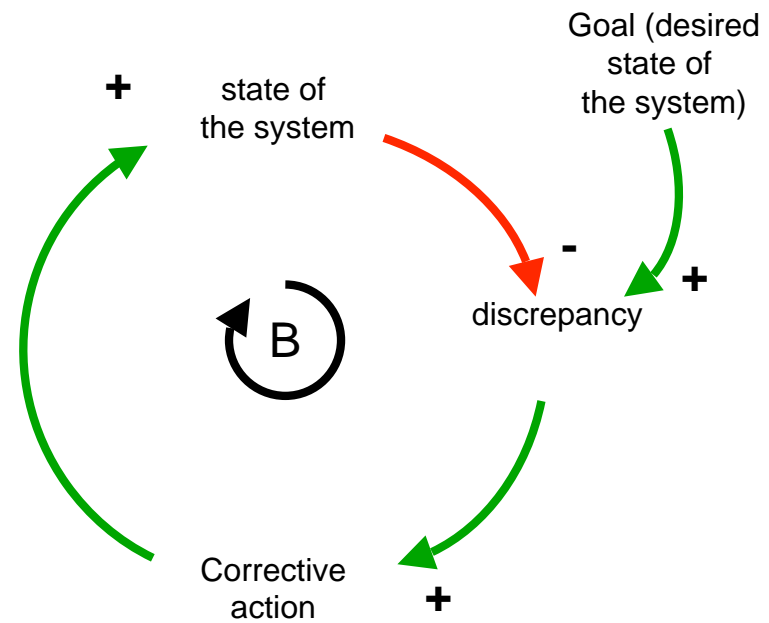
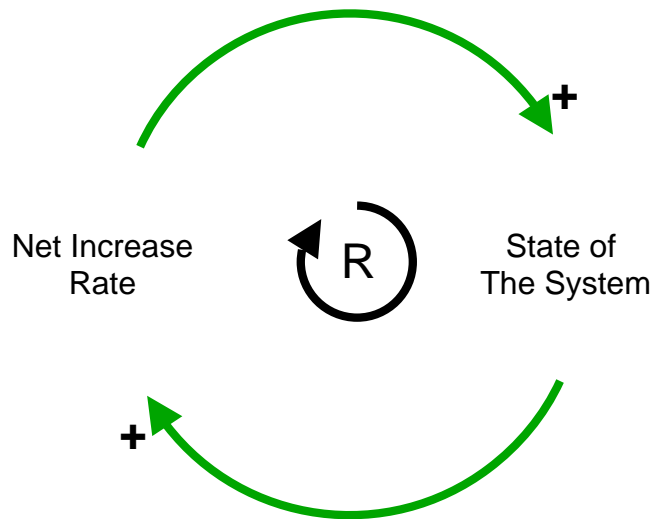
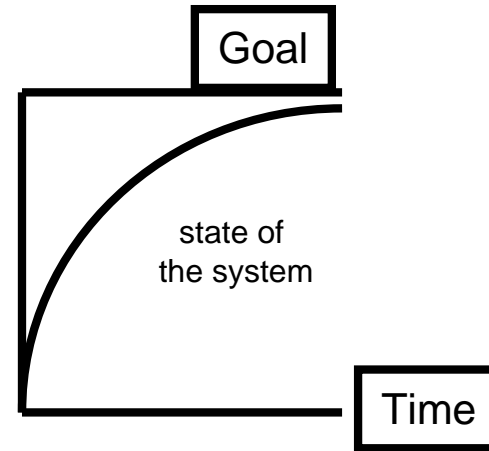
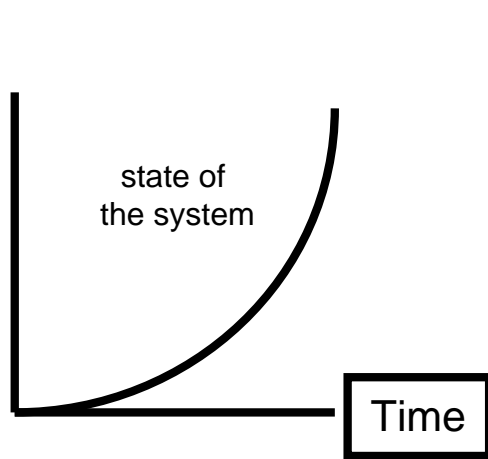
Option 3: Players See the Sense in Cooperation (Sherwood, 2002)

