

# Scaleable Technologies, Business Models and Societal Challenges

## Why Energy R&I Requires Mission orientation and Political Vision

IEA CERT EGRD WS on Future Energy Market Designs: R&I Needs  
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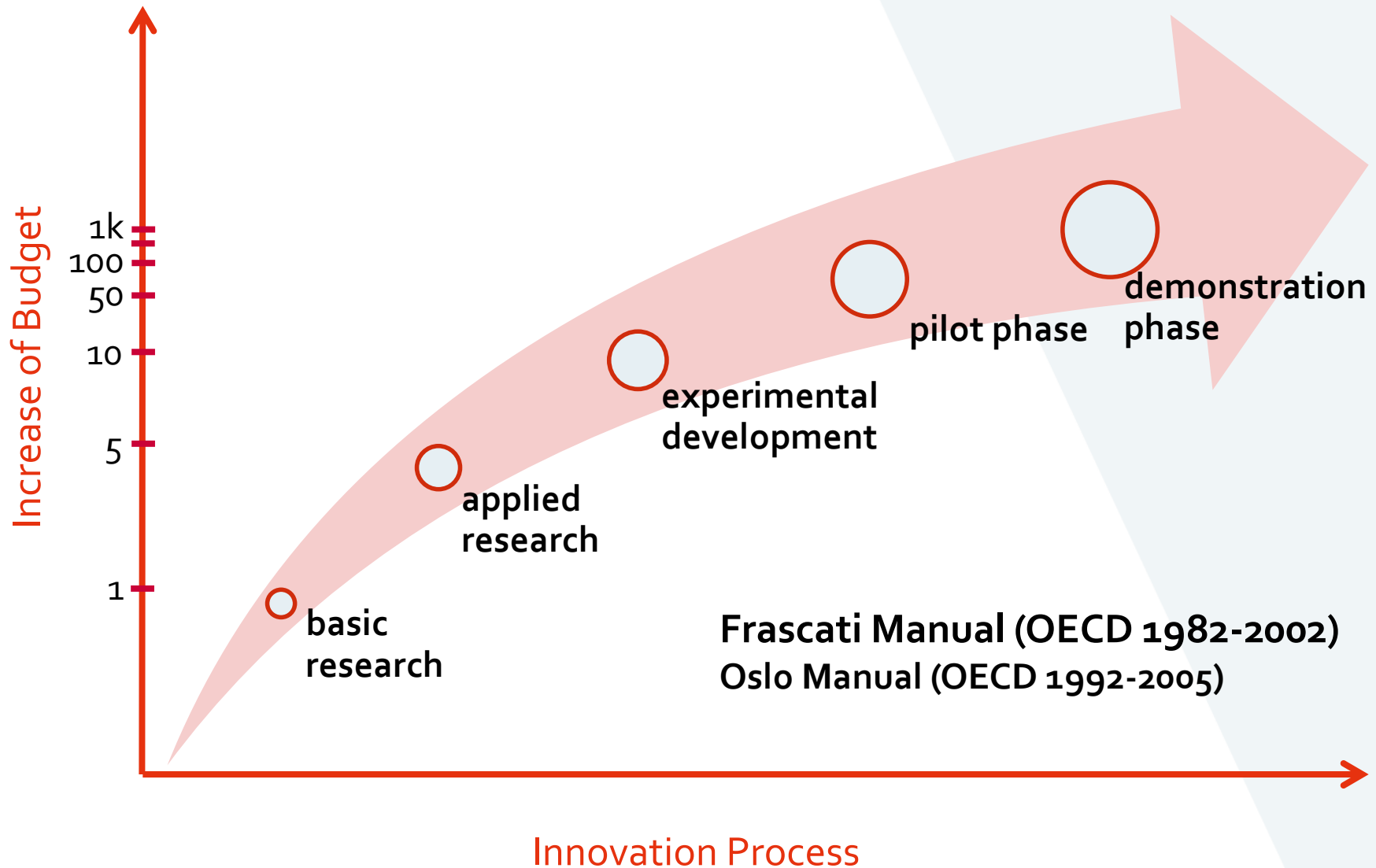
# Overview

- The innovation chain as a paradigm in R&I funding
- From technical artefacts to management of complexity
- The need for a systems approach
- The systems dimensions of complex societal challenges
- The innovation cycle and R&I funding
- Technology development and economic narratives
- Scaleable technologies and market pull
- Infrastructure investments and market frameworks
- Societal challenges, mission orientation and political vision
- And where is the market?

# The Innovation Chain – Still a Paradigm of Public R&I Funding

- Innovation was conceptualised in the 1970's and 1980's as a linear model (OECD Frascati and Oslo Manuals)
- The concept of an “innovation chain” emerged, leading to a “funding chain” in R&I funding
- Later, the image of an “innovation cycle” was crafted
- Modern innovation theory looks at innovation as a multi-dimensional process
- Today, innovation in complex systems is described in terms of transition pathways

## Dimensions of Innovation: The Classic Chain Concept



## Downsides of the Innovation Chain Concept

Encouraging the adoption of an overly simplified (economic) reference system,

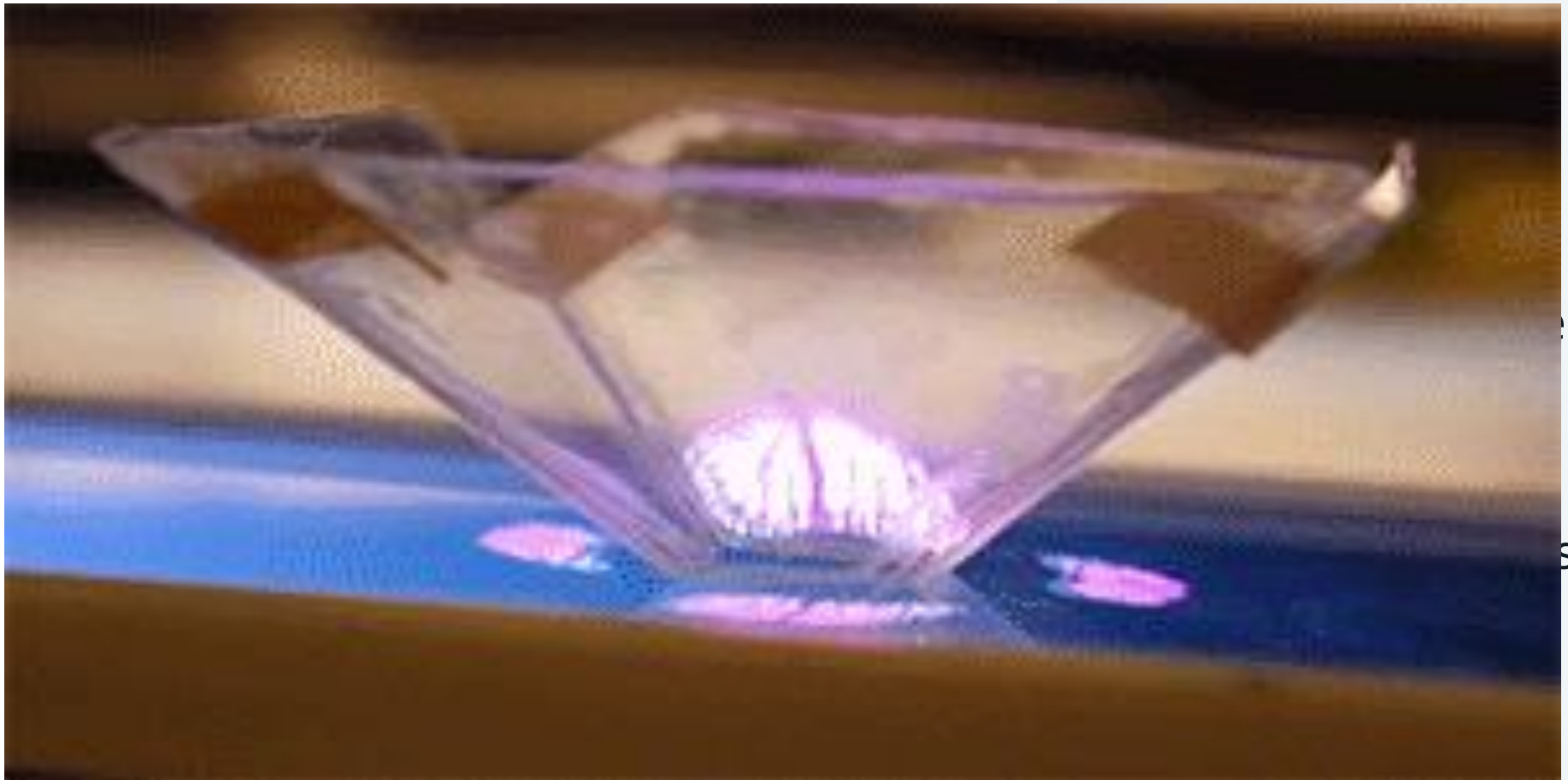
- putting economic needs (e.g. scalability) before solution orientation
- defining technology as a systems dimension, rather than using it as an enabler for change
- forcing the users to adapt to the artefacts, rather than making the artefacts serve the users
- bringing about “funding gaps”, which lead to “valleys of death” in the development process

