The governance of infrastructures: Applying a social ecological system approach

Autumn school 2015:

Concepts, frameworks and methods for the comparative analysis of water governance

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Economics of Infrastructures

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Ostrom's research approach

- Going beyond markets and hierarchies
- Multi disciplinary approach: economics, political science, sociology, biology
- Complex institutional arrangements in various sectors:
  - Water, urban school districts, police, etc.
- Central area's of research include:
  - Common pool resources -> 'free rider problems'
  - Polycentricity -> 'checks and balances'

Toonen, Theo, 2010. Resilience in Public Administration. The work of Elinor and Vincent Ostrom in a PA perspective Public Administration Review, 193-201.

Frameworks, theories, and models

- Distinction between
  - frameworks,
  - theories and
  - models
- Multiple level analysis
- Focus on actor behavior ('actor centric')

Framework

- "A framework is thus useful in **providing a common set of potentially relevant variables** and their subcomponents to use in the **design of data collection instruments, the conduct of fieldwork, and the analysis of findings** about the sustainability of complex SESs. It helps identify factors that may affect the **likelihood of particular policies** enhancing sustainability in one type and size of resource system and not in others"

Research challenge

- How can Ostroms SES framework contribute to novel approaches in the governance of infrastructures?

Local energy

UNSER HAMBURG
UNSER NETZ
für die Hamburger Energiewende.

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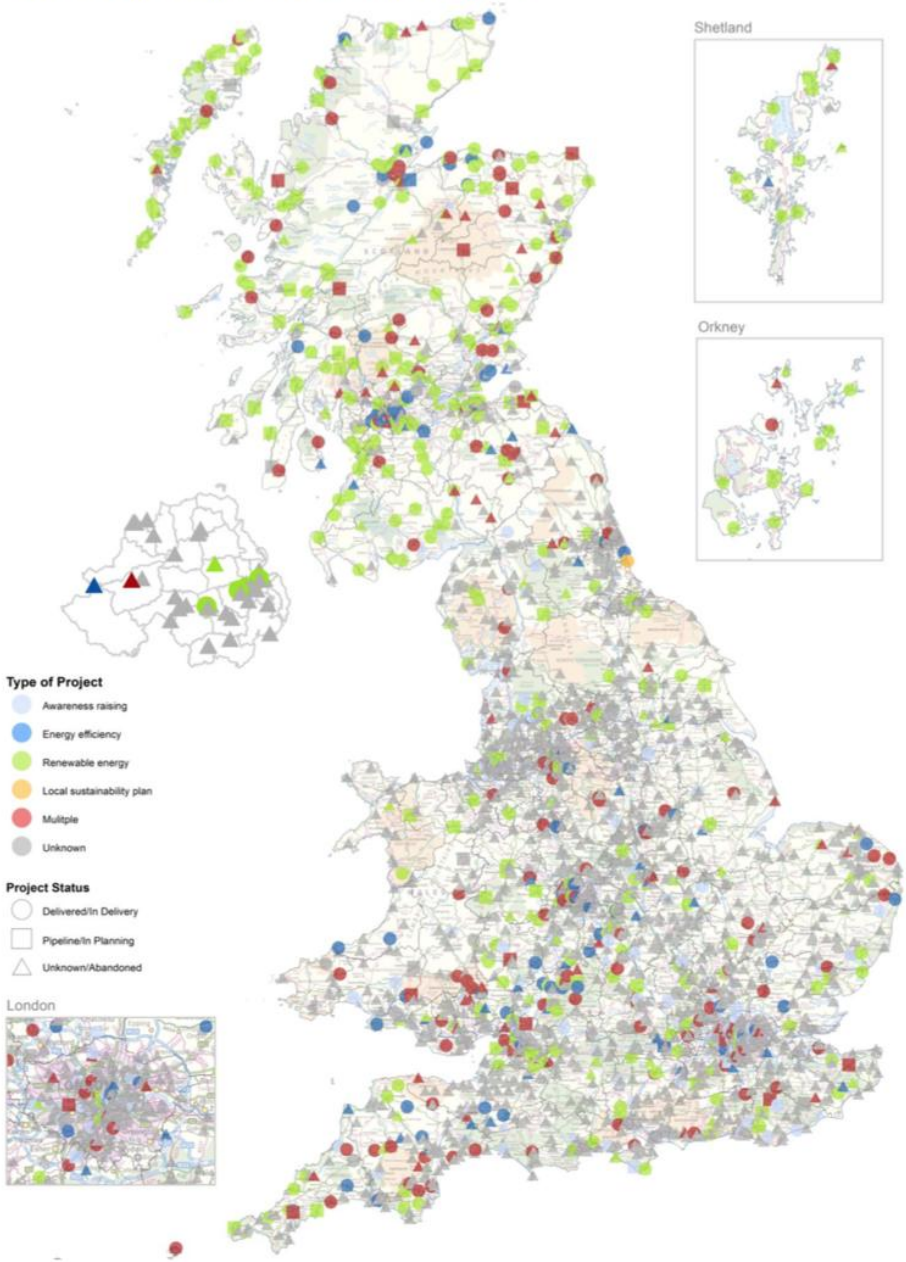
Figure 2: Location of community energy groups in the UK



