Requirements for Cities Transformation into Smart Ecosystems

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Workshop “Smart Cities digital transformation and digital competences for smart cities’ personnel”, 3 June 2020

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Five areas of requirements

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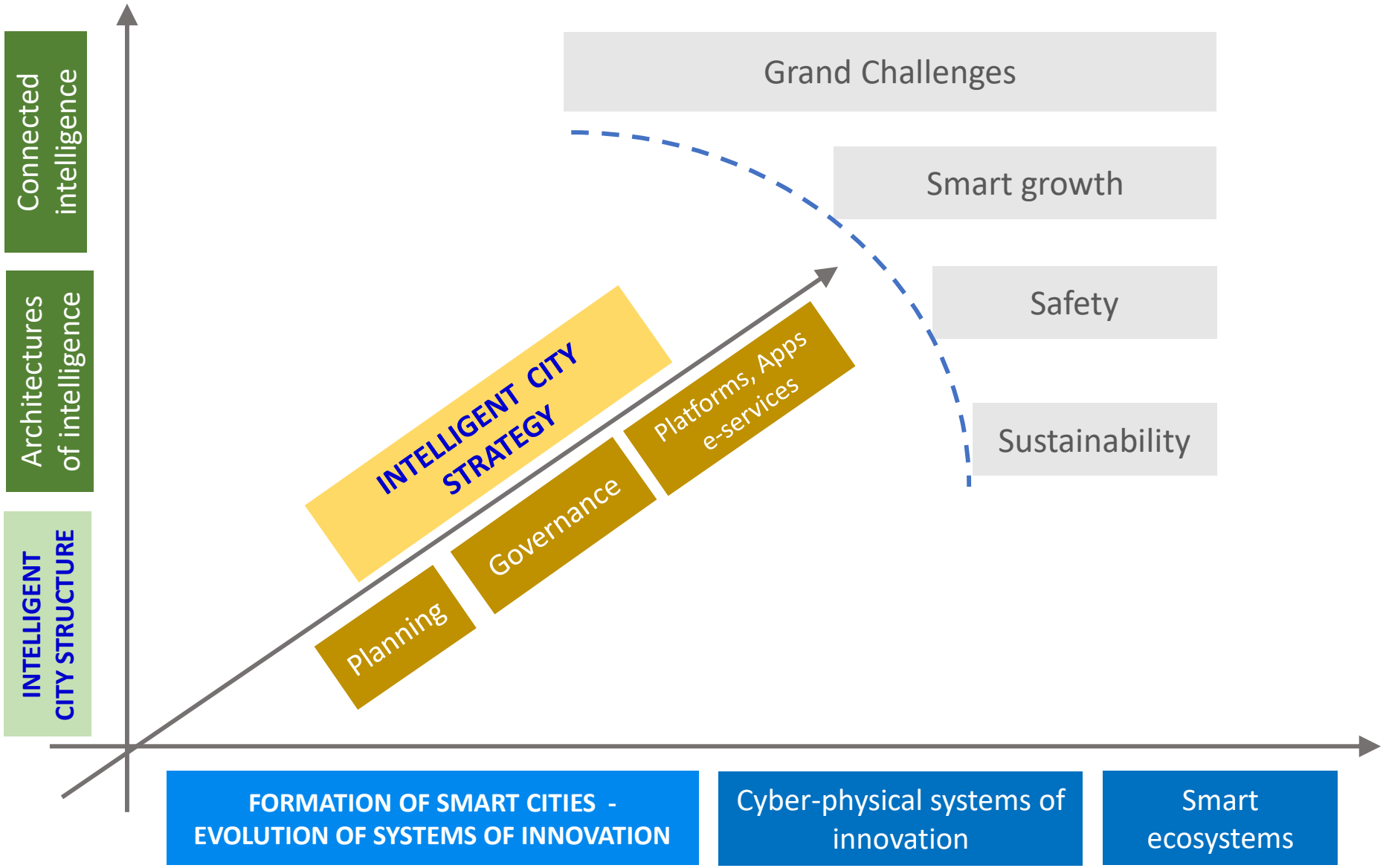


Requirements are based on research at URENIO, a laboratory of Aristotle University conducting research on intelligent cities since 2000

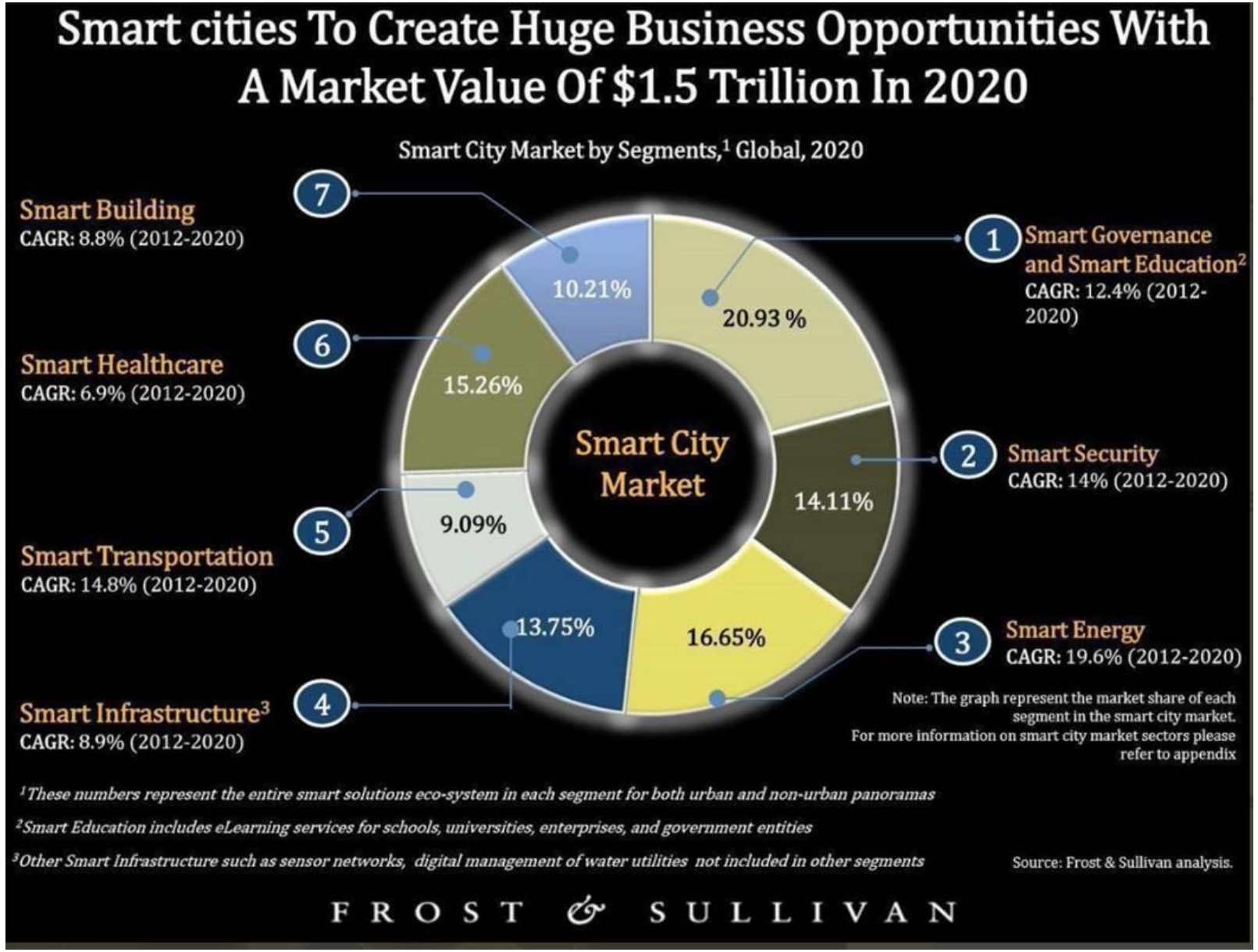
R1. Strategy development by city ecosystems

