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Socio-Economic Aspects of Water Reuse. Opportunities and Challenges.

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ISOE – Institute for Social-Ecological Research, Frankfurt/Main

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Drivers of Change and Demand for Reuse

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- Drivers of Change
  - Changing demand due to demographic change (e.g. rapid urbanization, but also population decrease)
  - Resource scarcity (e.g. water, nutrients)
  - Climate change
  - Ecological footprint
- Regions with the demand for reuse
  - (Semi-) Arid regions, e.g. southern Europe, MENA, Australia, southern Africa
  - Growing urban agglomerations, e.g. mega cities in Asia
  - Metropolitan areas dependent on resources of their hinterland, e.g. Frankfurt/Rhein-Main

Hypothesis

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"Water reuse bears great potential for agricultural irrigation in developing countries but also for domestic purposes in developed countries. However, social and institutional obstacles have to be overcome rather than technological ones in order to realize reuse on a larger scale."

Case Studies

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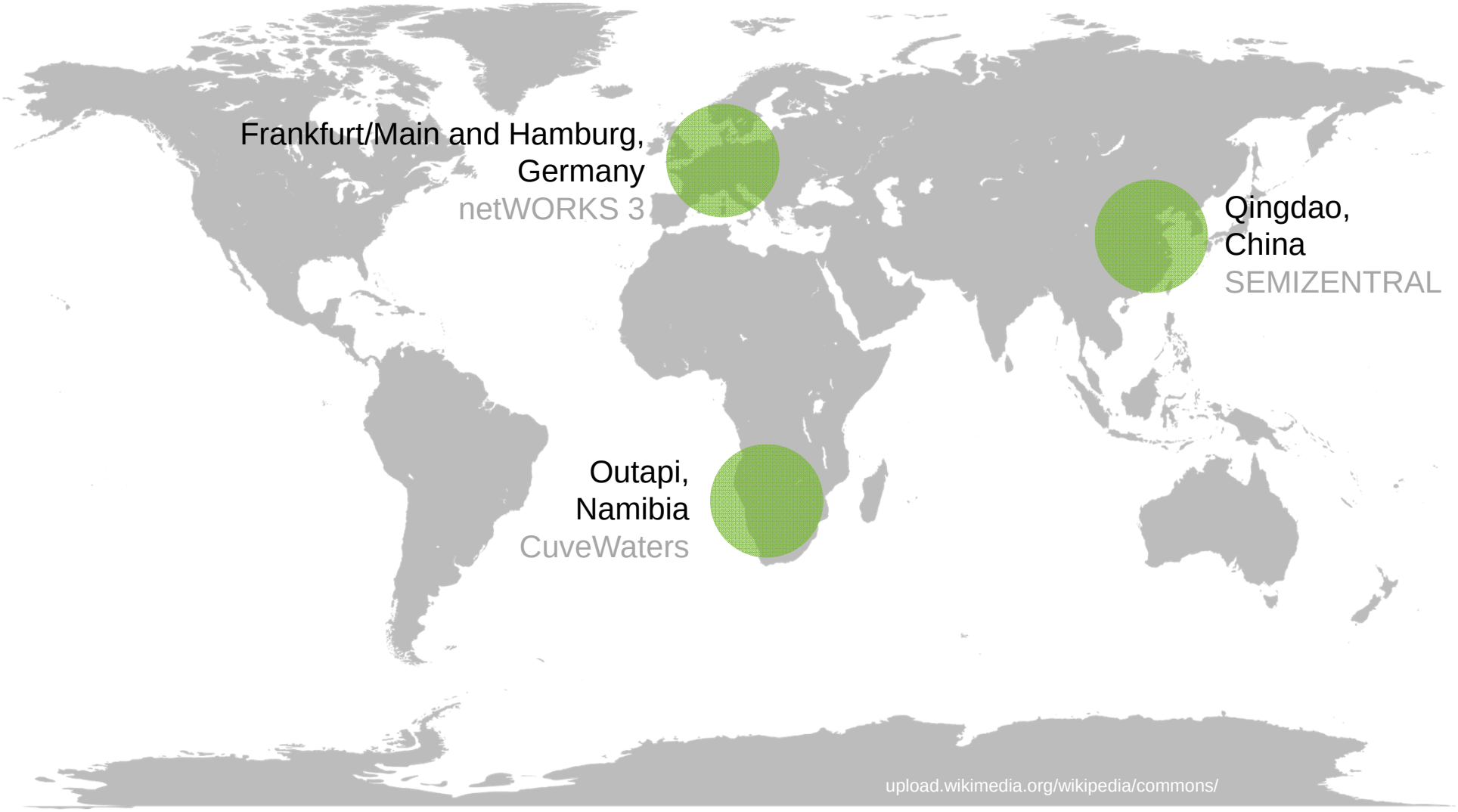

