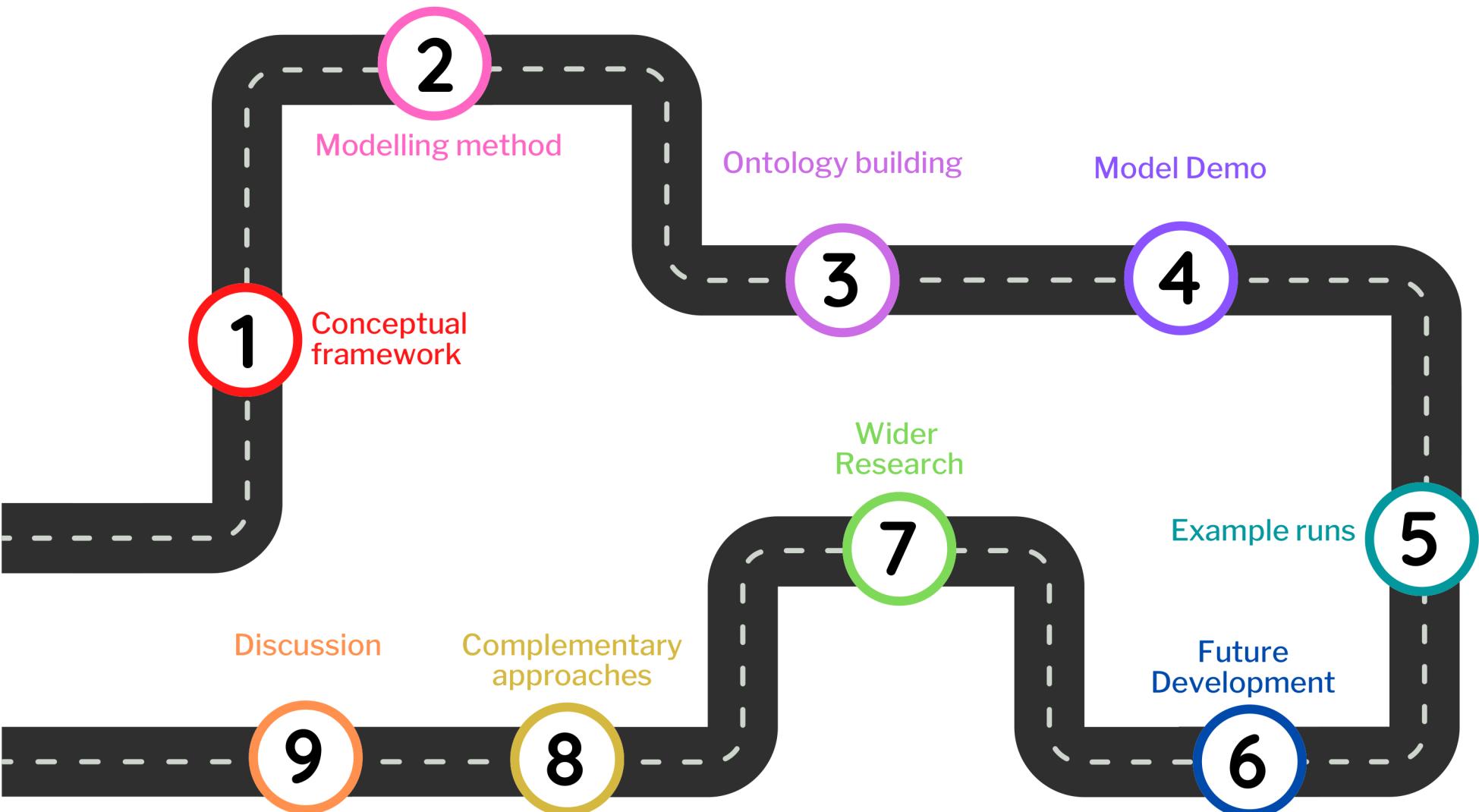




NOT-THAT-TRAGIC  
TRAGEDY OF THE COMMONS

# ROADMAP FOR TOTC



# Model Principles

## 3. Collective-choice arrangements

Group members must be able to create at least some of their own rules and make their own decisions by consensus. People hate being told what to do but will work for group goals that they have agreed upon

Communication

## 4. Monitoring

Managing a commons is inherently vulnerable to free-riding and active exploitation. Unless these undermining strategies can be detected at a relatively low cost by norm-abiding members of the group, the tragedy of the commons will occur

Cost of monitoring

Power associated with monitoring

## 5& 6 Conflict handling

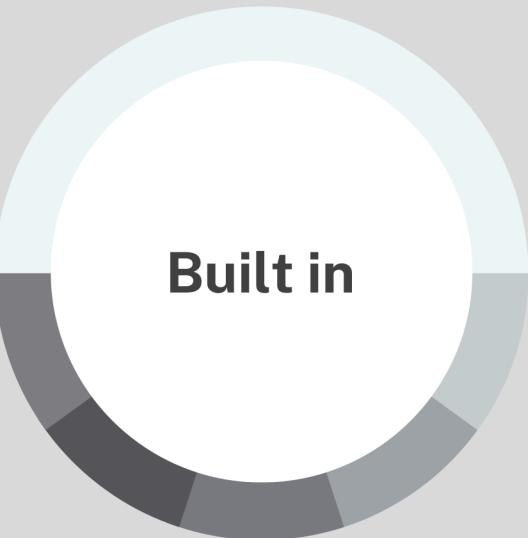
### 5.Graduated sanctions

Transgressions need not require heavy-handed punishment, at least initially. Often gossip or a gentle reminder is sufficient, but more severe forms of punishment must also be waiting in the wings for use when necessary

Cost proportional to frequency

### 6. Conflict resolution mechanisms

It must be possible to resolve conflicts quickly and in ways that are perceived as fair by members of the group



### 1. Clearly defined boundaries

The identity of the group and the boundaries of the shared resource are clearly delineated

### 7. Minimal recognition of rights to organise

Groups must have the authority to conduct their own affairs. Externally imposed rules are unlikely to be adapted to local circumstances and violate principle 3

## Target Outcome

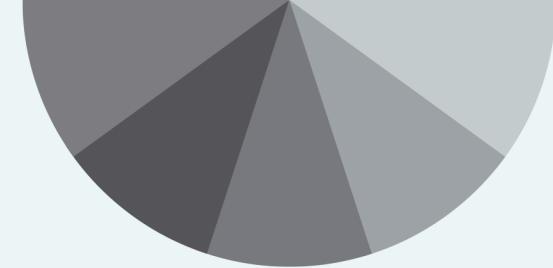
### 2. Proportional equivalence between benefits and costs

Members of the group must negotiate a system that rewards members for their contributions. High status or other disproportionate benefits must be earned. Unfair inequality poisons collective efforts

## Beyond the scope

### 8. For groups that are part of larger social systems, there must be appropriate coordination among relevant groups

Every sphere of activity has an optimal scale. Large scale governance requires finding the optimal scale for each sphere of activity and appropriately coordinating the activities, a concept called polycentric governance [20]. A related concept is subsidiarity, which assigns governance tasks by default to the lower jurisdiction, unless this is explicitly determined to be ineffective



# RESEARCH QUESTIONS

- UNDER WHAT CIRCUMSTANCES THE TRAGEDY OF THE COMMONS OCCURS?
- WHAT IS THE TRADEOFF BETWEEN GOVERNING & POLICING AND THEIR COST?

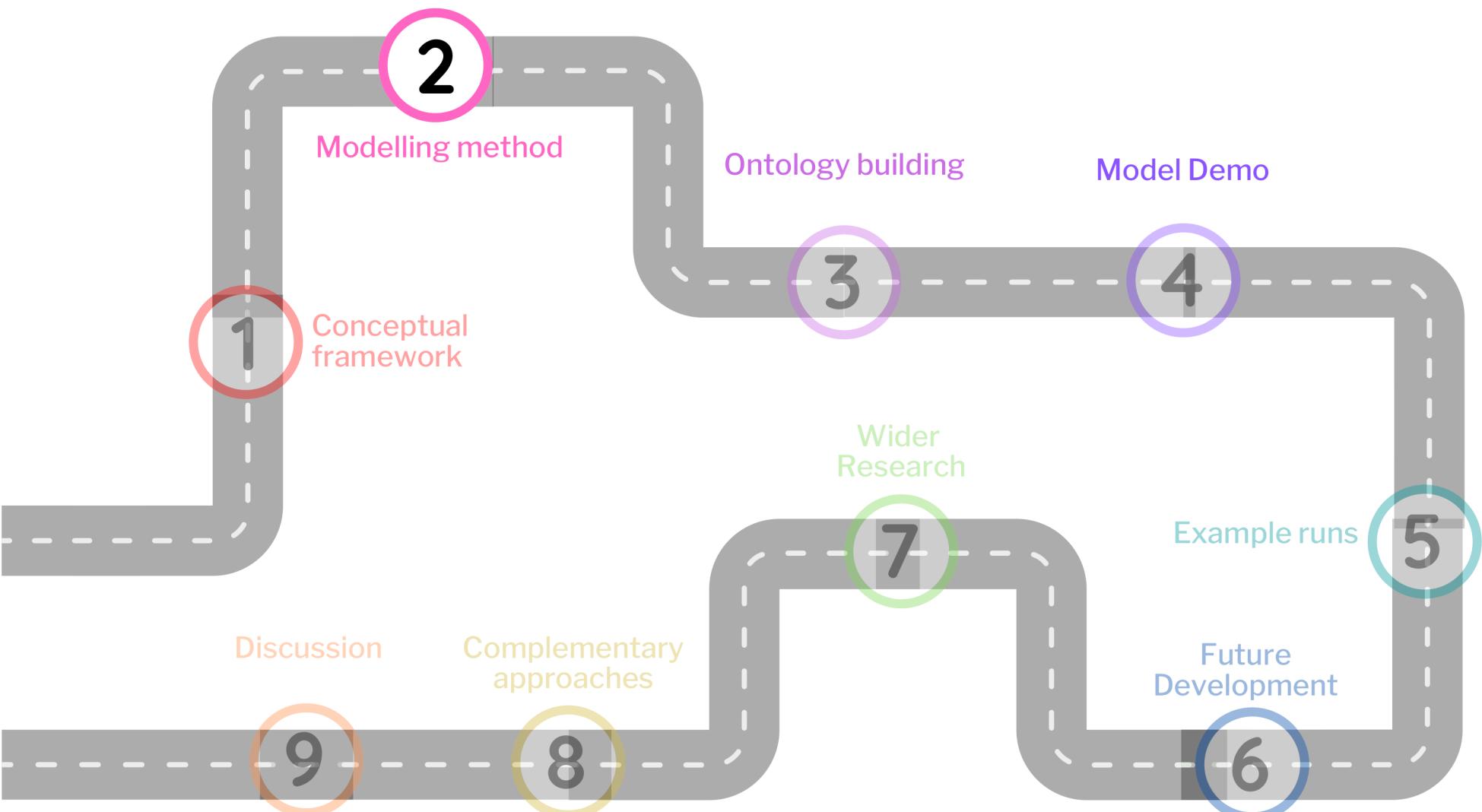
UNDER WHAT CIRCUMSTANCES THE TRAGEDY OF THE COMMONS OCCURS?

WHAT IS THE TRADE-OFF BETWEEN GOVERNING & POLICING AND THEIR COST?