The city is a heterogeneous system: a system of ecosystems

A hundred principal ecosystems in cities	**Area-based ecosystems**, defined by districts & neighbourhoods	➢ *Central Business District* ➢ *Housing districts* ➢ *Technology districts* ➢ *University campus* ➢ *Recreation areas* ➢ *Open and public Shopping malls* ➢ *Port areas*
	Vertical ecosystems, defined by activities	➢ *Manufacturing sectors* ➢ *Construction* ➢ *Finance* ➢ *Service sectors* ➢ *Trade and wholesale* ➢ *Education* ➢ *Health, Social care*
	Network-based ecosystems, defined by utility and other networks	➢ *Transportation* ➢ *Energy provision* ➢ *Water provision* ➢ *Waste management* ➢ *Telecom* ➢ *Broadband*

A 1943 map showing how London would look based on 'social and functional analysis', which Patrick Abercrombie helped to draw up

Digital transformation is fragmented into ecosystems / vertical markets



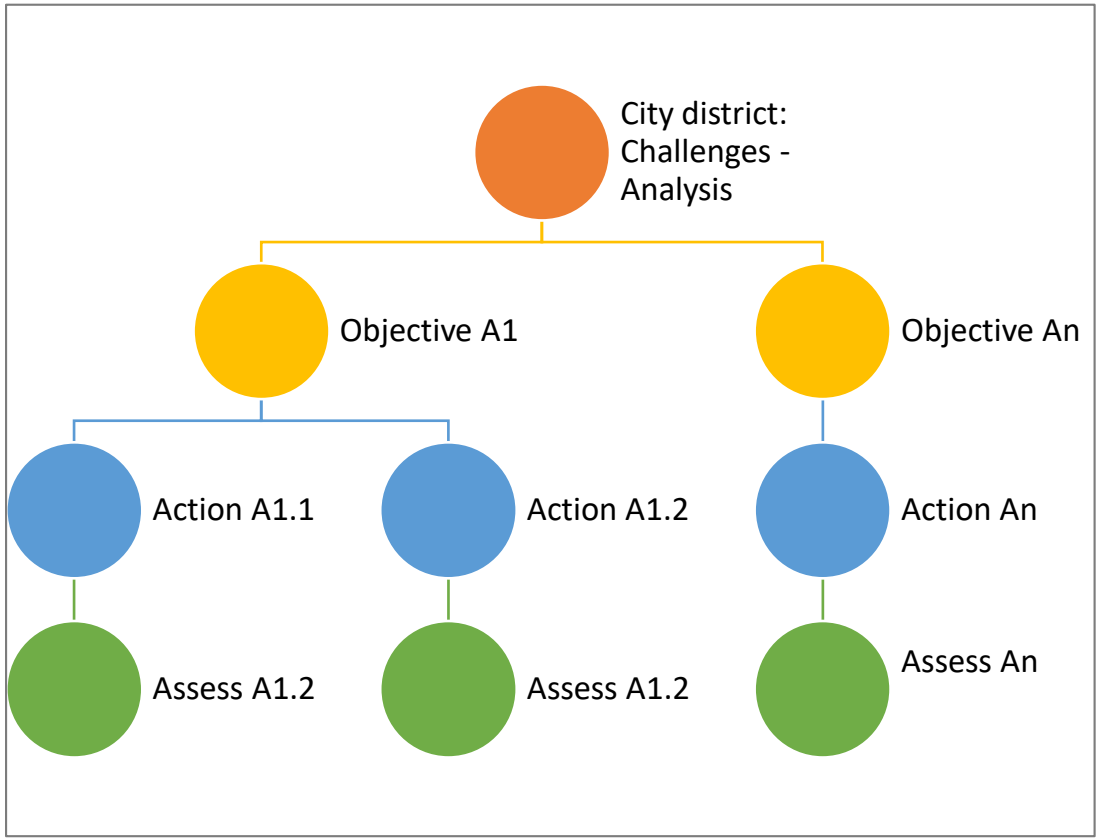
Very low interoperability

Interoperability across vertical smart city markets:

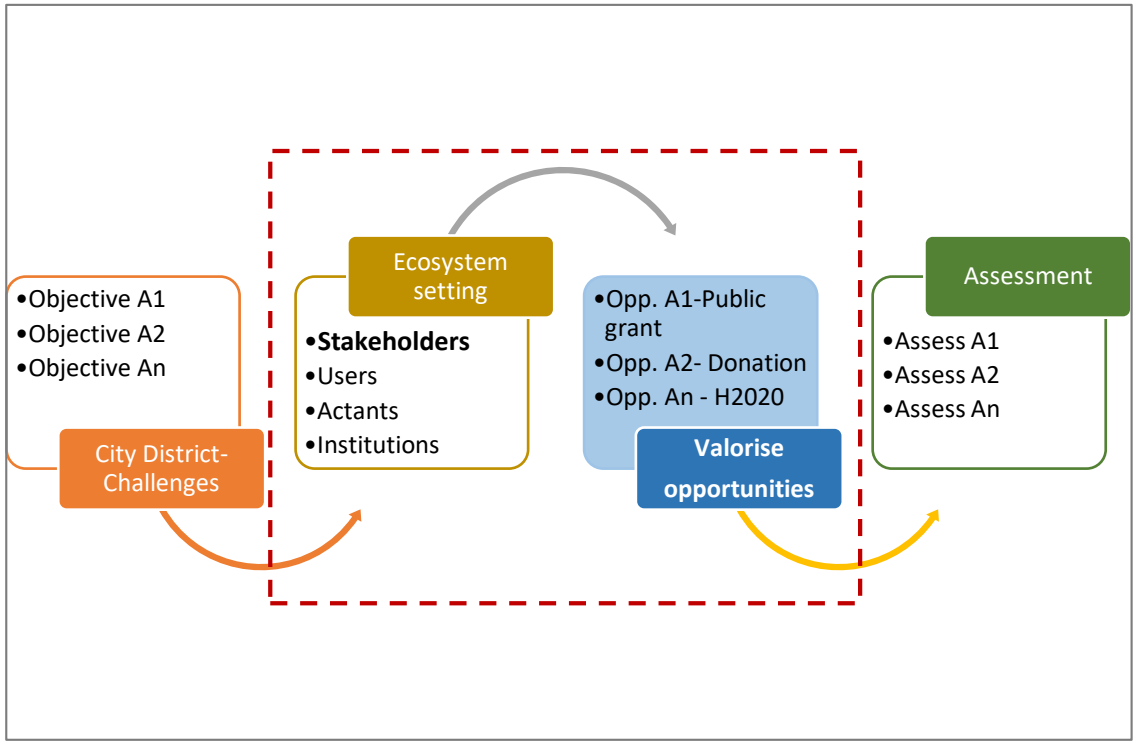
- Infrastructure: Broadband networks and sensors networks
- Cloud: Storage, VM, RAM, and applications environment