Transition Theory (Geels, Rotmans etc.)

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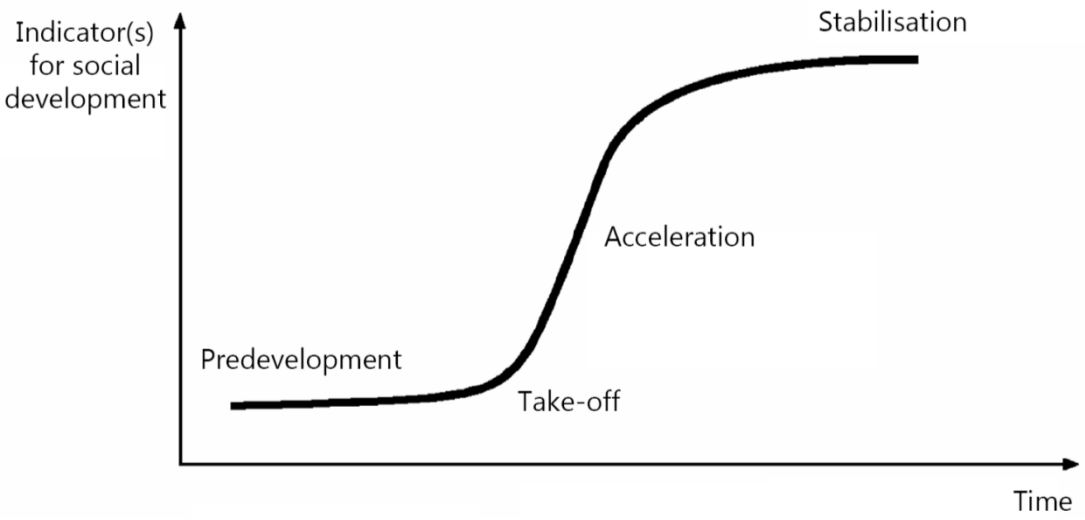
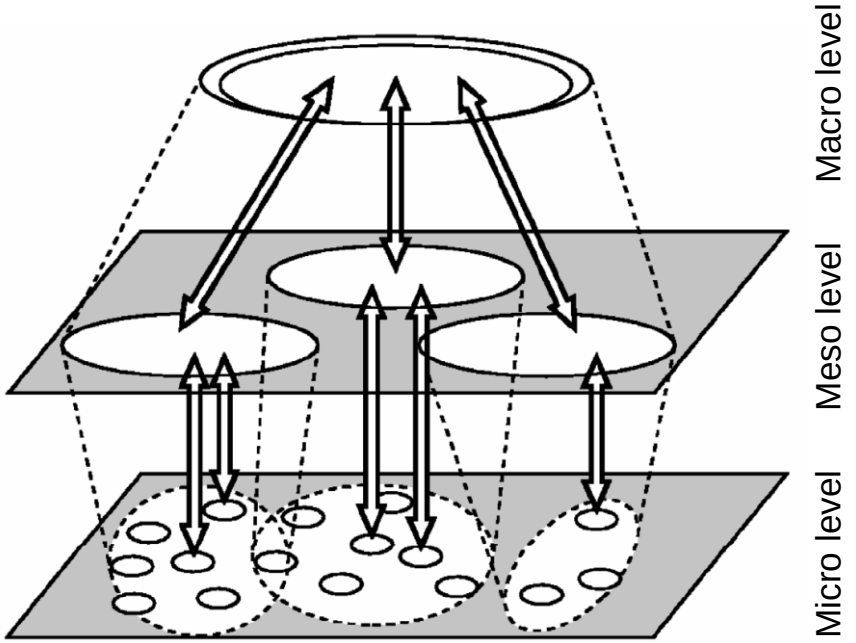
Transition phases



