Ecoesione
Coesione sociale nella Transizione Ecologica
System Thinking

Simone D'Alessandro

Department of Economics and Management, University of Pisa, Italy

Workshop inaugurale progetto Ecoesione
25 Settembre 2020

strategianazionaleper losviluppoSostenibile

UNIVERSITÀ DI PISA

MINISTERO DELL'AMBIENTE
E DELLA TUTELA DEL TERRITORIO E DEL MARE

World System

- Interlocking crises and macroeconomic feedbacks call for an understanding of (and an intervention in) the dynamics of the systems involved.
- This is the reason why we build models and if complexity increases and data are to play a major role, then computer-driven models are necessary.
- The most well-known attempt to build a computer model of the **world system** was described in *The Limits to Growth* (Meadows et al. 1972) using system dynamics.
- Stocks are interlinked through inflows and outflows that are driven by behaviour, information, and feedbacks.

The fundamentals

- **A system map** (a causal loop diagram) provides insight into a particular complex problem by revealing the interconnections, both obvious and hidden, between its elements.
- The idea behind systems mapping is that the **behaviour** of a particular problem (treated as a system) results from these interconnections, i.e. from its structure.
- Used in a **participatory manner**, systems mapping serves to capture the perceptions and mental models of individuals or teams, to express their hypotheses about causes and effects and to expand the boundary of thinking by showing what is connected to what – i.e. how changes in one part of the system might propagate to others and return.

Two approaches

Hard systems thinking (1940s–)	Soft systems thinking (1960s–)
• the observer is outside of the observed system	• the observer is part of the observed system
• systems and their boundaries are objectively given	• systems and their boundaries are defined by the observer
• paradigm: systems can be engineered	• paradigm: systems can be explored
• therefore the goal is optimisation and finding solutions	• therefore the goal is learning and accommodation
• fit for well-structured problems and agreement about what is to be improved	• fit for ill-structured problems and non-coercive stakeholder disagreement

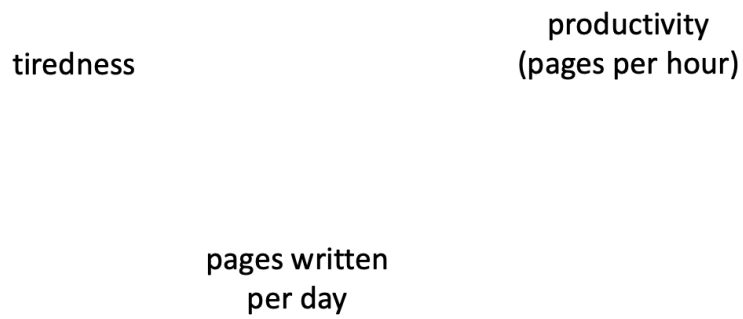
How to build system maps?

There are four basic elements:

- **Variables**.
- Positive and negative **causal relationships** (not correlations).
- **Delays** represent longer time delays between a change in the cause X and a change in its effect on Y.
- Positive and negative feedback loops are circular causalities providing the system with a continuous dynamic.

Elements of system maps: variables

- factors which help explain a particular problem have a scale such as low-high, more-less.
- if you're stuck, try to use 'level of X', 'number of X', 'rate of X', make your variable more specific or think about the unit of measurement.
- An example:
  How can a professional novel writer increase his/her output?

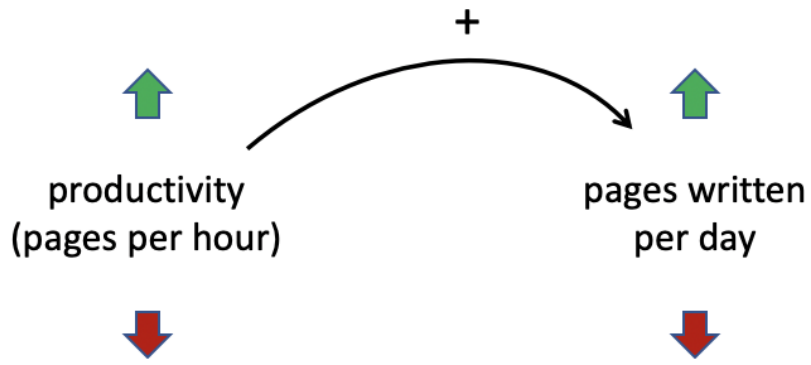


Elements of system maps: causal links

a positive causal relationship between cause X and effect Y means that X and Y move in the same direction:

- **an increase in X will lead to an increase in Y** above what it would otherwise have been (assuming all other variables remain constant).
- conversely, **a decrease in X will lead to a decrease in Y** below what it would otherwise have been.