- Some 5000 community energy groups in UK since 2008
- German Energiewende: 40% of renewable energy capacity is installed by energy cooperatives
- Denmark, Austria are other prominent examples
- Rapid growth towards a significant scale of energy provision

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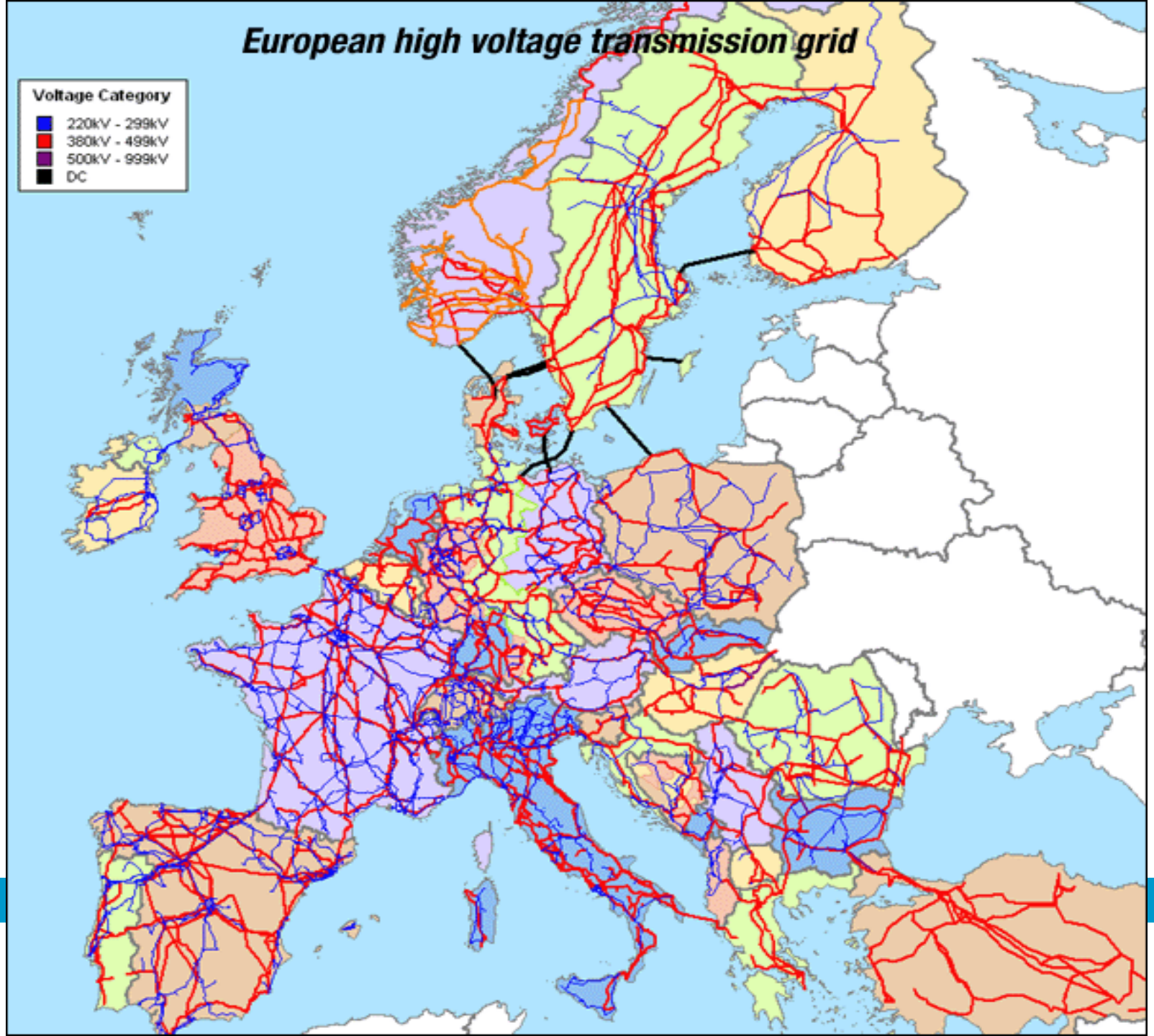
Technological drivers