Multi-level perspective



(Adapted from Rotmans, Kemp, van Asselt 2001)

Windows of Opportunity

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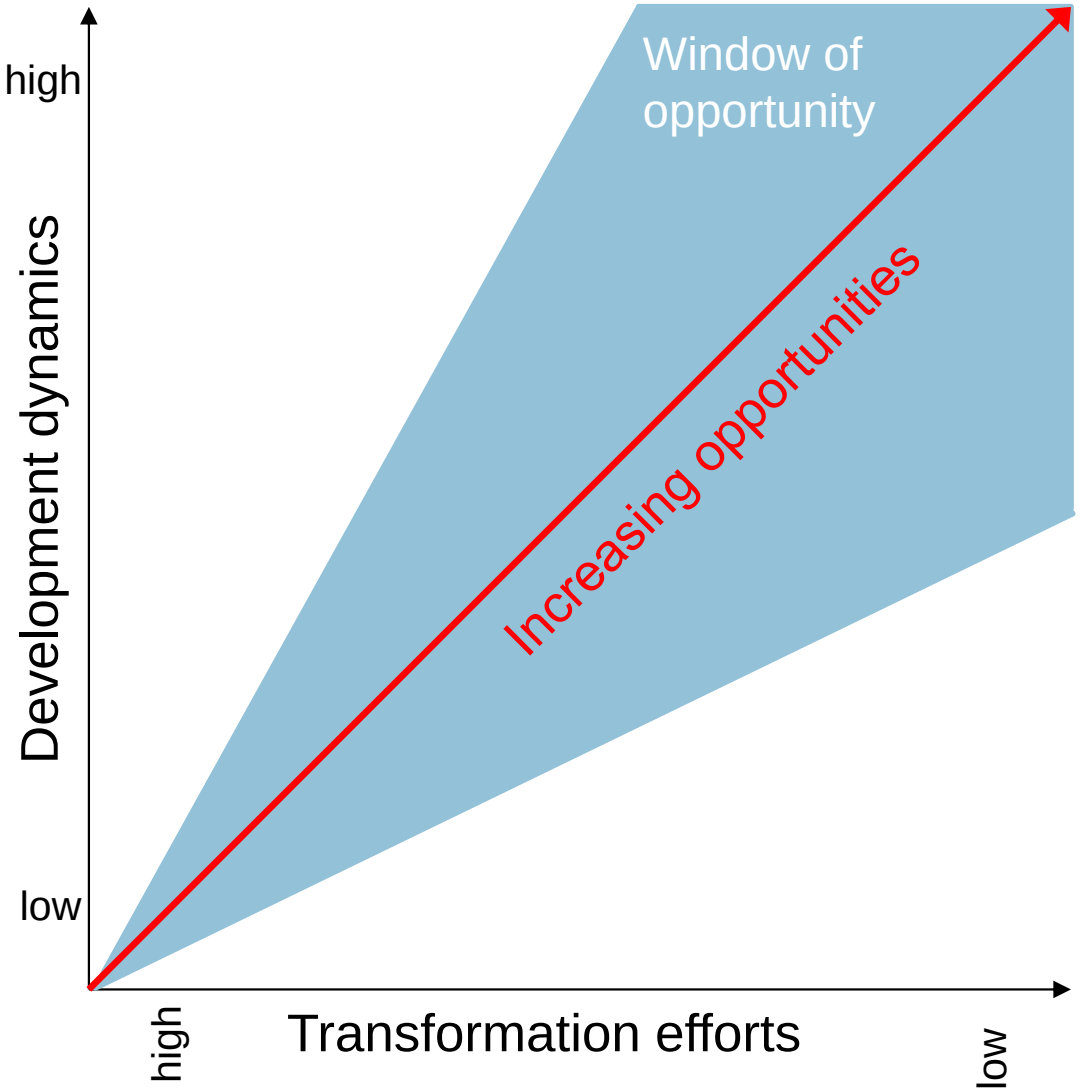