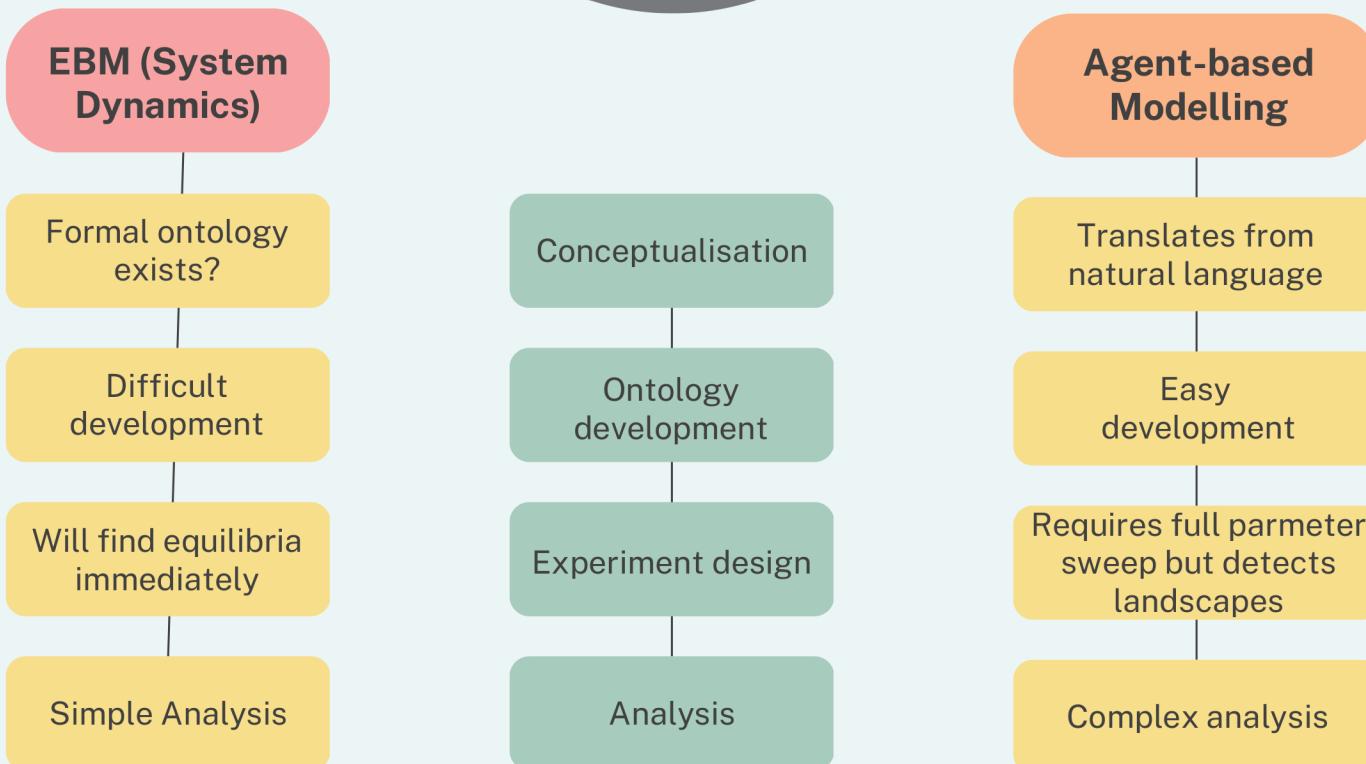
Output variable (to measure the results):  
**THE Tragedy**, i.e. all (most) cows are dead

Alternatives:  
count of all dead cows, no of herders still in business, eradication of defectors, grass, etc

# ROADMAP FOR TOTC

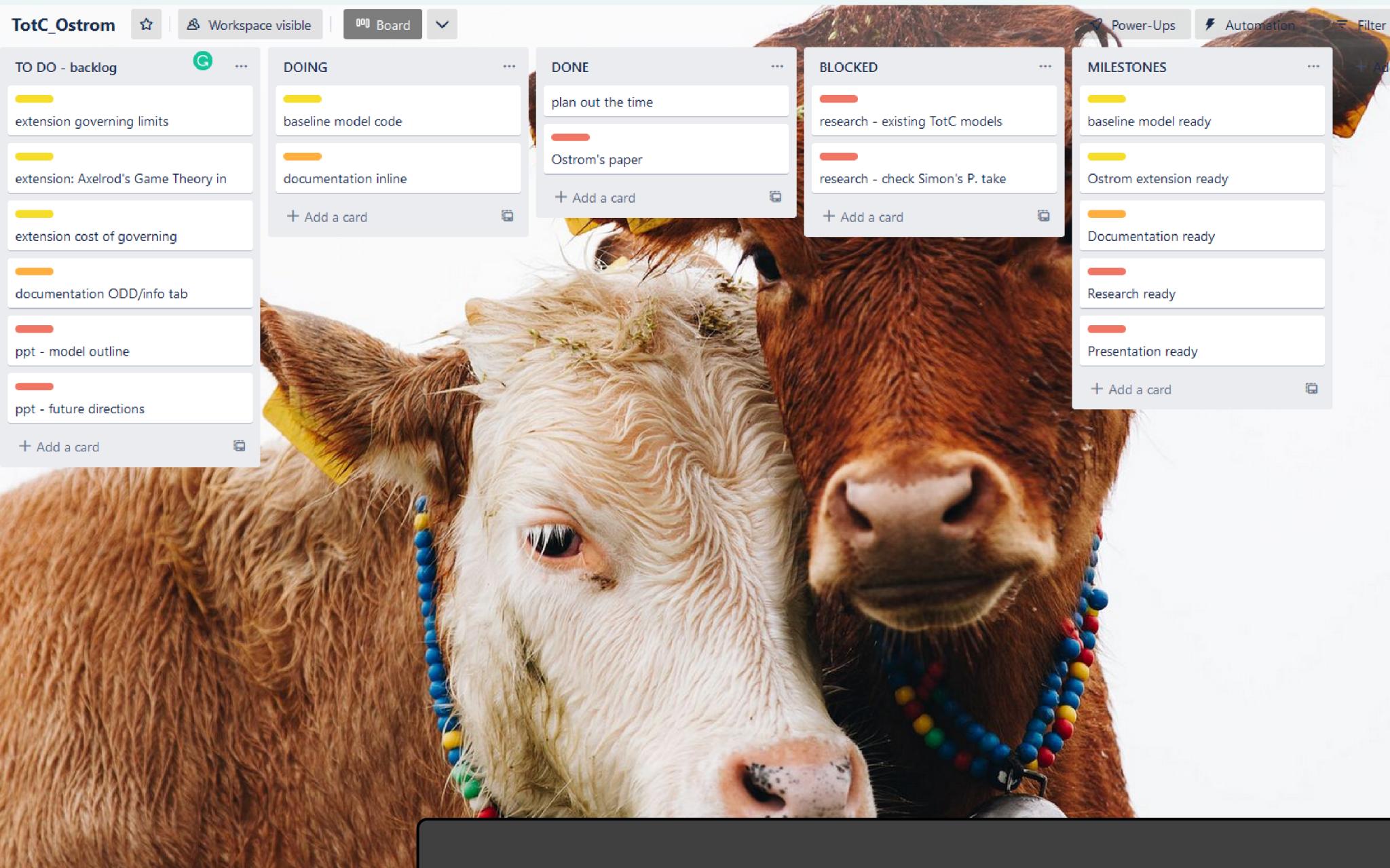


# Modelling Method



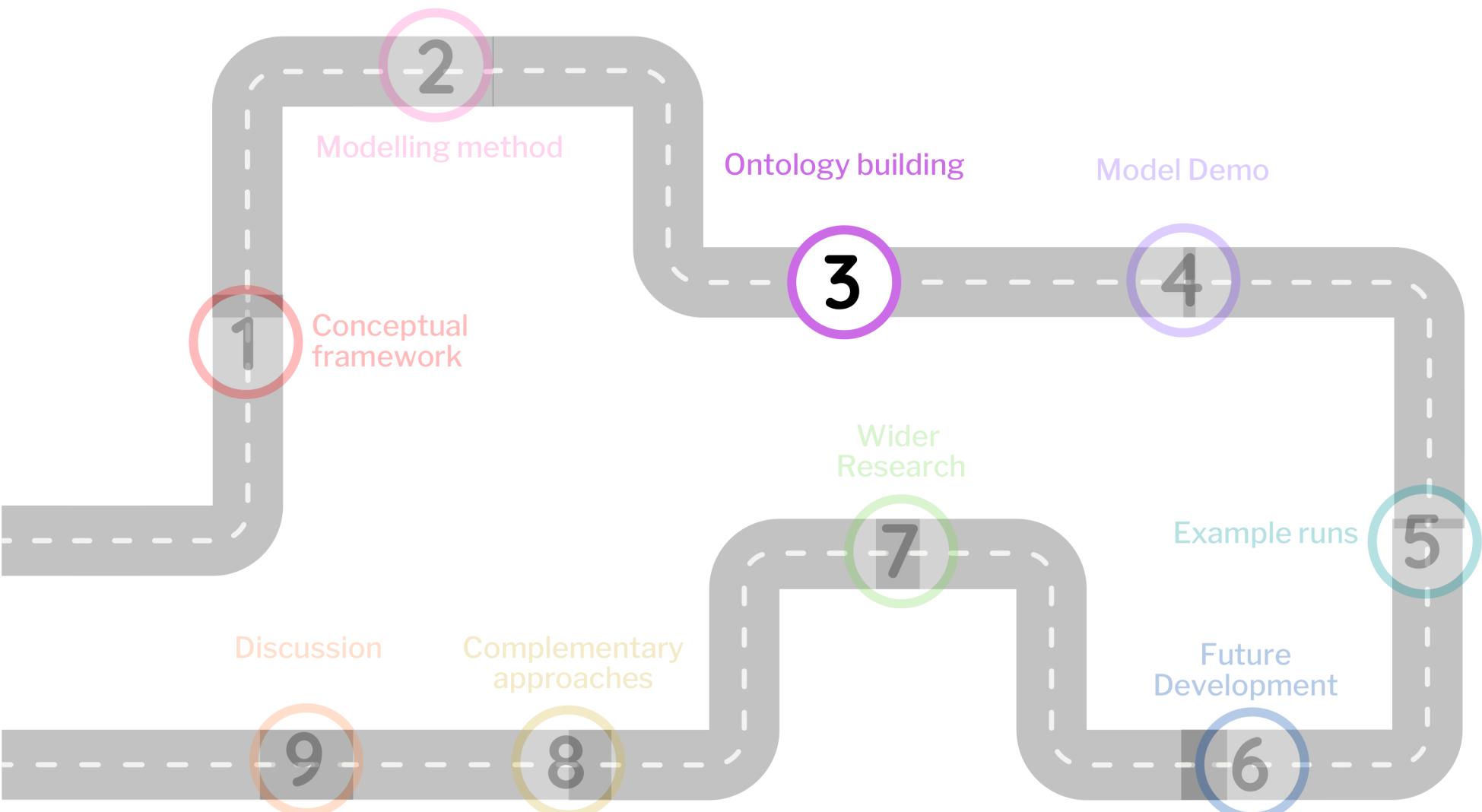
*Guest Editorial*, part of a Special Feature on [Empirical based agent-based modeling](#)  
**Empirically Based, Agent-based models**

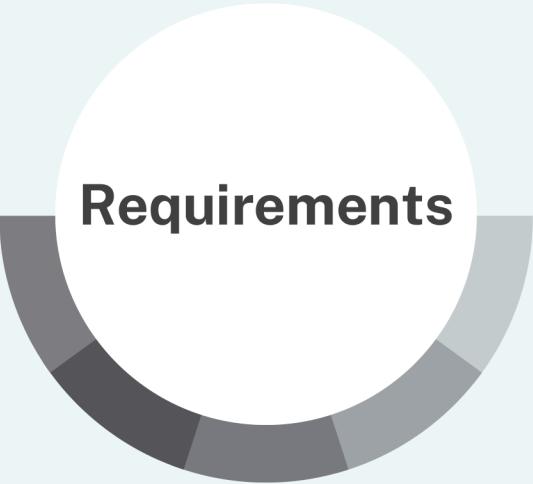
[Marco A. Janssen<sup>1</sup>](#) and [Elinor Ostrom<sup>2</sup>](#)