# An Over-simplified Model becomes an Ideological „Blinker“ for R&I Programmes



Should R&I funding be only about technologies  
and business cases?

# The Systems Expert's Response: Right Choice of Dimensions, and Reduction of Density



# The Evolvment of Society's Demand for Complex Innovation

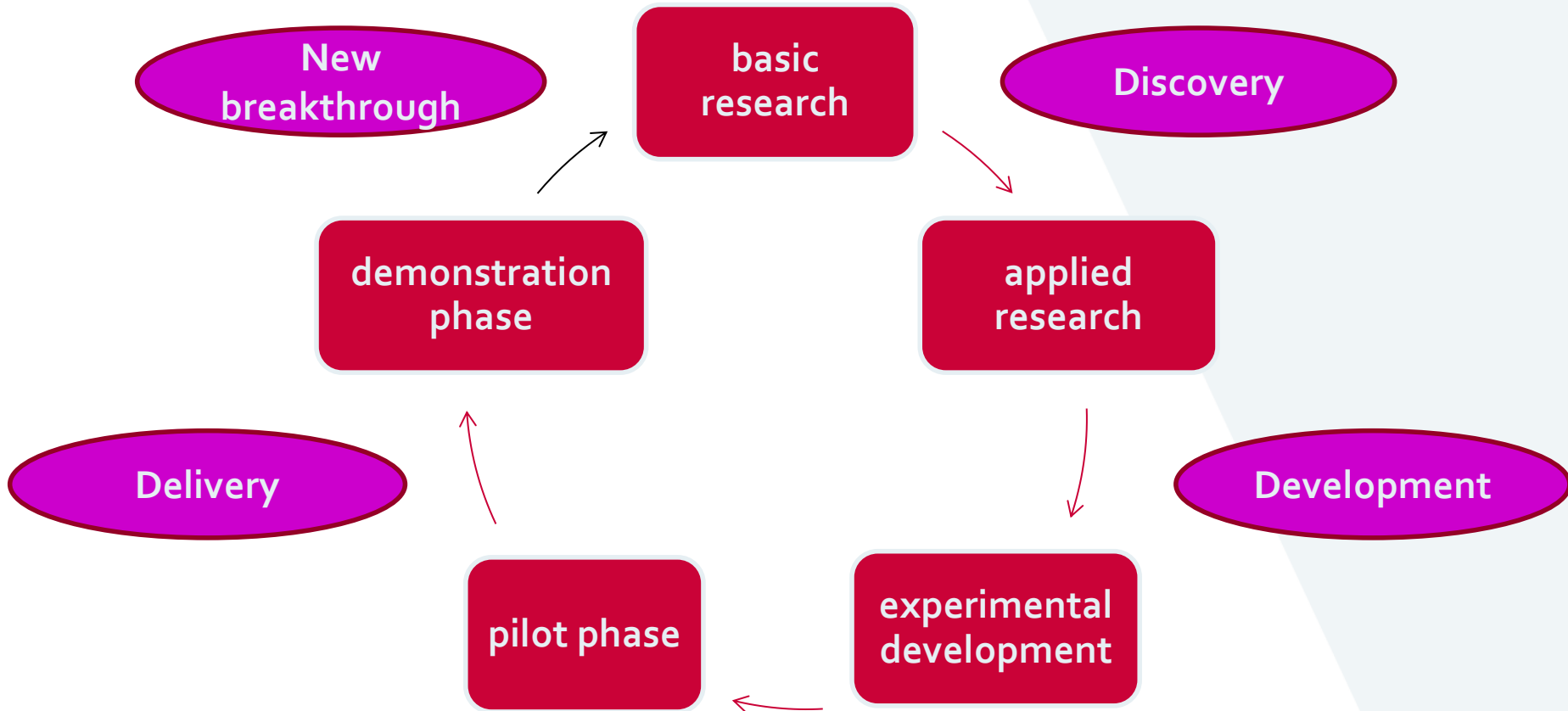
- 1970's: The moon-shot era
  - Anything is possible – technology as the main economic driver
- 1980's: Environmental technologies
  - Discovery of the limits to growth - technological innovation + environmental research & protection
- 1990's: Cleaner production, pollution prevention, technologies for sustainable development
  - Upstream management of value creation chain, new technologies + sustainable economic & environmental benefits,
- 2000's: Sust. development, corporate social responsibility
  - Economic + social + environmental innovation & sustainable benefits
- 2010's: Grand Challenges, Smart Cities, Urban Innovation
  - Responses to grand societal challenges, new governance models and understanding of complexity, involvement of multiple actors, integrated multi-dimensional planning processes, systems approach