(Adapted from Winker 2016)

Transformation Potentials in Model Cities

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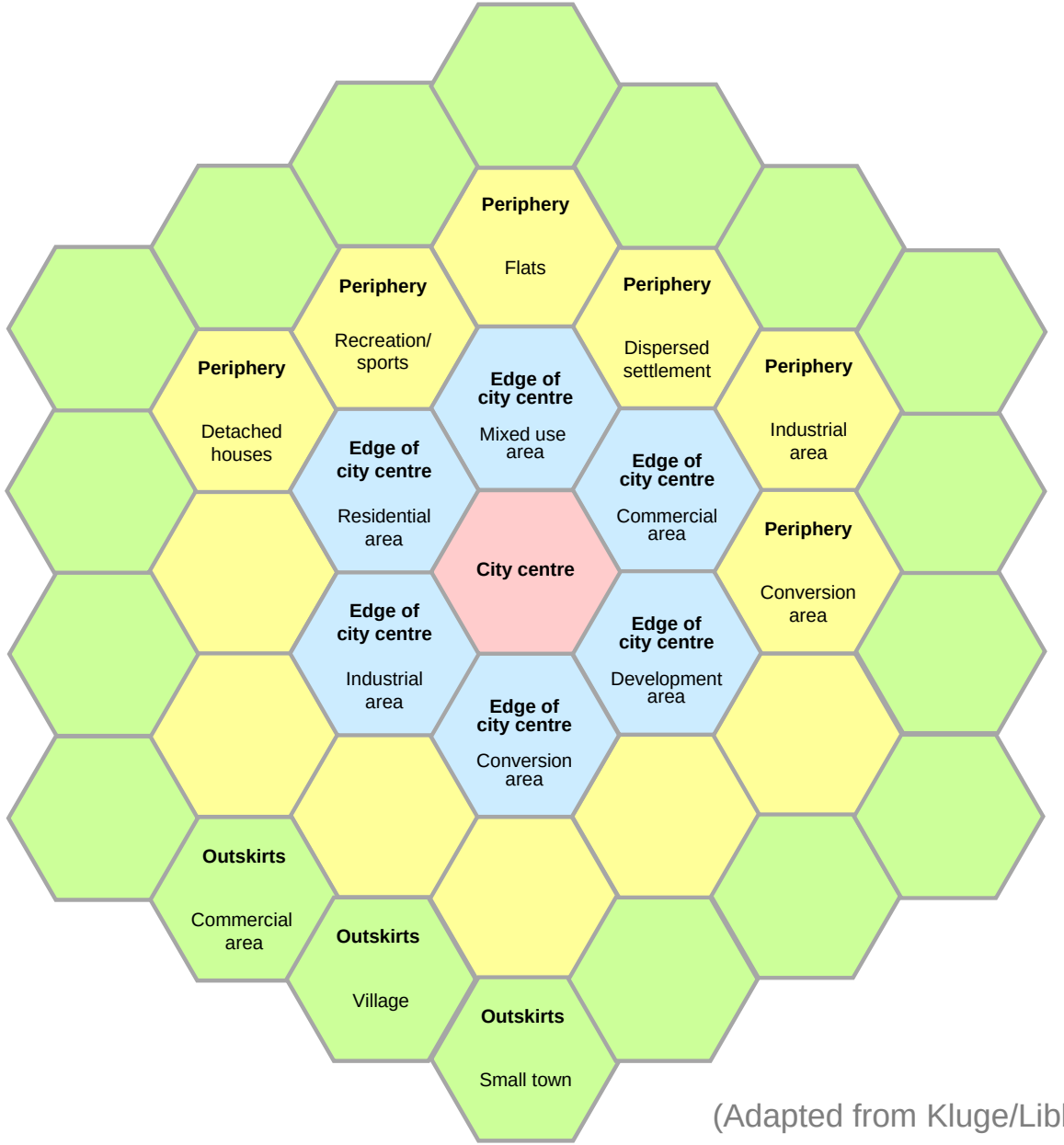

