

Smart Lighting – Smart Cities

IGOV Kenniscaf  , 26 juni 2016

dr.ir. Elke den Ouden



expertise in smart lighting & smart cities @ TU/e

TU / **e**

Technische Universiteit
Eindhoven
University of Technology



dr.ir. Elke den Ouden

TU/e Fellow

Department of Industrial Engineering & Innovation Sciences

New business development in public-private value networks



**Intelligent Lighting
Institute**

Smart lighting & smart cities



**Data Science Center
Eindhoven**



Valorisation projects for external clients

Changing roles in the innovation process

The past

- Traditional roles of government
- Traditional innovation processes in the industry

The present

- Smart city pilot projects

The future

- Smart governance for smart cities & societies

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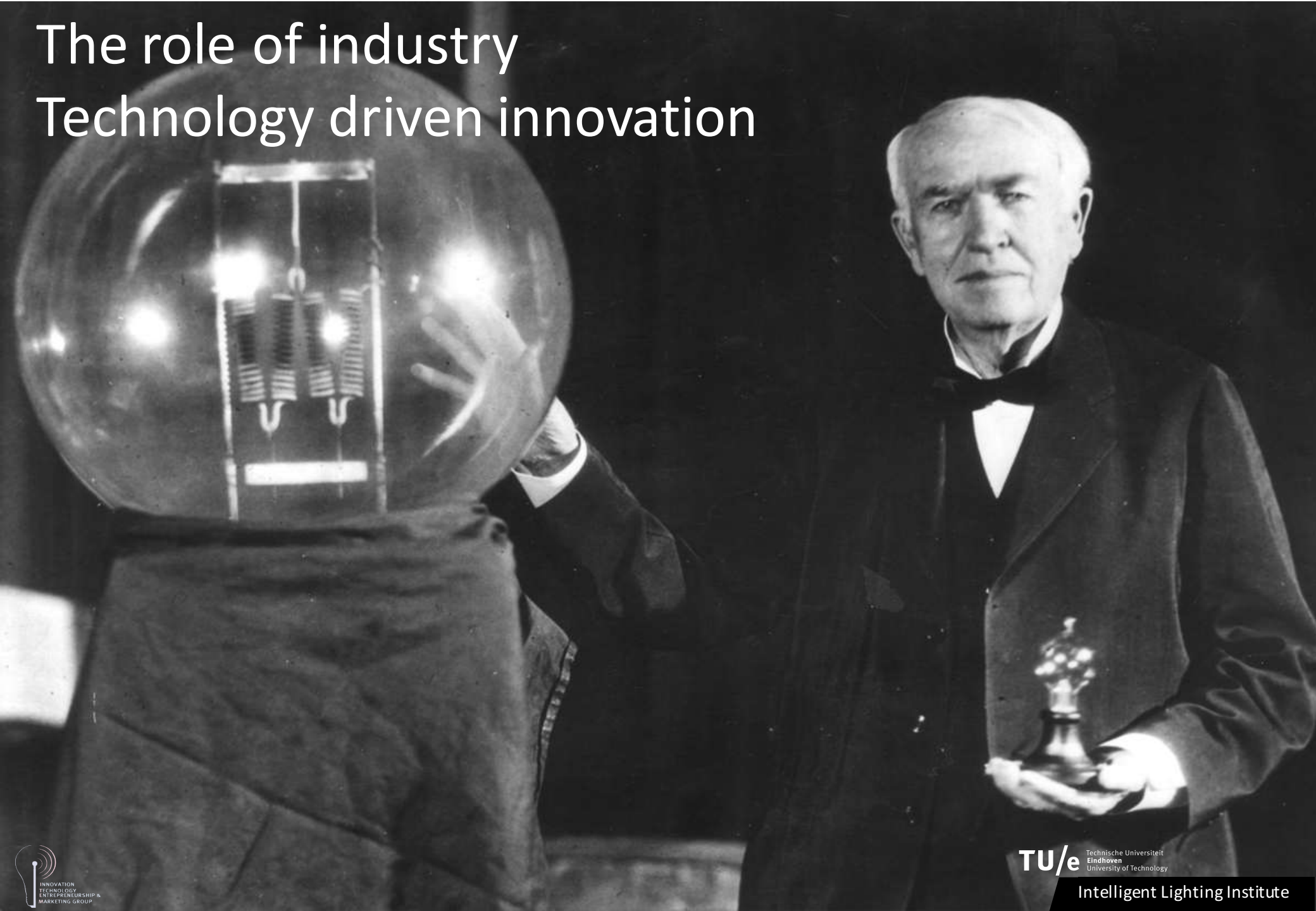
The past



The role of government:
Providing safety – procuring products

The role of industry

Technology driven innovation





This Room Is Equipped With
Edison Electric Light.
Do not attempt to light with
match. Simply turn key
on wall by the door.

The use of Electricity for lighting is in no way harmful
to health, nor does it affect the soundness of sleep.





Innovation in production processes

TU/e Technische Universiteit
Eindhoven University of Technology

Intelligent Lighting Institute

Traditional roles

Role of the industry

Innovator

- Gather insights in user needs
- Develop new products
- Marketing & sales
- Provide warranty

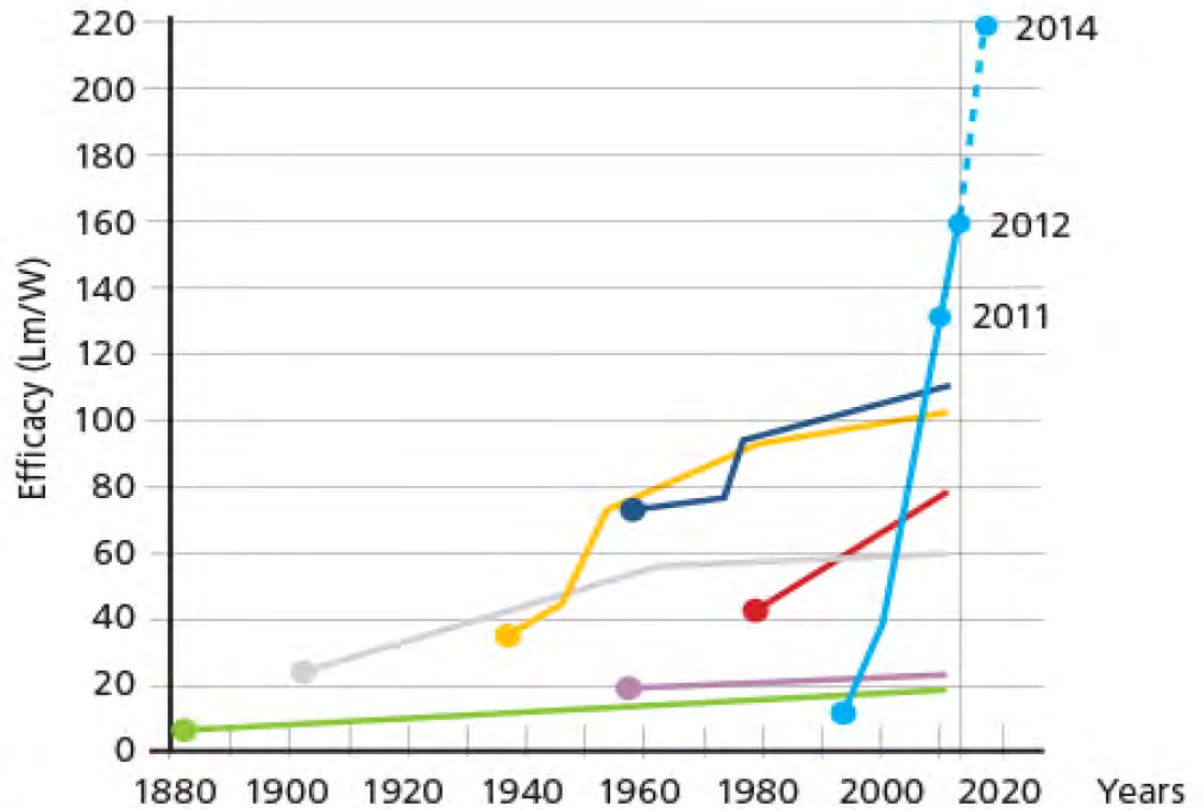
Role of the government

Buyer

- Laws and regulations
- Define needs in specific areas
- Procurement of products (tendering)
- Maintenance

Solid State is the new lighting technology

- Incandescent light bulb
- Mercury-vapor lamp
- Halogen lamp
- Fluorescent lamp
- Metal-halide lamp
- Compact fluorescent lamp
- LED



Transition in the lighting industry

The digitisation of lighting creates a revolution in urban lighting



Smart Lighting mogelijkheden ...

