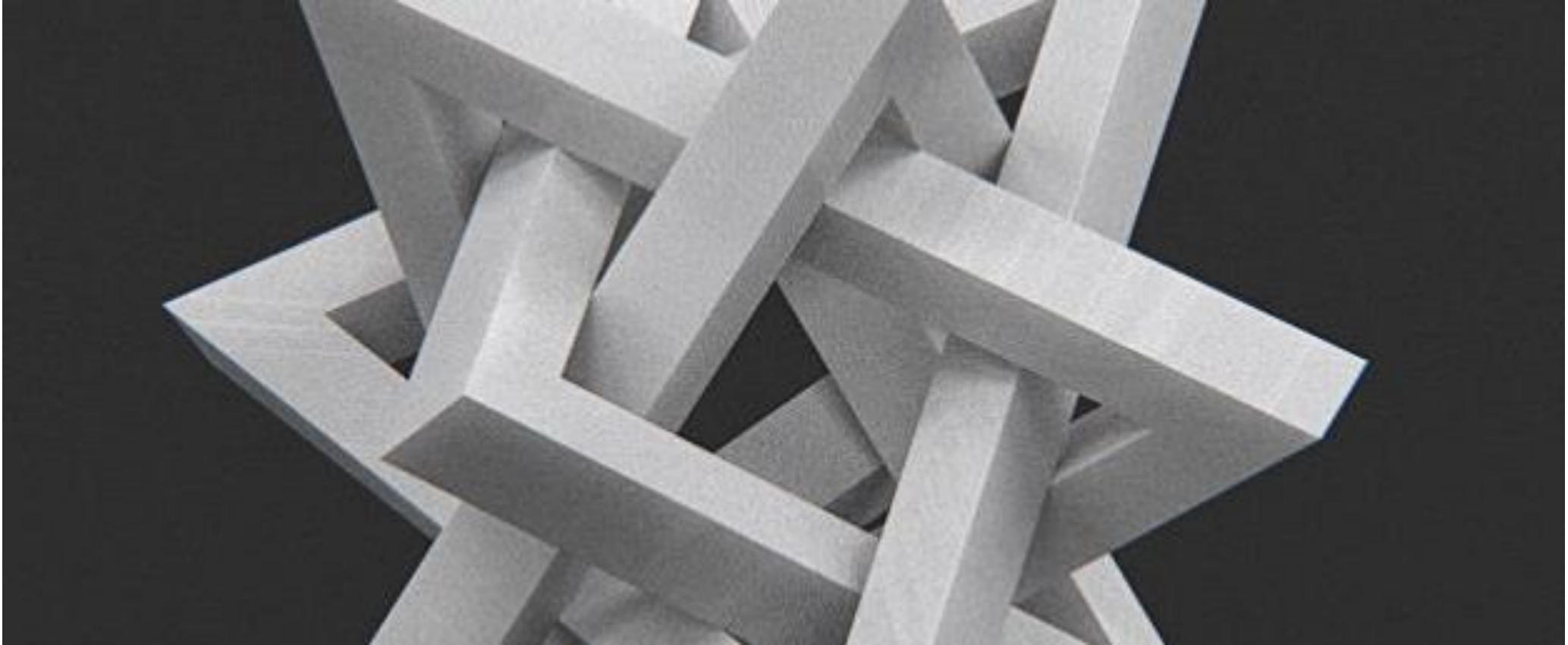


Energizer



<https://yourkite.org/toolkit/triangle/>

Systems thinking

14th of June 2023

Montpellier

Training module pilot network

Jo Bijttebier & Sylvie Fosselle



Systems thinking as an important competency in agroecology transition



Tools and exercises in systems thinking

Systems thinking: an important competency for Agroecology transition



Agroecology transition:

- Responds to/deals with **wicked problems**
 - interconnected with other systems (ecological system, economic system, ...)
 - many actors and thus perspectives involved
 - incomplete or inconsistent knowledge, from different changing visions, contradictory
 - No optimal solution
 - Examples?
- touches upon different systems
- and upon different scales/levels

Systems thinking: an important competency for Agroecology Living Labs



Agroecology LLs and RIs: Co-create **systemic innovation to deal with wicked problems**



Agroecology transition: other approach to evoke change - dominant approach

- Focus on measurable facts + simple causal mechanisms
- Looking for inherent aspects/attributes farms or farmers have
- Comparison of two 'stable situations'
 - Actual vs desired future situation
 - Both are clear defined, stable
- Policy advice/measures
 - Simplified to recipes
 - Based on simple causal relationships: if...then



Picture: Boerennatuur



Darnhofer et al. 2012



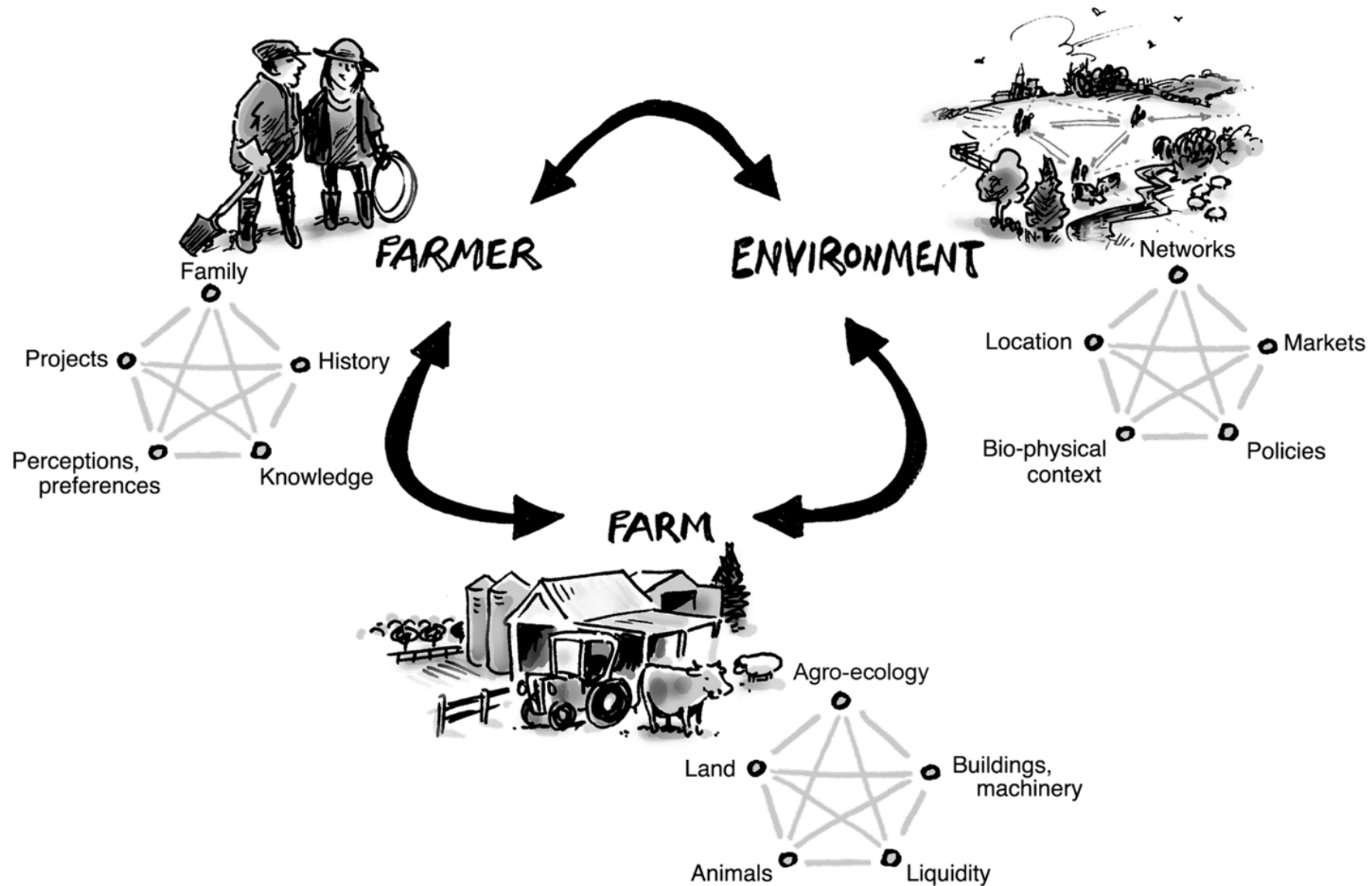
Picture: Boerennatuur

Agroecology transition: other approach to evoke change

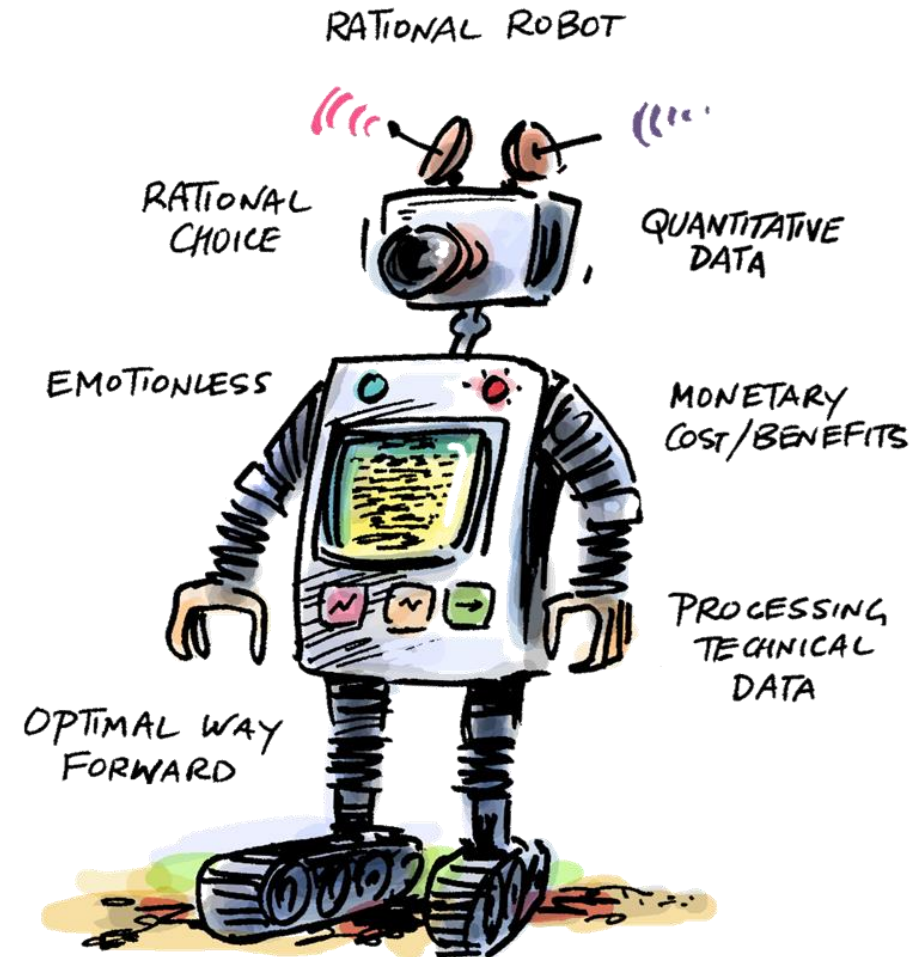
→ relation-process approach

- Emphasis on relations instead of attributes of farms/farmers
- Focus on making change possible
- Agriculture as process of relationships:
 - Human relations: ideas, perceptions, preferences, knowledge
 - Social relations: power, economic relations
 - Biological relations: plants, animals
 - Natural relations: ecosystem, climate, soil
 - Material relations: flows of nutrients
 - Technological: relations enabled by technology and machinery

Farming: entities + relations = dynamics



Challenge 1: The human



Challenge 2: The dynamics



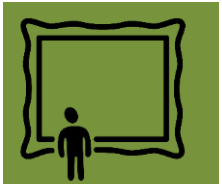
Moving is constant adjusting...