# TIME SPENT: 17 POMODOROS

# ROADMAP FOR TOTC





## Requirements

Herders - cows - grass - baseline TotC model

Death mechanism and regrowth mechanism

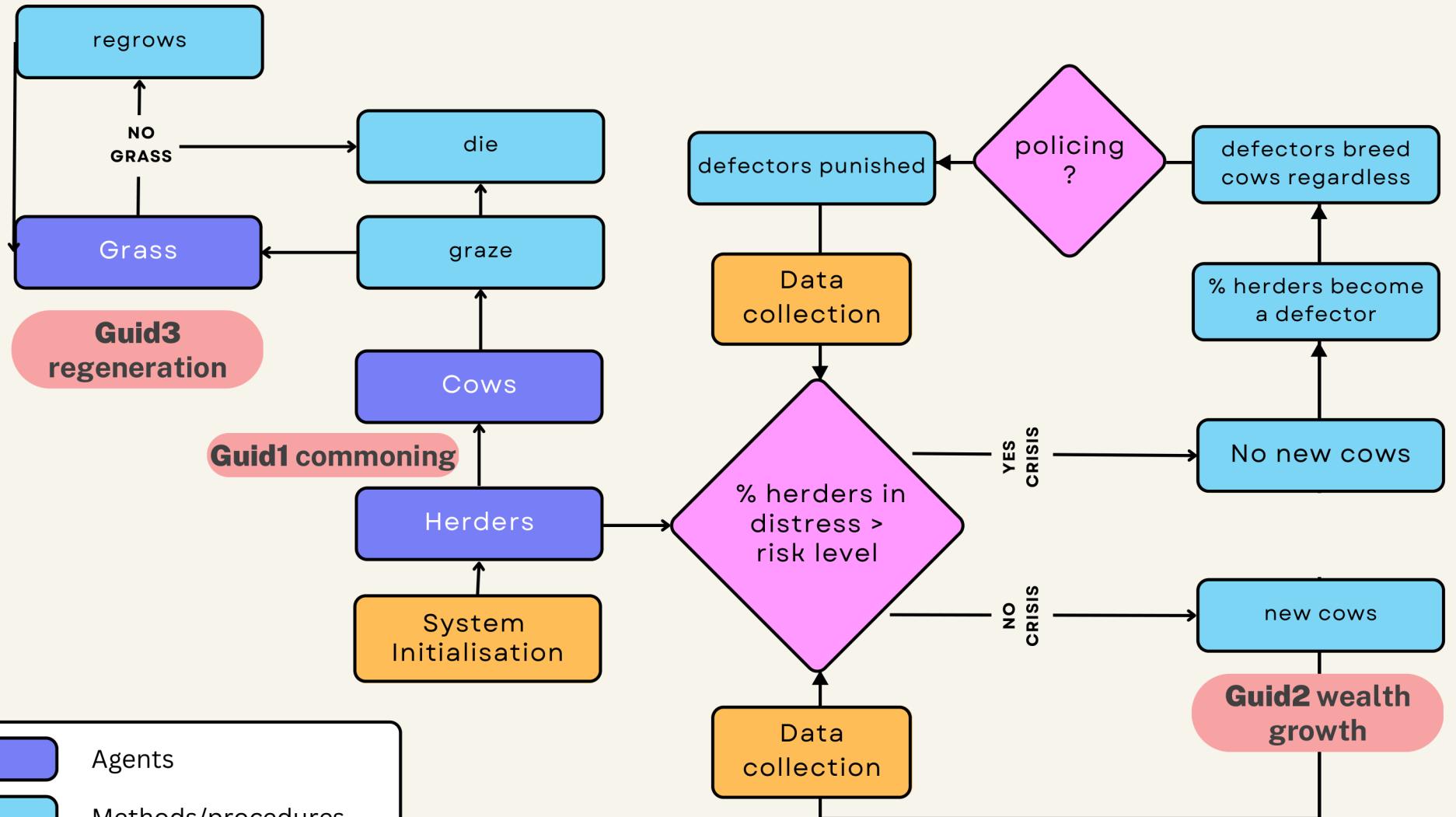
Wealth increase mechanism

Communication & cooperation (governing mechanism)

Unfair gain mechanism (defecting)

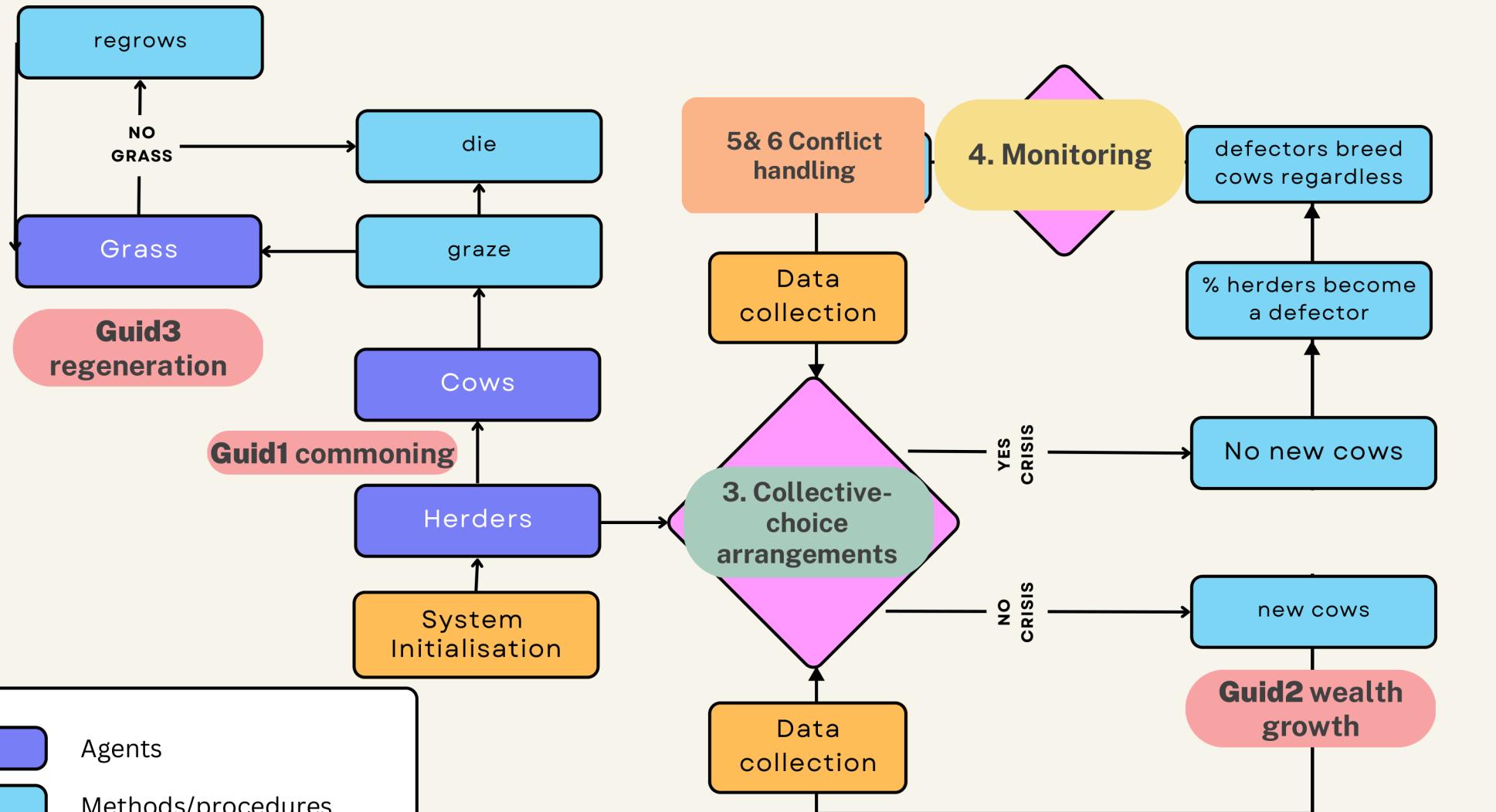
Policing mechanism, incl. cost

# Simulation flowchart



**Guid1.** Farmers share and interact with a common pasture by allowing their cows to graze  
**Guid2.** The more their cows graze, the wealthier they become  
**Guid3.** If cows don't continue to graze, the pasture will regrow at a certain rate  
**Guid4.** In the absence of commoning (i.e., governing rules), the tragedy of the commons would ensue; however, with governing rules intact, the pasture can continue to regenerate

# Simulation flowchart



**Guid1.** Farmers share and interact with a common pasture by allowing their cows to graze  
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## **Assumptions**

**Wealth measured in cows**

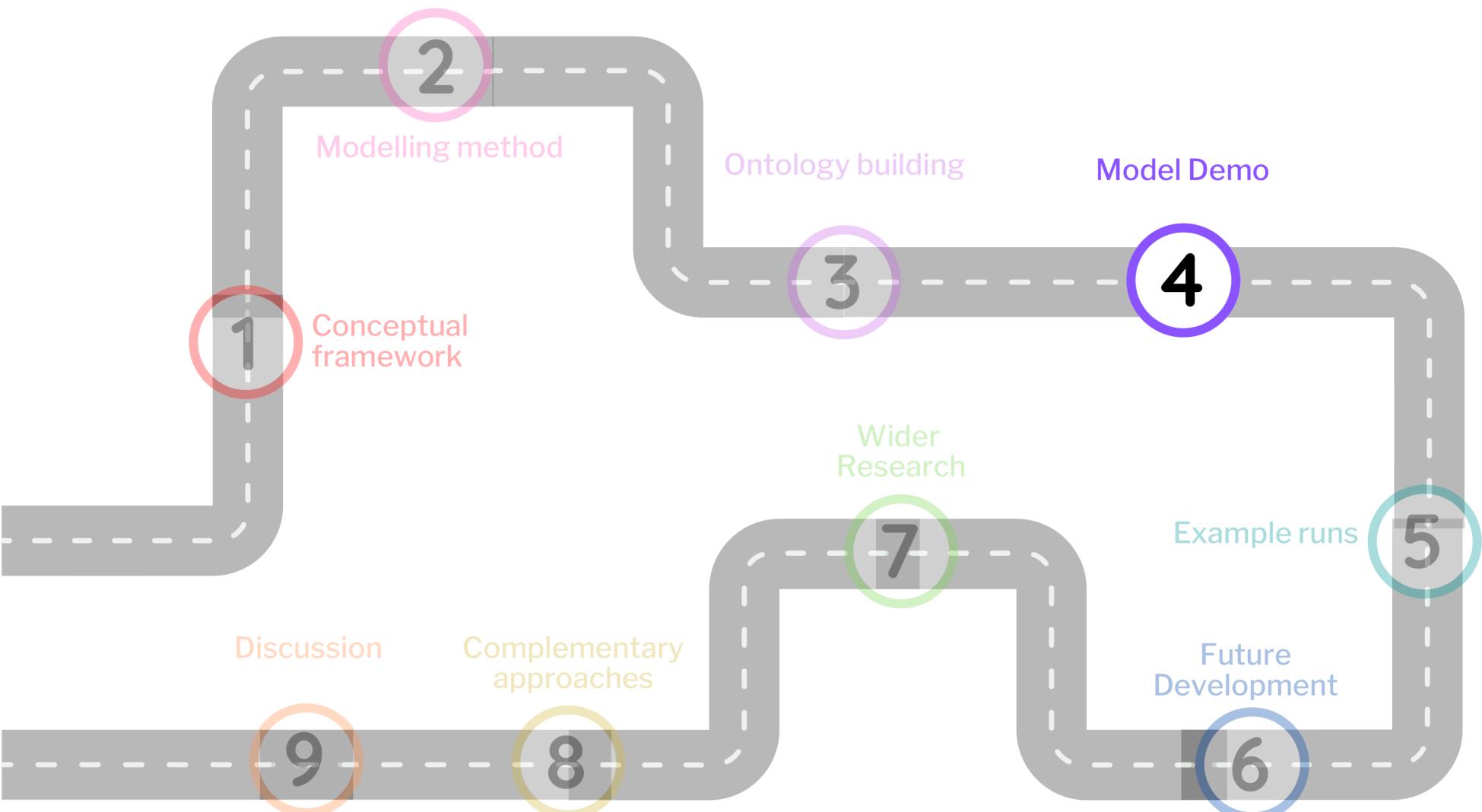
**Social dynamics: Game Theoretical framework**