R1: Strategy development at the level of city ecosystems

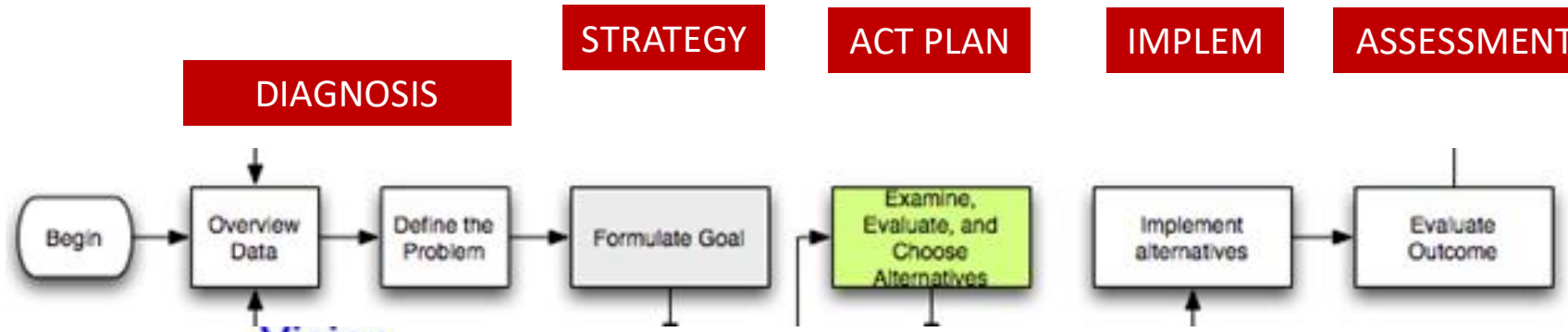
TRADITIONAL CITY PLANNING: STATE-LED, IERARCHICAL, TOP DOWN



SMART CITY PLANNING: COLLABORATIVE, VALORISING OPPORTUNITIES, BOTTOM UP



Skills: Turn strategic planning to digitally assisted (see OnlineS3)



Vision

SWOT

DELPHI

leads to a

Mission

which enables us to create the

SCENARIO BUILDING

Strategies

that provide the guidelines for

Goals and Tactics

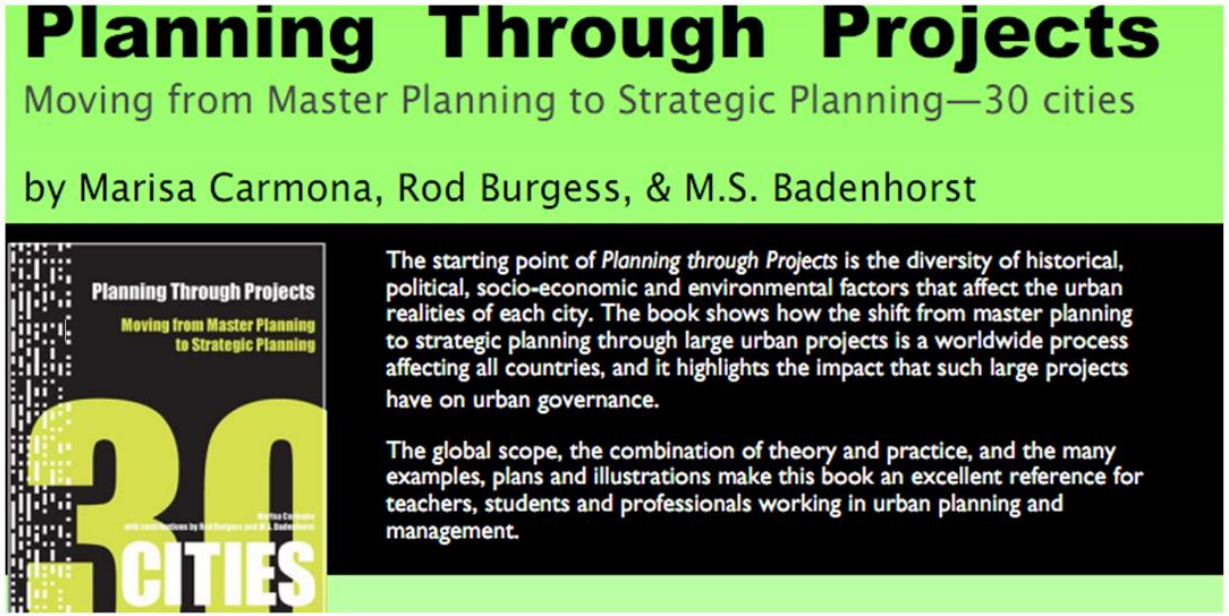
BALANCED SCORECARD

to be implemented and

Metrics

to measure their effectiveness

BENCHMARKING



R2. Integrated cyber-physical projects

Integrated cyber-physical projects may cover an entire ecosystem

What is **Vision Zero?**

Vision Zero is a strategy to eliminate all traffic fatalities and severe injuries, while increasing safe, healthy, equitable mobility for all. First implemented in Sweden in the 1990s, Vision Zero has proved successful across Europe — and now it's gaining momentum in major American cities.

Source: Vision Zero Network.