Interactieniveaus:

1. Dynamisch licht

- Gedefinieerde lichtscenario's
- Geactiveerd door vaste triggers
- Bijvoorbeeld timers

2. Adaptief licht

- Gedefinieerde lichtscenario's
- Geactiveerd door real time, lage bandbreedte triggers
- Bijvoorbeeld lichtsensoren, microfoons, bewegingssensoren

3. Interactief licht

- Real time lichtscenario's
- Geactiveerd door betrokkenheid gebruikers, hoge bandbreedte triggers
- Bijvoorbeeld camera's, interactieve beeldschermen, smart phones

4. Sociaal licht

- Interactief licht
- Geactiveerd door herkenning emoties en sociale relatie tussen gebruikers en systemen

Disruption in the industry

LED & integration in smart sensor networks create new opportunities for public lighting:

- Reduction of energy use & light pollution
- Increase perceived personal safety, comfort, hospitality, ...

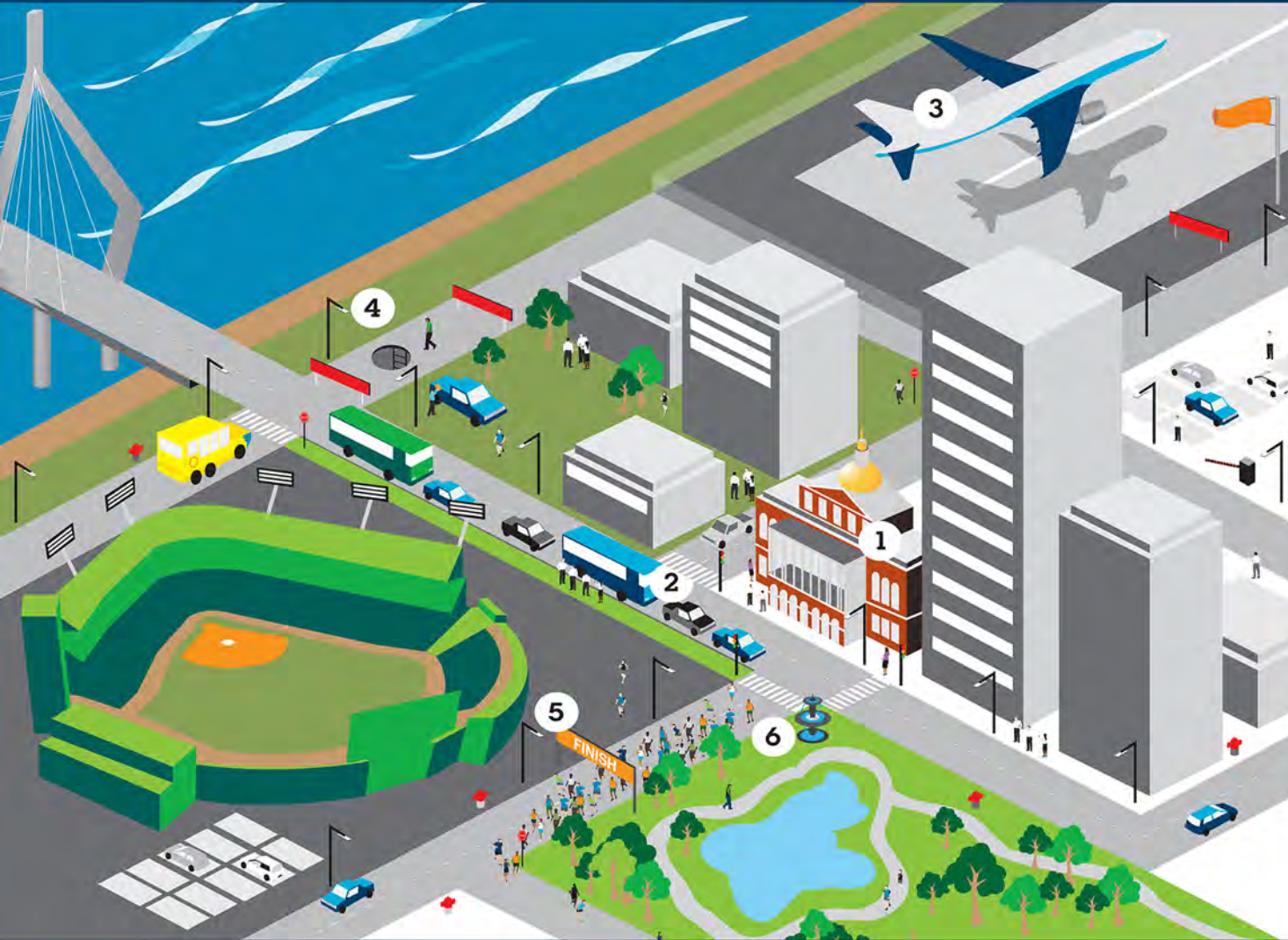
→ towards Smart City Solutions

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The present

Building a Smarter City and State

The Commonwealth of Massachusetts, The City of Boston and IBM are working together to transform the region's physical infrastructure, engage citizens, reduce costs and improve efficiency. Do you know where technology is at work where you live?



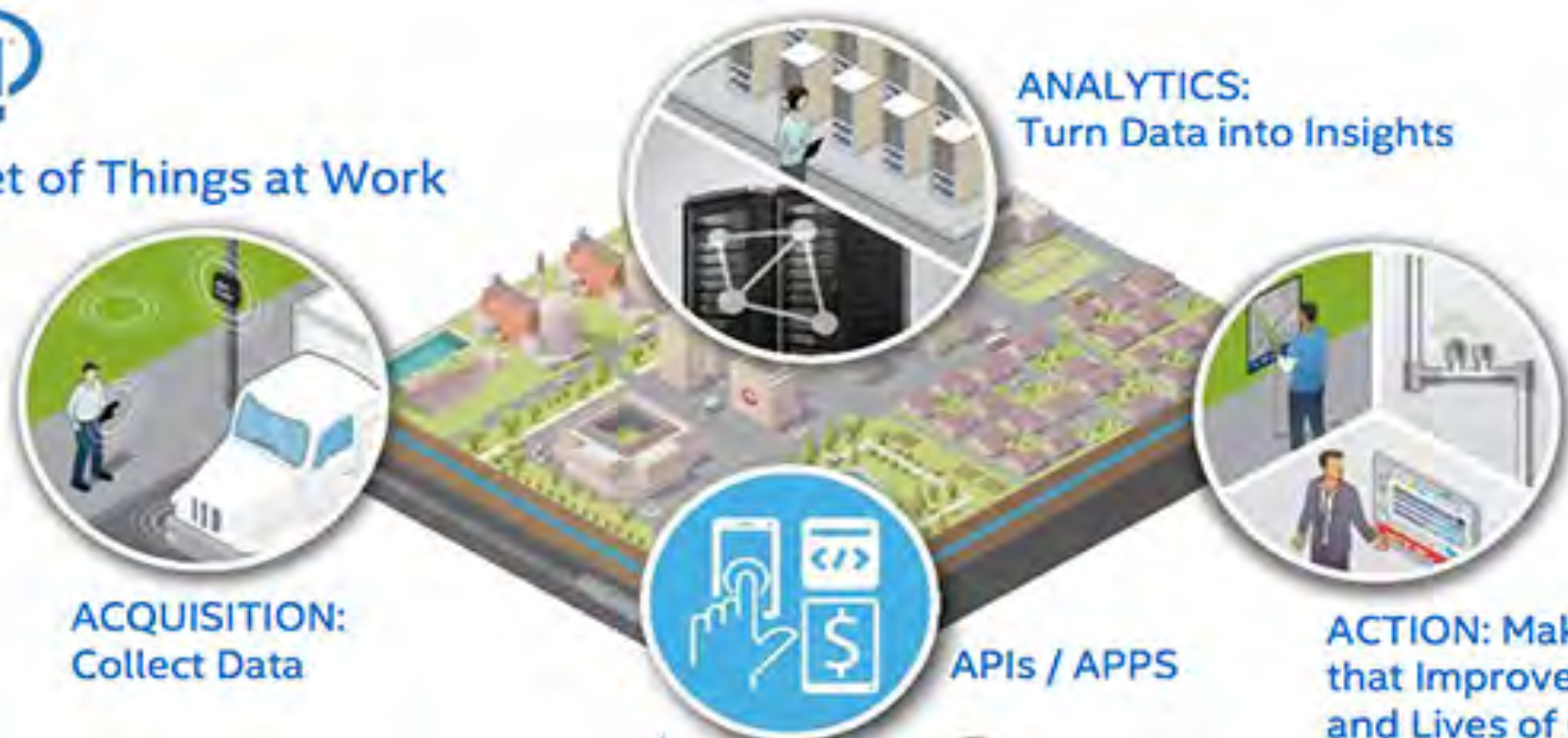
- 1 — Buildings:**
The state of Massachusetts owns 72 million square feet of property. Software helps improve maintenance, space and management across public sector buildings.
- 2 — Traffic:**
Approximately 1.9 million commuters travel by car a day in Boston. Officials examine how Big Data technology makes transportation more efficient and reduce pollution.¹
- 3 — Airport:**
Tens of millions of travelers pass through Logan Airport every year. Software helps the Port Authority better manage maintenance operations for equipment such as air conditioning, doors and escalators at Terminal A.²
- 4 — Physical Assets:**
Boston has more than 60,000 streetlights³ and 13,000 fire hydrants.⁴ Software helps city officials better manage and maintain physical assets.
- 5 — Special Events:**
More than half a million people attend events such as the Boston Marathon and July 4th fireworks every year. Software can integrate and visualize critical information across city departments including fire, police and emergency responders to help coordinate and plan special events.⁵
- 6 — Water:**
Massachusetts Water Resource Authority (MWRA) serves 2.5 million people in 61 communities.⁶ Using software, MWRA decreased corrective maintenance and project work orders by 38 percent.