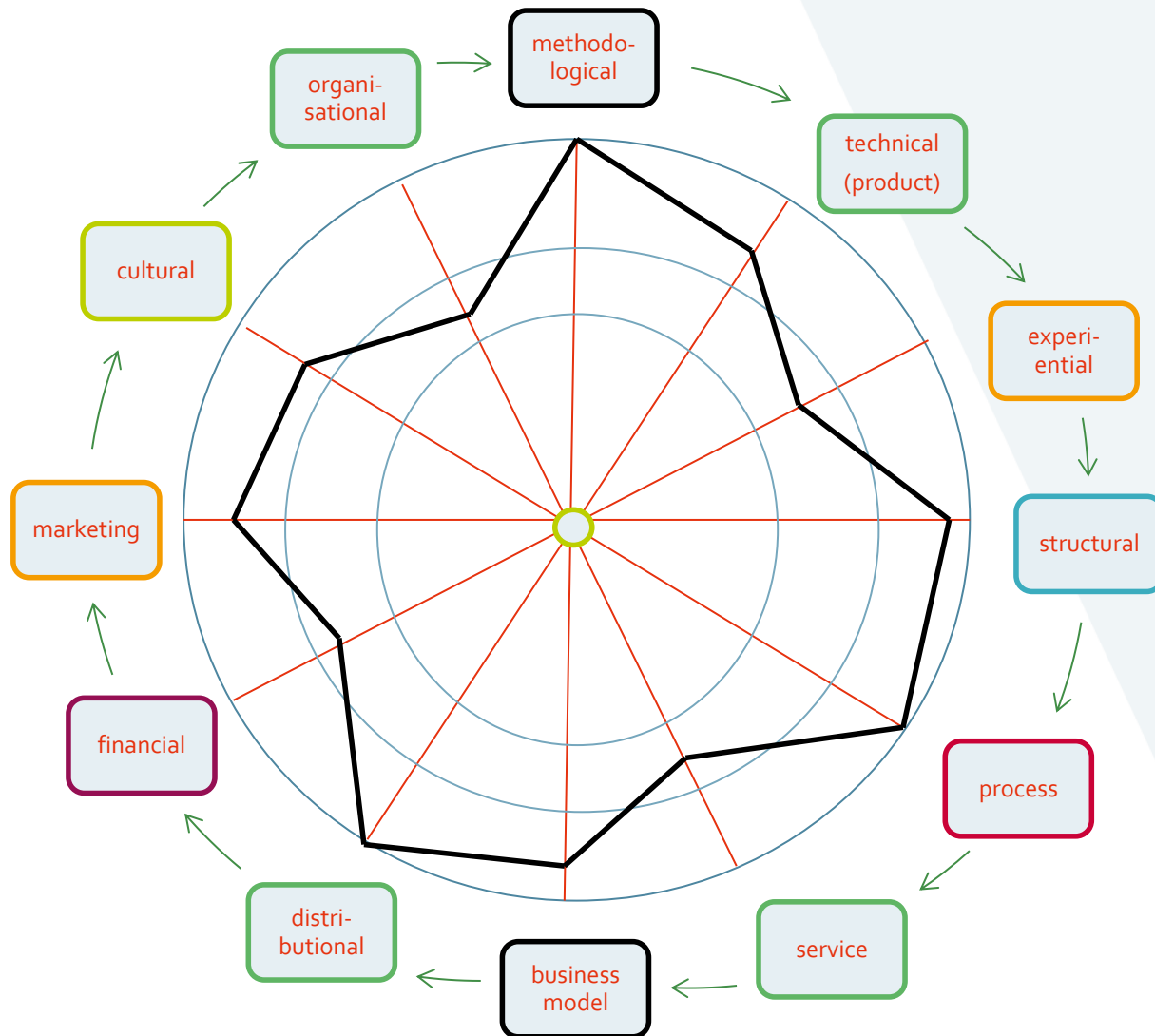
# The Systems View: Introducing Multi-dimensional Approaches

- Understanding a complex system requires a set of dimensions, which allows to keep the whole system in view, even when examining its details
- The same system can be described through different sets, and different numbers of (orthogonal) dimensions
- Our standard scientific disciplines are not necessarily able to adopt a systems view – often they operate within one systems dimension only
- Technology, for most systems, is not a systems dimension, it is rather an enabler for solutions

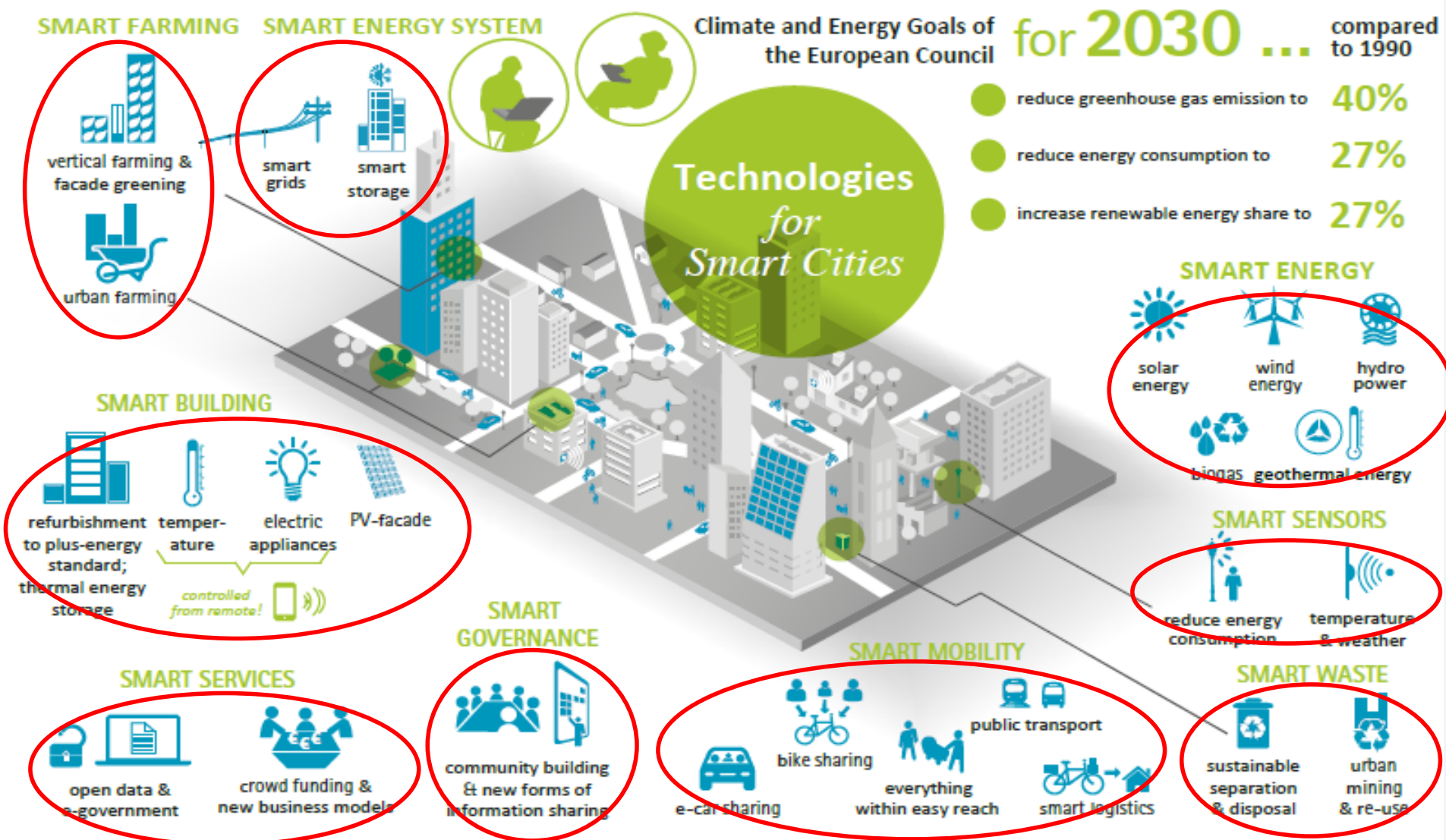
## Would the Innovation Cycle View Solve Our Predicament?