Table 8.2 Vision Zero implementation components

1. MAPPING	1.1	Data: Information collection and dataset creation
	1.2	Identification of high-injury network and risk areas
	1.3	Analytics: Fatalities and major injuries per areas and social groups
2. PEOPLE AND USER ENGAGEMENT	2.1	Reporting and witnessing by users
	2.2	Education: Develop a driving culture for Vision Zero
	2.3	Co-design of safety solutions with users
3. CITY DESIGN	3.1	Intersection re-design for visibility and safety
	3.2	Engineering solutions under the principles of VZ and Walk First
	3.3	Creation of arterial slow zones
4. INSTITUTIONAL MEASURES	4.1	Law enforcement
	4.2	Law and policy support VZ and reduce speed on city streets
	4.3	Training of officers on safety measures and recording of events
5. DIGITAL SPACES AND TECHNOLOGIES	5.1	Web-based information collection and dissemination
	5.2	Real-time watch and alert and transportation injury surveillance
	5.3	Car-pooling & car sharing for reducing travelled miles per capita
	5.4	Advanced video-based road-safety analytics
6. MONITORING AND ASSESSMENT	6.1	Definition of output and result indicators
	6.2	Dashboards, data recording and periodic reporting
	6.3	Analytics for assessment

https://visionzeronetwork.org/about/what-is-vision-zero/

Integrated cyber-physical projects may cover an entire ecosystem

Storage and trade of surplus solar energy through home batteries

Monetizing flexibility using a Virtual Power Plant, which incorporates solar-PV, load and home battery systems. It is not a real power plant but a virtual. Aggregating several small production units , like pv-rooftops, a power plant is created.

What is the goal of the project?

1. Improving the yield of solar panels: households will be able to store and/or trade surplus solar energy
2. Balancing (unpredictable) sustainable energy supply and demand in neighbourhoods.

A virtual power plant is an online platform which aggregates people's production and consumption of solar energy and stores the surplus locally. Due to this aggregation it's possible to trade energy on the wholesale markets: the use of a home battery lets you store energy when electricity prices are low and discharge the battery when there are high.

What is the result of the project?

Trading on the energy markets with battery systems installed at households is new. The concept requires a significant amount of ICT infrastructure, and will be connected to Alliander's smart grid. Through a pilot with more than 35 households in Amsterdam Nieuw-West, City-zen's partners will be able to test and improve the use of home batteries as a virtual power plant. After extensive testing upscaling to other neighbourhoods in the city will be possible.

Who initiated the project and which organizations are involved?

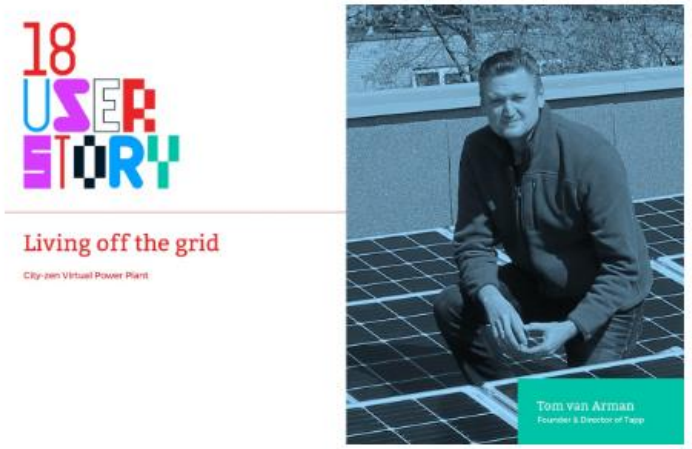
This project by Greenspread and Alliander is part of City-zen, a European funded project in Amsterdam and Grenoble.

What is the next step?

Currently already 25 home batteries have been installed at homes in the Amsterdam Nieuw-West district. We are still looking for a few more participants! So, if you are interested to participate, live in Amsterdam Nieuw-West and have PV panels: Send an e-mail to vragen@greenspread.nl or check the website (Dutch): http://www.greenspread.nl/diensten/smart/city-zen for more information!

Smart Stories

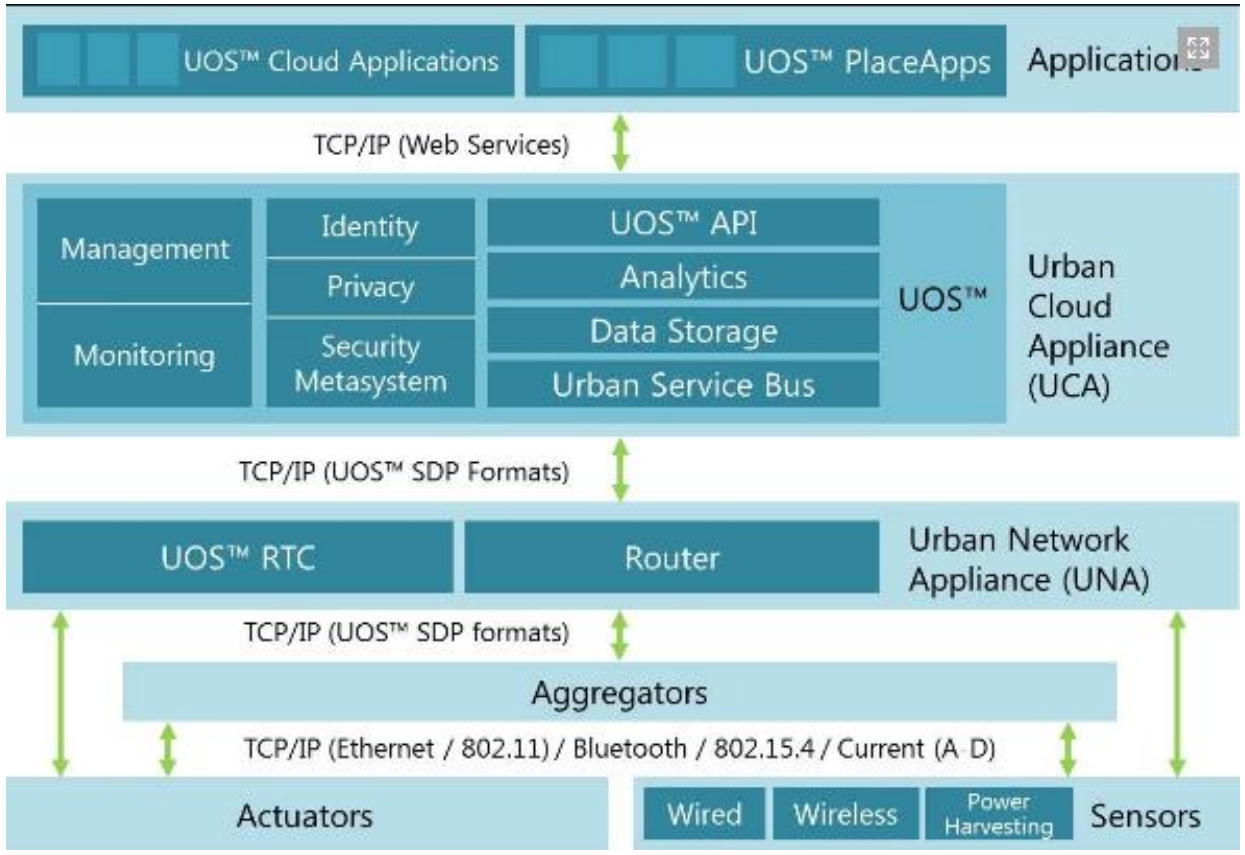
Check the article about the Virtual Power Plant featured in our online magazine 'Smart Stories':