Darnhofer et al. 2012

Agroecology transition: other approach and other methods to evoke change



Relational and process thinking



gaining a bigger picture > different levels



appreciating other people's perspectives

<https://www.youtube.com/watch?v=Miy9uQcwo3U>

The ability to see and understand relationships in dynamic systems

another way of looking = zooming in and out, bigger picture

another way of thinking = relational and cyclical thinking

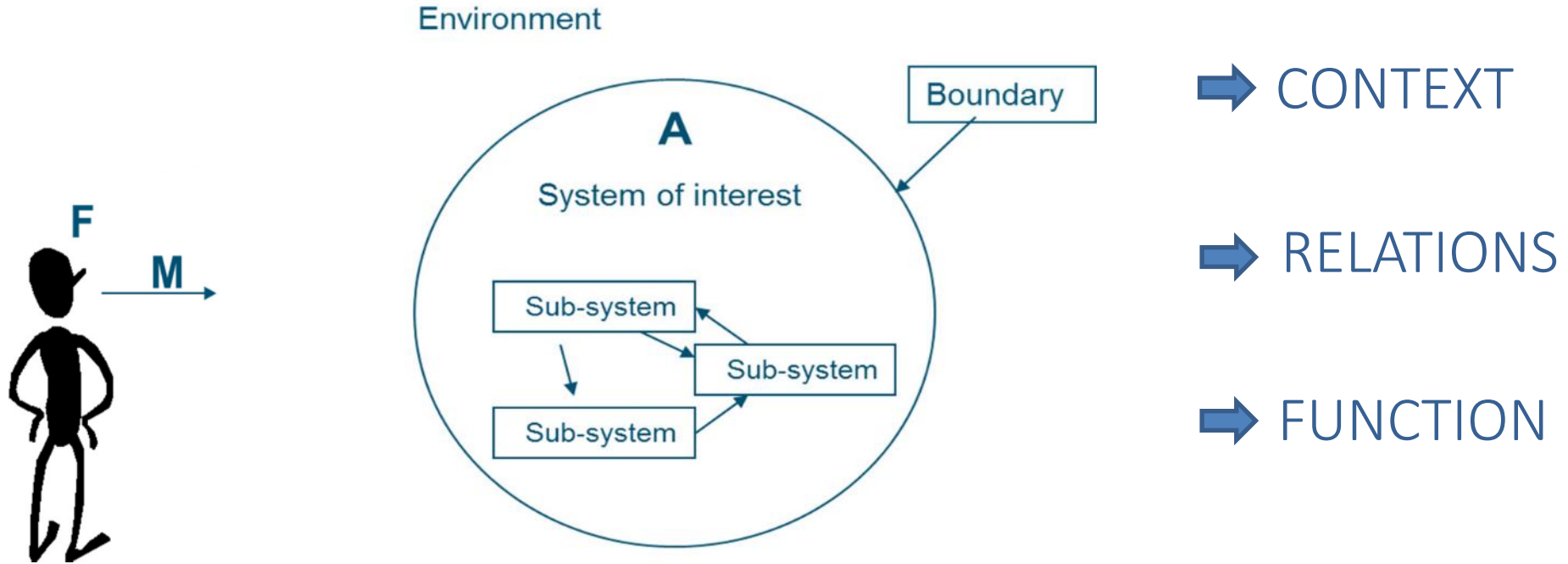
Other ways of addressing challenges = structural approach

Other language = systems language

SYSTEMS THINKING DOES NOT PROVIDE SOLUTIONS!

SYSTEMS THINKING IS DIFFICULT!

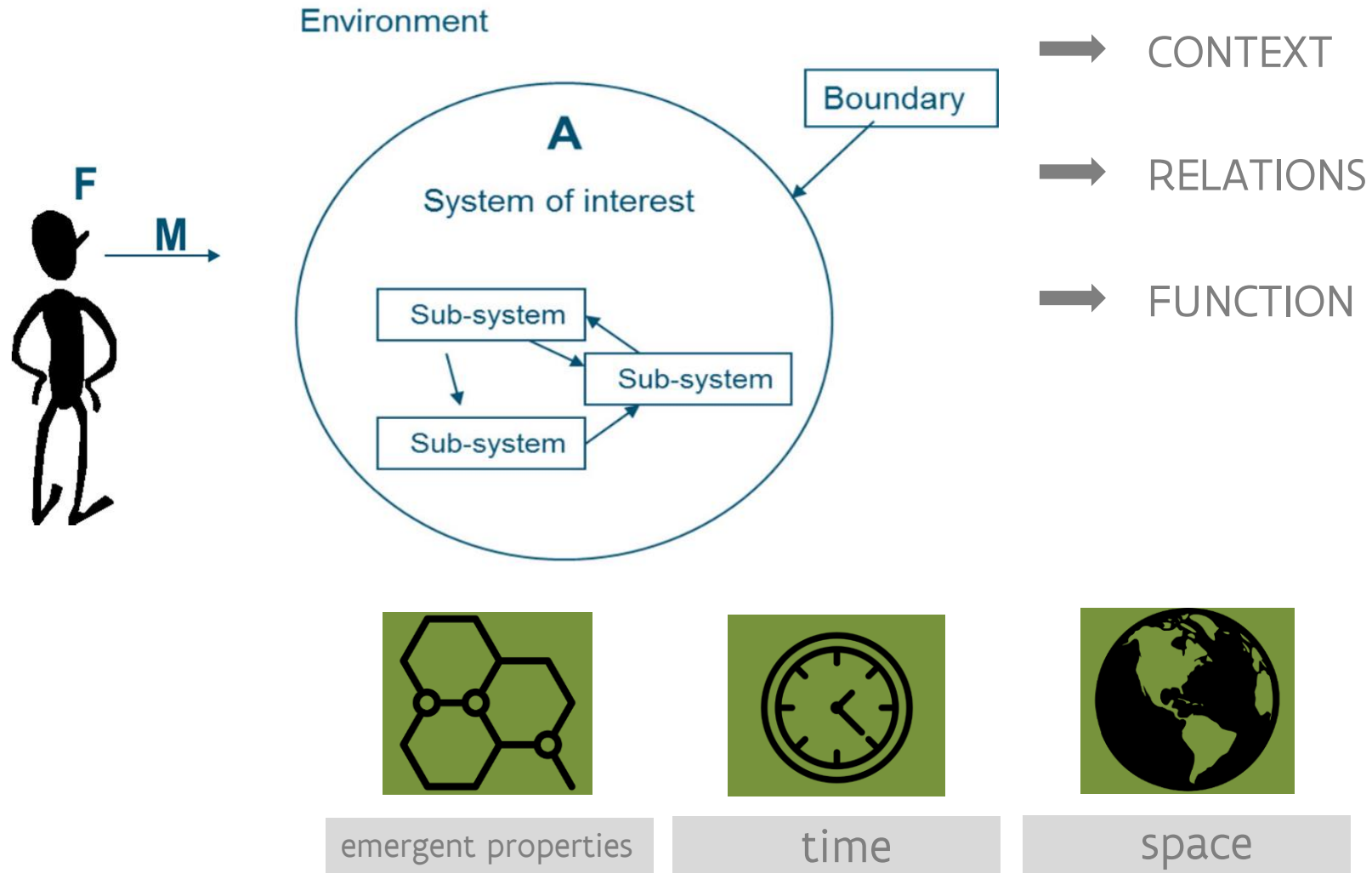
Systems thinking



Different perspectives:

Frame of reference and lifeworld create own truth: source/richness of discussions/ opinions

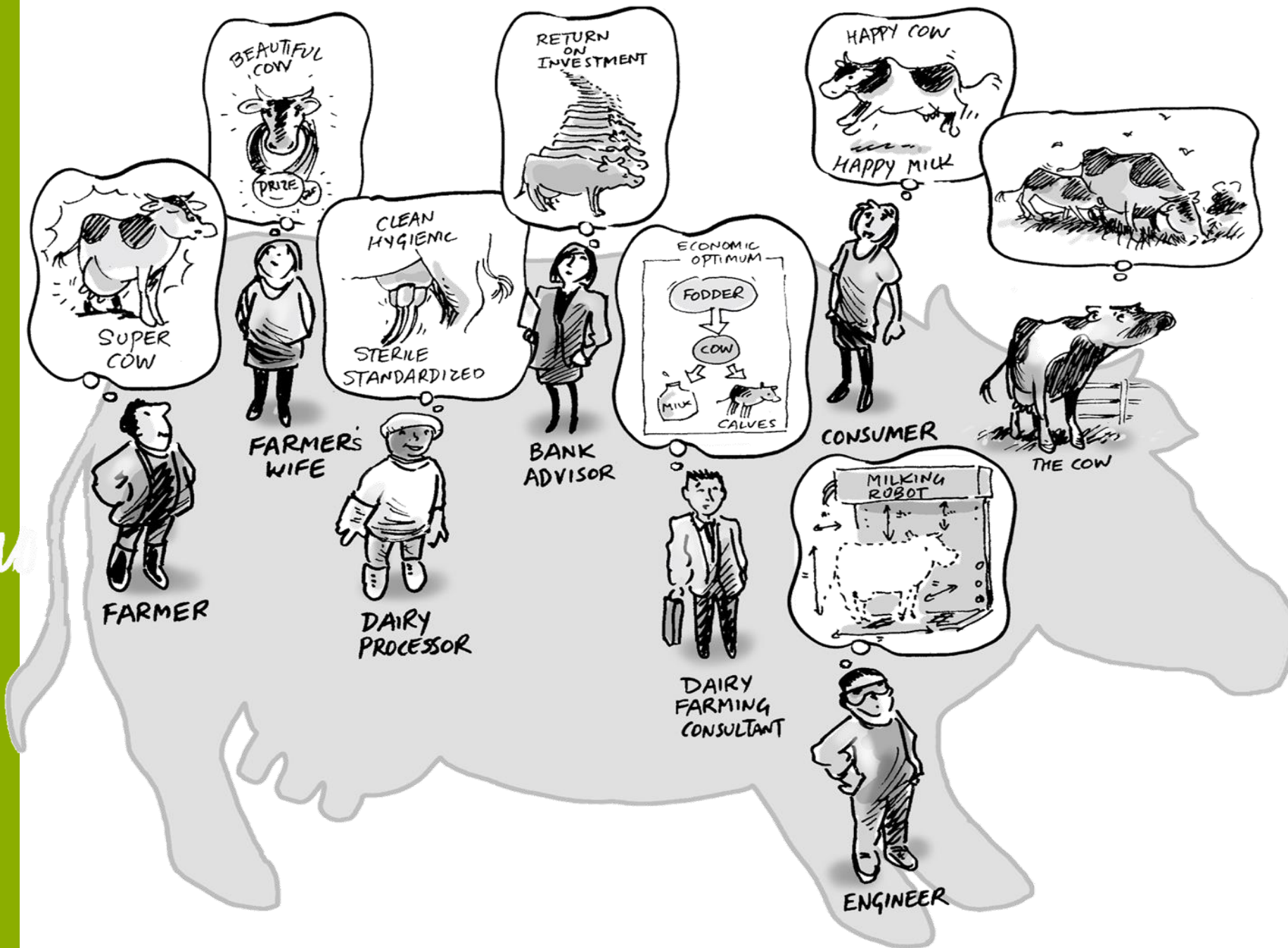
Systems thinking



Systems thinking : to look differently = zooming in and out

- ✓ Looking
 - To explore relations (and not isolating)
 - To better understand systems
 - Context
- ✓ How?
 - Zooming in on subsystems/details
 - Zooming out to see the bigger picture
 - Looking for relations between subsystems
 - From multiple perspectives