**Static governing rules**

**Cost of policing is proportional to its effectiveness  
Borne by everyone**

**Punishment is double the transgression**

# ROADMAP FOR TOTC





## Model Repo

[https://github.com/izaromanowska/TotC\\_ABM](https://github.com/izaromanowska/TotC_ABM)

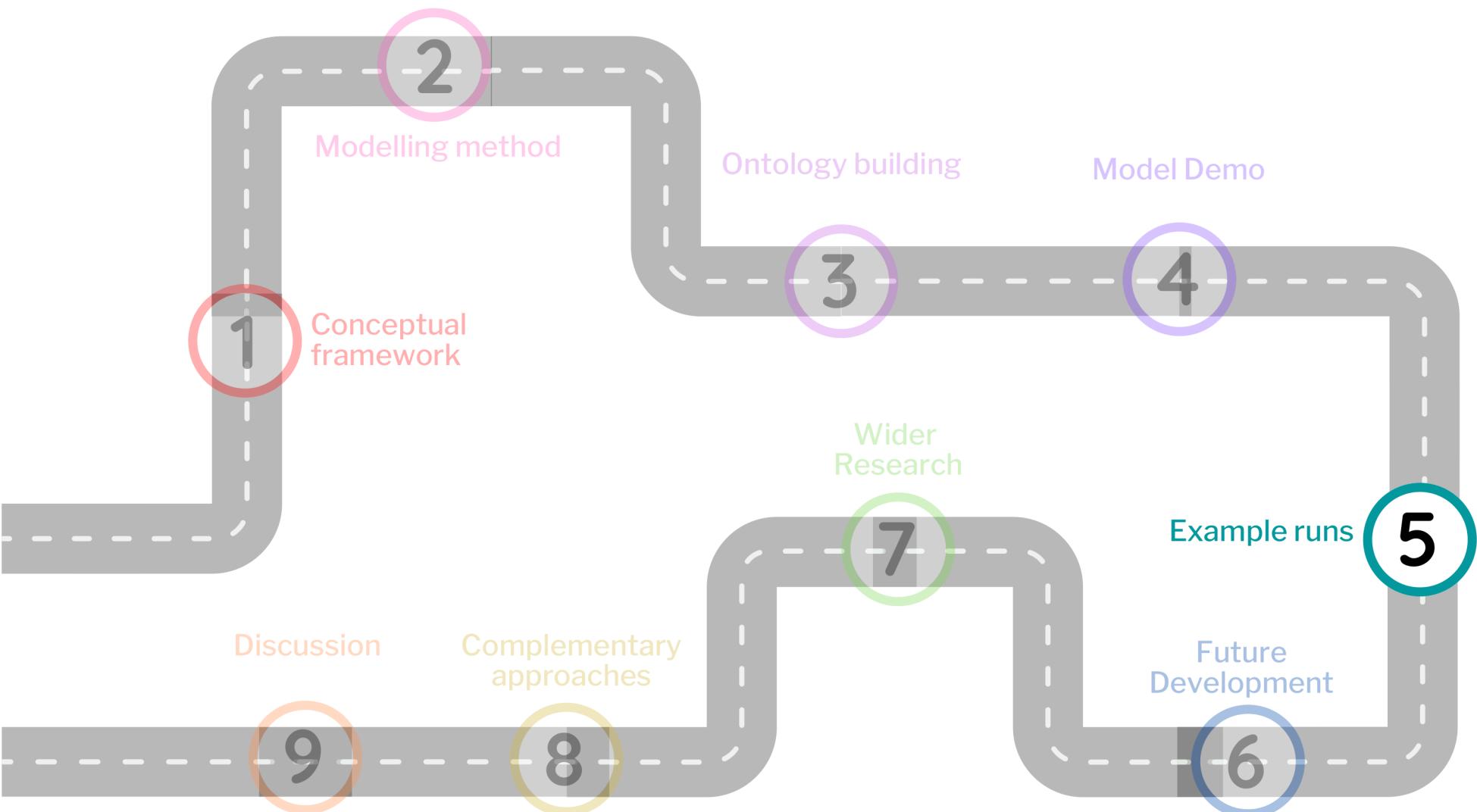
## Framework - NetLogo

<https://ccl.northwestern.edu/netlogo>

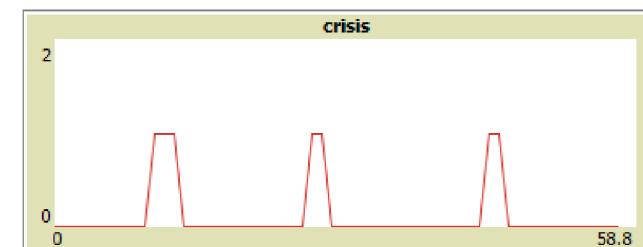
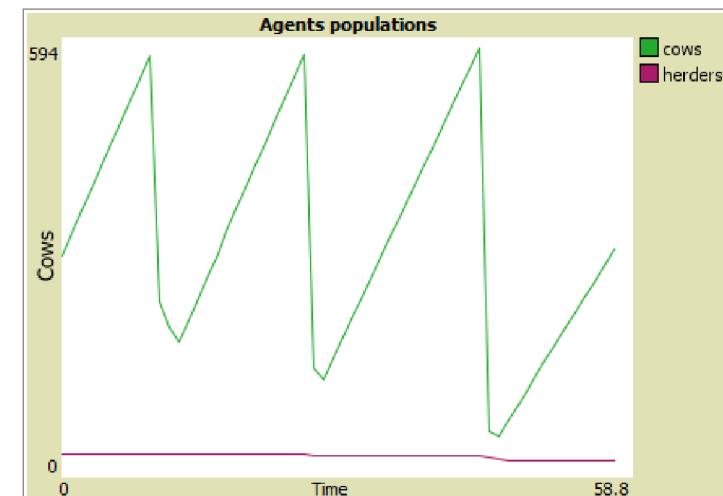
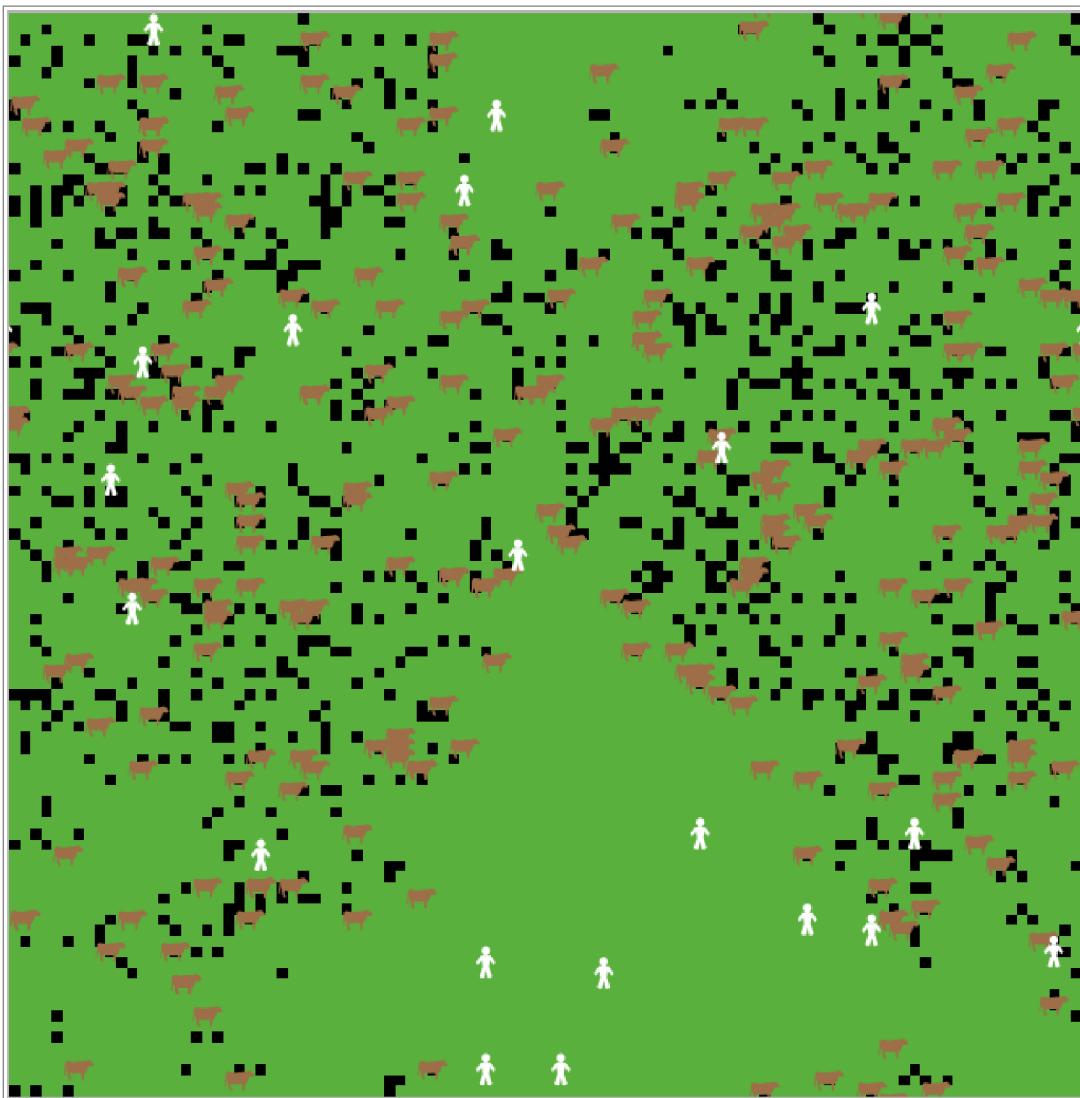
## NetLogo WEB