- Smart grids
- Distributed energy production
  - Solar PV
  - Wind power
  - Biogas
  - CHP
- Converging (energy-) infrastructures: gas, electricity, heat, transportation
- Challenge: power storage

Socio-economic drivers

- Democratization of energy provision
- Sustainability
- Economics: Efficiency and costs


European high voltage transmission grid
Voltage Category
220kV - 299kV
380kV - 499kV
500kV - 999kV
DC

Self governance

- Conditions for successful self governance of social-ecological systems according to Ostrom
  - Design principle for institutions
  - Expected cost and benefits of different actors

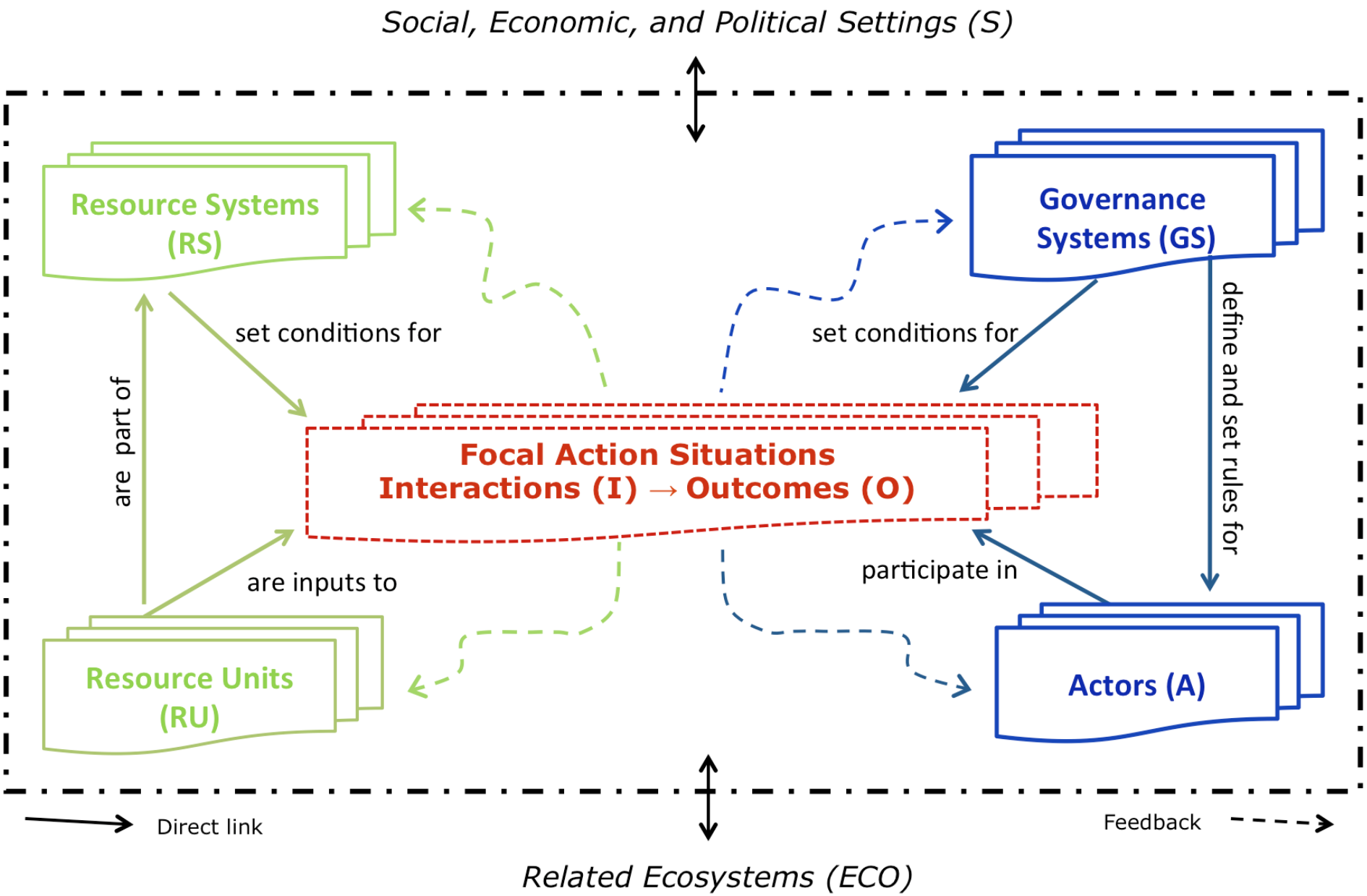

Social, Economic, and Political Settings (S)
Resource Systems (RS)
Governance Systems (GS)
set conditions for
set conditions for
define and set rules for
are part of
Focal Action Situations
Interactions (I) → Outcomes (O)
are inputs to
participate in
Resource Units (RU)
Actors (A)
Direct link
Feedback
Related Ecosystems (ECO)

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Table 1. Second-tier variables in framework for analyzing an SES

Social, Economic, and Political Settings (S)

S1- Economic development. S2- Demographic trends. S3- Political stability.
S4- Government settlement policies. S5- Market incentives. S6- Media organization.

Resource System (RS)

RS1- Sector (e.g., water, forests, pasture, fish)
RS2- Clarity of system boundaries
RS3- Size of resource system
RS4- Human-constructed facilities
RS5- Productivity of system
RS6- Equilibrium properties
RS7- Predictability of system dynamics
RS8- Storage characteristics
RS9- Location

Governance System (GS)

GS1- Government organizations
GS2- Non-government organizations
GS3- Network structure
GS4- Property-rights systems
GS5- Operational rules
GS6- Collective-choice rules
GS7- Constitutional rules
GS8- Monitoring & sanctioning processes

Resource Units (RU)

RU1- Resource unit mobility
RU2- Growth or replacement rate
RU3- Interaction among resource units
RU4- Economic value
RU5- Size
RU6- Distinctive markings
RU7- Spatial & temporal distribution

Users (U)

U1- Number of users
U2- Socioeconomic attributes of users
U3- History of use
U4- Location
U5- Leadership/entrepreneurship
U6- Norms/social capital
U7- Knowledge of SES/mental models
U8- Dependence on resource
U9- Technology used

Interactions (I) → Outcomes (O)

I1- Harvesting levels of diverse users
I2- Information sharing among users
I3- Deliberation processes
I4- Conflicts among users