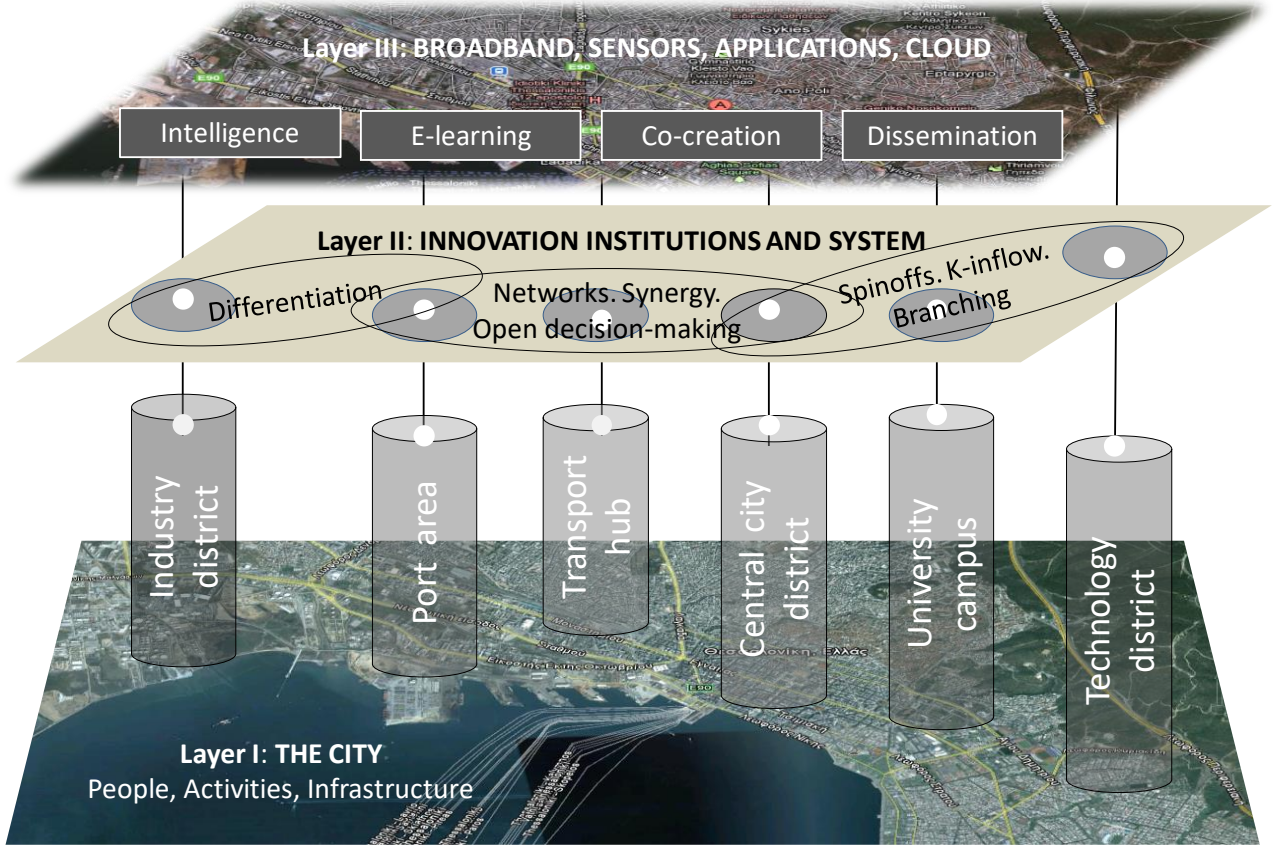


https://amsterdamsmartcity.com/projects/city-zen-virtual-power-plant

R2: Double integration of components, intra digital and inter-digital

Integration into the urban digital system



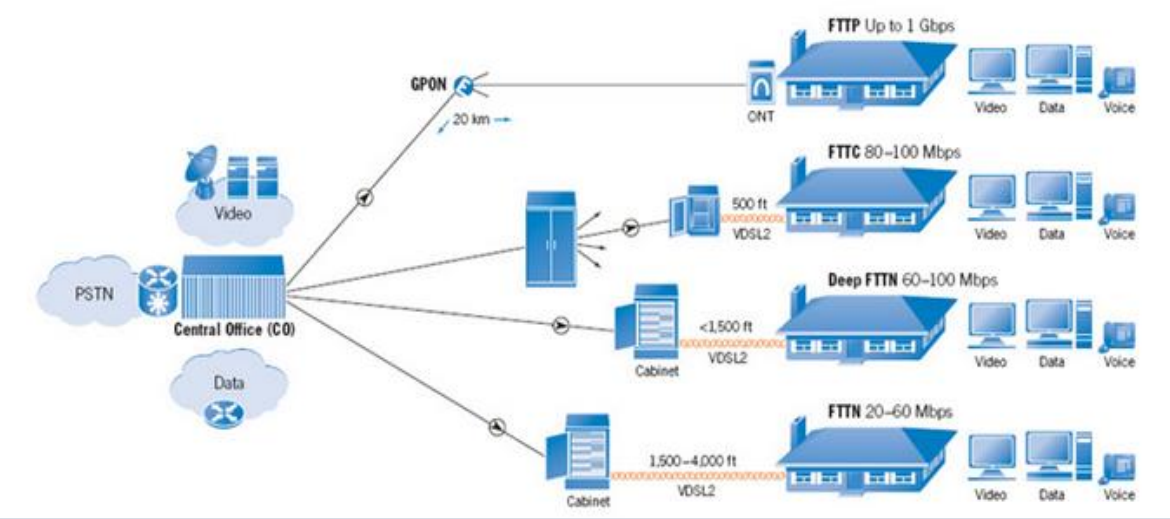


Into the city district: integration of urban, innovation and digital systems

Source: http://www.cisco.com/web/about/ac78/docs/Living_PlanIT_SA_Handouts_C-scape.pdf