<https://www.youtube.com/watch?v=9y518j86rv&feature=youtu.be>

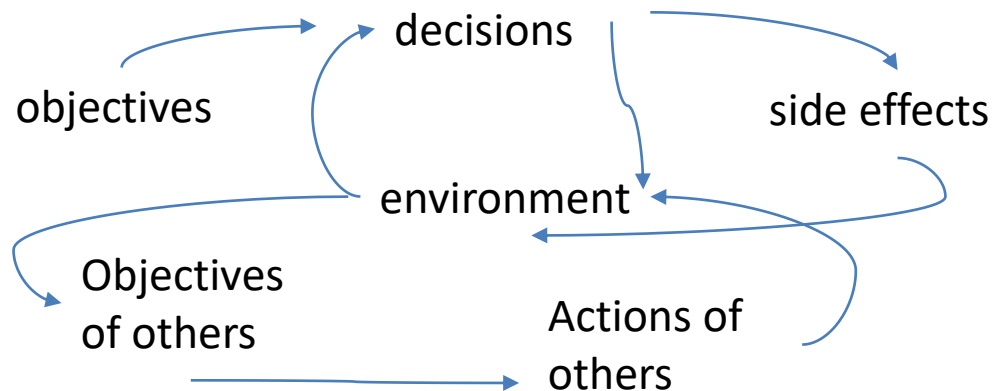
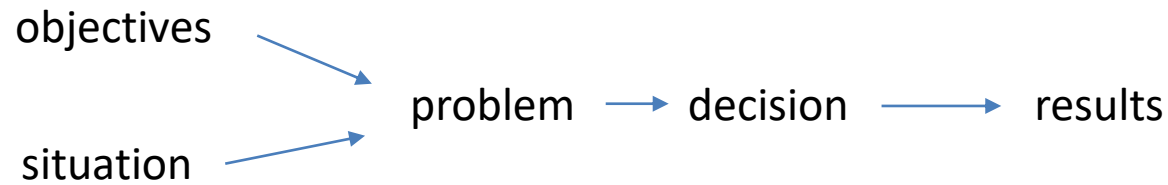


How do we
conceptualize
cows?

Depends on
the relations
we prioritize!

Systems thinking: other way of thinking = cyclical thinking

- ✓ A influences B
- ✓ B influences A } together they influence C
- ✓ Interactions, feedback mechanisms
- ✓ Delay in effect vs direct effects



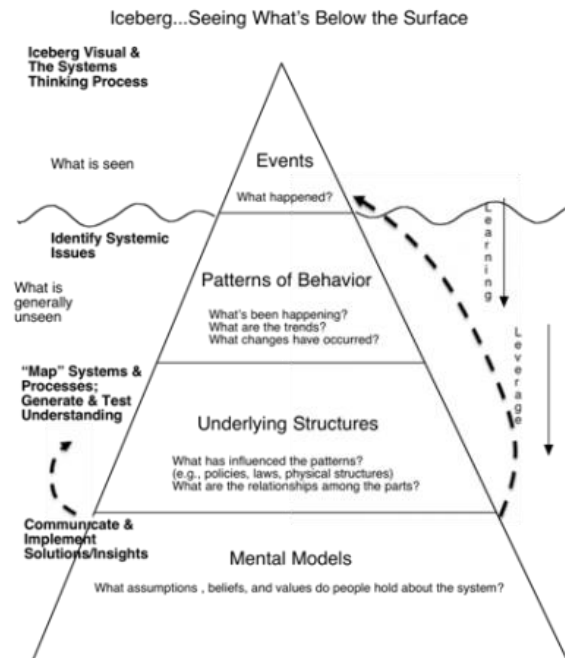
Systems thinking: other way of addressing problems = structural approach

- ✓ Addressing the source rather than the symptoms
- ✓ Understanding interests and underlying values

Understanding/gaining
insights



Finding solutions



Systems thinking: other language = systems language

- ✓ **System boundaries**: delimiting/defining the system of interest
- ✓ **Architecture of the system**: most imports **components** & subsystems
- ✓ **Variables** and **relations and interactions** between variables
- ✓ **Dynamics**: systems react on disturbances/changes in the **context**
= relations and interactions with the context
- ✓ **Patterns**: many different dynamics result in (identifiable) **patterns**
within these dynamics

eg. ranking in an animal group: pecking order in
chickens

Concepts that help us think about these systems

resilience

= ability to ensure the provision of the system functions in the face of increasingly complex and accumulating shocks and stresses, **through capacities of robustness, adaptability and transformability** (*SURE-Farm Approach to Assess the Resilience of European Farming Systems by Meuwissen et al., 2022*)

agro-ecology

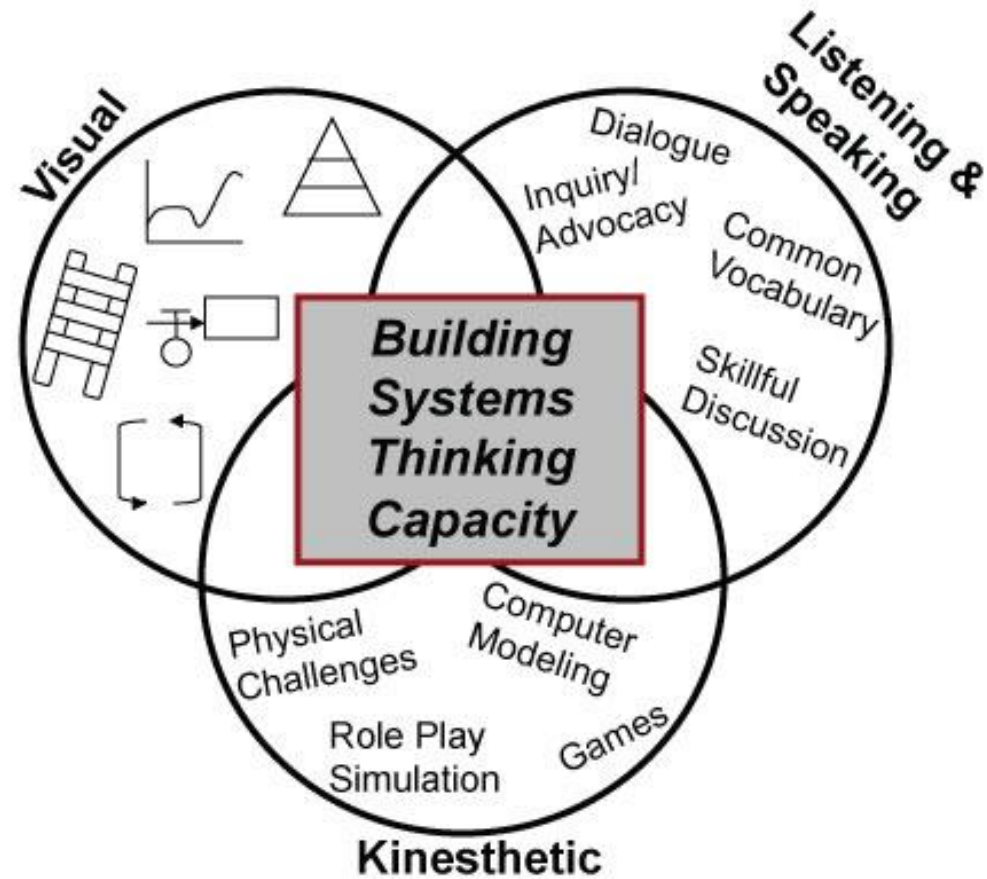
use of relationships between people, agriculture and nature for the design and management of sustainable farm and food systems.



circular economy

Circular thinking instead of linear thinking by (re)use of materials and products with the highest possible quality