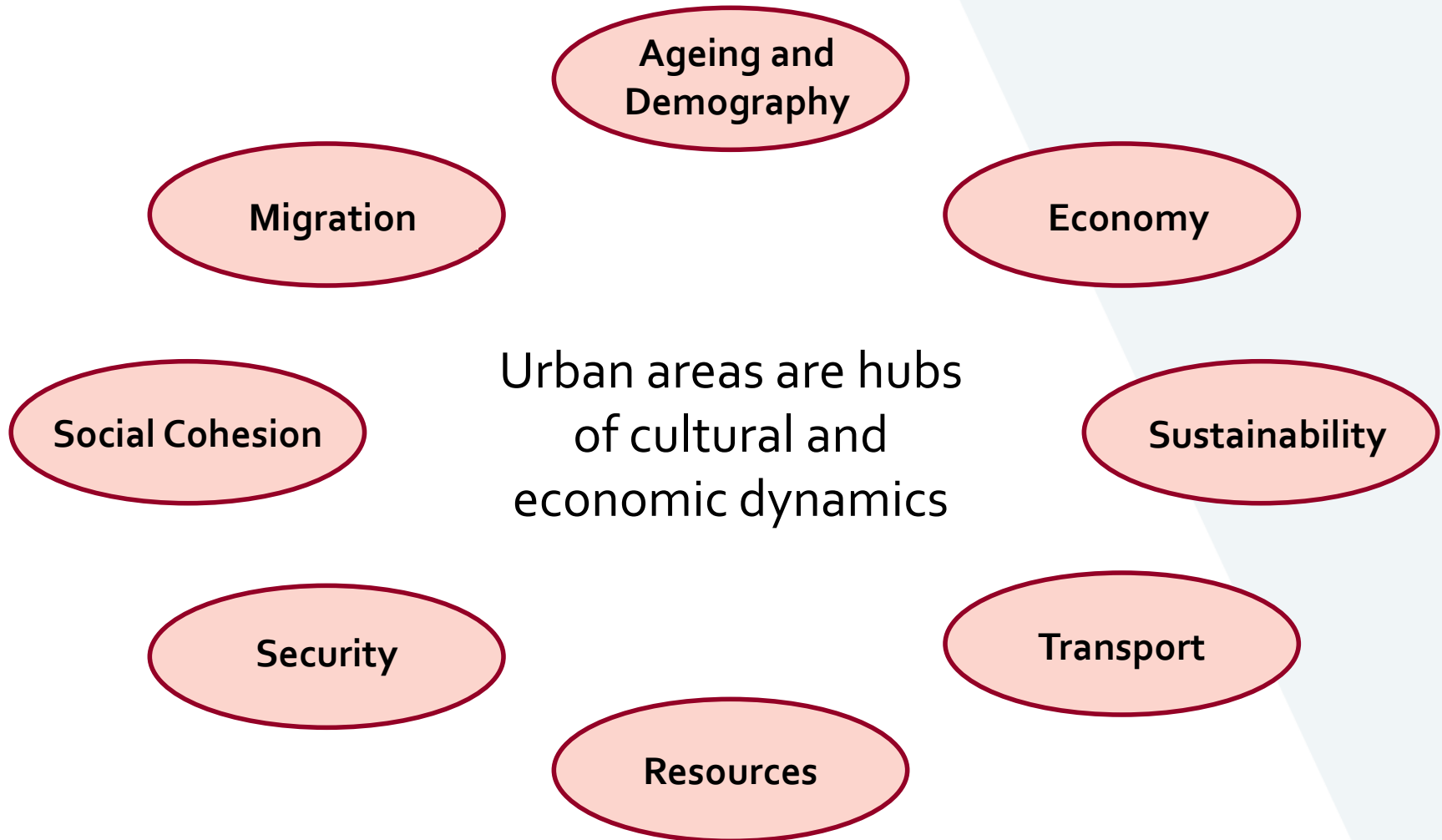
## Example 1: (Product-) Innovation, From Cycle to System



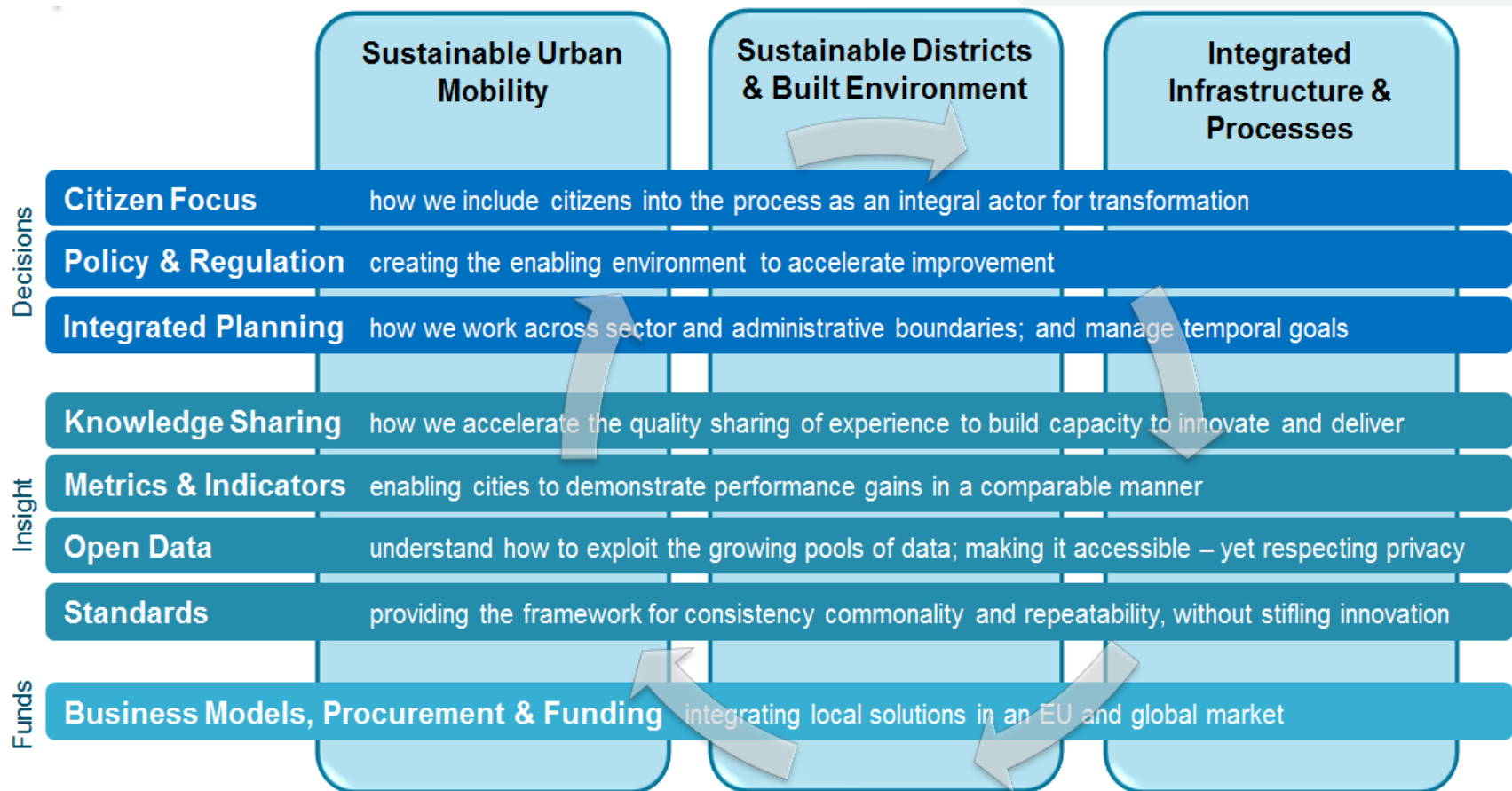
## Example 2: Clusters of Smart Urban Technologies don't Qualify as Systems Dimensions