Skills: Vary per type of smart city project

INFRASTRUCTURE

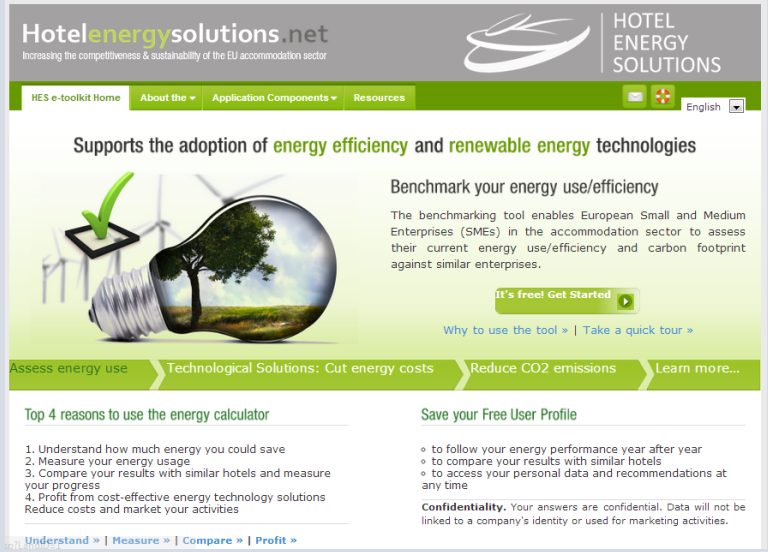


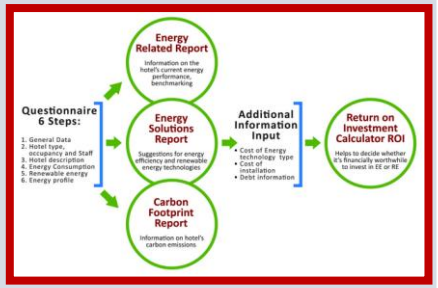
FOCAL CYBER-PHYSICAL PROJECTS

Smart projects

- #01 Geuzenveld
- #02 West Orange
- #03 eManagement Haarlem
- #04 Onze Energie
- #05 Smart Challenge
- #06 ITO Tower
- #07 Monumental Buildings
- #08 Decentral Generation: Fuel Cell Technology
- #09 Zuidas Solar Challenge
- #10 Online Monitoring Municipal Buildings
- #11 Ship to Grid
- #12 Moet je Watt
- #13 Klimaatstraat
- #14 Smart Schools Contest
- #15 ZonSpot
- #16 Swimming Pools