How can a professional novel writer increase his/her output?

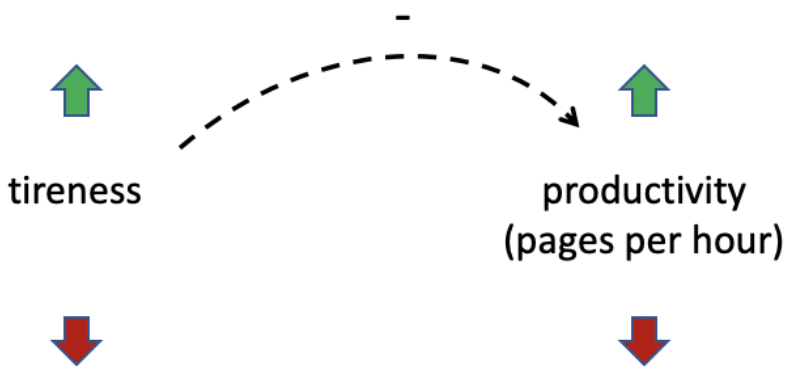


Elements of system maps: causal links

a positive causal relationship between cause X and effect Y means that X and Y move in the same direction:

- **an increase in X will lead to an increase in Y** above what it would otherwise have been (assuming all other variables remain constant).
- conversely, **a decrease in X will lead to a decrease in Y** below what it would otherwise have been.

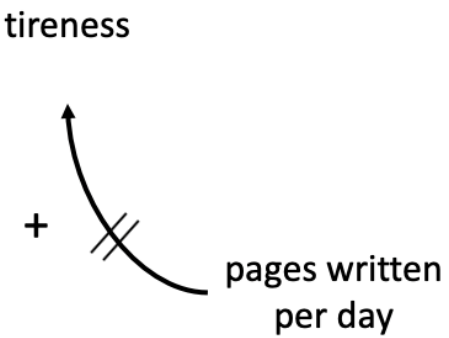
How can a professional novel writer increase his/her output?



Elements of system maps: delays

- Delays represent longer time delays between a change in the cause X and a change in its effect on Y.
- They tend to have significant implications on the behaviour of the system.

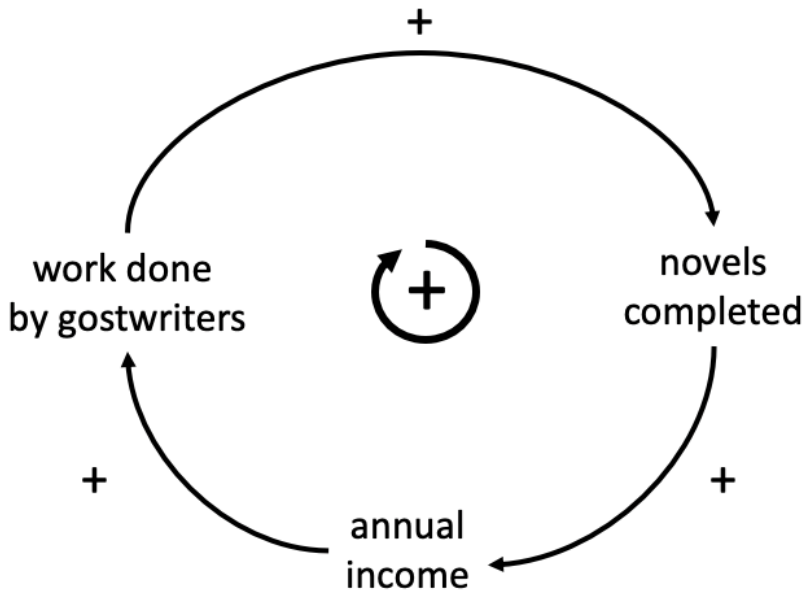
How can a professional novel writer increase his/her output?