(Adapted from Kluge/Libbe 2010)

ConvGrey: Greywater and Heat Recovery on Quarter Level

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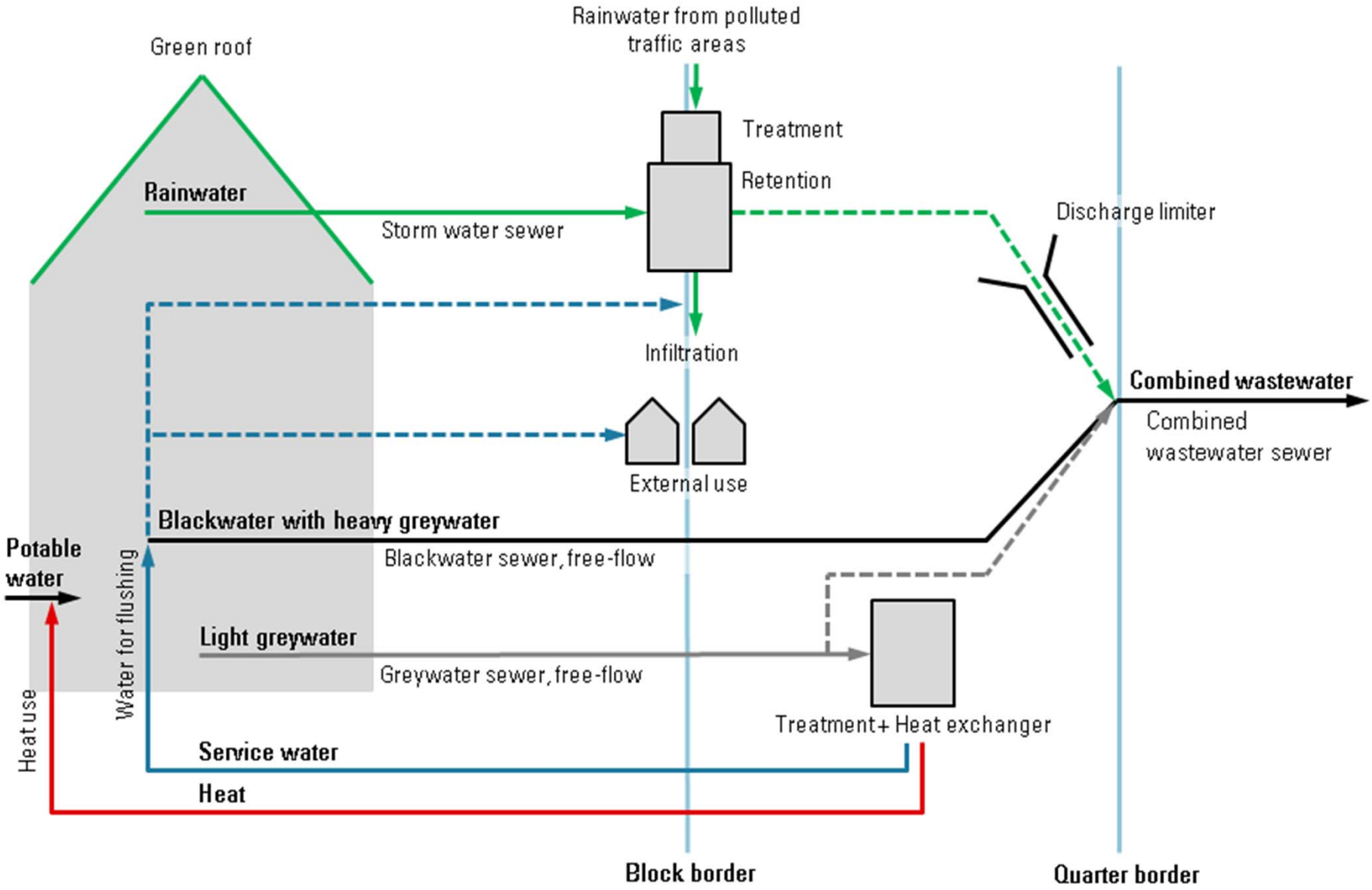