Systems thinking tools



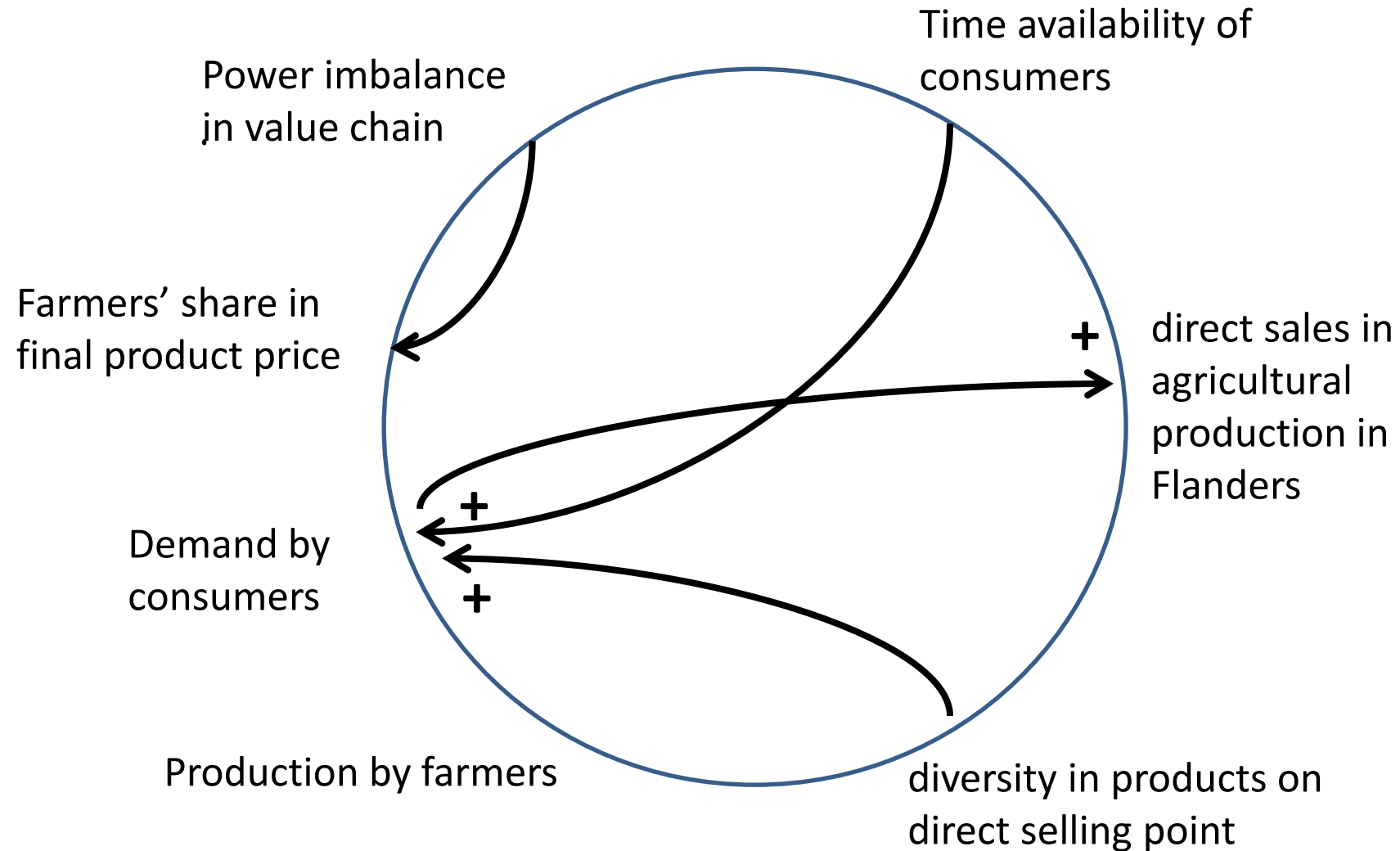
Visual tools



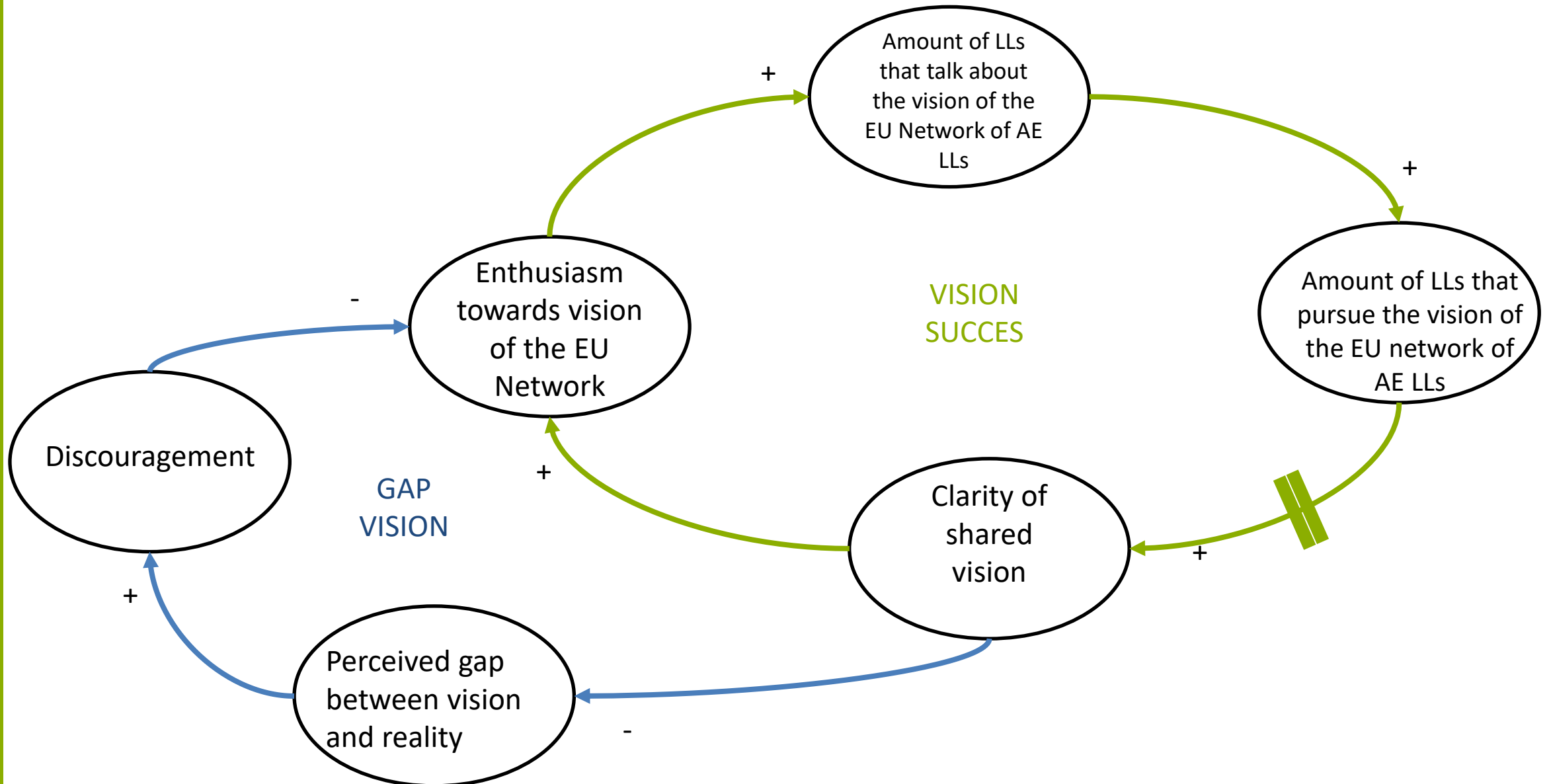
- Clarifies complex issues by capturing the essence of a system/challenge
- facilitate learning and communication
- Eg.:
 - mind maps
 - causal diagrams
 - actor maps
 - Connection circle maps
 - Behavior over time graph



Connection circle map on 'direct selling of agricultural products' in Flanders



Reinforcing and balancing loops



Participation tools



- To include different stakeholder groups to gain full understanding of the system
- Join different perspectives, views, expertise, knowledge
- Eg. World café, focus group, etc



Computer-based tools



- Add quantitative results to the qualitative model
- Predict/simulate of a system's behavior over a certain period of time (to inform decision makers)
 - **Stock and flow diagram:** adding relevant quantities and rates to the causal loop diagram
 - **System dynamics simulation model:** A computerized model that quantifies relationships and can measure stock and flows, analyze feedback loops, and run scenarios.
 - **Other:** agent-based modelling; discrete event modelling

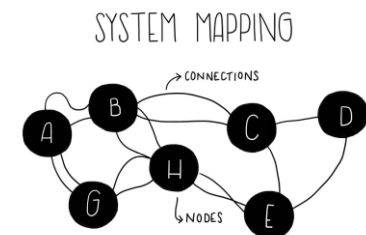
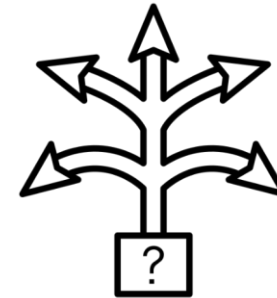
Tools and exercises in systems thinking



- **Causal map**
- **Actor map**

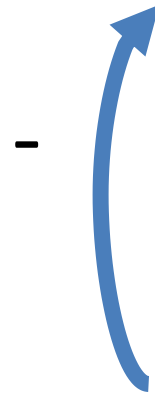
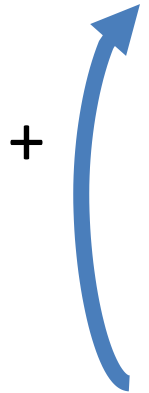
Causal mapping why

- The first challenge with problems in systems is to understand them, to make the issue clear and understandable
- Focuses on how elements in a system impact each other
- Insights generated from causal maps help:
 - To understand the problem/issue
 - To create possibilities to undertake action
 - To show how impact of activities will affect other elements in the system

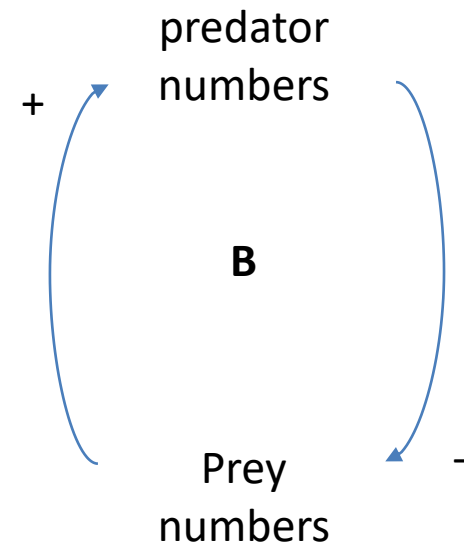
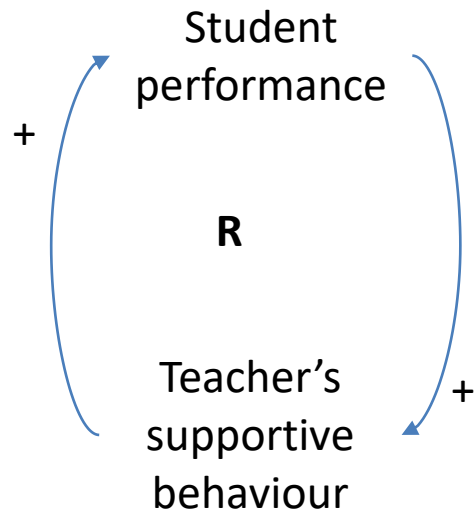


Causal mapping

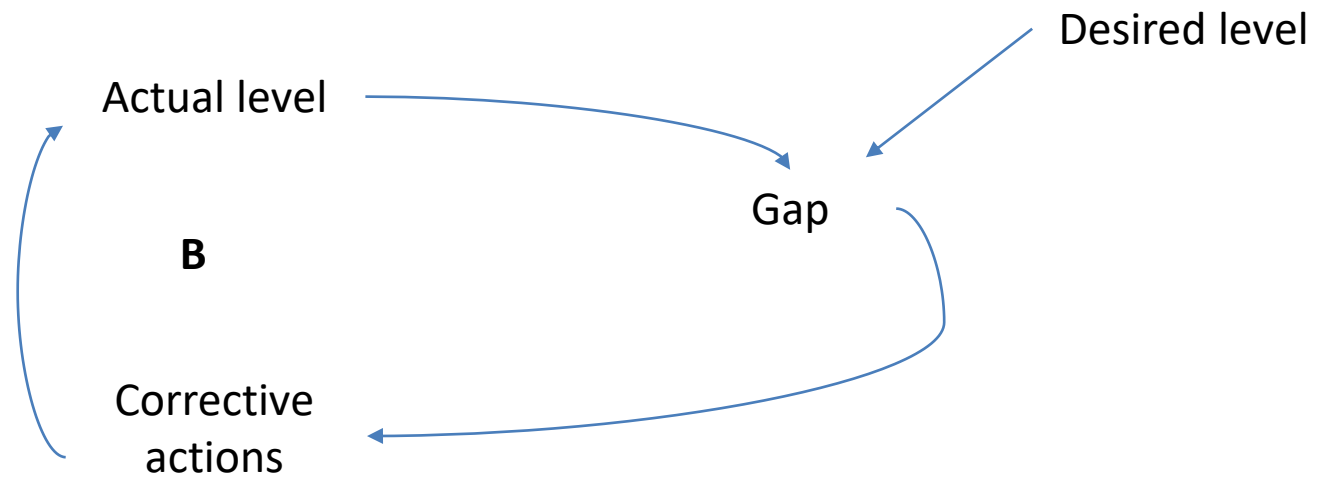
- If a change in X causes a change in Y in the same direction
- If a change in X causes a change in Y in the opposite direction