<https://www.netlogoweb.org/launch>

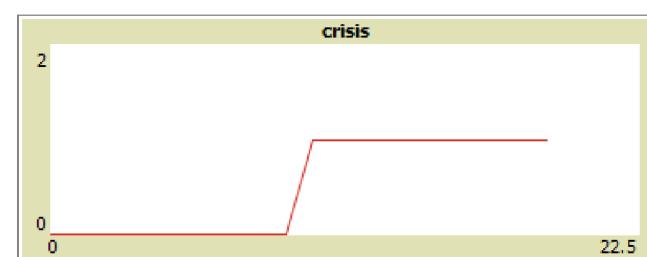
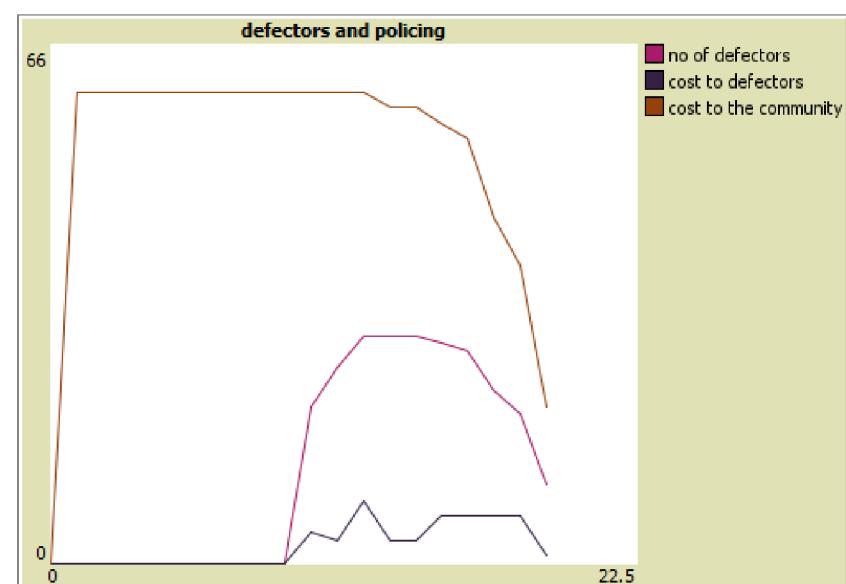
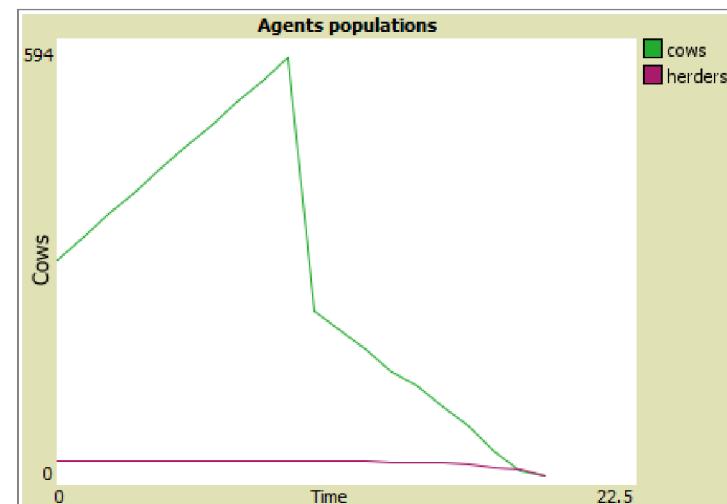
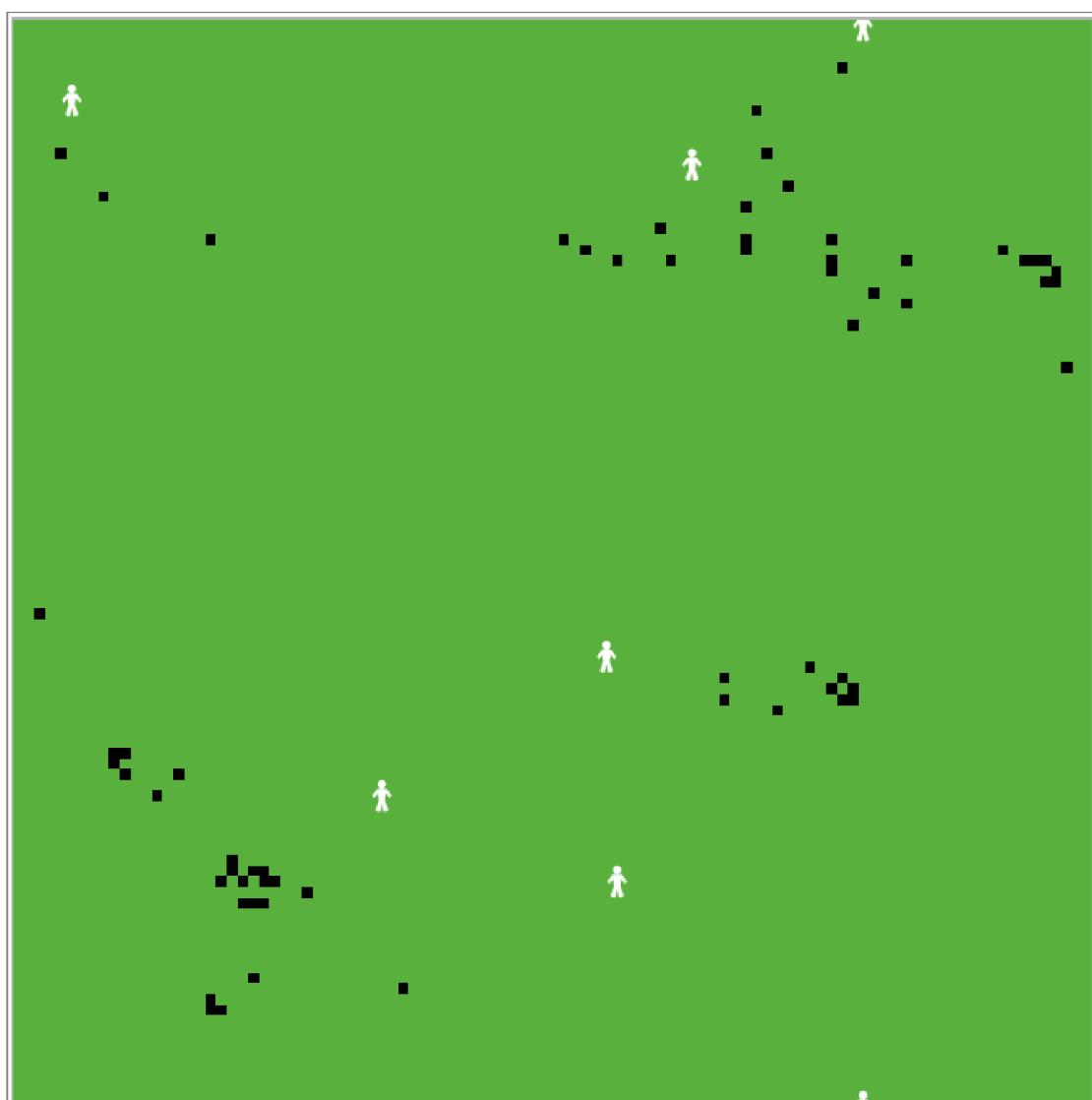
# ROADMAP FOR TOTC



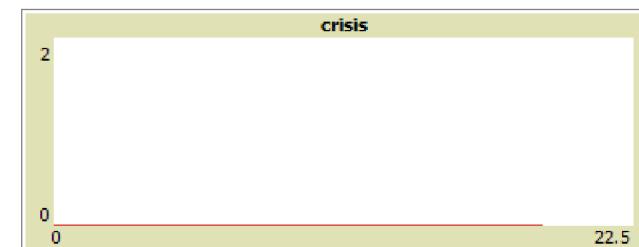
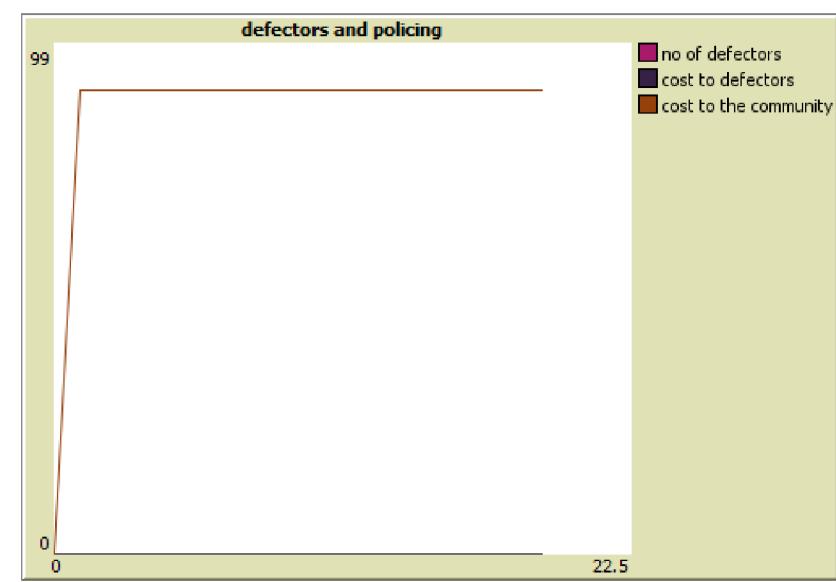
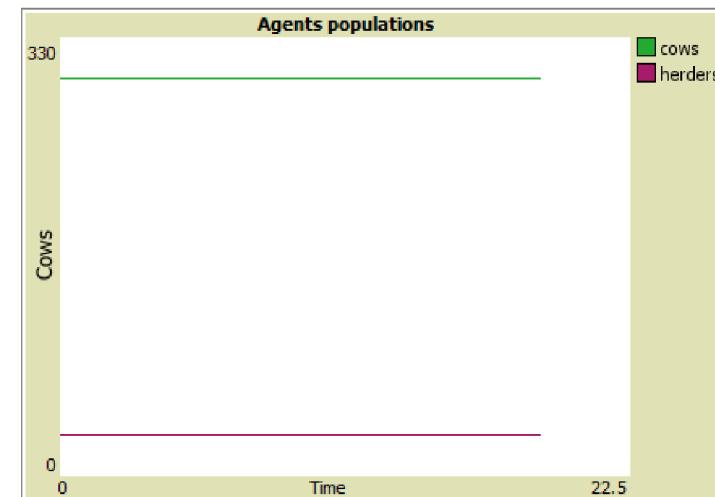
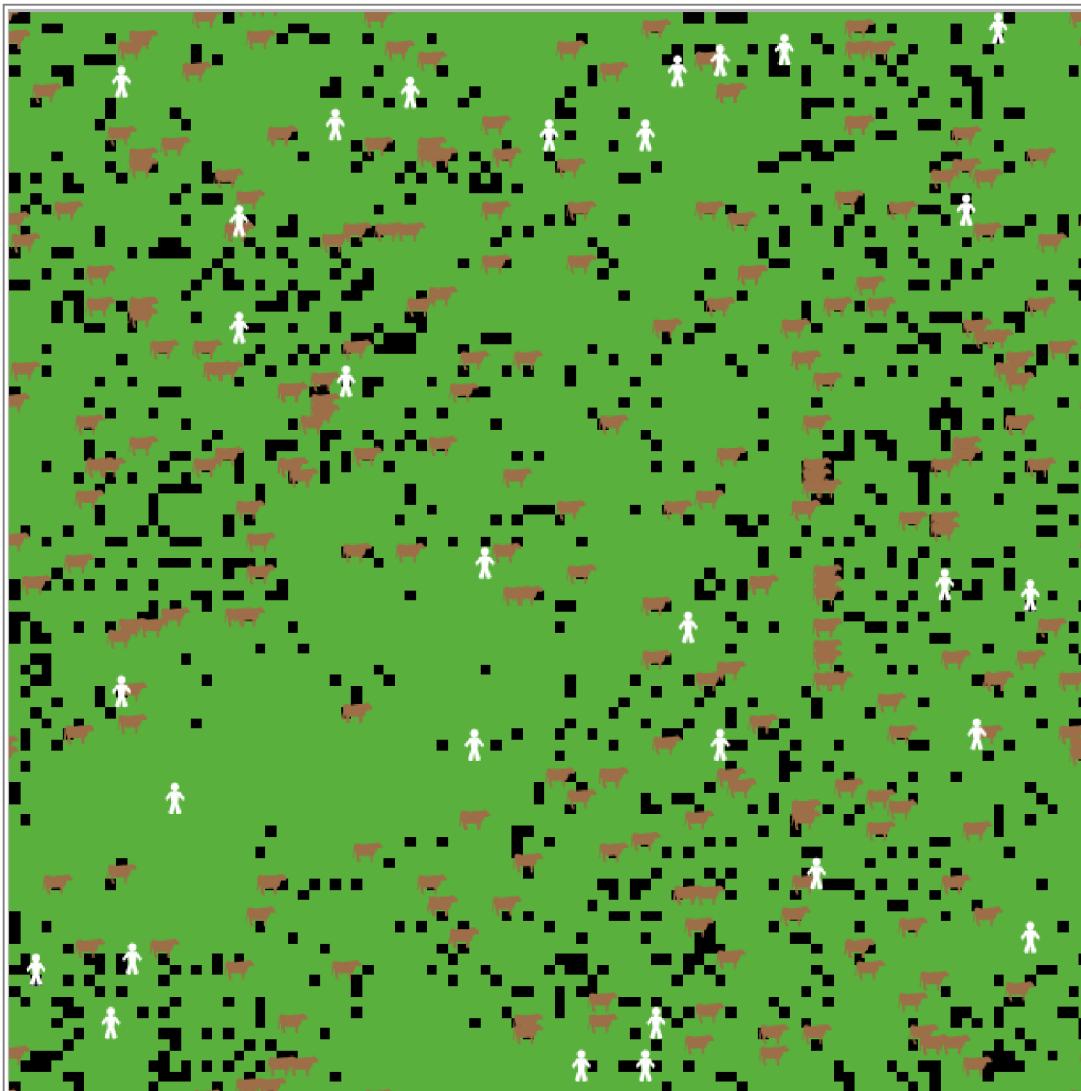
# REGULAR FLUCTUATIONS