## Example 3: Dimensions of the Urban Challenge

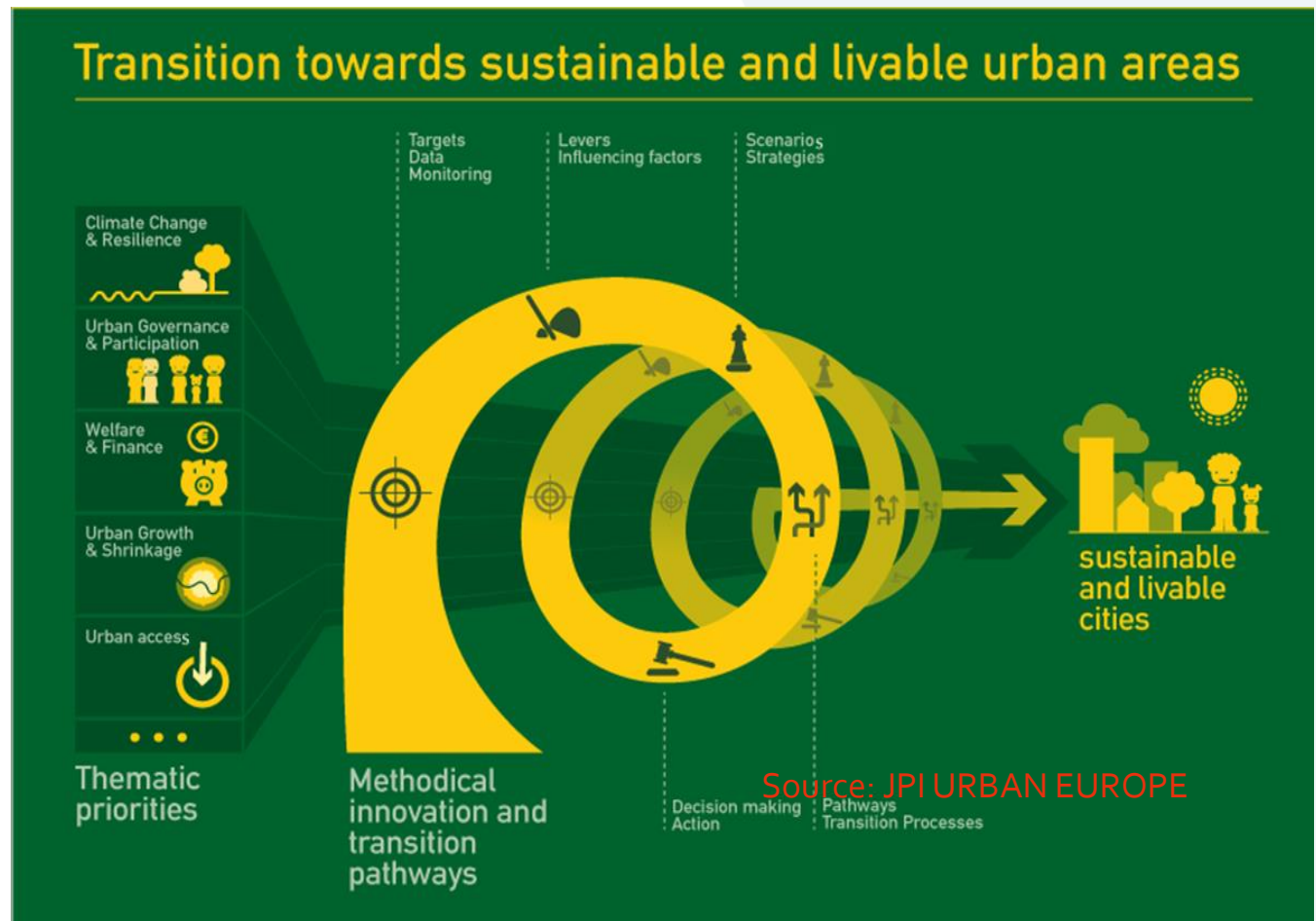


## Example 4: Systems Dimensions Used by EIP SCC



## Example 5: Systems Dimensions in the Transition Model of the JPI Urban Europe

1. Environmental resilience and sustainability
2. Governance and participation
3. Welfare and finance
4. Vibrant urban economies
5. Accessibility and connectivity



# Case Study

## The European Strategic Energy Technology Plan (SET Plan)



## Strategic Energy Technology Plan (SET-Plan)

### The SET-Plan is the technology pillar of the EU's energy and climate policy

The SET-Plan, adopted by the European Union in 2008, is a first step to establish an energy technology policy for Europe. It is the **principal decision-making support tool for European energy policy**, with a goal of:

- Accelerating knowledge development, technology transfer and up-take;
- Maintaining EU industrial leadership on low-carbon energy technologies;
- Fostering science for transforming energy technologies to achieve the 2020 Energy and Climate Change goals;
- Contributing to the worldwide transition to a low carbon economy by 2050.

# A recap: SET Plan actions under the Energy Union

## Energy Union

*Research, Innovation and Competitiveness Priorities*

## SET-Plan 10 Key Actions

No1 in  
Renewables



- 1 Performant renewable technologies integrated in the system
- 2 Reduce costs of technologies

Sustainable  
Transport



- 7 Competitive in global battery sector and e-mobility
- 8 Renewable fuels and bioenergy

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Consumers in  
the Energy  
System



- 3 New technologies & services for consumers
- 4 Resilience & security of energy system

Carbon Capture  
Utilisation and  
Storage



- 9 Carbon Capture Storage / Use

Efficient Energy  
Systems



- 5 New materials & technologies for buildings
- 6 Energy efficiency for industry

Austria 

Austria 

Nuclear Safety



- 10 Nuclear safety

- 6 actions reflecting AT national focal areas
- 2 actions chaired by AT

SET Plan Action	Temporary Working Group	Endorsement	Type of Challenge
1 & 2	Concentrating Solar Power/Solar thermal electricity	2017	scaleable technolgy
1 & 2	Photovoltaic	2018	scaleable technology
1 & 2	Deep geothermal systems	2018	scaleable technolgy
1 & 2	Offshore wind	June 2018	scaleable technolgy
1 & 2	Ocean energy	2018	scaleable technolgy
3.1	Smart solutions for energy consumers	June 2018	business model/regul.
3.2	Smart cities and communities	June 2018	complex challenge
4	Energy Systems	2017	challenge/business model/regulation
5	EE for buildings / Renewable heating and cooling	June 2018	complex challenge /business model
6	EE for industry	2017	technol./business model/regulation
7	Batteries for e-mobility & stationary storage	2017	scaleable technology
8	Renewable fuels & bioenergy	June 2018	scaleable technology
9	Carbon capture and storage/use	2017	complex challenge
10	Nuclear Energy	Late 2018	complex challenge