(Adapted from Davoudi et al. 2016)

Intended Ecological Effects of Water Reuse

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- Resource protection
  - Local ecosystem functions
    Contribution to the production, preservation and strengthening of blue and green infrastructure
  - Water protection (surface waters)
    Reduction of inputs of nutrients (N, P) and ecotoxicological substances
  - Soil and groundwater protection
    Reduction of inputs of ecotoxicological substances
  - Energy and climate protection
    Emission of Greenhouse gases (CO_2 equivalents)
- Resource use
  - Resource balance
    Drinking water demand
    Electricity demand
    Heat recovery

Impacts of Water Reuse

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Economical impacts

- Utilities, investors
  - Costs
    Annual costs
  - Revenues
    Potential revenues from products of novel water infrastructure systems
  - Long-term competitiveness, innovation leadership
    Effects on image and know-how
  - Ability of system change (flexibility)
    Duration of depreciations
- Investors, residents
  - Economic viability
    Impact on specific costs (rent, rent including heating)

Social impacts

- Exclusion
  - Socio-economic, cultural barriers
    Risk of exclusion
- Usability, practicality
  - Ease of handling
    Ease of use for operators and residents
- Environmental awareness
  - Awareness raising regarding resource use (water, energy)
    Sensitization potential (residents, operator, investor, politics)

Transformation Efforts (1)

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Organisation

- Organisational structures
  Adaptation efforts
- Operation
  Competence (operational procedures, customer service, technical know how), qualification requirements.
- Cross-sectoral coordination
  Transaction efforts, coordination efforts (tap water, fire water, energy, urban planning, traffic, waste, green space, investors etc.).

Governance

- General principles for spatial planning and infrastructures
  Synergy potential (spatial planning, regional planning, urban planning, energy, water, waste etc.)
- Involvement of relevant stakeholders (political decision makers, technical actors, interest groups, general public)
  Coordination requirements, efforts at persuasion
- Entrepreneurial risk
  Regulatory risks

Transformation Efforts (2)

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Laws and standards

- EU law, federal law
  Council Directive 91/271/EEC; Basic Law for the Federal Republic of Germany; German water resources law; Code of construction law etc.
- Federal state law
  Water act; local government law; state building regulations; local rates act
- Municipal law
  Land-use plan, statutes
- Contracts
  Urban development contracts, public/private contracts
- State of the art
  Technical standards

Governance of Transformation Processes

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- Institution necessary which can initiate and coordinate the transformation process
  Cooperation management for planning, implementation and operation
- Open/transparent planning process needed
  Facilitated by coordinator, participatory approach, integration of expert and practical knowledge, informed choices
- Political or administrative body which carries the idea fosters process
  E.g. the planning authority
- System or innovation leader necessary for implementation
- Conventional separation of domains is obsolete
  E.g. water, wastewater, energy, waste