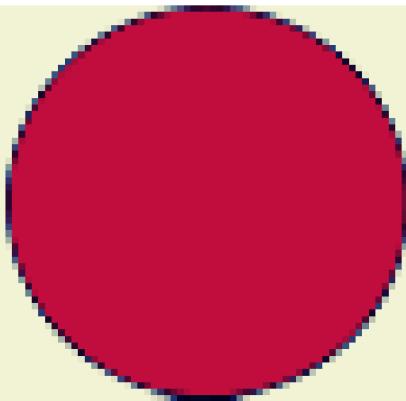
# COLLAPSE



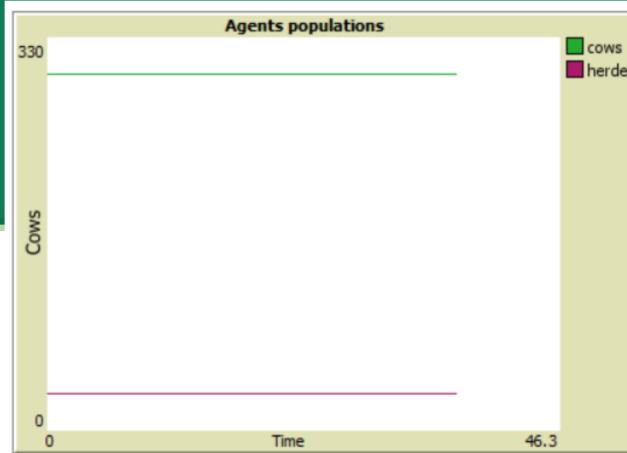
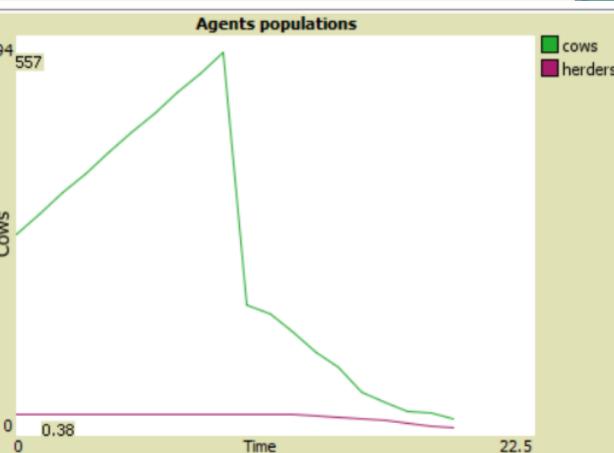
# STABLE!



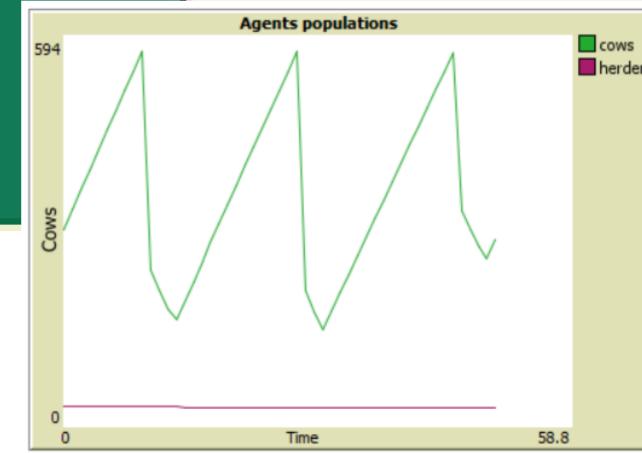
**Stable**  
cost of policing == new herds

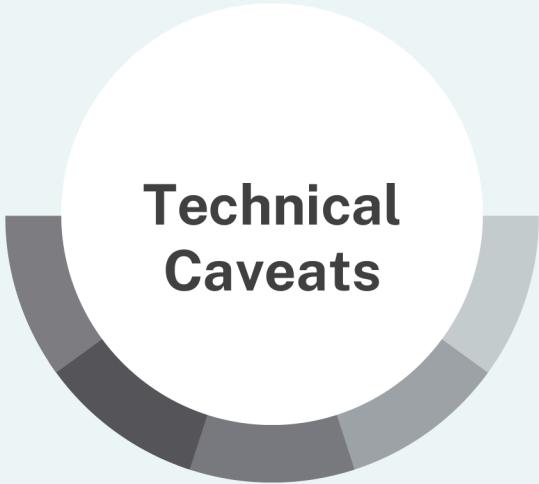


**Tragedy**  
overshot is too fast  
too risk averse



**Fluctuations**  
slower process  
they can lift themselves  
from the brink





## Technical Caveats

NetLogo is good for fast prototyping, but... sooo slooow

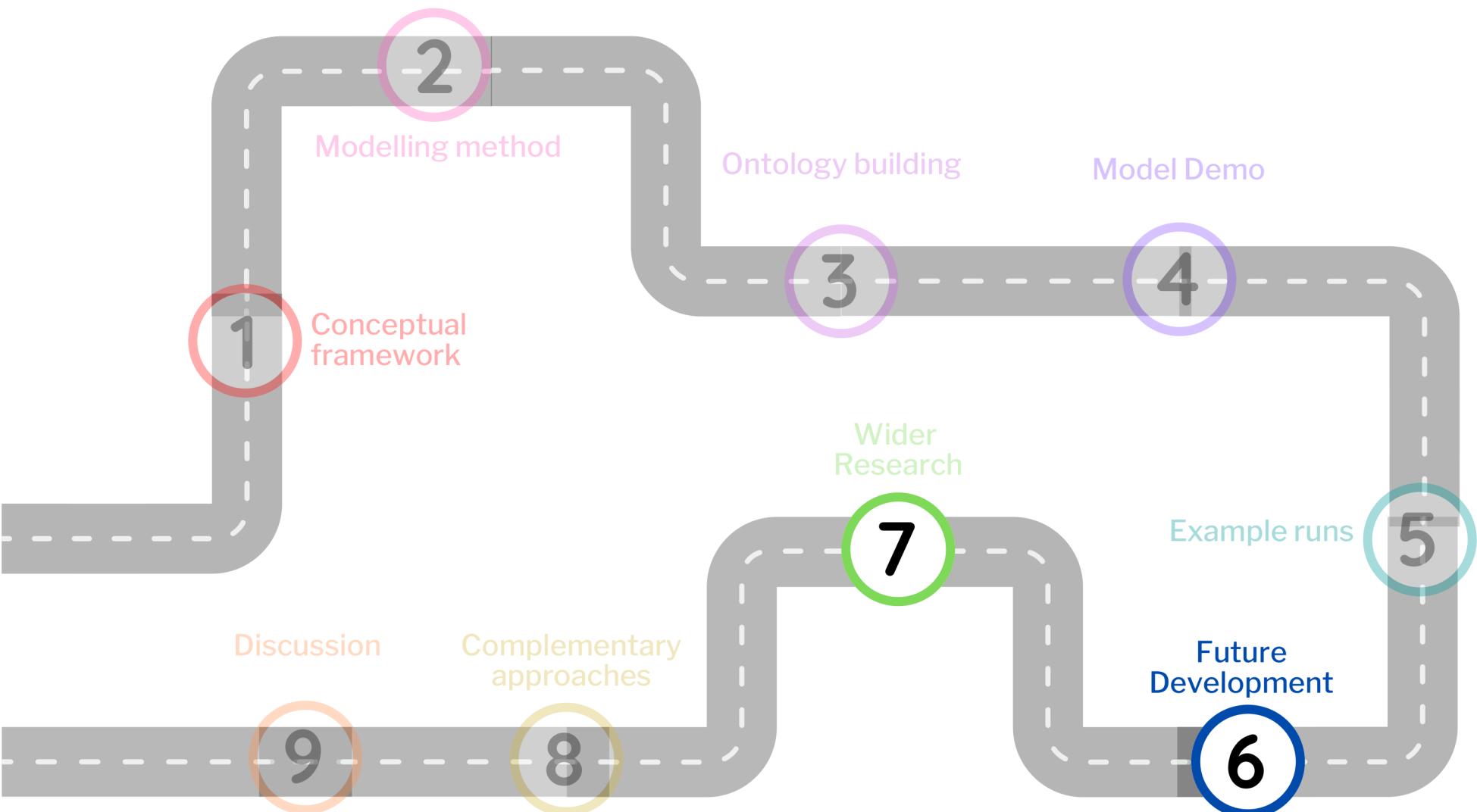
Next step: porting to Python

Code testing & optimisation

Full run and analytics

We could refactor into system dynamics

# ROADMAP FOR TOTC



# Rapid Literature Overview: Zotero + Research Rabbit

**1 selected paper**

Elinor Ostrom  
Governing the Commons  
↳ 1932  
No PDF

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governing the commons

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The Tragedy of the Commons

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- The Tragedy of the Commons: The Evolution of Institutions for Collective Action
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- On the Way Towards New Public Management? The Governance of University Systems in England, the Netherlands, Austria, and Germany
- Comparing Higher Education Governance Systems in Four European Countries
- Our common future
- The infrastructure of modernity: indirect social relationships, information technology, and social integration
- Chaos For the Halibut
- The Struggle to Govern the Commons
- Reforming foreign aid: the role of international public goods
- The Logic of Collective Action
- Cities: Managing densely settled social-ecological systems
- Panarchy: Understanding Transformations in Human and Natural Systems
- Political Ecology and the New Institutionalism
- The Tragedy of the Commons
- Geschicht und Kontext: De-Institutionalisierungsprozesse und geschlechtliche Differenzierung
- The New Institutionalism: Contradictory Notions of Change
- Resilience of ecosystems: local surprise and global change.
- Resilience and adaptive cycles
- Contemporary capitalism: the embeddedness of institutions
- The Internet and its social landscape
- Complex Systems: Chaos and Beyond: A Constructive Approach with Applications in Life Sciences
- A dynamic approach to forest regimes in developing economies
- Adaptive Co-management in Social-Ecological Governance
- Self-Governance Systems in Nepal: Institutions, Infrastructure, and Collective Action
- Selbststeuerung des Wissenschaft
- Between Facts and Norms
- Institutions, Institutional Change and Economic Performance
- Institutions, Institutional Change and Economic Performance
- Institutions, Institutional Change, and Economic Performance
- The logic of collective action: public goods and the theory of groups
- Delinking, re-linking and the perception of resource scarcity
- governing the commons
- Governing the Commons: The Evolution of Institutions for Collective Action
- Crafting Institutions for Self-Governing Irrigation Systems
- Understanding Institutional Diversity
- A General Theory for Analyzing Sustainability of Social-Ecological Systems
- The Drama of the Commons
- Rules, games, and common-pool resources
- Rules, Games, and Common-Pool Resources
- Institutional Theory in Political Science: The New Institutionalism
- Germany: A Latecomer to New Public Management
- Dryland Coping with Uncertainty, Thresholds, and Changes in State
- The Logic of Collective Action: Public Goods and the Theory of Groups.
- Environmental Sustainability of Water Projects
- Village Republic: Economic Conditions for Collective Action in South India