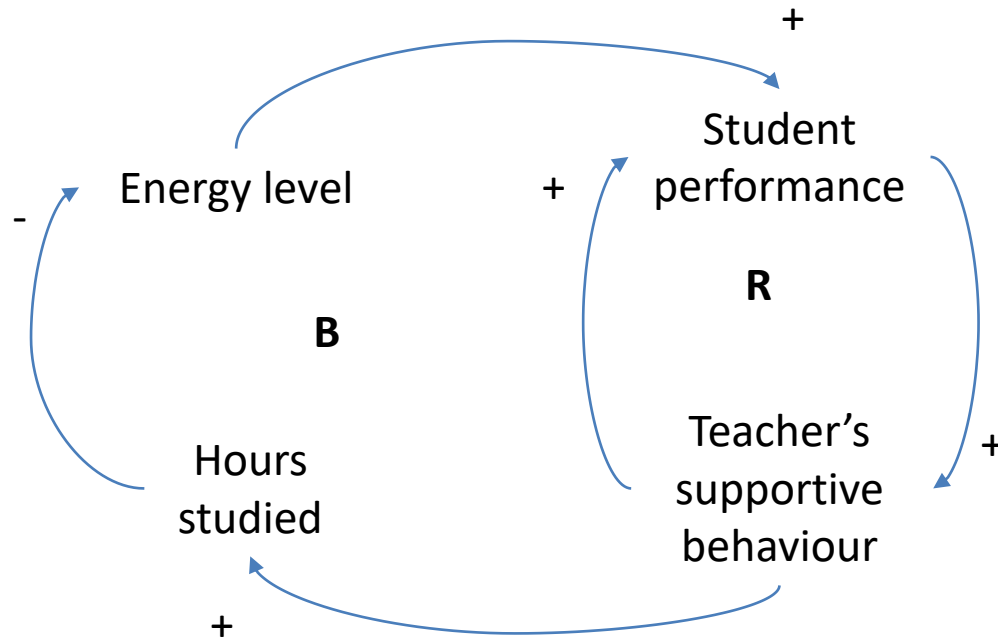
Reinforcing and balancing loops



Balancing loops

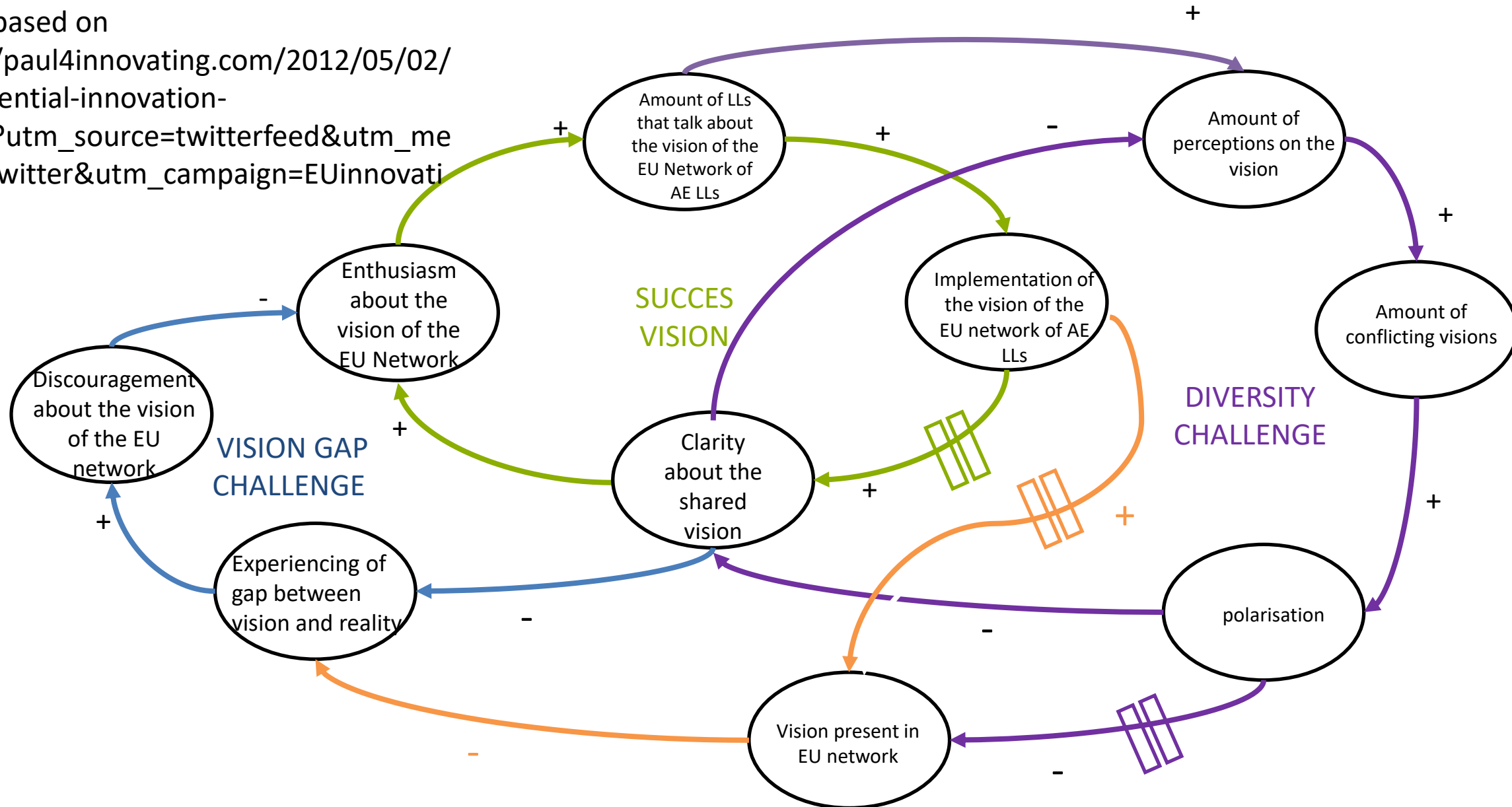


Reinforcing and balancing loops



Causal maps reveal circular patterns

Figure based on
https://paul4innovating.com/2012/05/02/the-essential-innovation-vision/?utm_source=twitterfeed&utm_medium=twitter&utm_campaign=EUinnovati
on



Constructing causal maps can build bridges between actors with different backgrounds

- Causal maps origin from system dynamics but aren't applied that much in organisations to visualise problems and find possible solutions.
- People with social research background find it too technical, while people with technical research background lack linearity
- This can be the strength of causal maps, to build bridges between people with different backgrounds
- You learn to understand each other's language building together causal maps

What are causal maps?

- A visualisation of variables with arrows, structured in circular patterns
- The maps should provide enough detail to reveal the feedback mechanisms, but they also need to simplify so the important dynamics get visible
- The challenge is to make a customized map
- It is difficult to find good instructions (systems dynamics is often very technical)
- Inspiration from Hans Vermaak

Before: define boundaries

- Choose the right level
- Gather enough information or perceptions, observations
- Gather both hard and soft information

Causal maps: instructions

before	Define boundaries
1	Choose 10-20 variables
2	Start to tell the story, look for feedback loops and add missing links
3	Check arrow
4	Tell the story using the whole diagram and redraw
5	Find driving and measuring variables
after	Test the diagram

Based on Hans Vermaak “een causal diagram maken in vijf stappen” uit Meer dan de som der delen, systeemdenkers over organiseren en veranderen, Brechtje Kessener en Leike van Oss, 2019, Boom Uitgevers Amsterdam

1. Choose 10 -20 variables

- Use a noun, not a verb
- Use variables that represent quantities that can vary over time
- Choose the neutral or positive sense of a variable
- Don't choose variables that contain too much information, make them concrete eg. demography vs ageing
- Choose hard and soft variables
- Don't choose variables that are part of a certain solution, start from 'as is'.

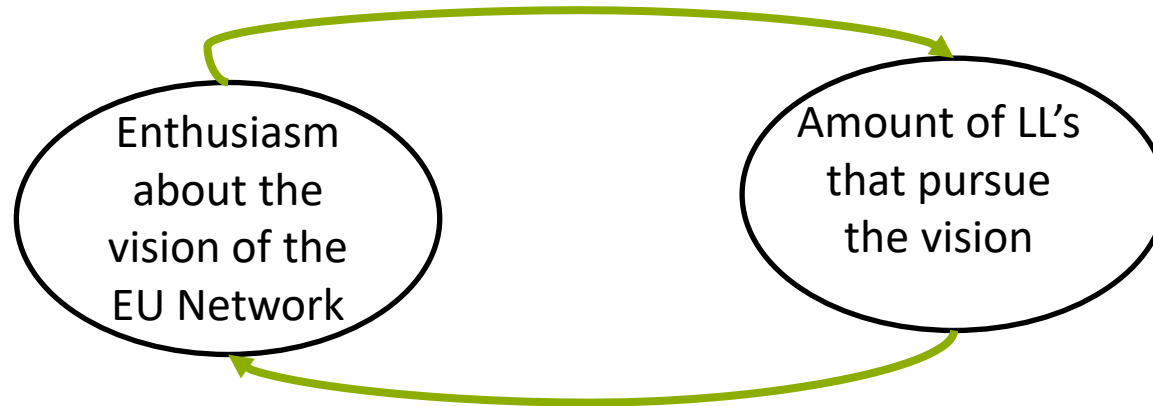
2. Start to tell the story, look for feedback loops and add missing links