## Lessons learned from Process of SET Plan Working Groups

- Challenges vary between SET Plan key priority actions
  - Renewable energy technologies typically follow a market logic
    - Technology development enables market pull
    - Economies of scale lead to cost reduction
  - Some technologies just need the right business models
    - Need for regulatory intervention
    - Business models depend on regulatory framework
  - Other technologies are faced with complex societal challenges
    - Complex stakeholder mix
    - Local politics play a key role for long-term vision & market stability
    - Consensus with customers/civil society needed for sustainable solutions
- No „one size fits all“ solution for all SET Plan key priority actions

## Example:

# Mission for SET Plan Action on Smart Cities

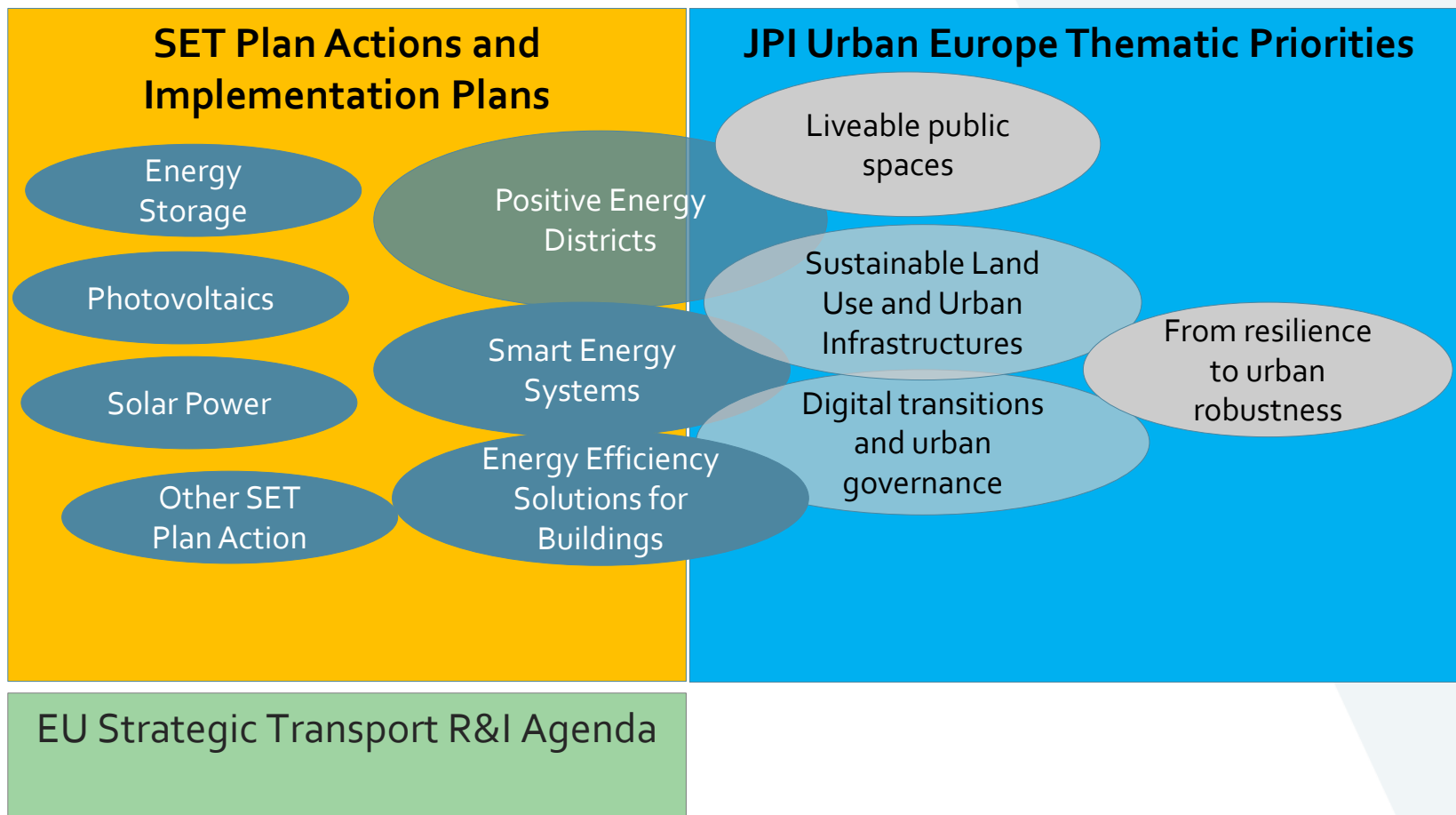
“Enhance capacities of cities, industry and research to make Europe a global role model and market leader

- in technology integration for and deployment of **Positive Energy Districts** taking into account aspects of inclusiveness
- with the aim **by 2025** to have at least **100 successful Positive Energy Districts** synergistically connected to the energy system in Europe and
- with a strong export of related technologies.”