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1. Agent Decision Making

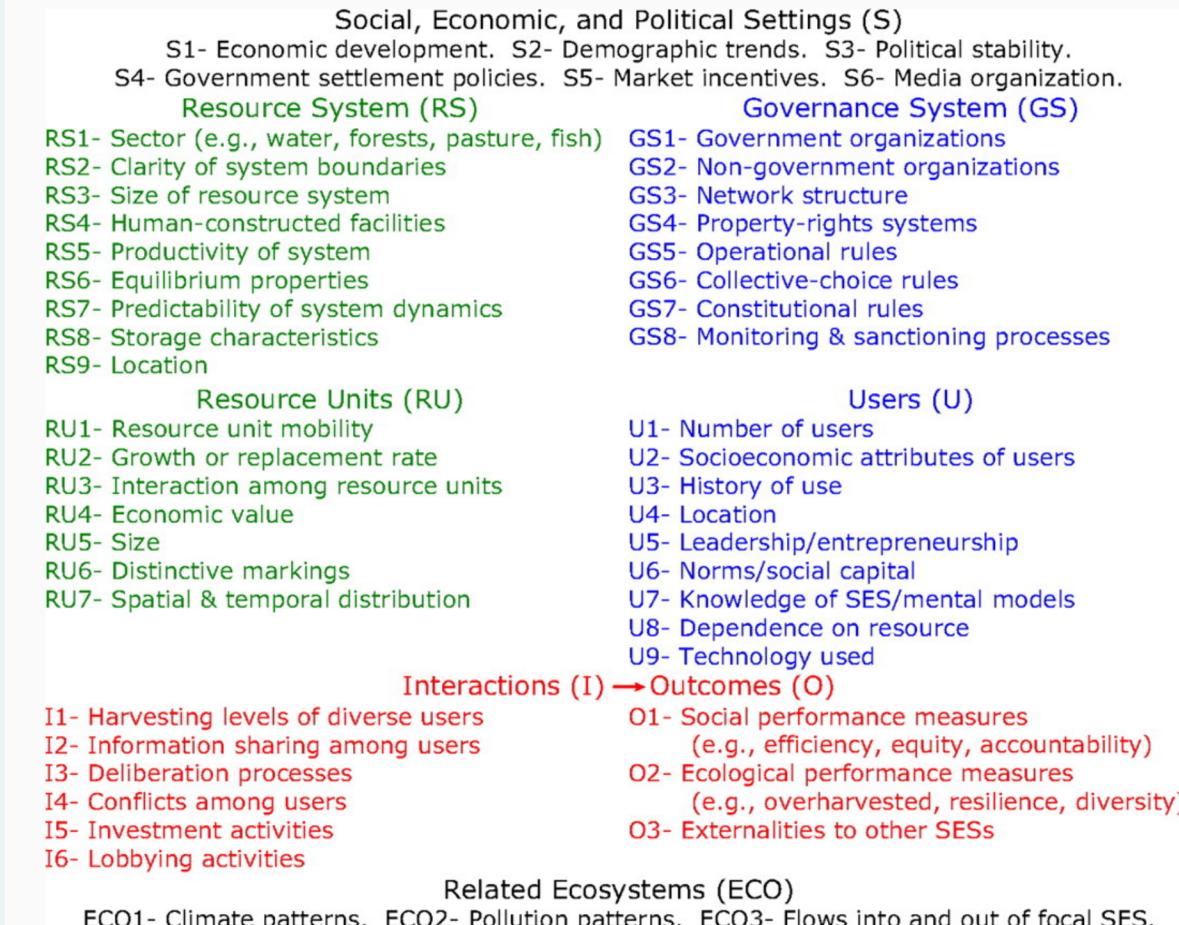
2. Dynamic social structure (evolution)

3. Diverse & multiple resources

4. Dynamic power dynamics

5. Farmers satisficing (as per H. Simon)

# General Framework kindly provided by Ostrom herself



Ostrom, Elinor. 2009. "A General Framework for Analyzing Sustainability of Social-Ecological Systems." *Science*.  
<https://doi.org/10.1126/science.1172133>.

# Critical directions of development

## Includes (well hidden in the SI) a formalised GT model for decision making

of harvesting with existing operational rules ( $GS5E$ ), which may be open access, with the expected benefits using a new set of operational rules ( $GS5N$ ). Each user  $i$  must ask whether his/her incentive to change ( $D_i$ ) is positive or negative.

$$D_i = B_i GS5N - B_i GS5E, \quad (1)$$

where  $B_i$  is expected benefits. If  $D_i$  is negative for all users, no one has an incentive to change and they will not self-organize. If  $D_i$  is positive for some users, they then need to estimate three types of expected costs:

- C1: Up-front costs of time and effort spent devising and agreeing upon new rules;
- C2: The short-term costs of implementing new rules; and
- C3: The long-term costs of monitoring and maintaining a self-governed system over time.

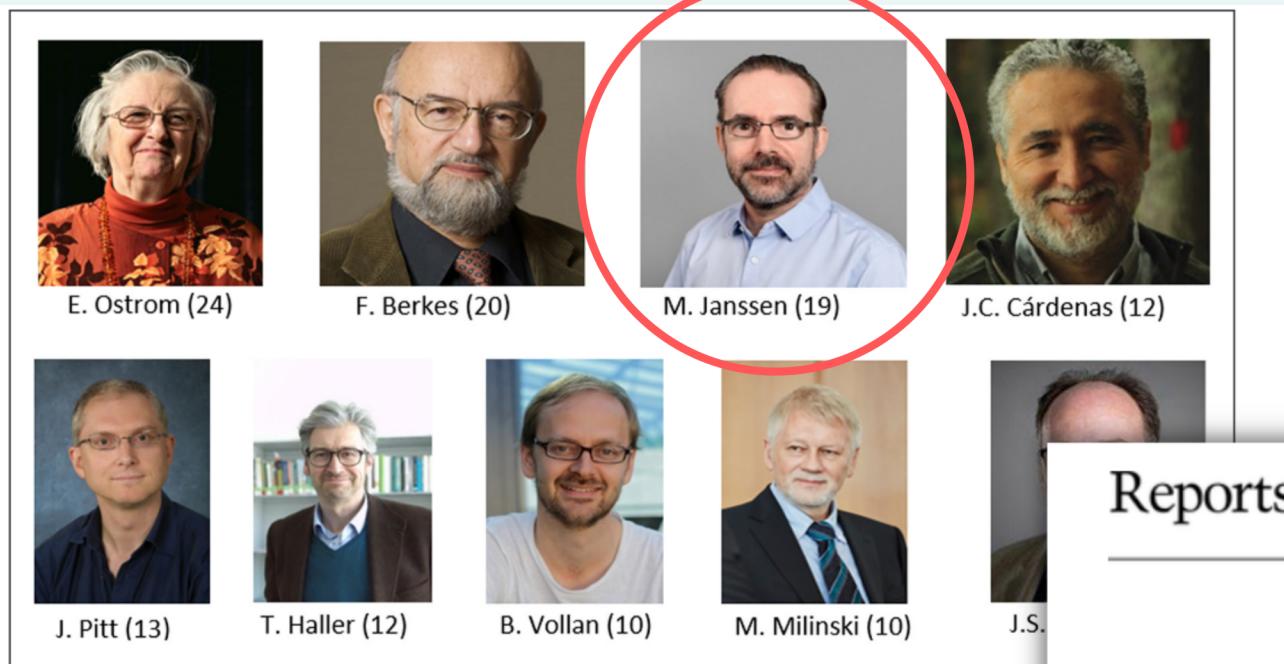
If the sum of these three costs for all users exceeds the incentive to change, no user will invest the time and resources needed to create new institutions. Thus, if

$$D_i < (C1_i + C2_i + C3_i) \quad (2)$$

for all  $i \in U$ , no change occurs. But, if for at least one coalition  $K \subset U$  there is a “winning

### 1. Agent Decision Making

# Rapid Literature Overview: Zotero + Research Rabbit



**Figure 5:** Most prolific authors.

## Reports

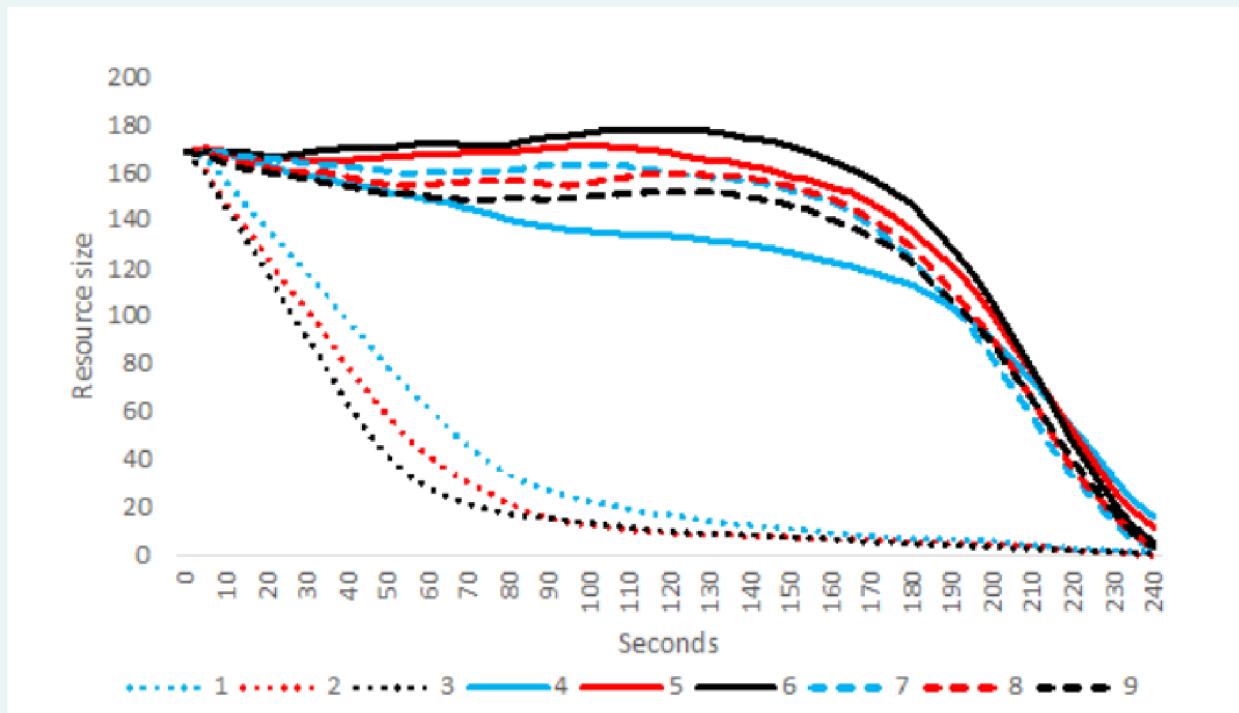
Sunk-Cost Effects and  
Vulnerability to Collapse in  
Ancient Societies<sup>1</sup>

Laerhoven, Frank van, Michael Schoon, and Sergio Villamayor-Tomas. 2020.  
“Celebrating the 30th Anniversary of Ostrom’s Governing the Commons: Traditions  
and Trends in the Study of the Commons, Revisited.” *International Journal of the  
Commons* 14 (1): 208–24. <https://doi.org/10.5334/ijc.1030>.

MARCO A. JANSEN, TIMOTHY A. KOHLER, AND  
MARTEN SCHEFFER  
Center for the Study of Institutions, Population, and  
Environmental Change, Indiana University, 408 N.  
Indiana Ave, Bloomington, Ind. 47408-2700, U.S.A.