Integrated Urban Planning

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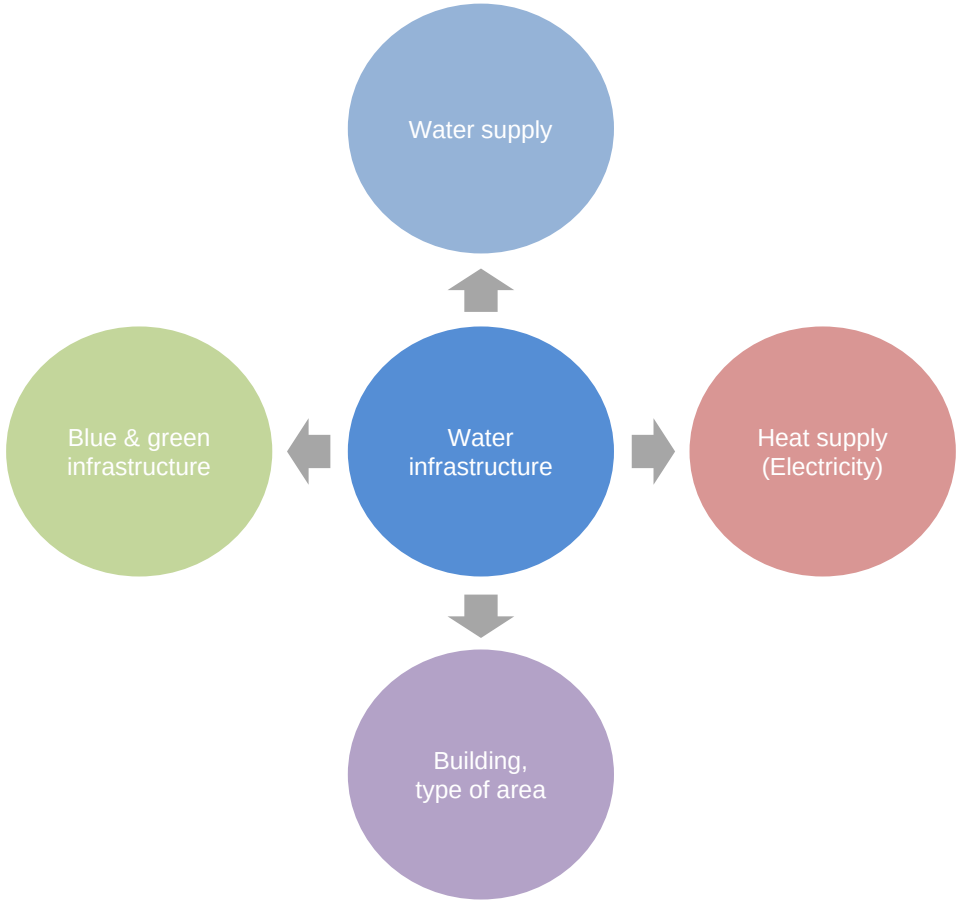
- Early planning of urban planners, architects, energy suppliers
  Before land-use planning
- Coordination with other infrastructures
  Energy, open space planning, grey, blue and green infrastructures
- Contributes to municipal strategies and general principles
  Climate protection, quality of life



(Adapted from Winker 2016)