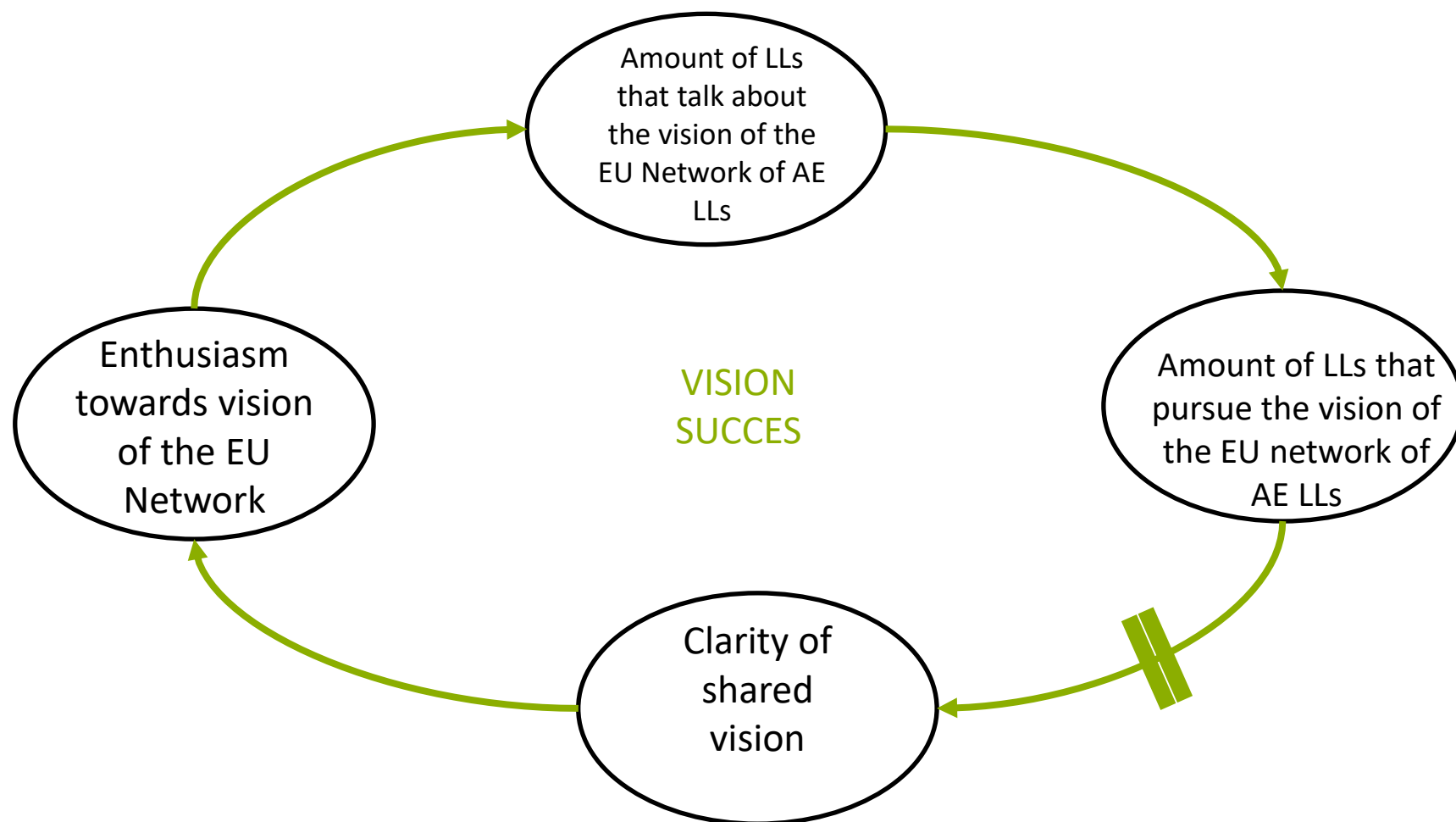
- Once you have the most important variables, start from 2 - variables and name the impact they have on other variables, link them
- Start with drawing feedback loops
- Somebody starts with 3 variables, there doesn't have to be consensus from the beginning
- If the first person get stuck, the others can help

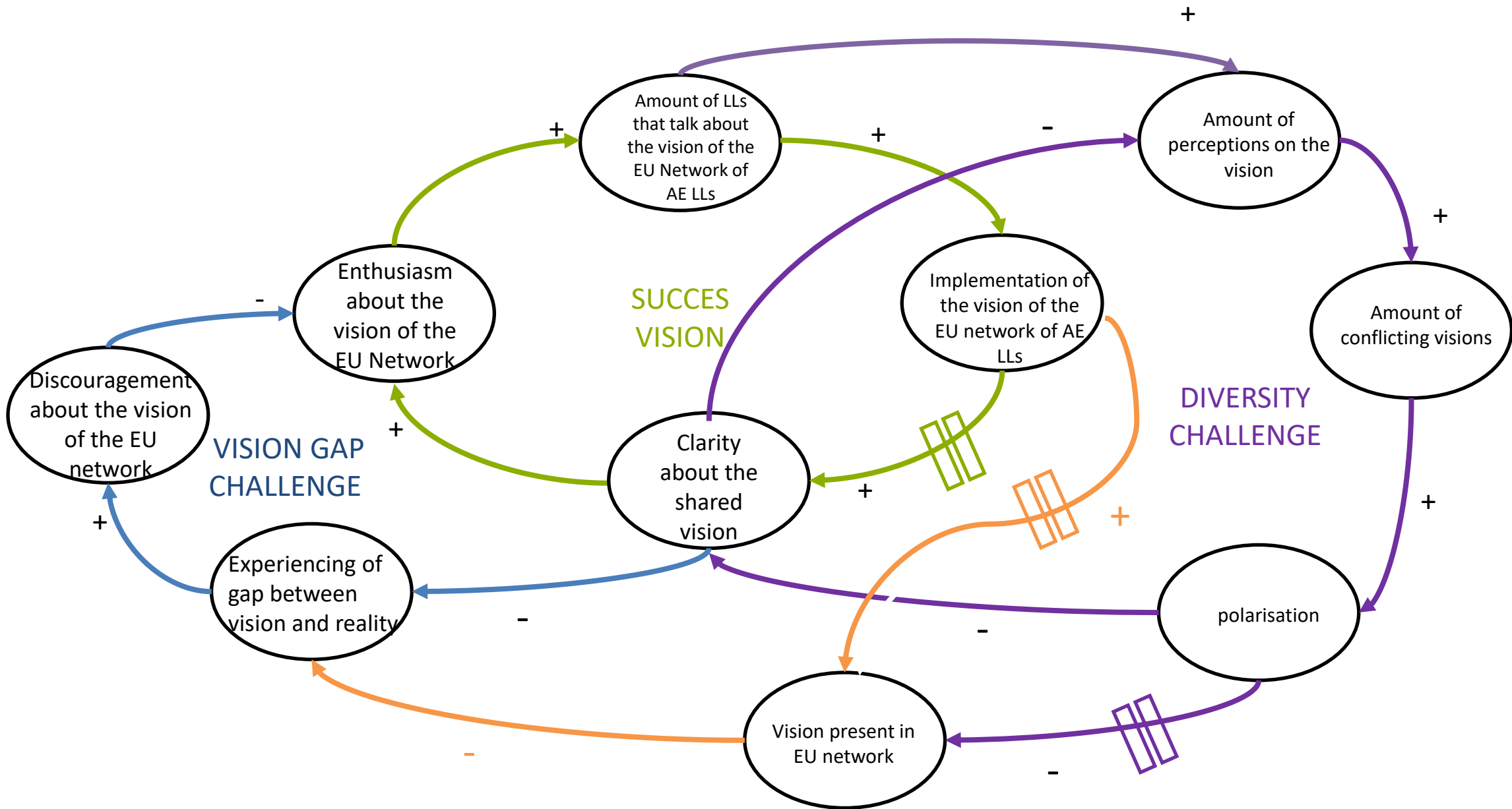
3. Check arrows

- Check the causal relation, arrow = more of this, means more/less of that
- For each arrow question: does more of variable X will lead to more/less of variable Y? → if this is not clear, then remove the arrow

- Avoid duo's







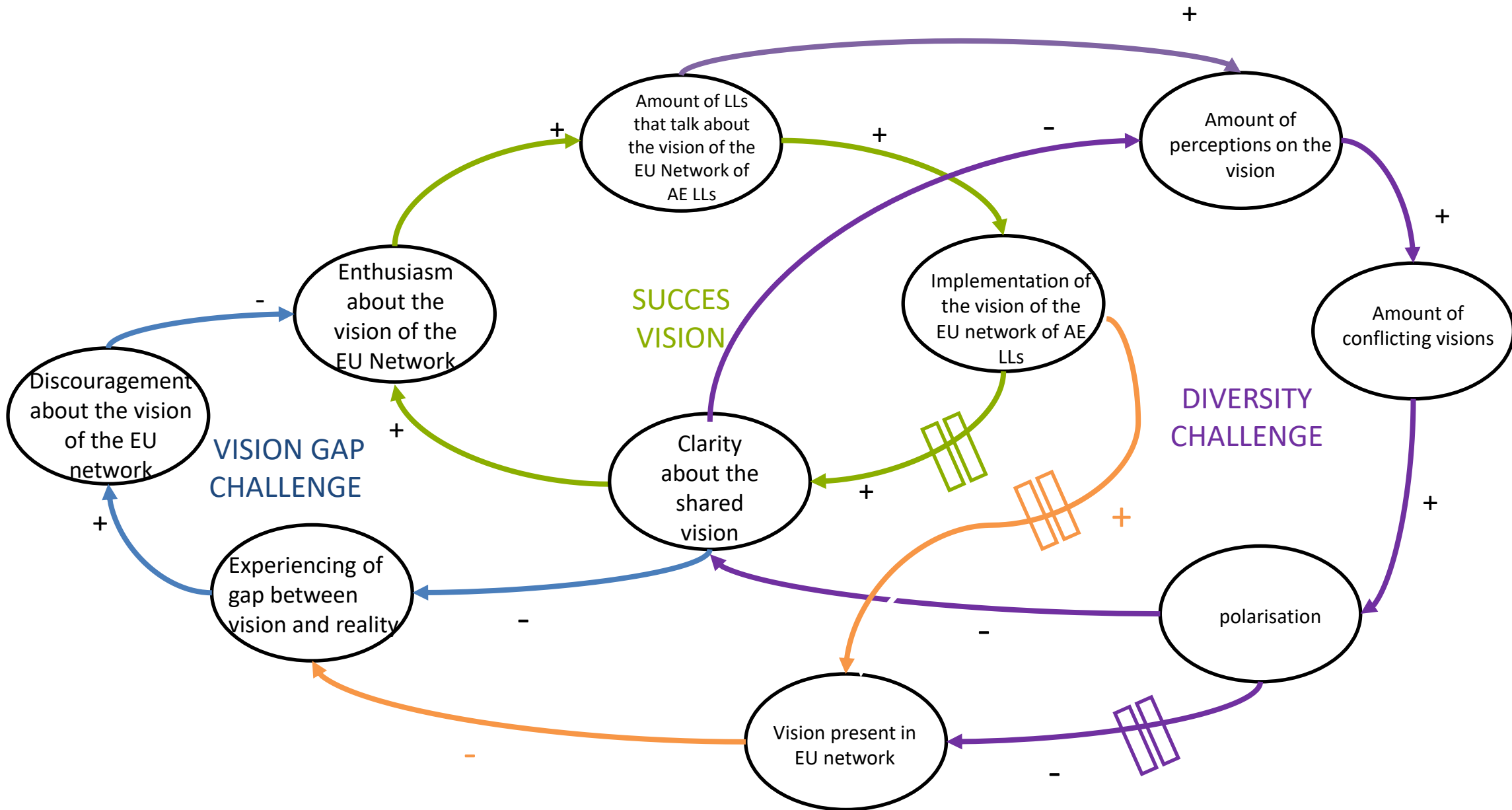
- A variable can only appear once on 1 position
- Refine your map by adding polarity
 - + for a reinforcing relation
 - for a balancing relationor by visualising a delay effect



4. Tell the story using the causal loop map and redraw

- Now you have a rough map with some loops with the most important variables, there will still be some failures in it.
- By telling the story through the map you/others will hear where things do not convene with the causal map
- This makes it clear where you need to addapt the map

- Long parts in your map without branches ou can probably shorten: if 2 variables in between do not impact other variables then they do not have added value to your story
- If the drawn relations do not clarify enough what you want to tell, there might be 2 possible problems:
 - Consequences not clear, variables where no arrows start from
 - Causes not clear, if the presence of a variable can't be clarified enough by the arrows towards it