¹ Boston ranked fifth most traffic-prone city in nation. Daily Free Press: <http://dailyfreepress.com/2013/02/11/boston-ranked-fifth-most-traffic-prone-city-in-nation/>
² About Logan International Airport: <http://www.massport.com/logan-airport/about-logan/page/default.aspx>
³ Street Lighting Division for the City of Boston
⁴ Current Newsletter, July-August 2011: http://www.bwsc.org/notice/public_notice/CUR_2011_4_JUL_AUG.pdf
⁵ BAA Offers Runner Deferral: Wait til Next Year, Boston.com: http://www.boston.com/sport/marathon/coverage/2012/04/17/baa_offers_runners_deferral_wait_til_next_year/
⁶ About Massachusetts Water Resource Authority: <http://www.mwra.state.ma.us/02org/html/whats.htm>





Internet of Things at Work



ACQUISITION:
Collect Data

ANALYTICS:
Turn Data into Insights



APIs / APPS

ACTION: Make Decisions
that Improve Businesses
and Lives of Citizens



Citizens & Community



Health & Wellbeing



Transport & Logistics



Energy Systems



Environmental Monitoring



Water & Waste



Built Environment

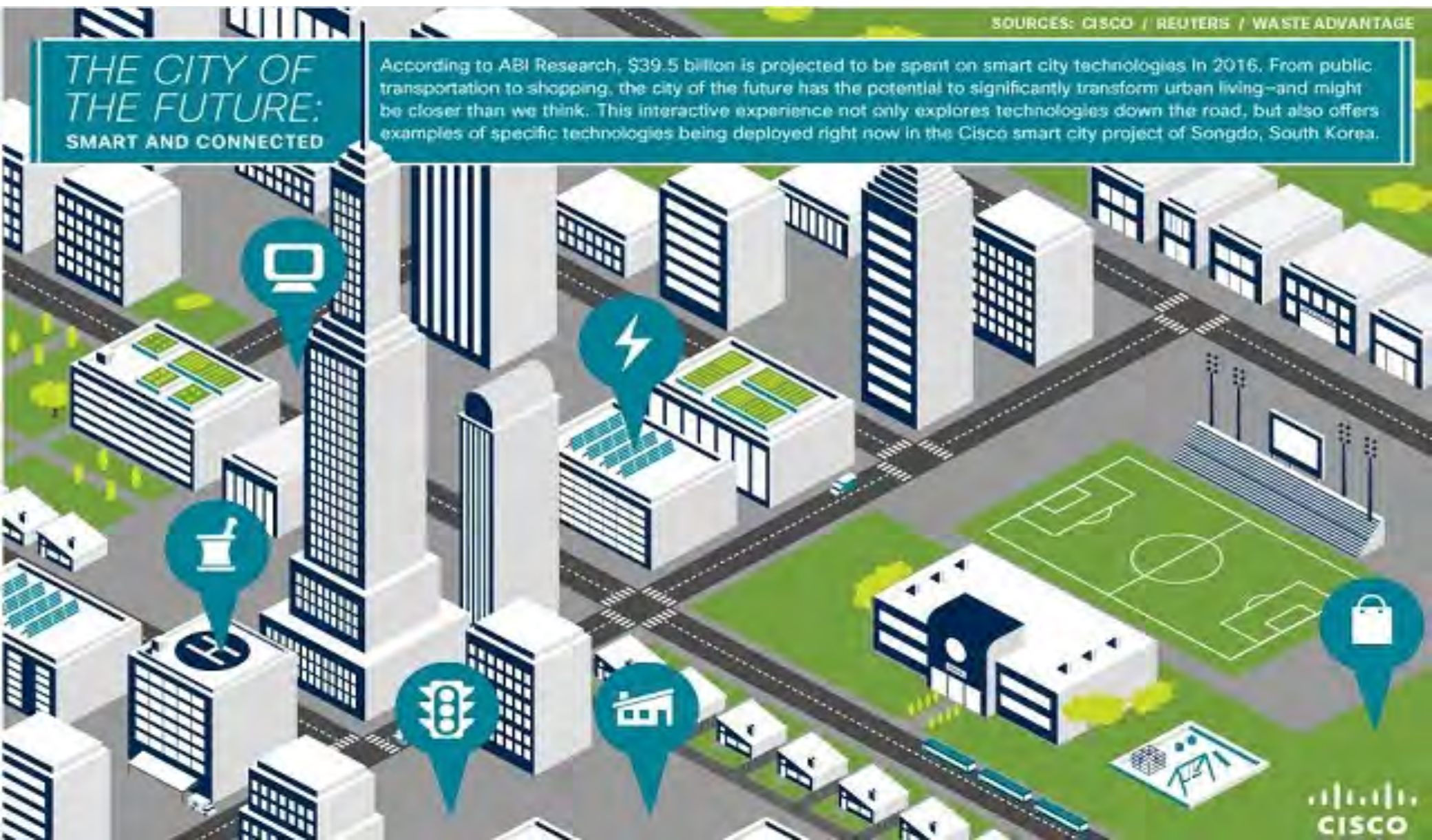


Economy & Innovation



THE CITY OF THE FUTURE: SMART AND CONNECTED

According to ABI Research, \$39.5 billion is projected to be spent on smart city technologies in 2016. From public transportation to shopping, the city of the future has the potential to significantly transform urban living—and might be closer than we think. This interactive experience not only explores technologies down the road, but also offers examples of specific technologies being deployed right now in the Cisco smart city project of Songdo, South Korea.



Current roles

Role of the industry

- Gather insights in user needs **together with leading cities**
- Develop new products **& services**
- Marketing & sales
- Provide warranty **& maintenance**

Role of the government

- Laws and regulations
- Define needs in specific areas
- **Experiment in pilot projects**
- Procurement of products **& services** (tendering)

Many smart city projects are pilot projects...

- with the (un)reliability of prototypes
- small scale = little impact on strategic ambitions
- without standards or platforms to support further innovation or upgrades

... so how do we get beyond the pilot?

3 The future

Disruptive technologies enable smart solutions



Improve **functionality**:

- Improved performance and reduced energy consumption

Improve **liveability**:

A vibrant and sustainable city for its citizens

... but how does it contribute to quality of life?



How can technology serve the needs of people?
What services will increase quality of life?