Cooperation e.g. During Implementation

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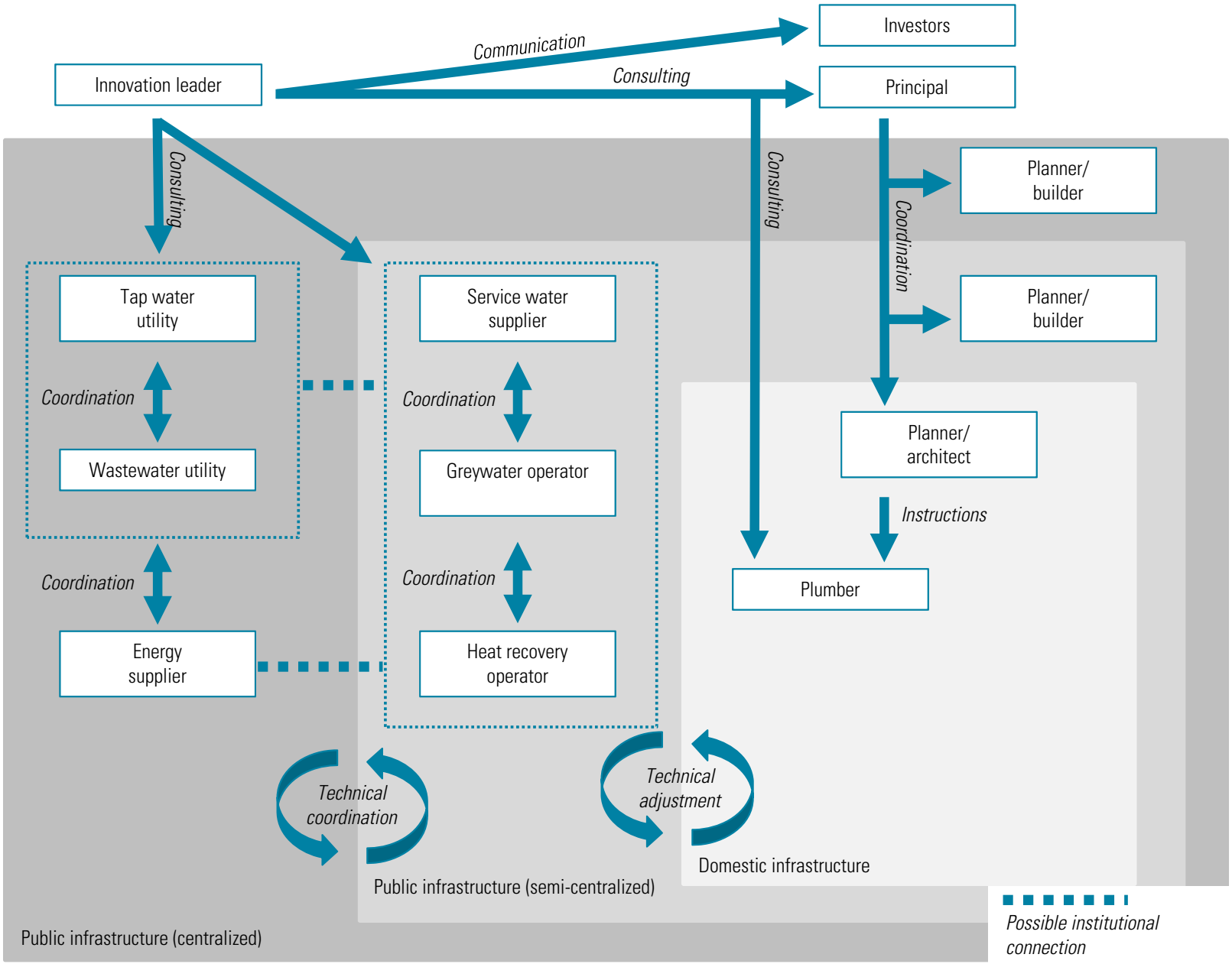

(Adapted from Kerber et al. 2016)

Conclusions and Outlook

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- From unified systems to differentiated systems
- Service water and recovered heat from greywater need own tariff structures
- Complex socio-technical configuration needs bundling of economical and planning aspects
- Political task to set up supporting conditions to enable dialogue, pre-planning of urban designs and cooperation management
- Further open questions
  - Financing of reuse infrastructures?
  - Rural or structurally weak areas?

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Thank you for your attention.

GEFÖRDERT VOM

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