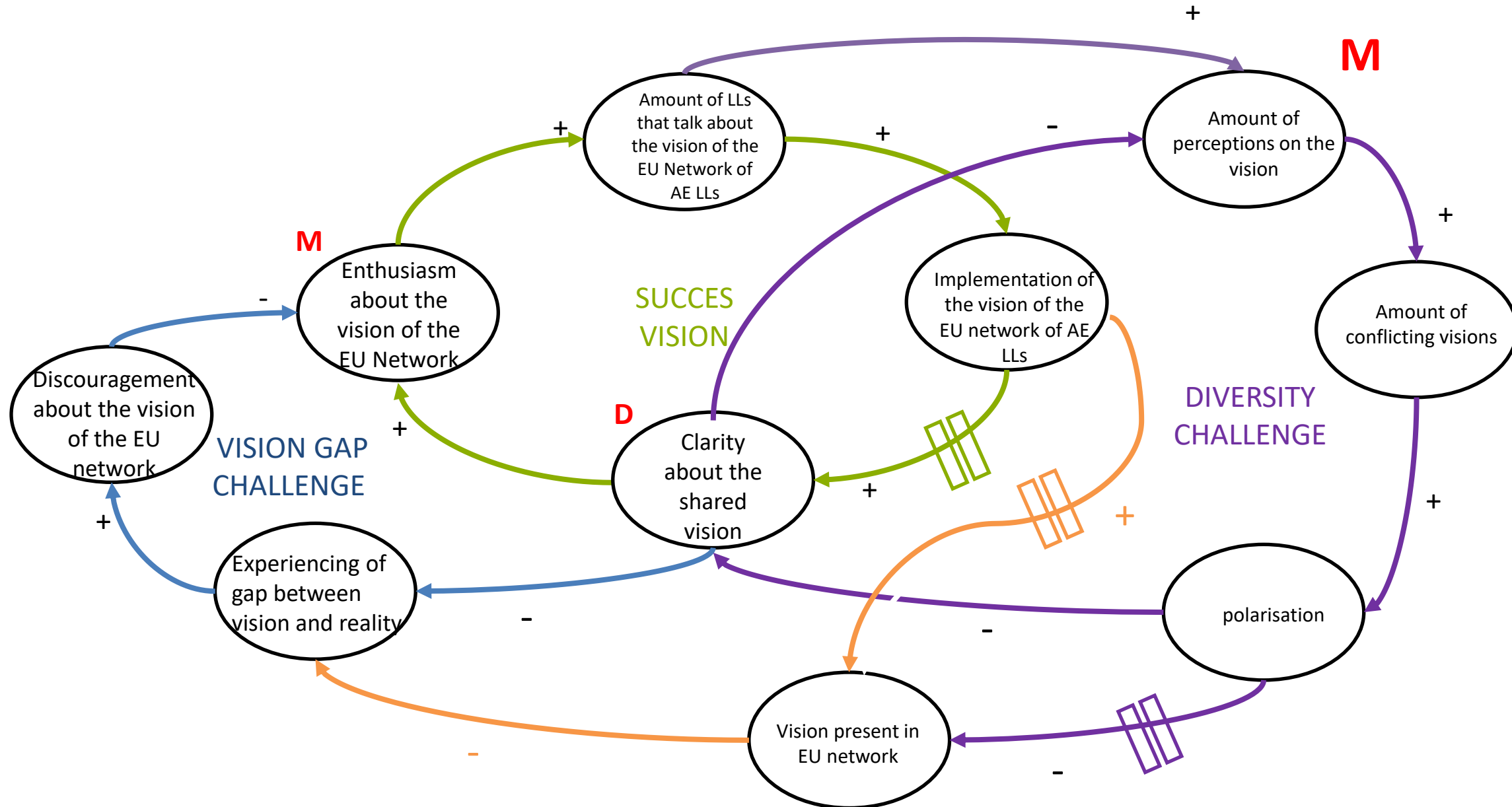


- A causal map needs time, sometimes mechanisms are hidden in a bunch of arrows
 - Draw round forms, feedback mechanisms need to look like loops, only then our brain will recognize them.
 - For each loop: create enough space in your diagram en reduce crossing arrows
 - Make different storylines clear with different colours or put them in different corners or give the feedback loop a different name

5. Look for possible levers and indicators of change

- Look for driving variables (with little effort you can have maximum effect), variable with more outgoing than incoming arrows
- Look for measurable variables (where changes can be noticed quickly), variable with more incoming than outgoing arrows

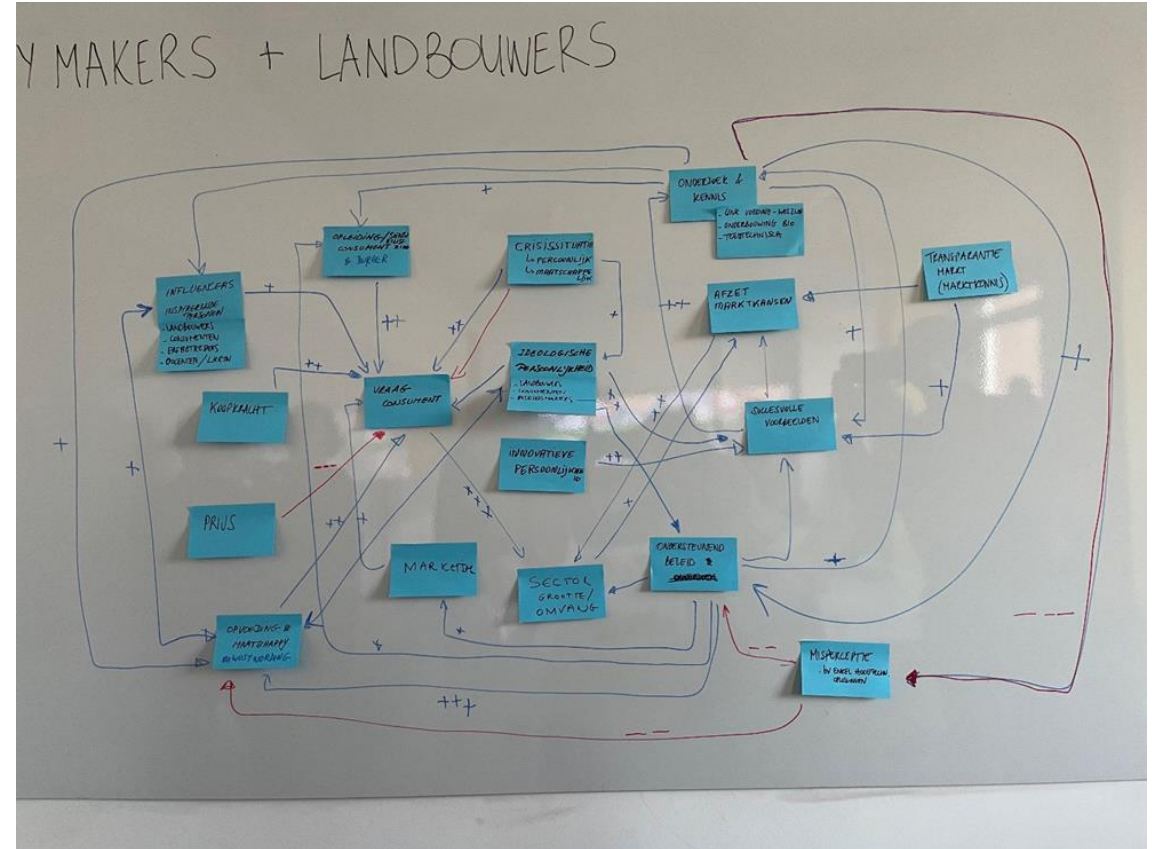
Driving and measurable variables



What is the correct map?

- Different groups will make different maps for one issue. Both are correct and wrong because these are models, not reality, they provide a subjective meaning. Both are valuable.

ilvo



How to test?

- Test the map with the stakeholders, if the map entails the different perspectives, then this is a good indication
- You can test by using a computersimulation/gaming tool
- You can test in reality by trying to do something on the levers that were revealed in the map

Tips and tricks

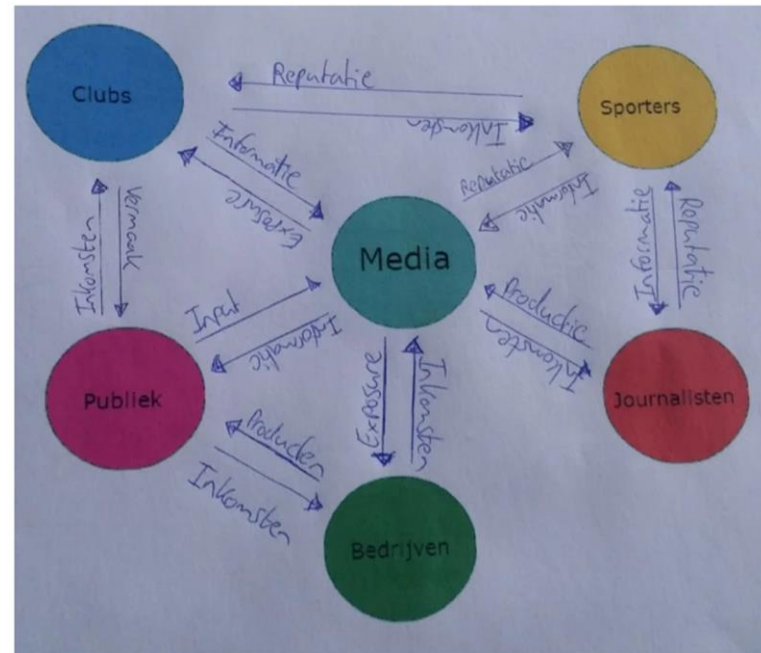
- Systems thinking in the beginning creates frustration -> carry through
- Sometimes you can draw if you're not on the right level-> zoom out and check the level
- It is no rocket science -> it is about persistence
- Do this in groups, with more people you can see more and think in a broader way

References

- <https://thesystemsthinker.com/>
- https://paul4innovating.com/2012/05/02/the-essential-innovation-vision/?utm_source=twitterfeed&utm_medium=twitter&utm_campaign=EUinnovation
- <https://hansvermaak.com/en/>

Actor mapping

Actor maps: visual representation of the key actors that make up and/or influence a system, as well as their relationships to one another related to the system of interest.



Actor mapping why?

By making explicit the actors, their roles and relations within the system of interest, actor maps allow to question both the system's components (the actors/roles) and its organization, and so help to understand and reorganize sustainably:

- Understanding the system: level of **engagement** (who is involved, who is affected), strength of connections among actors, explore perspectives
- Identify **strengths and weaknesses**: e.g. points of conflicts
- Identify potential **points of intervention** and levers of change: new relationships, collaborations.

Actor mapping

Frame the system

- Identify the system of interest
- Set clear boundaries:

The desired geographic scale of the map (e.g., local, regional, national)?

What level of detail is appropriate for the actor map?

What is the degree of specificity desired of the map (generic versus specific)?

- Dependent on purpose of the map, available resources (time, expertise, etc)

Actor mapping

Identify key actors and roles

- Individuals, organisations, whole industries, nations
- Roles: the way an actor or group of actors behave in relation to the system of interest (eg funding, marketing, advising, etc)
- Focus on roles provides safe space

Actor mapping

Identify relationships between the actors in the map

- **Relations as value transactions:**

Both intangible as tangible value based transactions

How do these flows create incentives and motivate actors to behave the way they do?