Layered model for smart urban solutions

Societal Needs



Services: for societal stakeholders

ICT: data and application

Devices: sensors, lights

Infrastructure: dense network

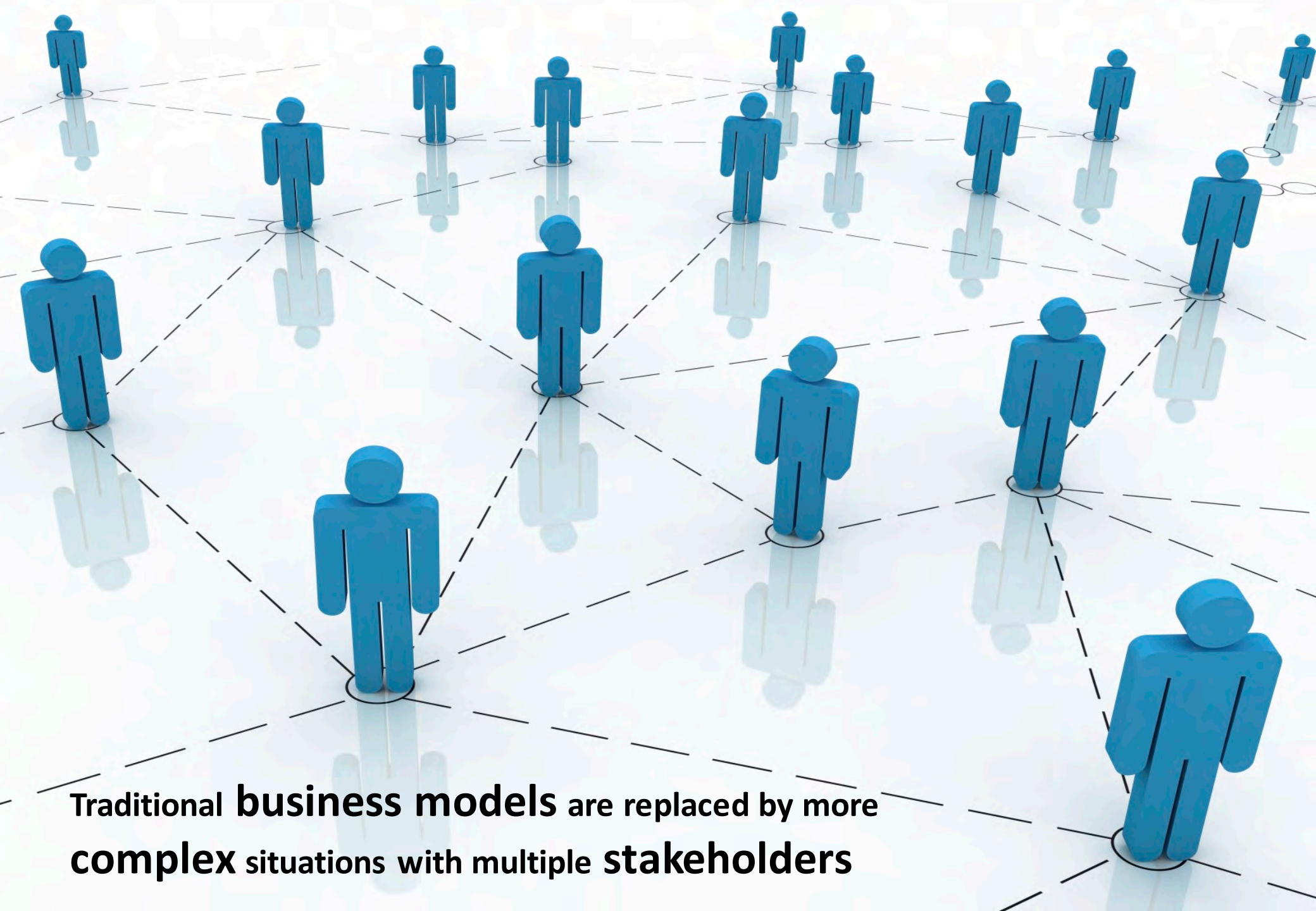
Meaningful applications

Technology enablers

The need for business ecosystems

Nobody has all the information, and nobody will be able to get a transformation going on his own...





Traditional **business models** are replaced by more **complex** situations with multiple **stakeholders**

Future roles

Role of the industry **Innovator**

- Co-creation of new products & services
- Continuous innovation

Role of the government **Driver**

- Laws and regulations
- Drive innovation from societal needs
- Procurement of solutions (tendering)

Amsterdam Smart Light - Hoekenrodeplein

am **smart** / erdam
city

Sustainability

- Reduction light pollution
- Light on demand
- Flexibility for different use of area

Safety:

- Image of the Bijlmer / ZuidOost area
- Crime prevention
- Crowd management @ events

Hospitality:

- Social safety & social cohesion
- Attracting people
- Triggers to stay

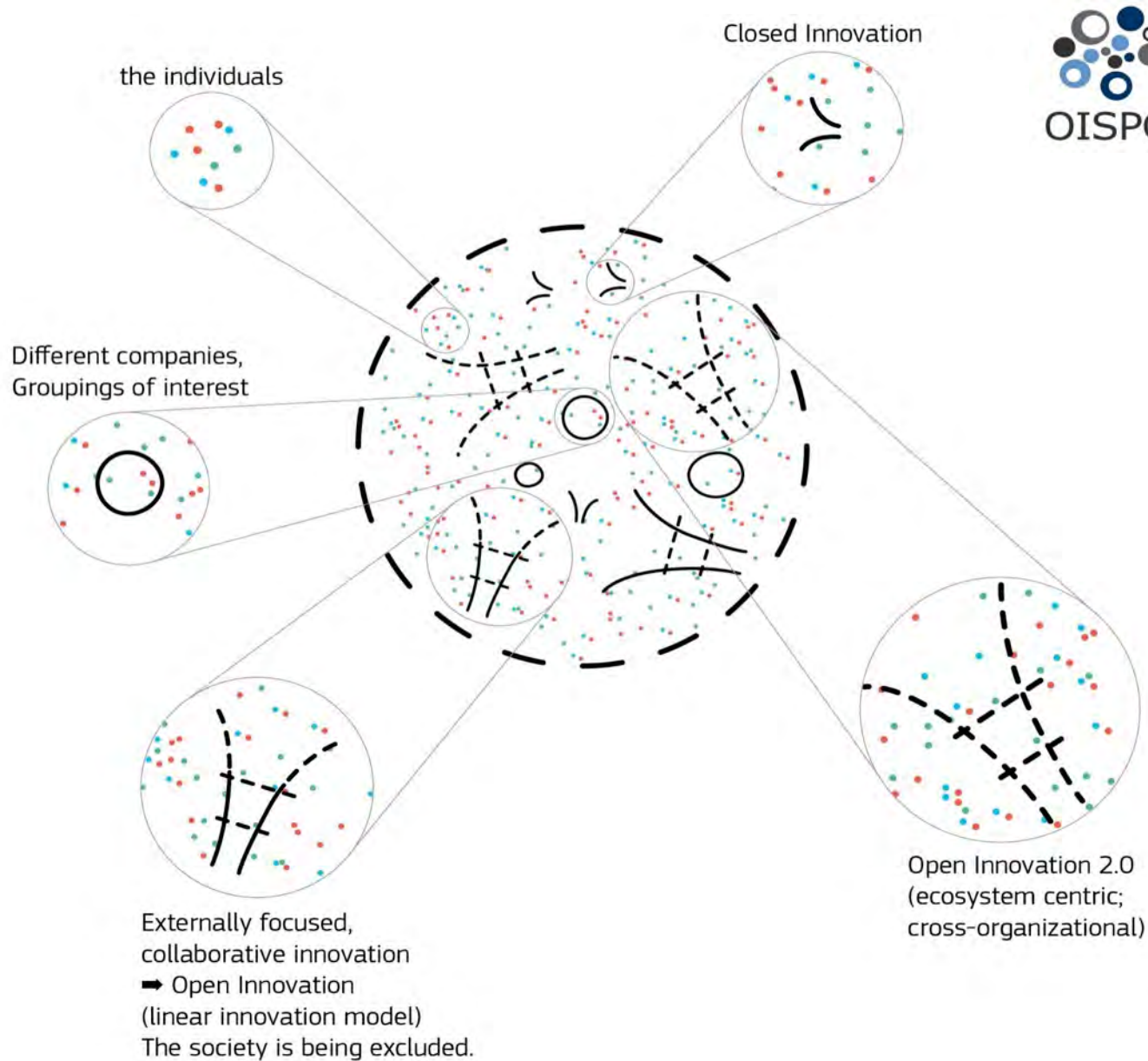
Amsterdam Smart Light - Hoekenrodeplein



am smart/erdam
city



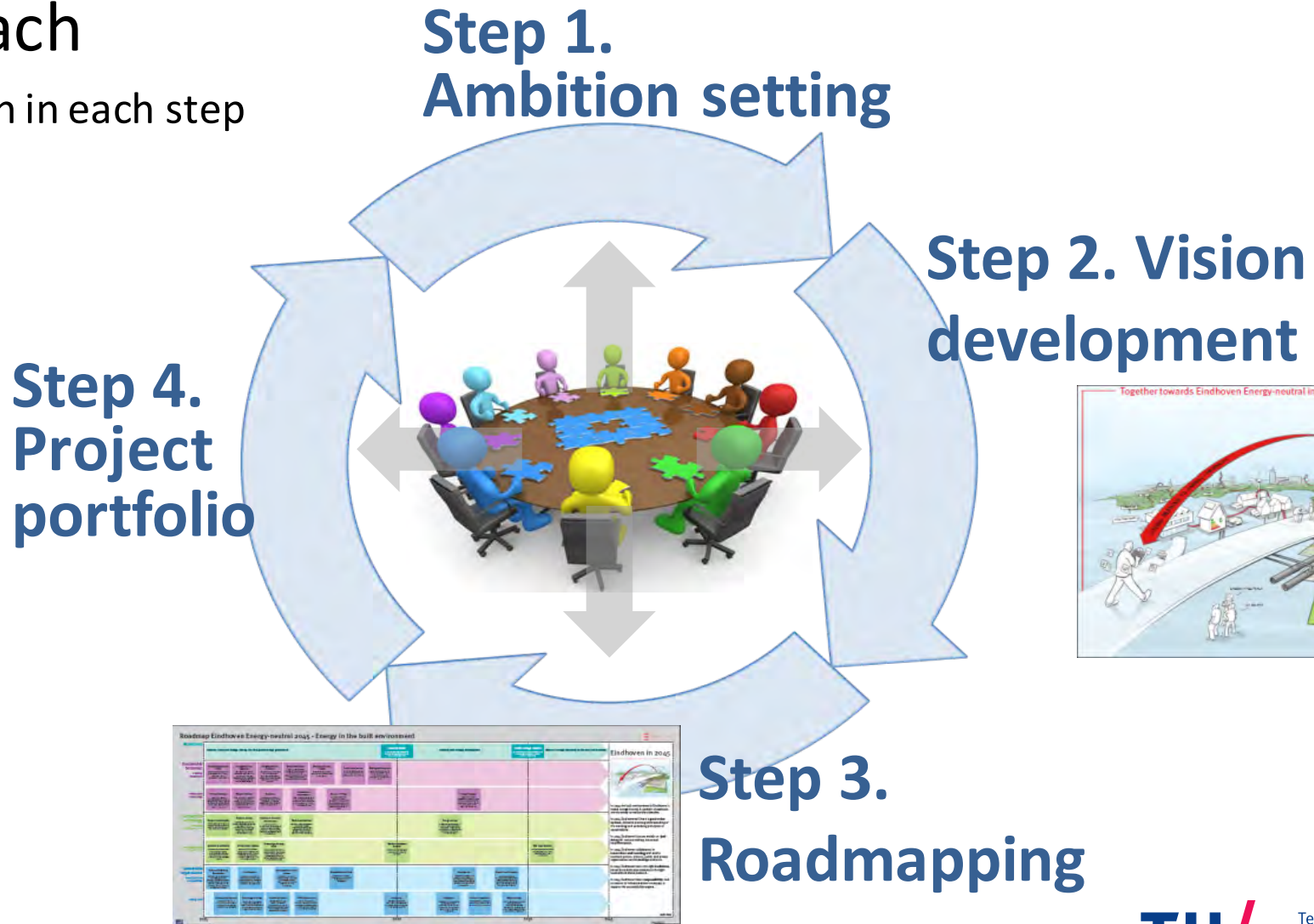
Open Innovation 2.0



Co-creating visions & roadmaps

Approach

Co-creation in each step



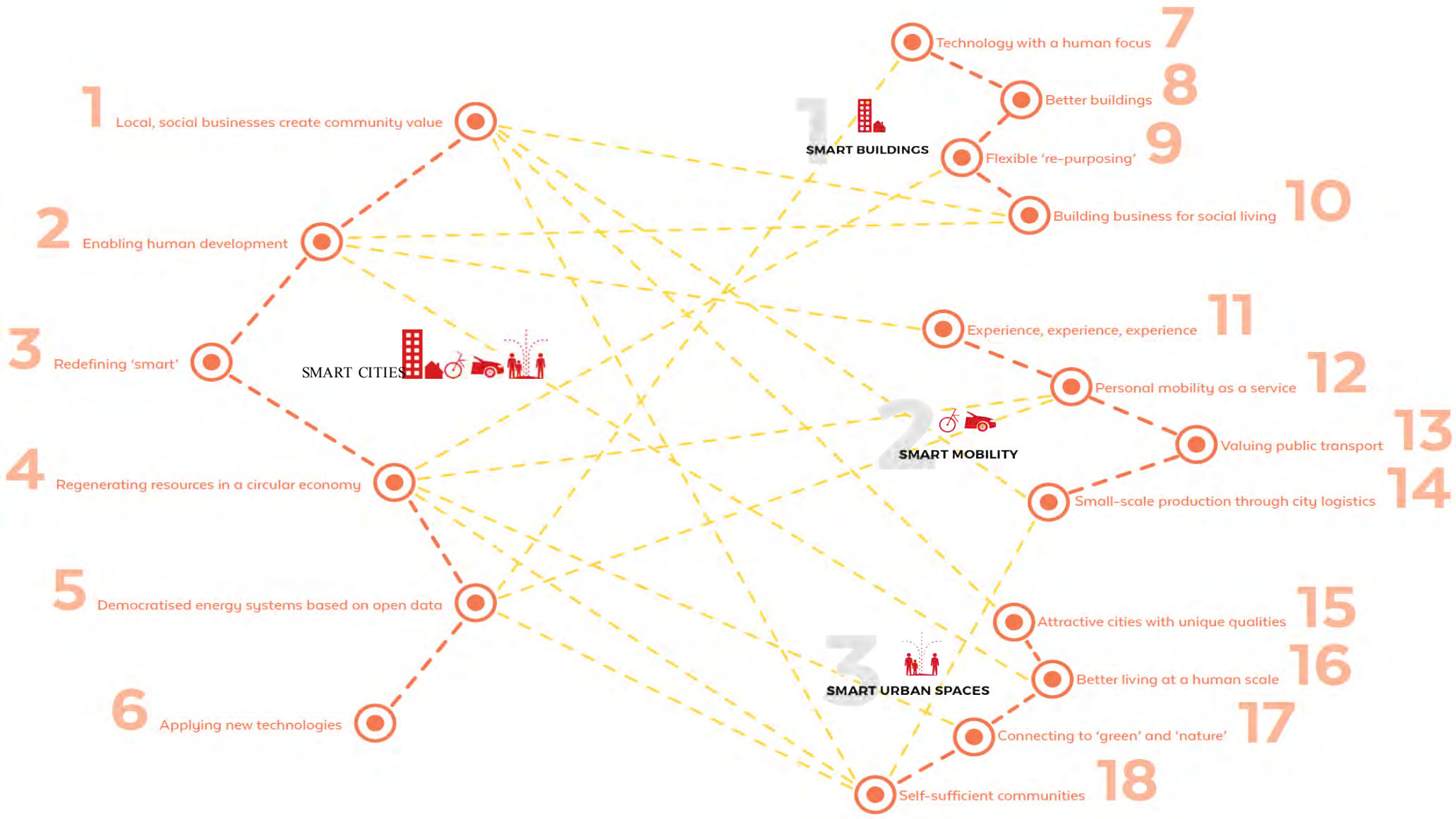
R4E

ROADMAPS
FOR
ENERGY®



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 649397

Drivers for Change for Smart Cities



1 Local, social businesses create community value

In 2050, smaller businesses creating real social value at local level are the norm. Communities and cooperatives have developed new business models ensuring constant investments in infrastructure. These enable the development of new products and services delivering social and environmental value. Innovation means co-creation and cooperation, aimed at creating end-user values. Self organising, self-managing communities are the new social and market paradigm - all enabled by the new city governance models. These drive the transition to empowered citizens who demand a range of sustainable solutions. Municipalities facilitate this transition by creating the required economic and legal frameworks, and by constantly focusing on the public interests.