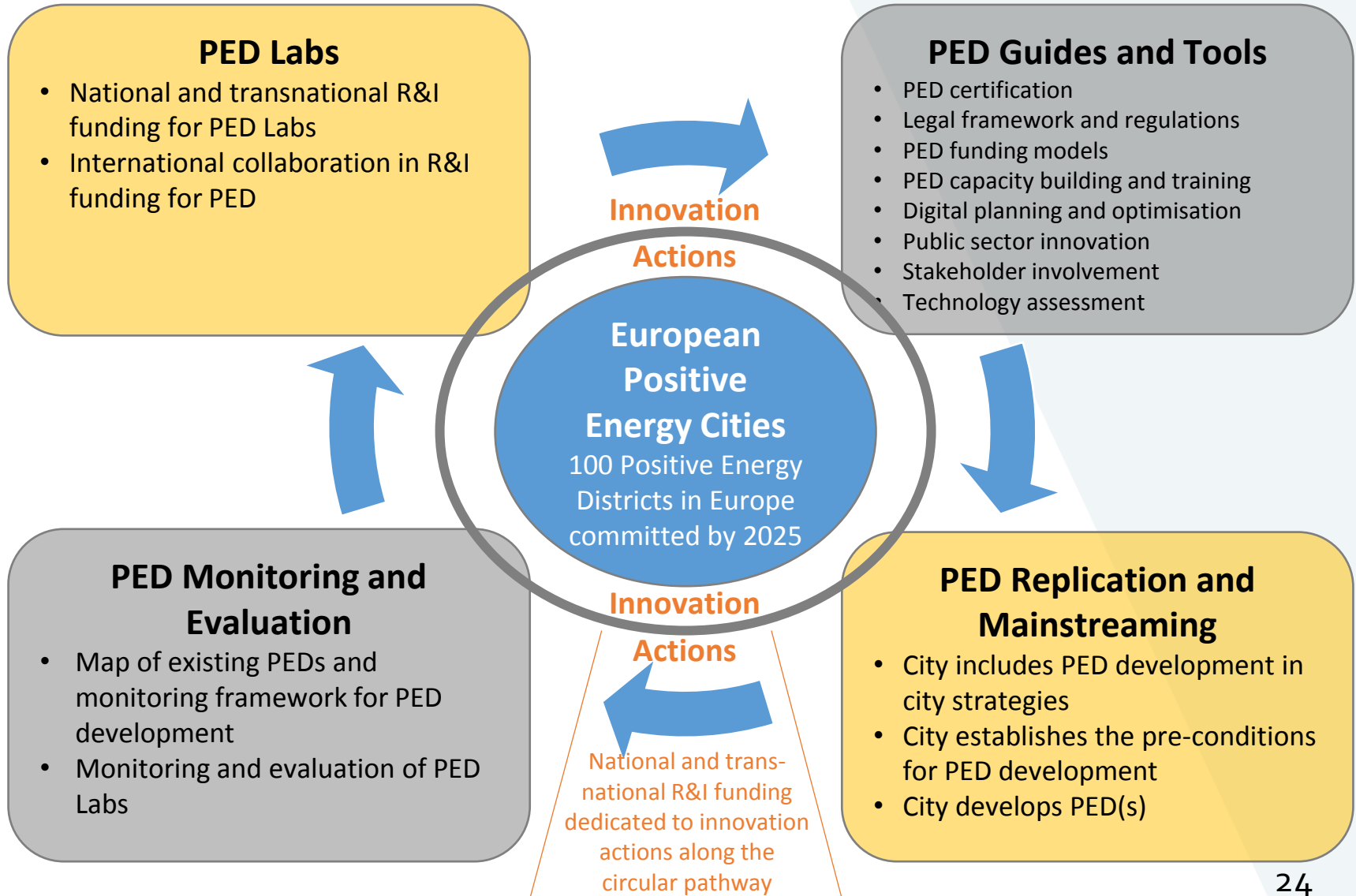
## Positive Energy Districts: Sustainable and Liveable Urban Areas

- The overarching goal of the SET-Plan Action 3.2 is to deliver a contribution to sustainable and liveable urban areas inspired by UN Habitat and the UN Sustainable Development Goals (SDGs)
- Positive Energy Districts (PED) are a means to contribute to urban sustainability
- The goal of establishing sustainable and liveable urban areas calls for the integration of PEDs with technological, spatial, regulatory, financial, legal, environmental, social and economic perspectives
- Sustainability aspects will play a strong role in the PED definition and the KPIs of PEDs