I5- Investment activities
I6- Lobbying activities

O1- Social performance measures
(e.g., efficiency, equity, accountability)
O2- Ecological performance measures
(e.g., overharvested, resilience, diversity)
O3- Externalities to other SESs

Related Ecosystems (ECO)

ECO1- Climate patterns. ECO2- Pollution patterns. ECO3- Flows into and out of focal SES.

How to compare SES with infrastructures?

- Comparable system features of SES and infrastructures?
- Fundamental material differences between SES and infrastructures?
- Similarity of coordination needs?

Comparable system features?

- System delineation and determination of relevant variables (What & why?)
- Governance of resource systems that are strongly related to human intervention
- Infrastructures as part of a SES -> environmental sustainability
- Infrastructures as distinct STS -> technical sustainability

Material differences between SES and infrastructures?

- Resource System (RS): natural systems vs men made systems
- Resource Service Units (RSU): harvesting eco system services vs infrastructure services
- Multi leveled, nested systems
- Actor centric approach

Similarity of coordination needs?

- Collective action problems in SES as well as in infrastructures
- Appropriation is often a key issue in SES (access control, crowding, overuse))
- Provisioning is important in infrastructures (innovation, replacement, investments)

Design principles for the governance of long-enduring institutions of SES

- Clearly defined boundaries
- Proportional equivalence between benefits and costs
- Collective choice arrangements
- Accountable monitoring
- Graduated sanctions
- Conflict resolution mechanisms
- Minimal recognition of rights to organize
- Nested enterprises

Variables potentially mitigating the expected costs & benefits of self-governance

- Size of resource system
- Productivity of the system
- Predictability of system dynamics
- Resource unit mobility
- Number of users
- Leadership
- Norms/ social capital
- Knowledge of the SES
- Importance of resource to users
- Collective choice rules

Prospects and challenges

- Platform for cross sectorial analyses of infrastructures
- 'Third way' beyond markets and hierarchies?
- SES framework can help to understand and analyze the increasing complexity of infrastructures
- How to apply concepts like self governance and polycentricity to infrastructures?
- Under what circumstances can self governance be trusted and applied to infrastructures?