SMART CITIES

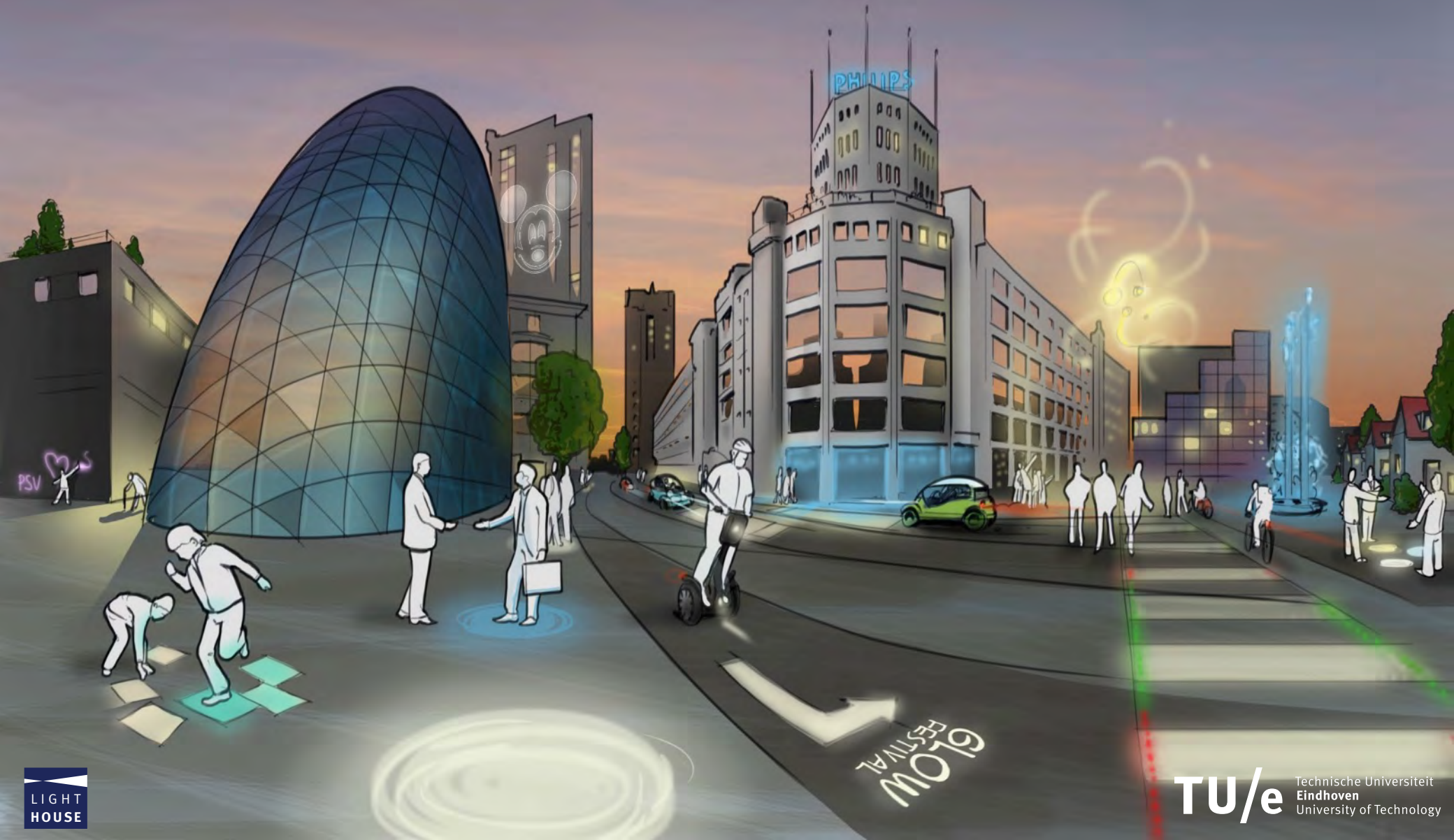


5 Democratised energy systems based on open data

In 2050, energy systems are open, bidirectional, multi-purpose platforms on which (renewable) energy and energy management services are open to all. Entrepreneurs have developed business models that provide value for them, for their users and for society at large. Citizens can choose freely from a range of available options. The system ensures privacy and security of users, who are always in control. Ambient energy networks provide connectivity for (wireless) access to data and energy. Increased computing power and artificial intelligence make system resilient: self-organising, self-sustaining and self-learning.



Vision urban lighting Eindhoven 2030



Roadmap Urban Lighting Eindhoven 2030

More info:
www.eindhoven.nl/smartlight
www.tue-lighthouse.nl



Main values in Scenario 2030:

- An emission aware lighting grid will bring CO₂, energy and lighting together.
- The facilities are sustainable and new facility possibilities for the social urban space.
- The municipality
 - manages the smart lighting grid as a public utility, increasing safety in the outdoor space, including social safety, traffic systems and air quality
 - is responsible for 'granular' and 'granular' for public interest
 - is more transparent and sustainable
 - is open to change the perception of the public space, as being open rather than closed space
- Safeguarding for citizens:
 - that there will always have a say in their own public space
 - that there will be involved in the development of their neighborhood, also as co-creator of their environment
 - that the basic provision is free for all, and optional extra's at a fee
- Setting up provisions for:
 - enabling public interest: engaging citizens, participation, involvement of citizens, signaling collective effects etc.
 - enabling the grid for all kinds of activities: three classes in commercial/public to ensure continuous development and for the quadruple helix
 - allowing for experiments, by enabling (temporary) living labs to co-create and test solutions with various partners

Roadmap Eindhoven 2030





Stratumseind



DE-ESCALATE

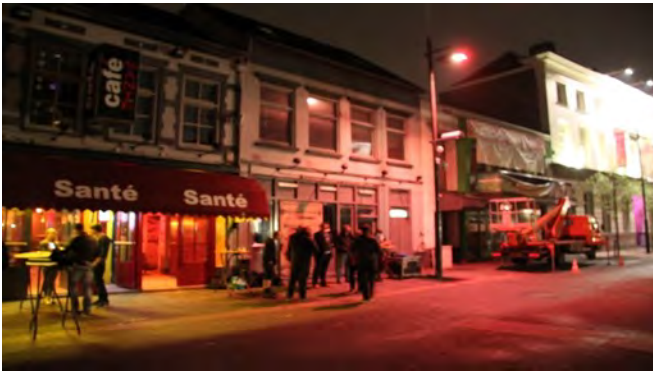
Light as mediator

DE-ESCALATE: Light as mediator



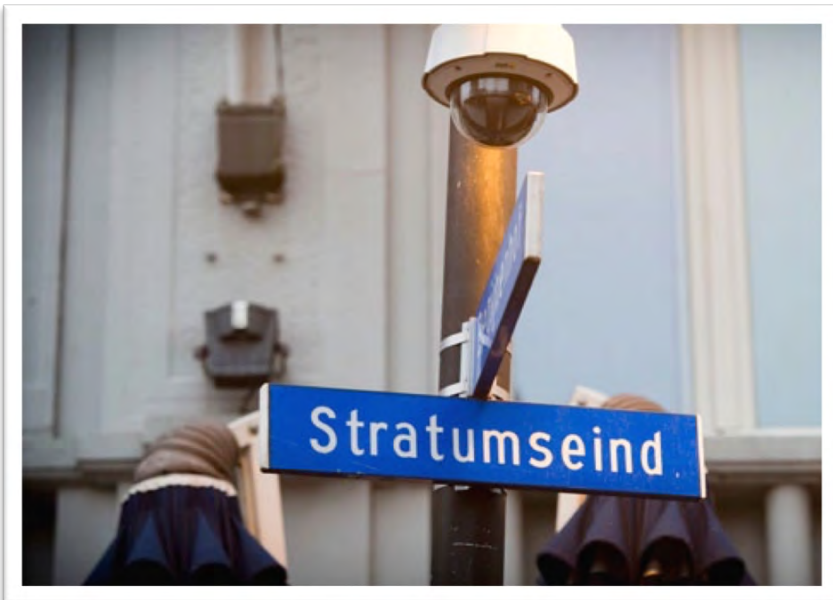
Stratumseind:

Defusing escalating behaviour through the use of interactive light scenarios

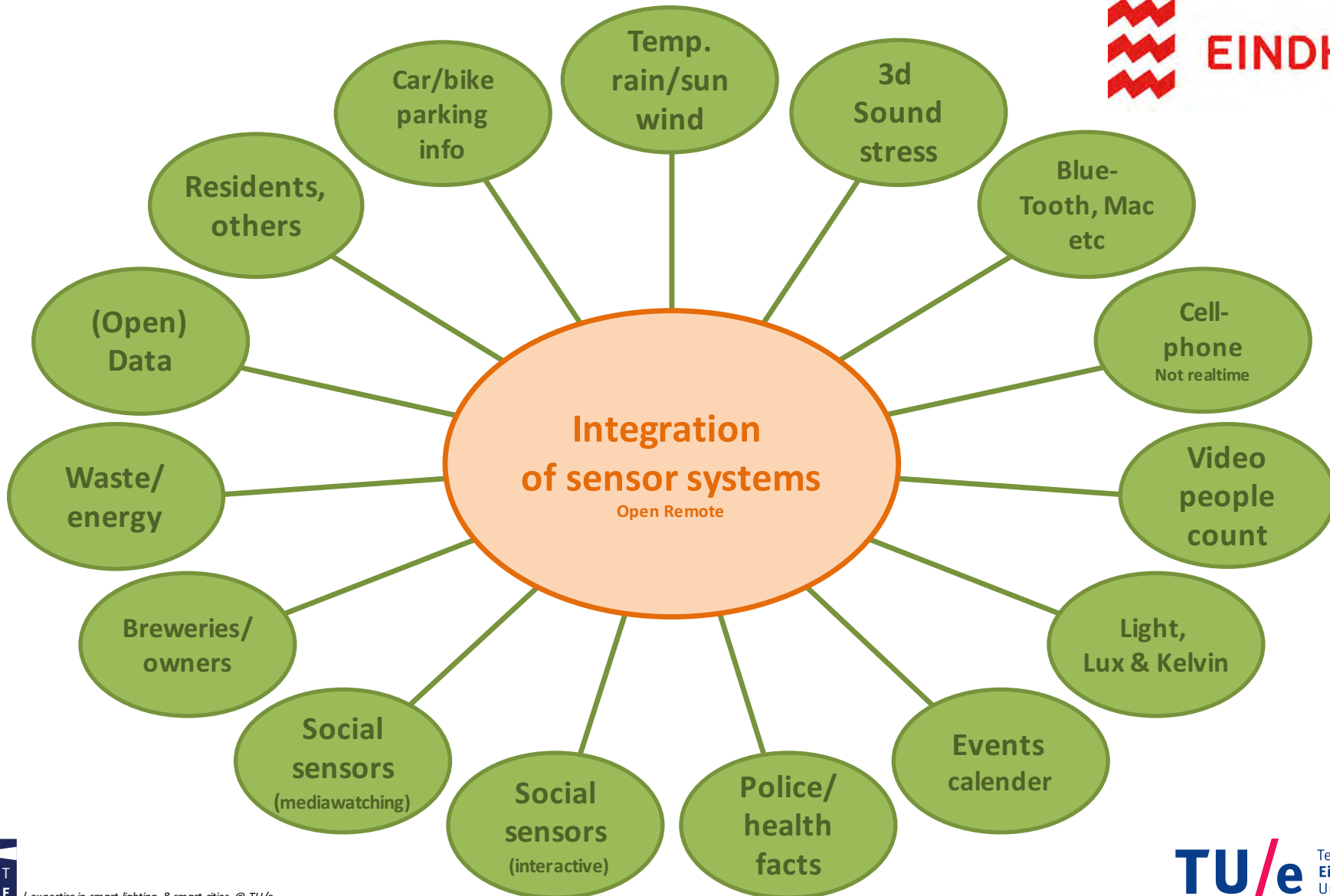


Living Lab Stratumseind

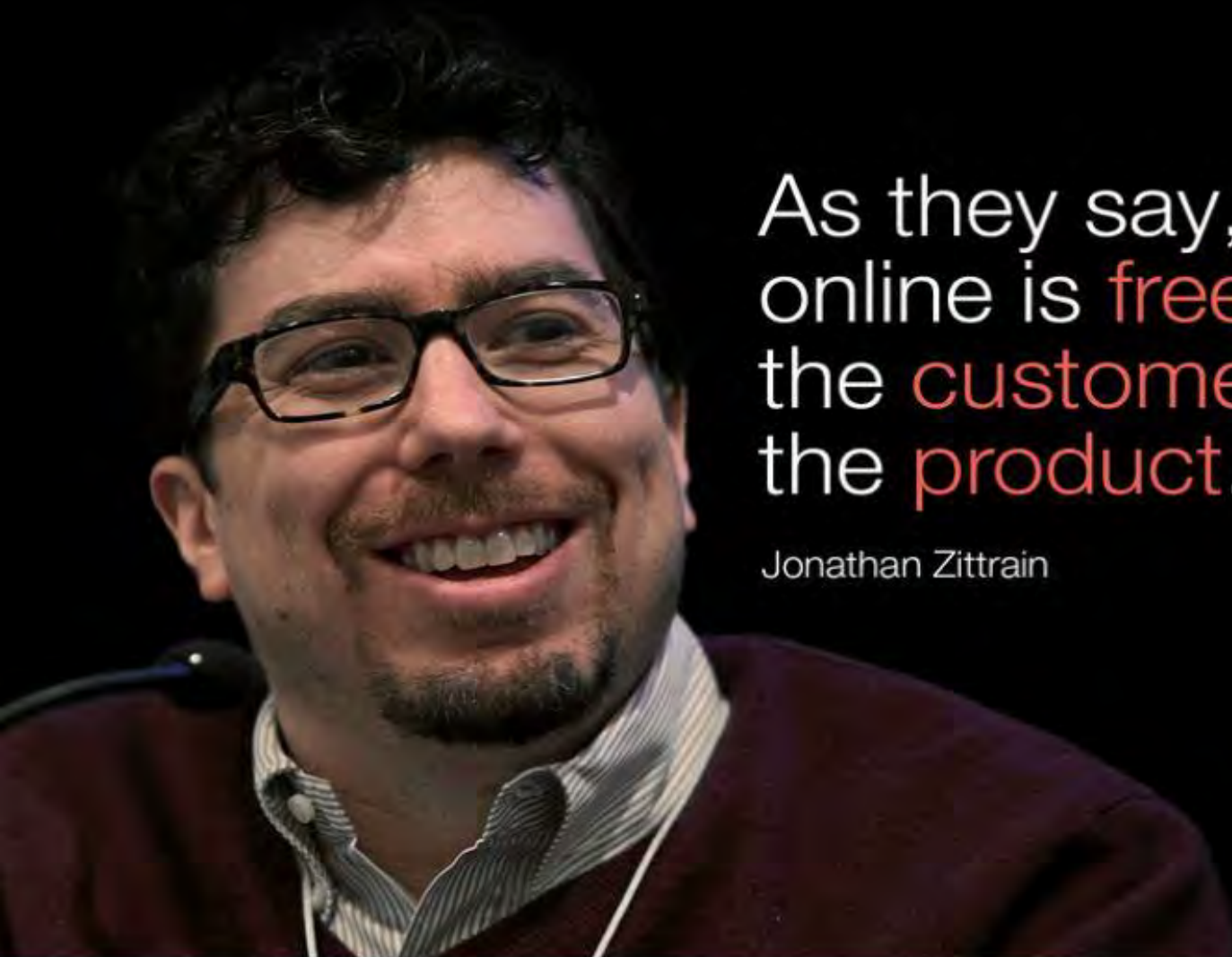
- Collecting data, analysis for correlations
- Base camp: data hub to bring together questions and solutions
- Towards smart city solutions



Living Lab - Sensor system integration



Data driven business models



As they say, if something online is **free**, you're not the **customer** – you're the **product**.