## Urban Transition for Sustainable Urbanisation

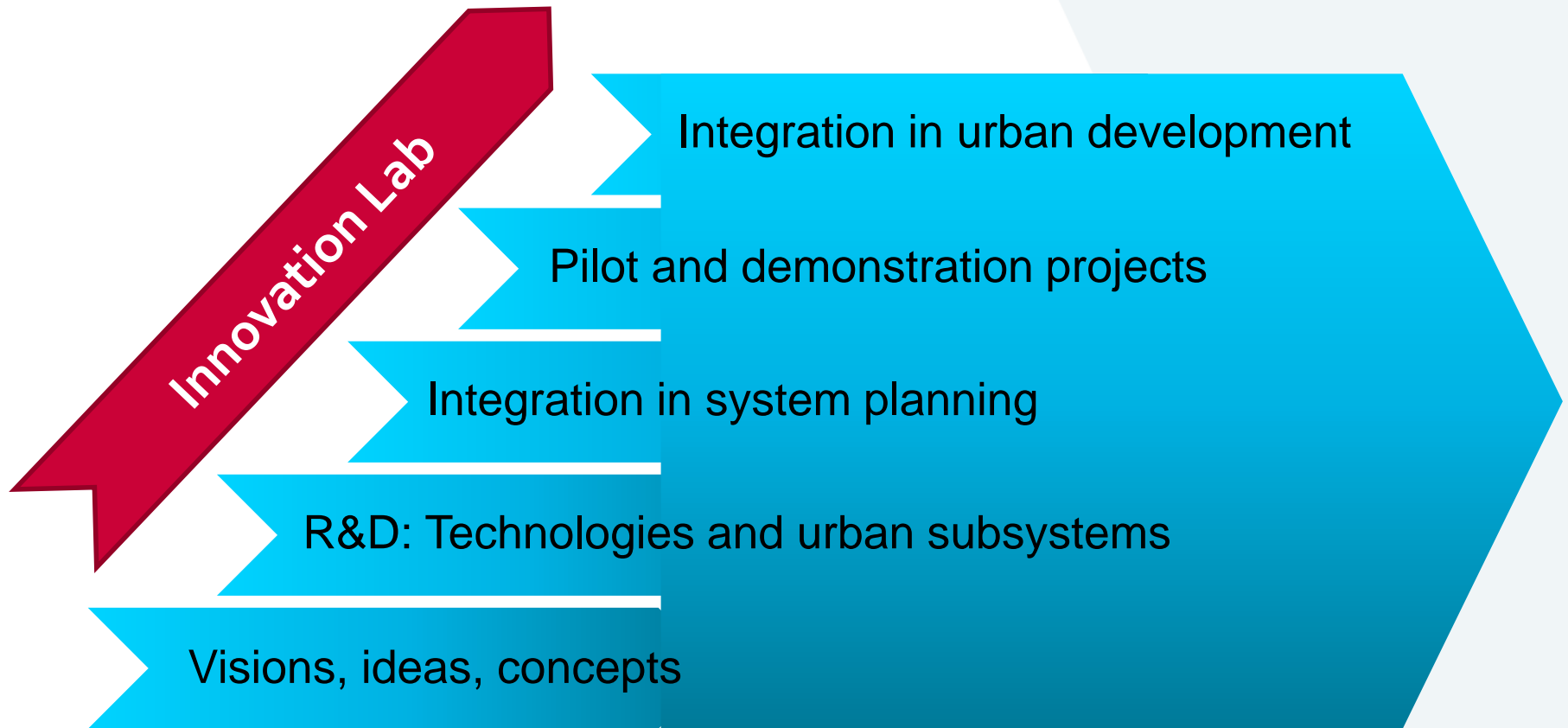


# Implementation Plan for Positive Energy Districts

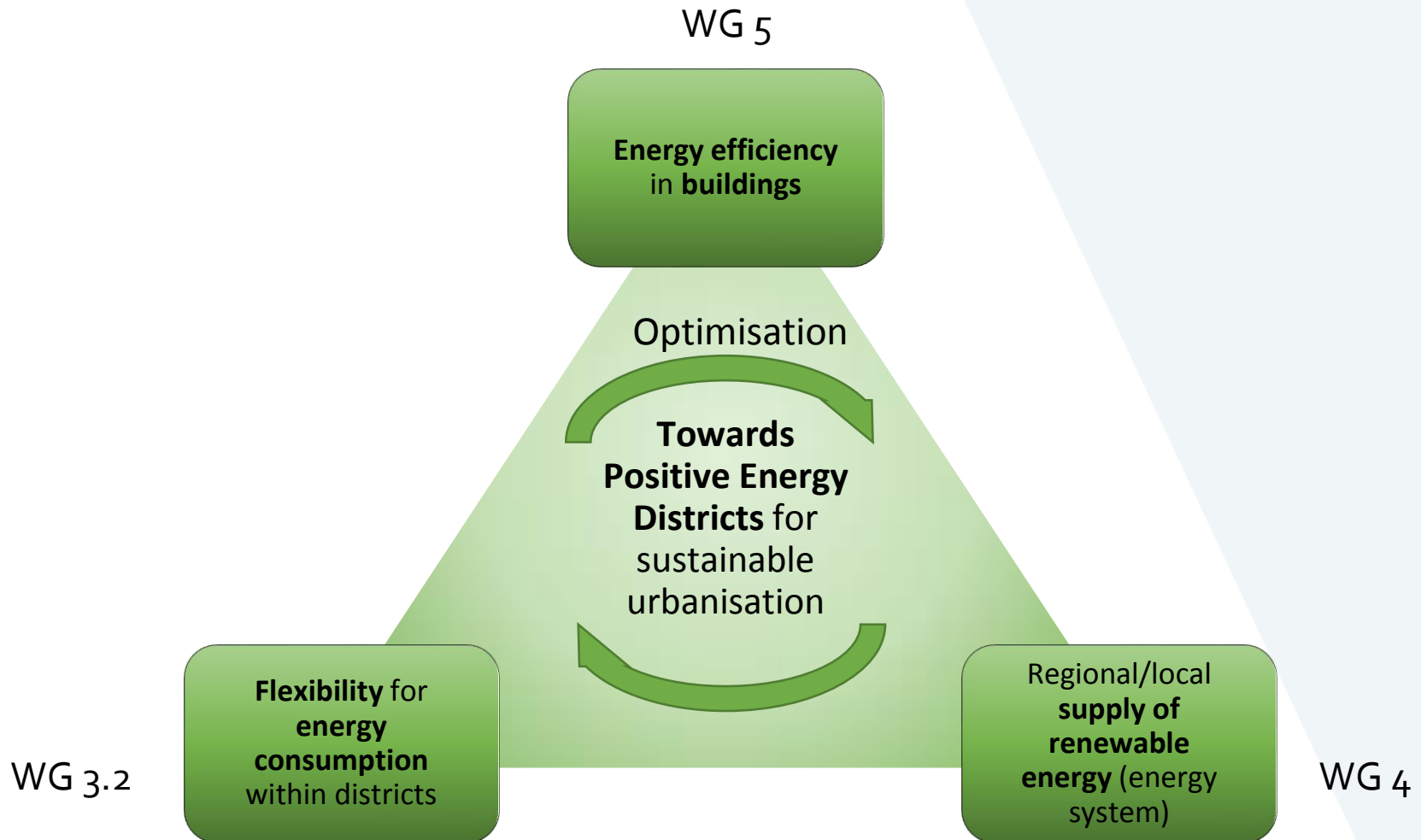




# The Role of Innovation-Labs: Empowering the Cities



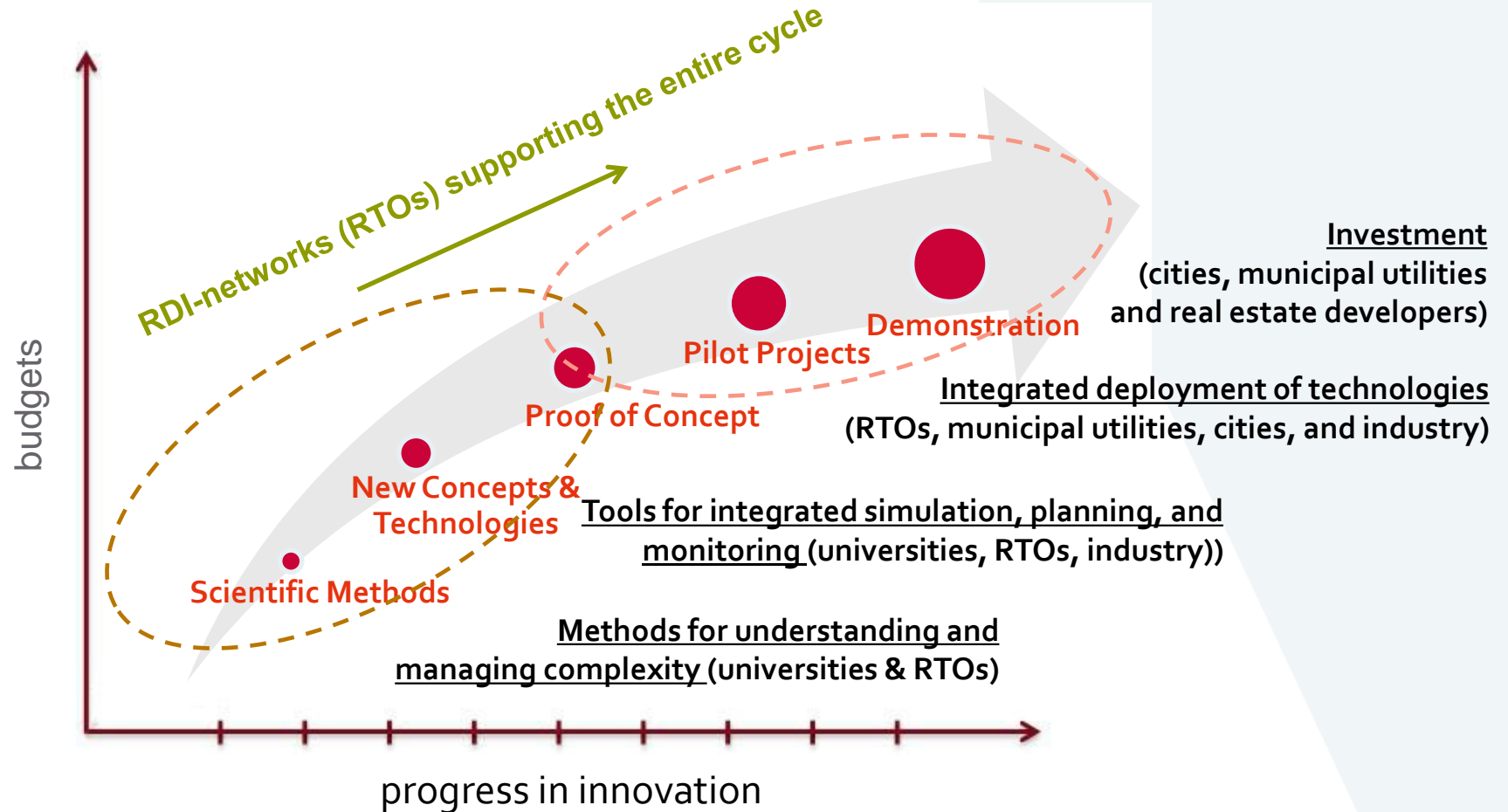
## How SET Plan Actions need to collaborate



## Structures needed for Implementation Programmes



# Actors Driving Innovation in the Urban Field



## Programme Management for PEDs Needs to make Sure all Relevant Stakeholders stay involved

- Sustained political commitment on municipal level
- Involvement of all relevant stakeholder groups in the creation of a shared vision
- Ongoing dialogue among societal actors
- Identification of and support to the problem owners
- Cohesive programme management

<https://setis.ec.europa.eu/>



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