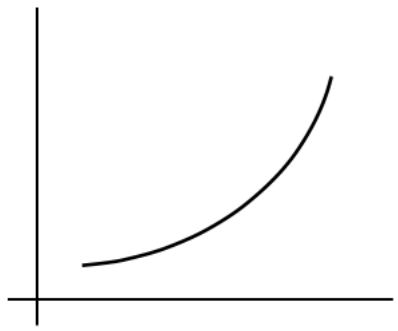


Elements of system maps: feedback loops

- positive (reinforcing) feedback loops lead to exponential growth or exponential decay.
- They bring the system out of control look for limits to growth which keep the system in check name your loops.

How can a professional novel writer increase his/her output?





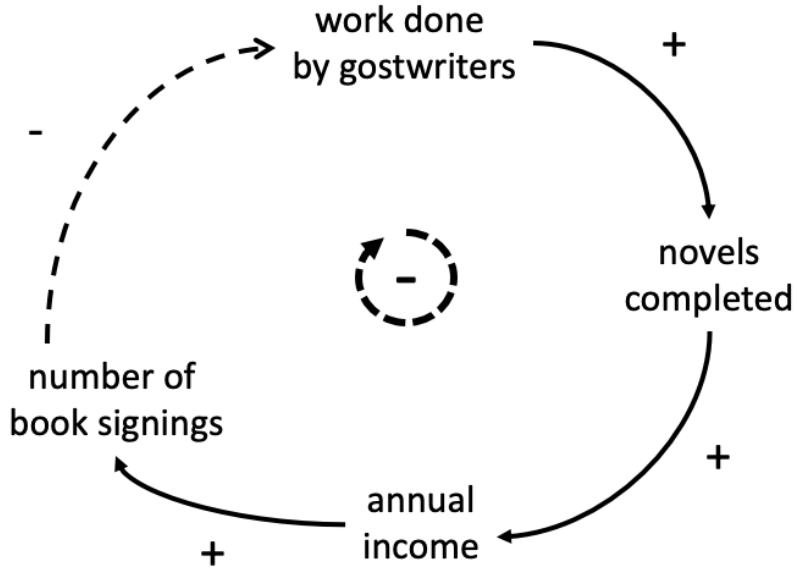
The system sustains the initial move

Elements of system maps: feedback loops

- a negative (balancing) feedback loop has self-regulating and stabilising effects.

- i.e. immediately after finishing a novel less work done and more book signings visited, then more work done and less book signings, leading to next novel completion.

How can a professional novel writer increase his/her output?

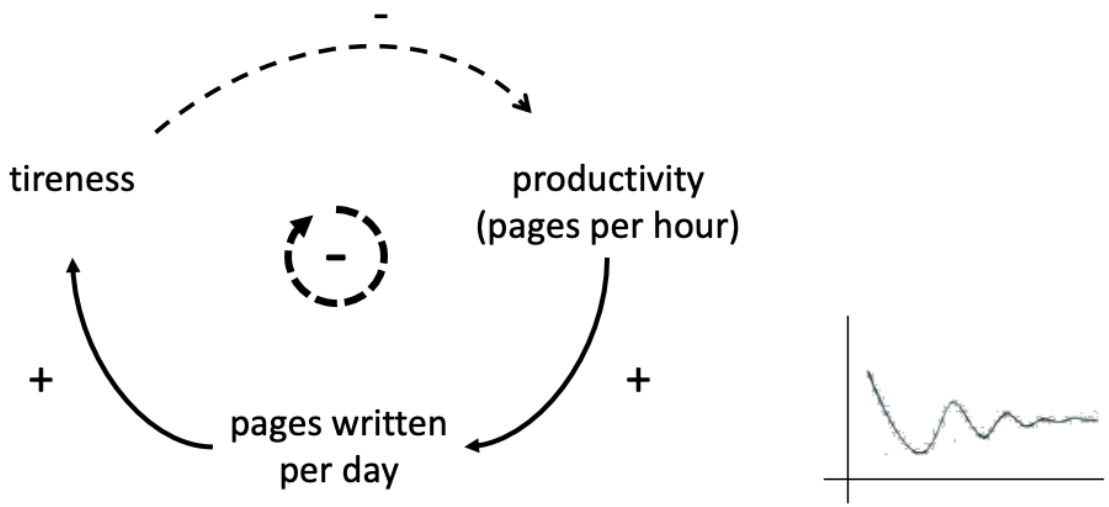


Elements of system maps: feedback loops

- a negative (balancing) feedback loop has self-regulating and stabilising effects.