UTILIITIES: TRANSPORT AND ENERGY

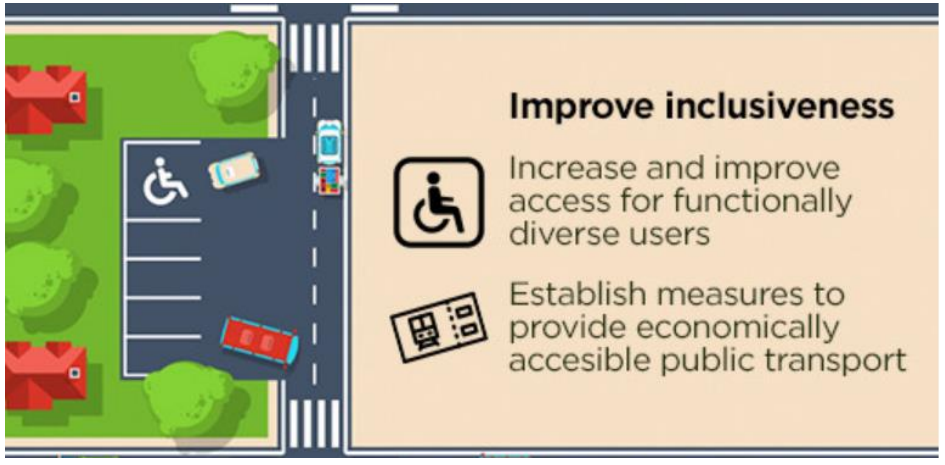




CITY DISTRICTS AND CAMPUS

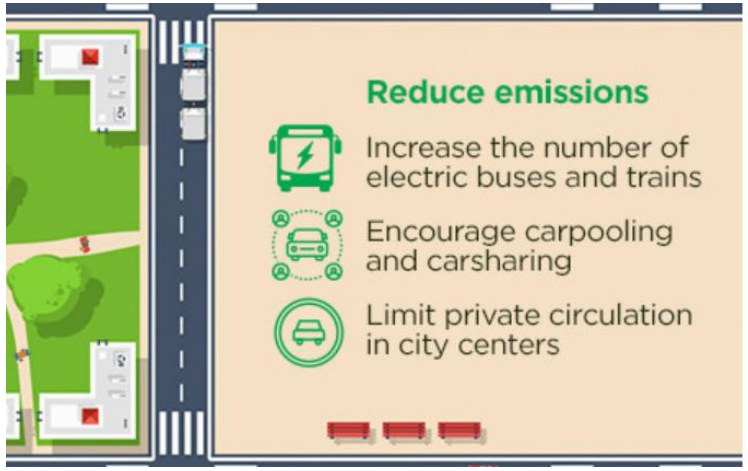
R3. Group of e-services per ecosystem

A group of digital services is needed to transform a city ecosystem

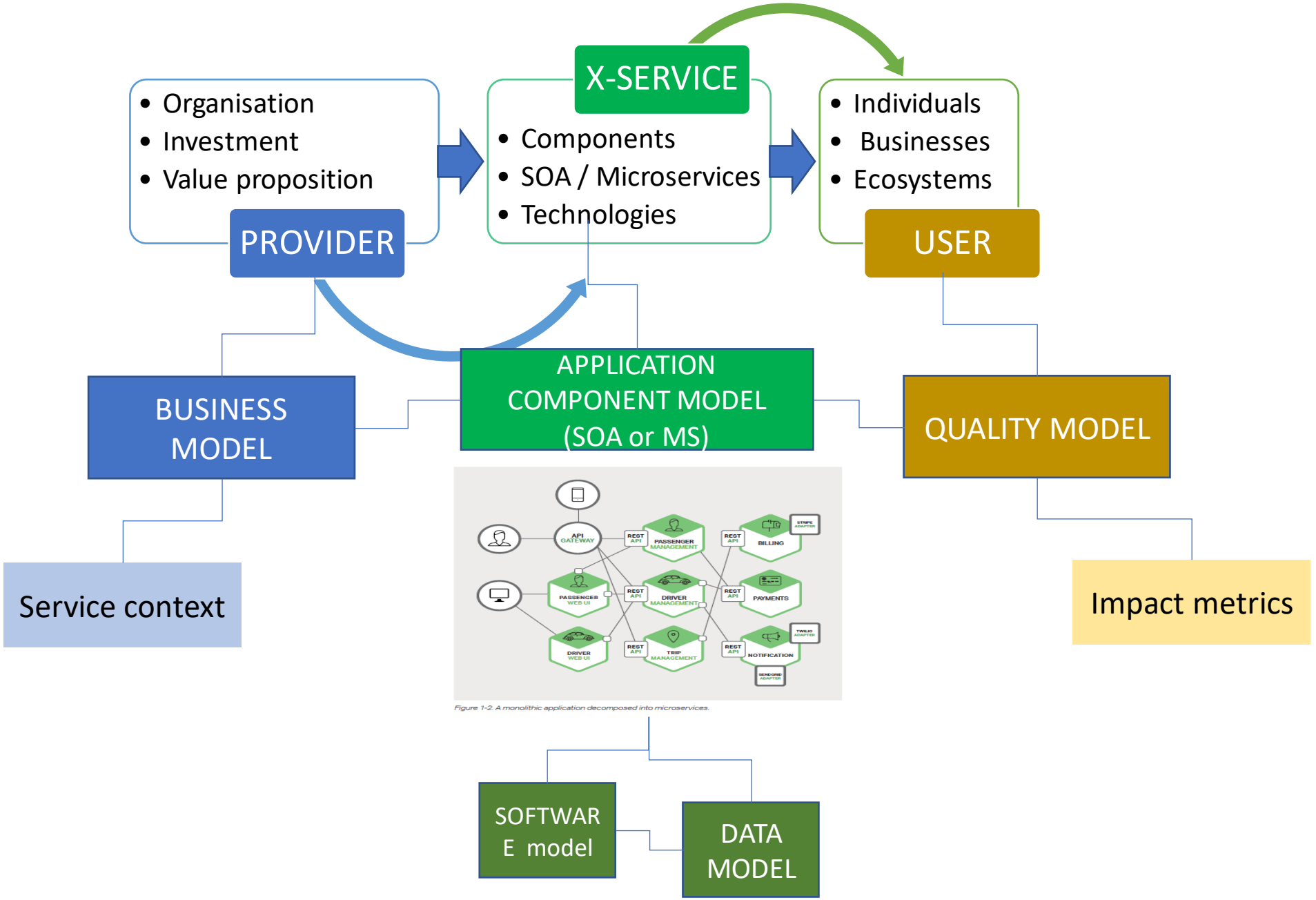


13 digital services for smart transport

https://www.smartcitylab.com/



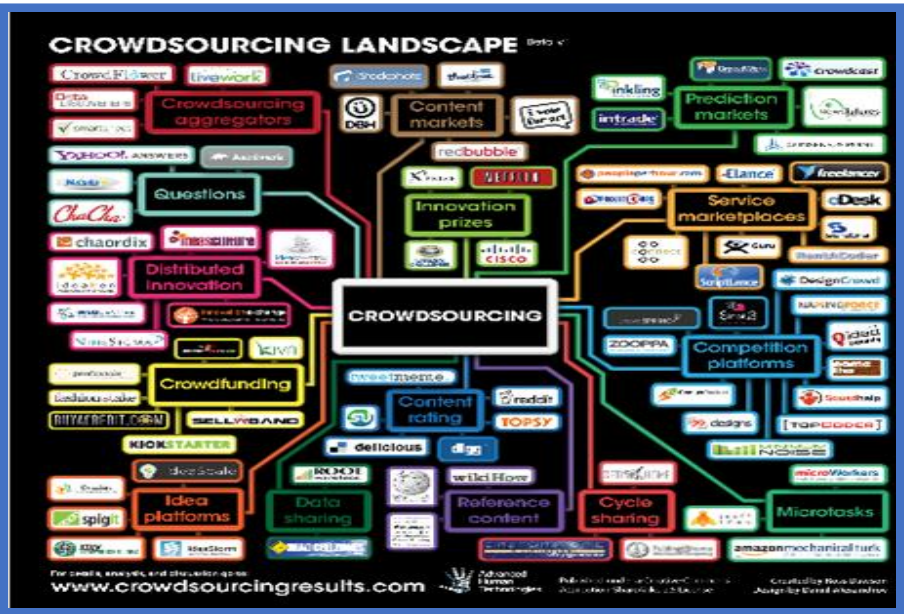
Each digital service needs a combination of complementary models



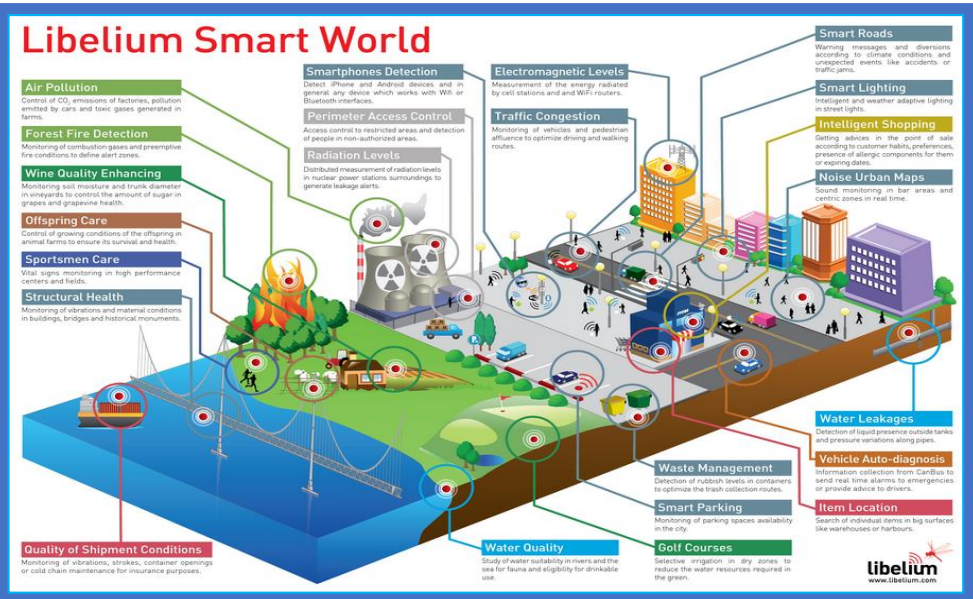
R3: Development of models and combination of digital technologies