- **Strength of relationships** (weak, strong, missing)

What are the values, accepted paradigms, models people use to understand the system?

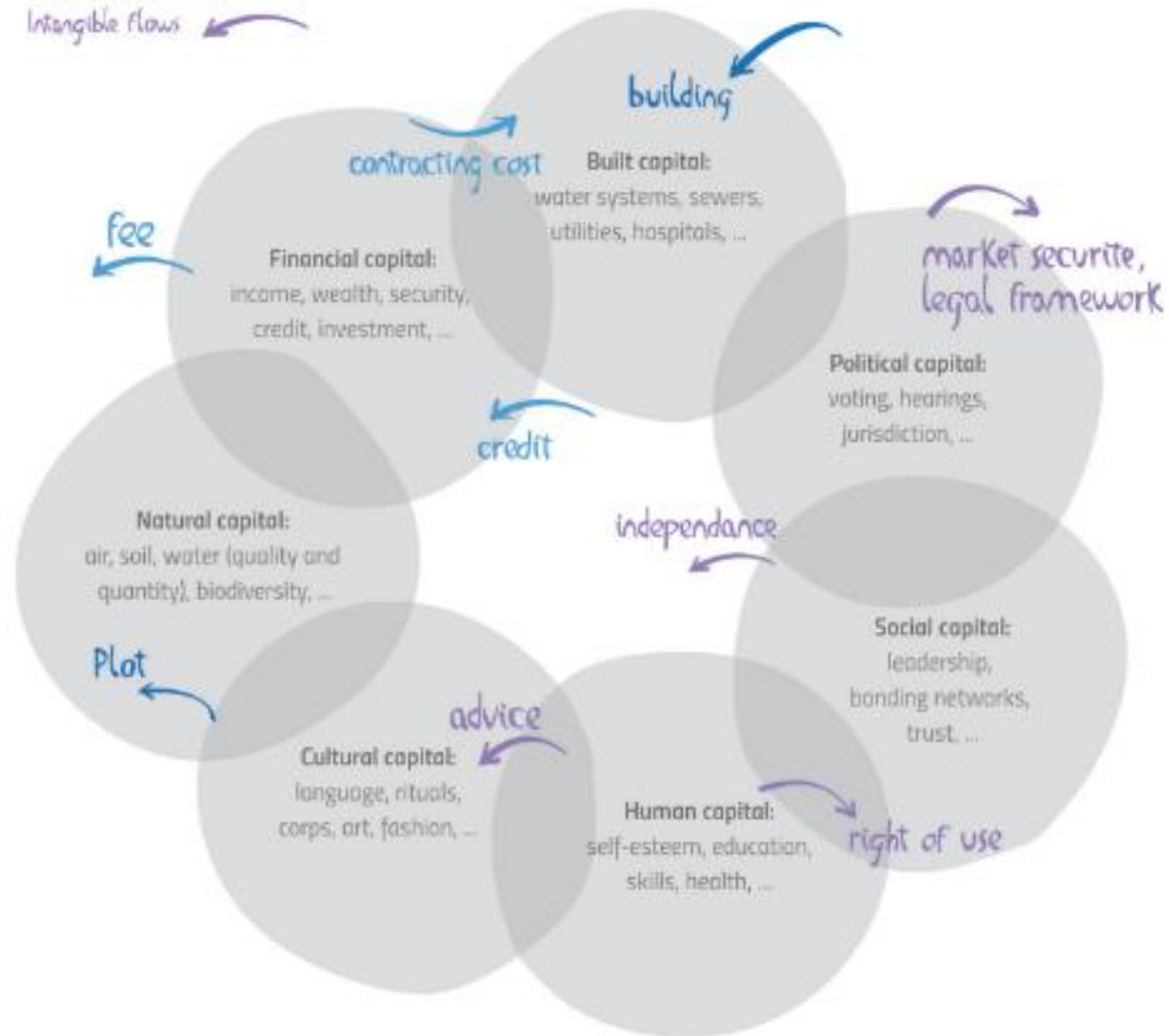
- **Nature of relationships:**

Collaborative, conflictual, mutual, etc

Power relations: rules (formal and informal); who gets to alter the rules? For whom do the rules favor?

Transactions (tangible and intangible)

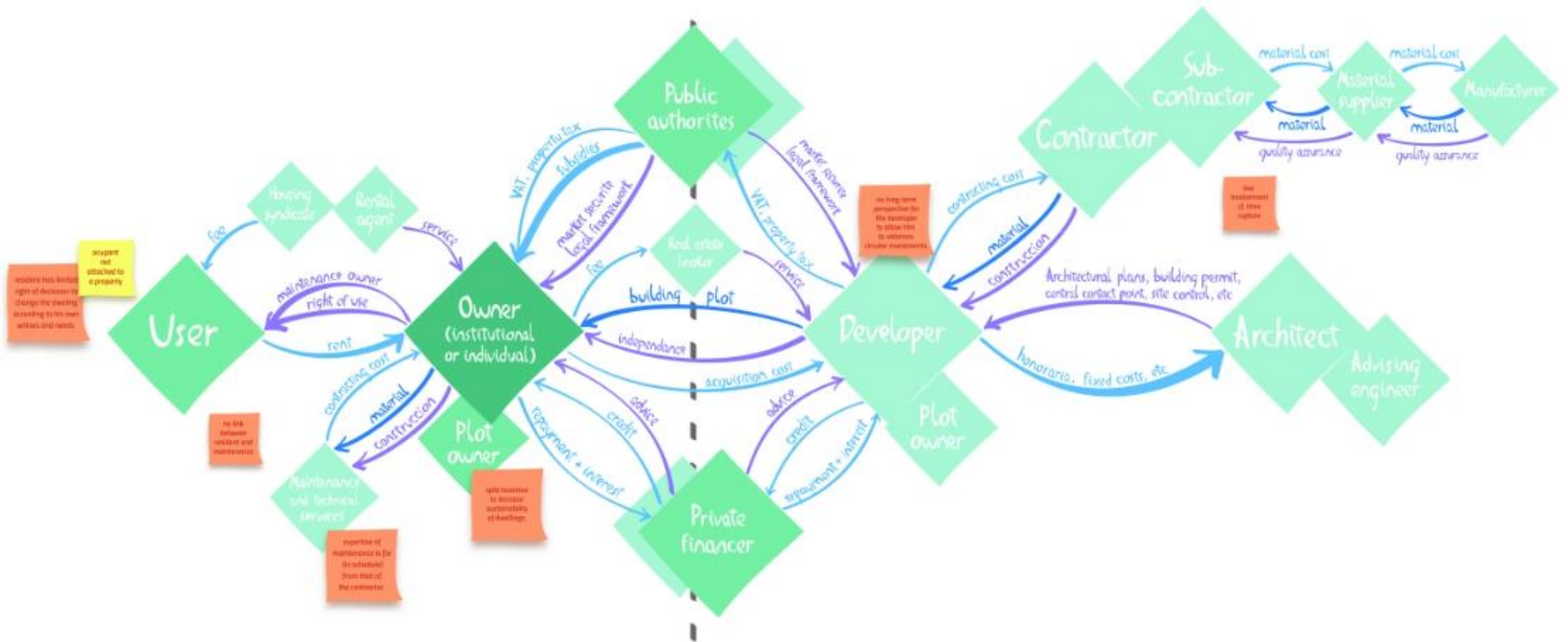
Financial flows
Material flows
Intangible flows



Actor mapping

Identify strengths and weaknesses

- At system level or at level of 1 or some roles
- Are all relevant actors involved? Do we miss particular actors?
- Do actors get what they need/expect from each other, do actors expect more?
- Do we need some reorganisation of relationships to maximize value creation? Redistribution of values and responsibilities?



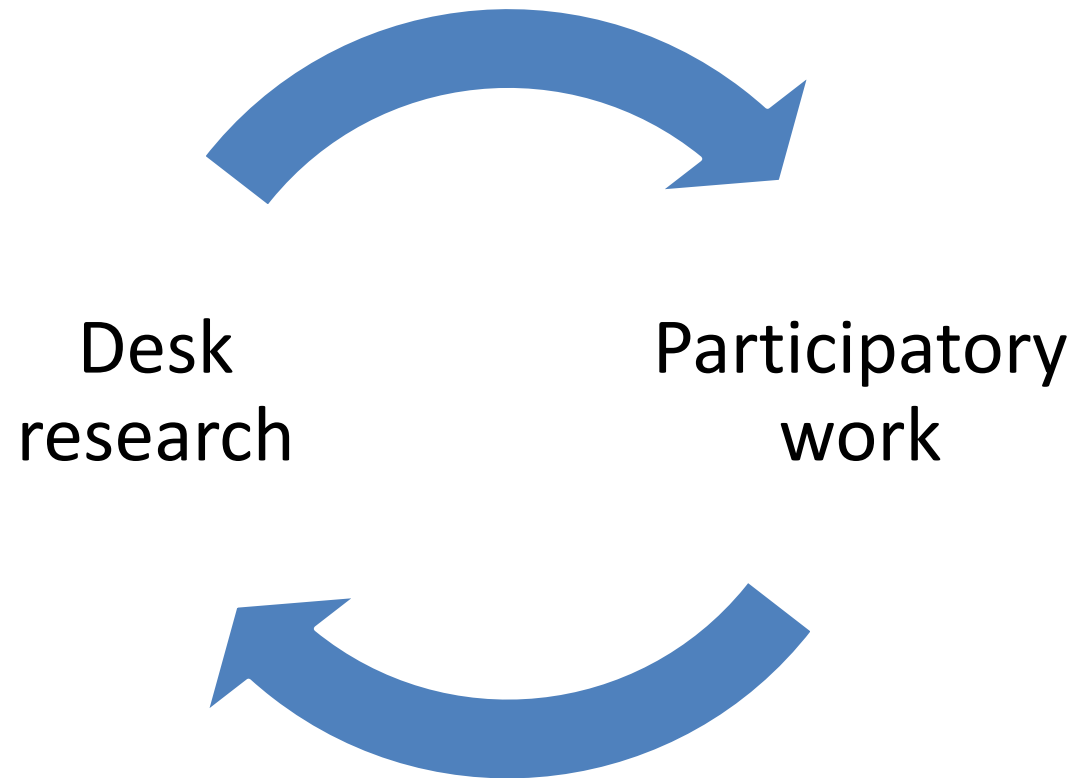
Value Network Mapping: a method for unravelling system relations – CRISTIAN MATTI

Actor mapping

From mapping to design

- Co-creation of interventions (new intermediary roles; reconnecting role; new transactions or the redistribution of value in existing transaction)
- Assess the relevance and feasibility of intervention
- Plan implementation of the intervention (resources required, who is involved, etc)

Actor mapping: the approach



References

- <https://transitionshub.climate-kic.org/publications/value-network-mapping/>
- Alvial Palavicino, C., Matti, C., & Witte, J. (2022). *Motion Handbook: Developing a Transformative Theory of Change*. Transformative Innovation Policy Consortium (TIPC); Utrecht University Centre for Global Challenges.
- Silvestri, G., Diercks, G., & Matti, C. (2022). *X-Curve. A sensemaking tool to foster collective narratives on system change*. DRIFT and EIT Climate-KIC