- i.e. immediately after finishing a novel less work done and more book signings visited, then more work done and less book signings, leading to next novel completion.

How can a professional novel writer increase his/her output?



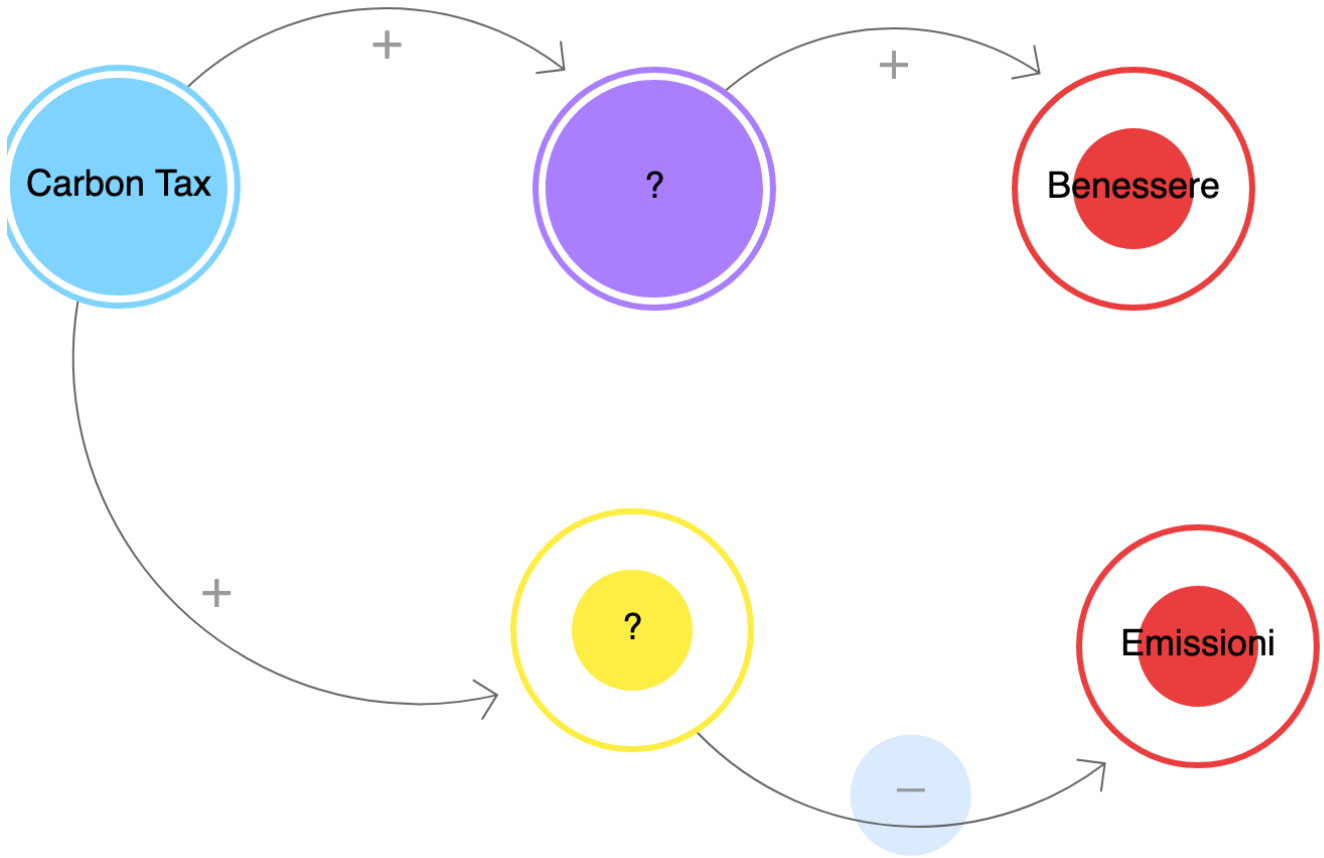
The system fights against the initial move

Causal loop diagrams enable to . . .