Causal Loop Diagram



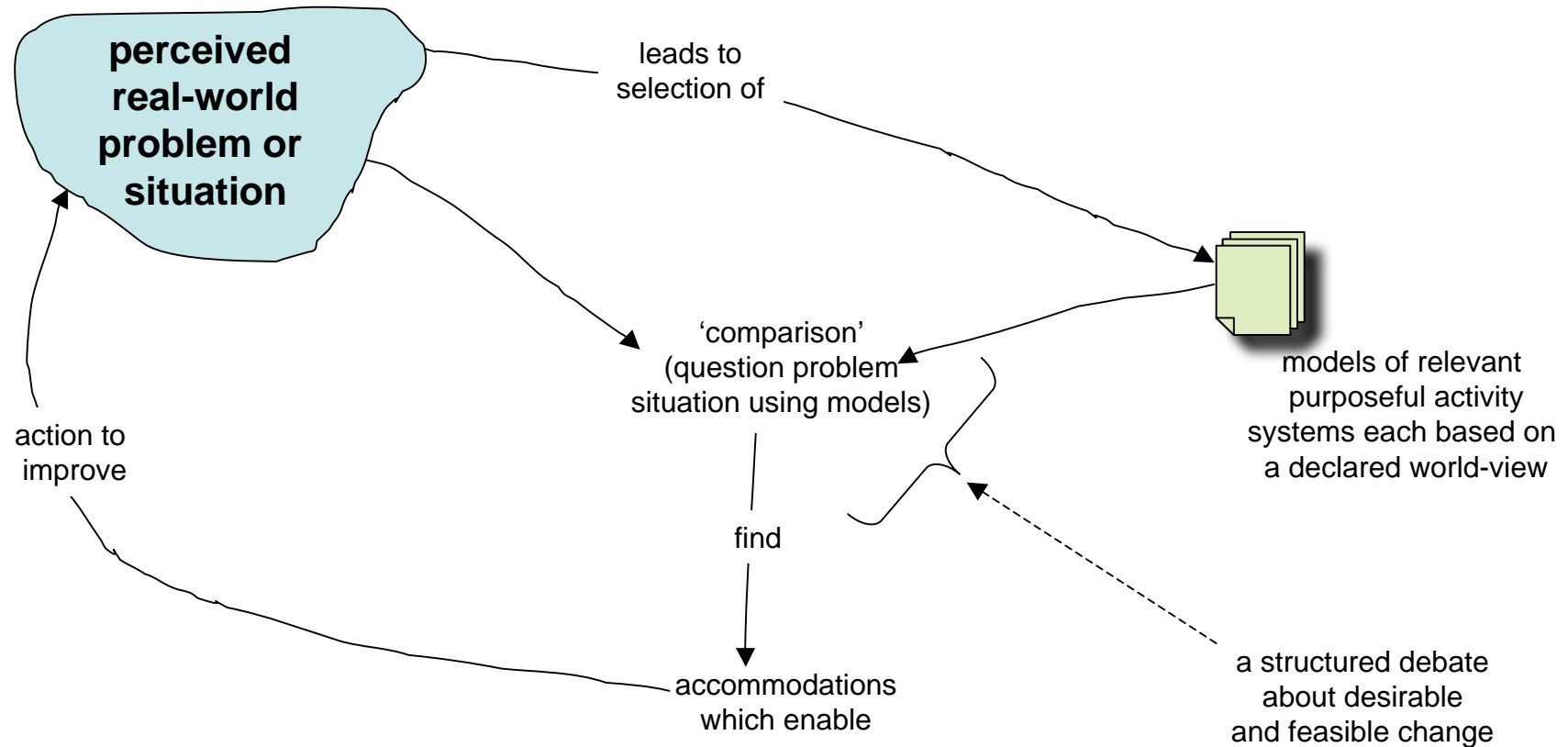
Best Solution: Goals Match—Combined Benefit!

System Dynamics: Growth - Goal Seeking Structure & Behavior



Some Models from Soft Systems Methodology -- Checkland

The inquiring/learning cycle of SSM (Checkland, 1999)



Principles

- real world: a complexity of relationships.
- relationships explored via models of purposeful activity based on explicit world visions.
- inquiry structured by questioning perceived situation using the models as a source of questions.
- 'action to improve' based on finding accommodations (versions of the situation which conflicting interests can live with)
- inquiry in principle never-ending; best conducted with wide range of interested parties; give the process away to people in the situation.

Method for Unstructured Problems