Jonathan Zittrain



Principles Data in Public Space

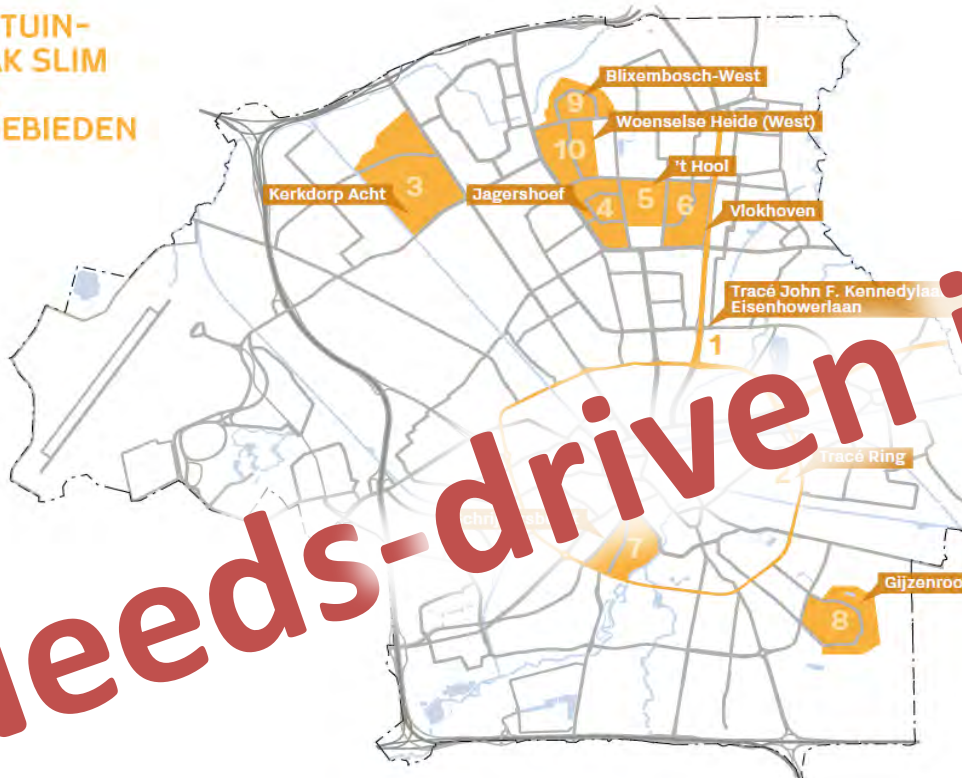


a.	Data residing in the public space (further on: data) belong to everyone. These data are an asset of the public. Data that are collected, generated or measured (for example by sensors that are placed in the public space) should be opened up such that everyone can make use of it for commercial and non-commercial purposes. While doing so, privacy and security aspects should be taken into consideration.
b.	Data may contain personal information. These data can therefore impact the private life of individuals. The rules specified in the Personal Data Protection Act are applicable here. These data may only be opened up after they have been processed (for example, by anonymization or aggregation) such that there are no privacy threats anymore.
c.	Data which do bring privacy or security risks along may only be used according to the privacy legislation. Storage and processing of these data should be performed according to the existing legislation.
d.	Data that do not contain personal information (anymore) should be placed such that everyone can access these data in an equal manner (for example, through an Open Data portal). We call this “opening up” the data. There should be no technical or juridical obstacles that limit, discriminate or block access to data.
e.	Data are always opened up free of charge, without unnecessary processing (as much as possible in a raw form) and according to the functional and technical requirements that are yet to be defined.
f.	A distinction is made with regard to personal data (such as an e-mail address or payment information) that are collected with full awareness and after an explicit consent of the individuals. Use of these data is defined by an agreement between the parties involved according to the rules of privacy legislation (such as an end user agreement).
g.	The city authorities always have an insight into which data is collected in the public space, independently of whether these data can or cannot be opened up.
h.	The city authorities keep an ongoing dialogue with the parties that contribute to the development of data infrastructure in the city and strive to create earning opportunities and a fruitful economic climate.

Now in 2016 ...

The procurement of continuous innovation in public lighting: creating 10 living labs in the city.

PROEFTUIN-
AANPAK SLIM
LICHT:
TIEN GEBIEDEN



Needs-driven innovation



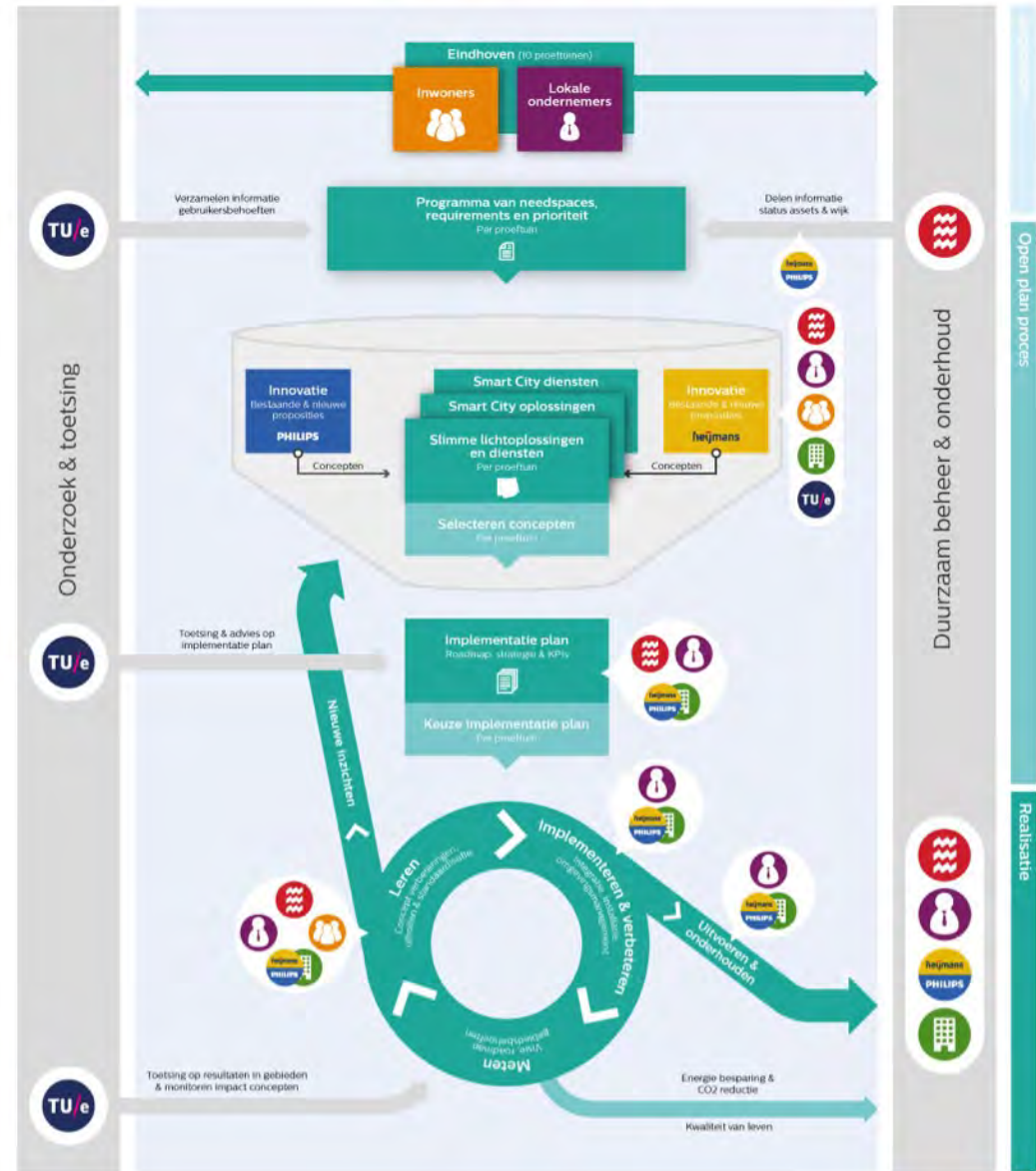
Continuous innovation

Co-creation with:

- residents
- local entrepreneurs

in 3 phases:

- needs identification
- solutions
- implementation & improvement



Questions?