- tackle complexity by focusing on one causal linkage at a time
- visually express the relationships which we carry in our heads
- go beyond thinking in disciplines
- acquire a synthetic insight into the behaviour of the system from its structure

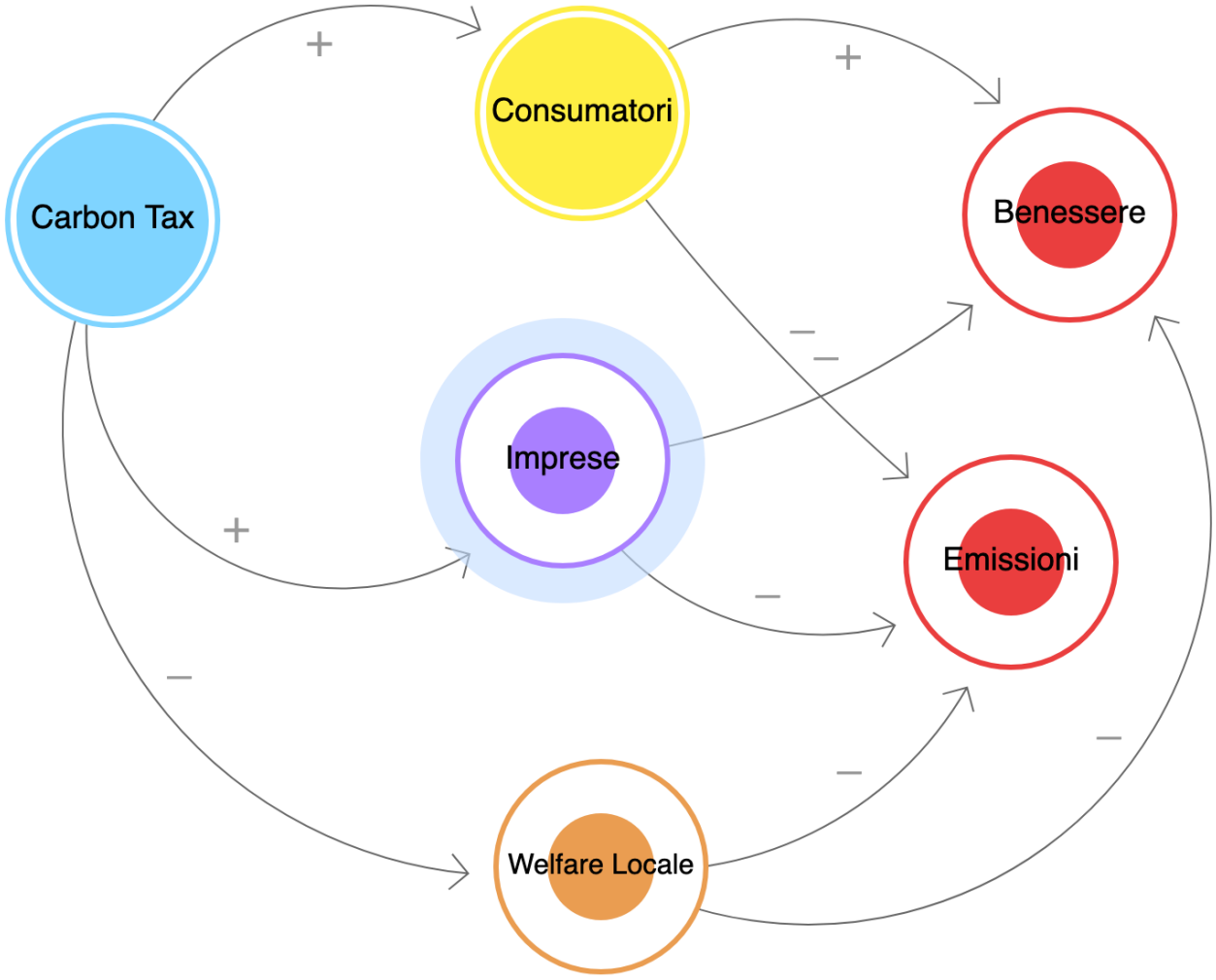
Guiding question

La carbon tax può indurre una riduzione di emissioni e un aumento di benessere?