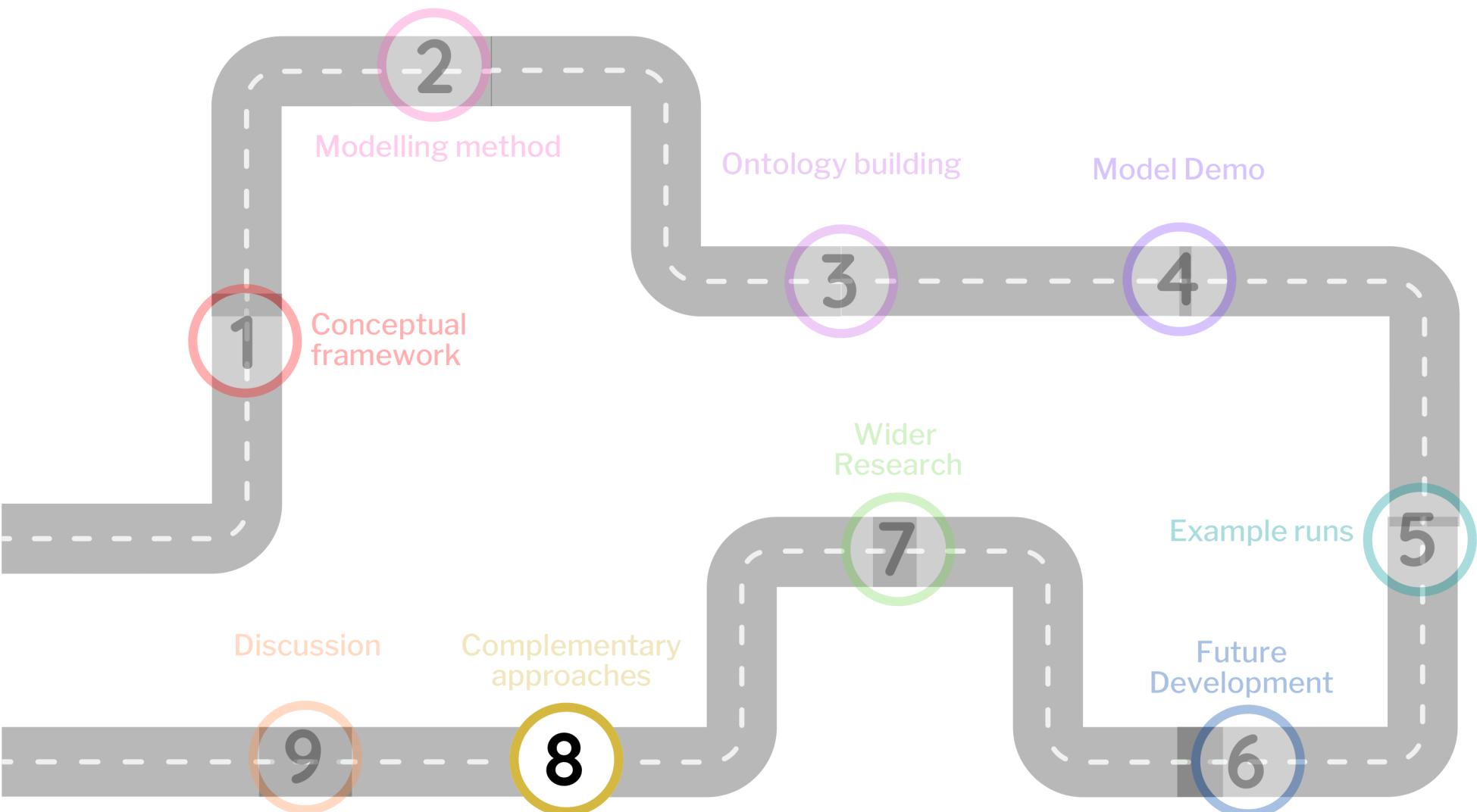
# Rapid Literature Overview: Zotero + Research Rabbit

## 3. Diverse & multiple resources



Janssen, Marco A., Daniel DeCaro, and Allen Lee. 2022. "An Agent-Based Model of the Interaction Between Inequality, Trust, and Communication in Common Pool Experiments." *Journal of Artificial Societies and Social Simulation* 25 (4): 3. <https://doi.org/10.18564/jasss.4922>.

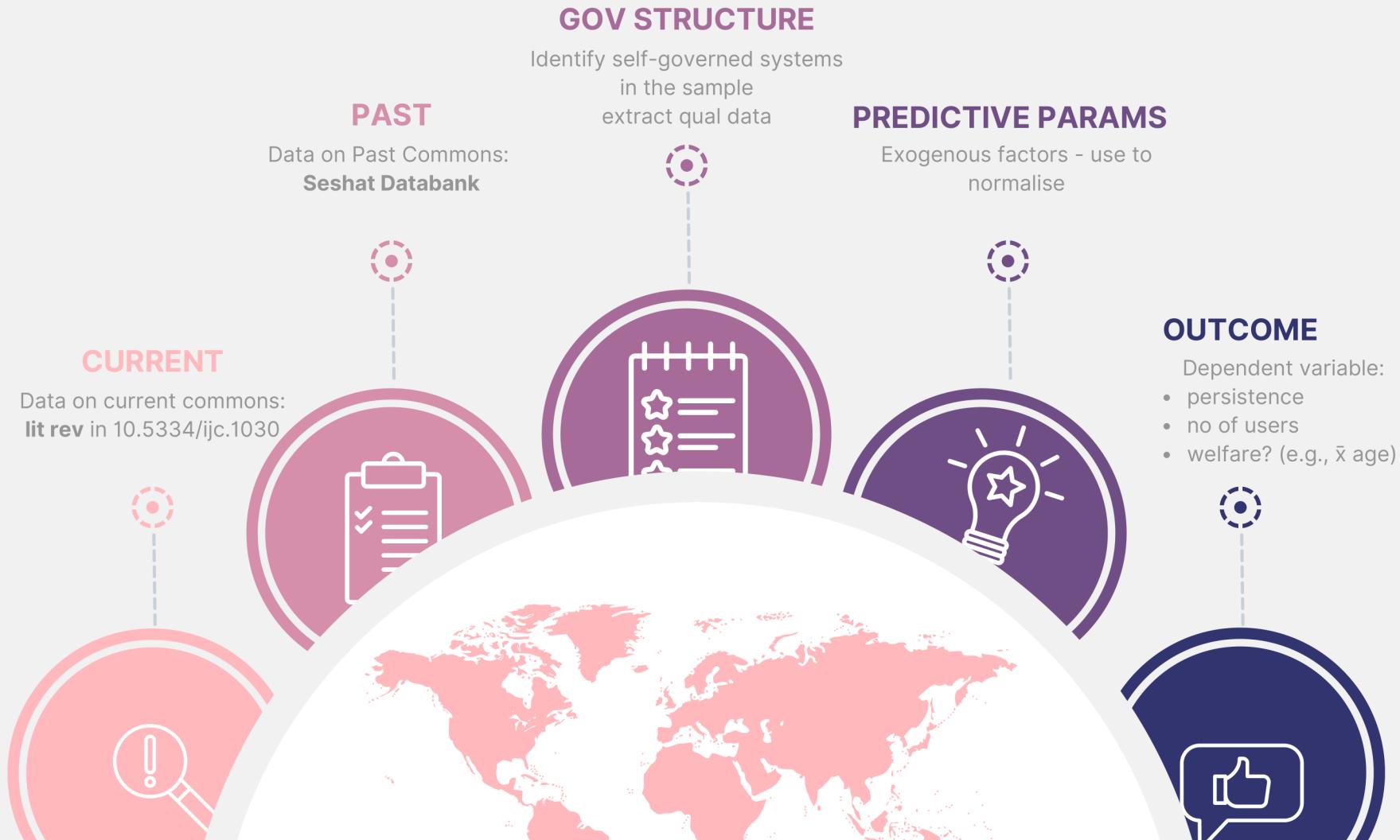
# ROADMAP FOR TOTC



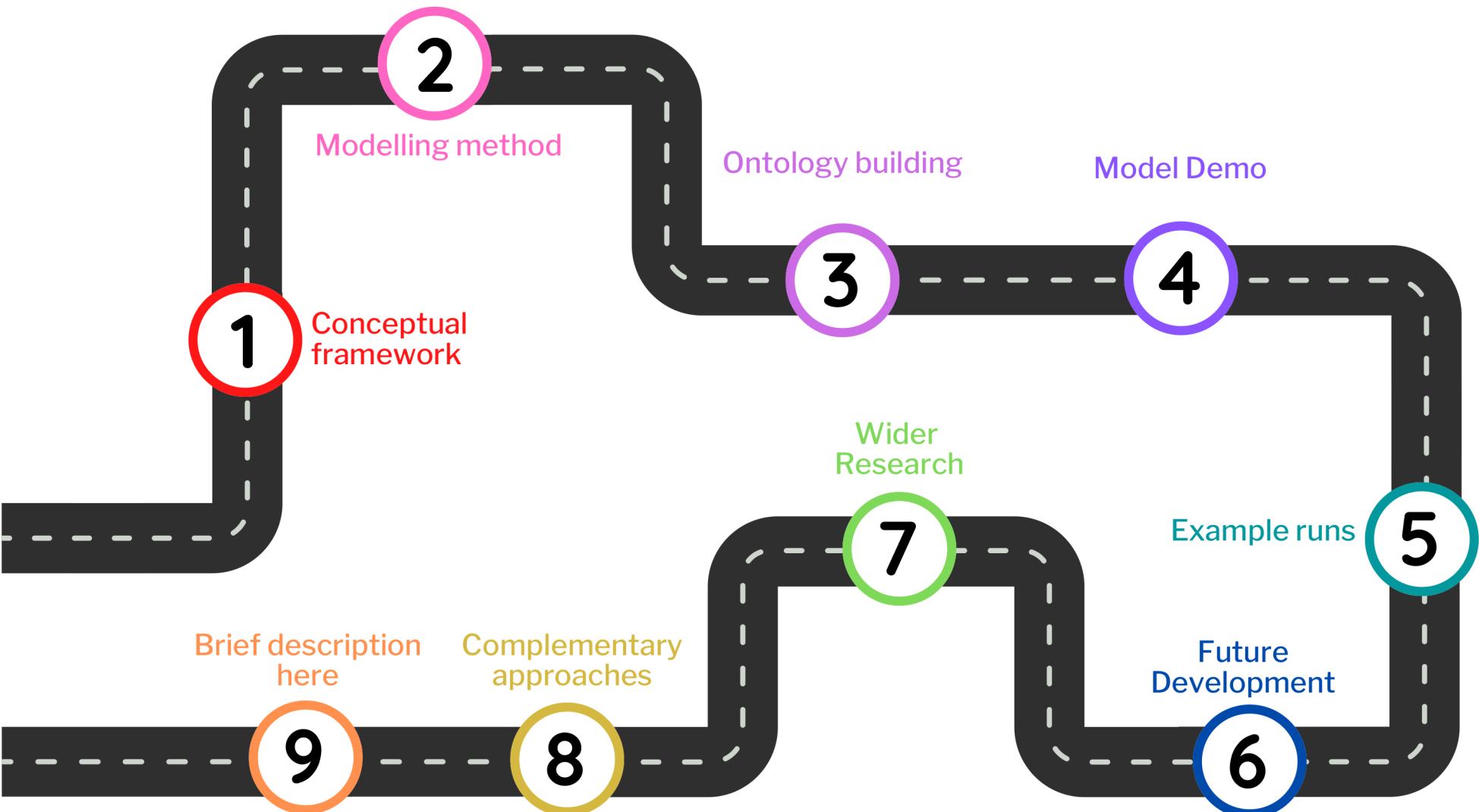


# Data angle

Commons across the world



# ROADMAP FOR TOTC



# ROADMAP FOR TOTC