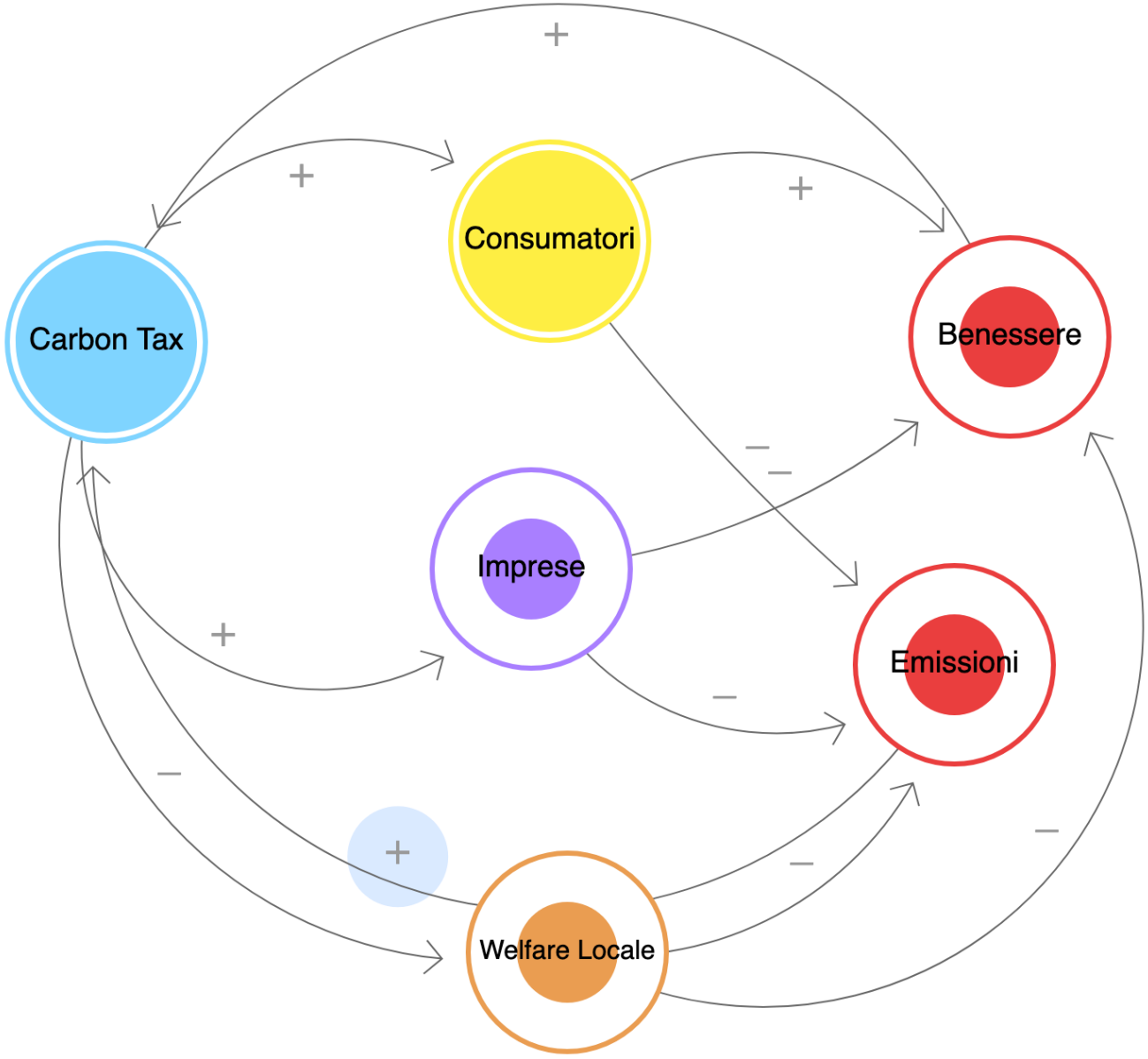
Guiding question

La carbon tax può indurre una riduzione di emissioni e un aumento di benessere?



Guiding question

La carbon tax può indurre una riduzione di emissioni e un aumento di benessere?



Click on the following link

We will explore the issue with the aim to achieve shared insights into the problem and mutual learning.

The map serves as an abstraction of reality and a product of group learning.

Focus on what is necessary for explaining the problem: synthesis is the art of leaving things out.

https://ncase.me/loopy/v1.1/