1995: Visual

2006: Crowd

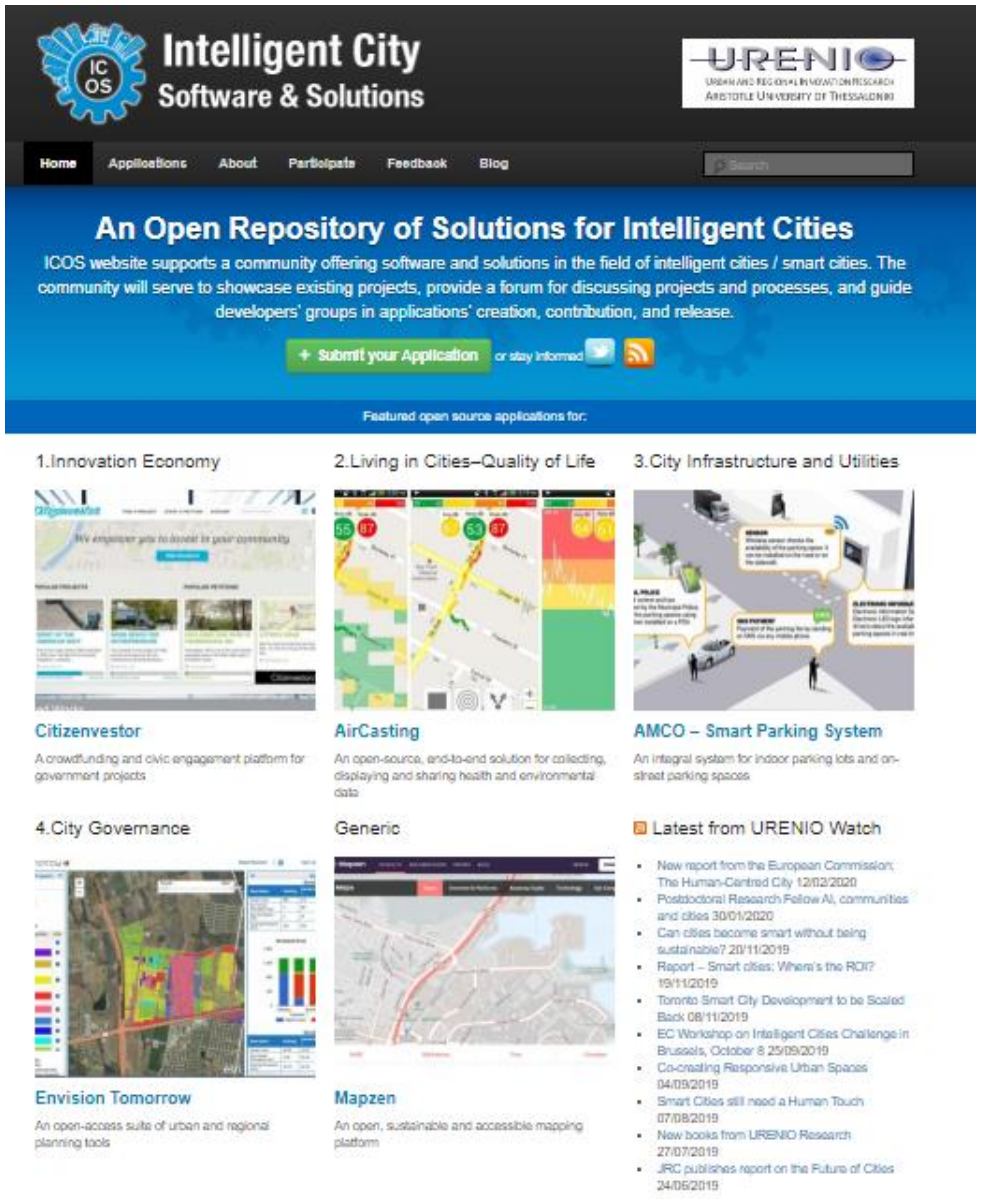


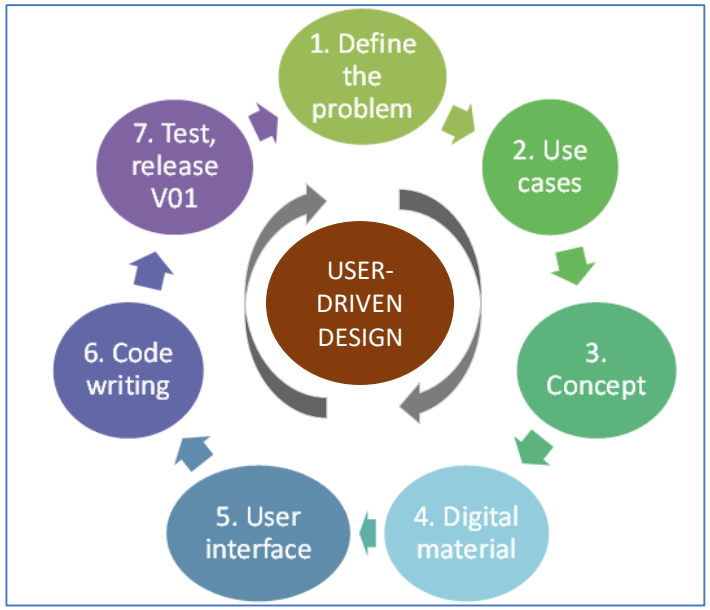
2009: Sensors

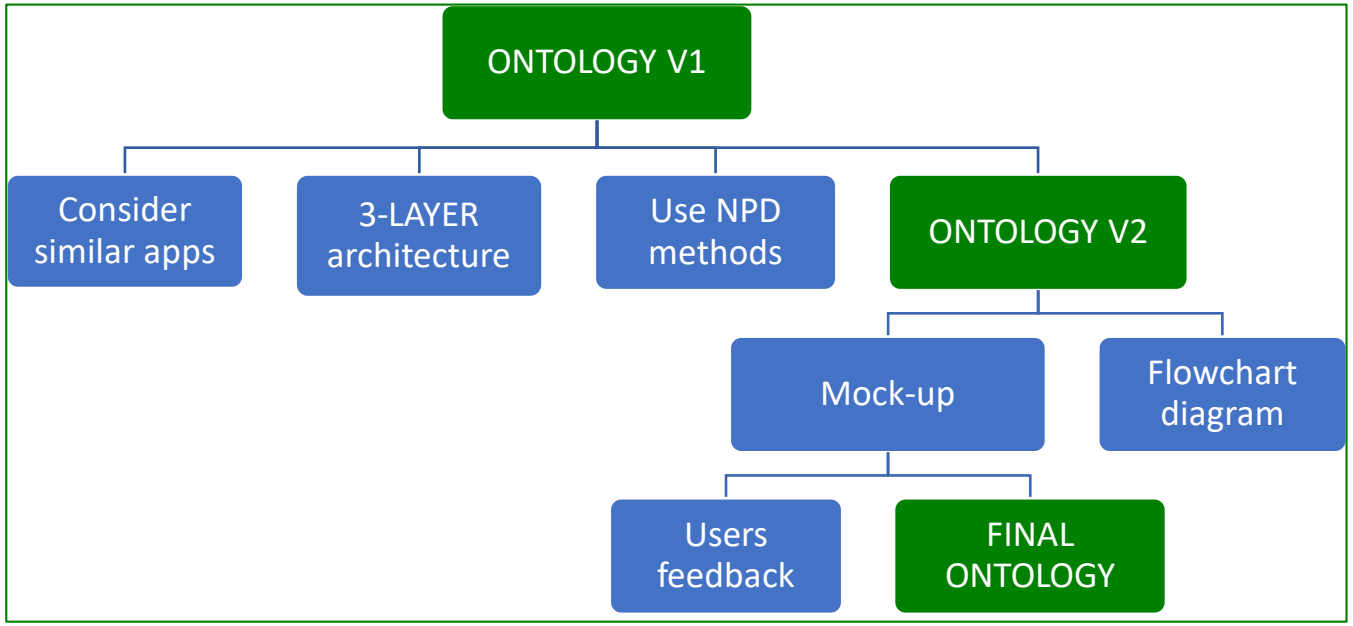


2018: AI

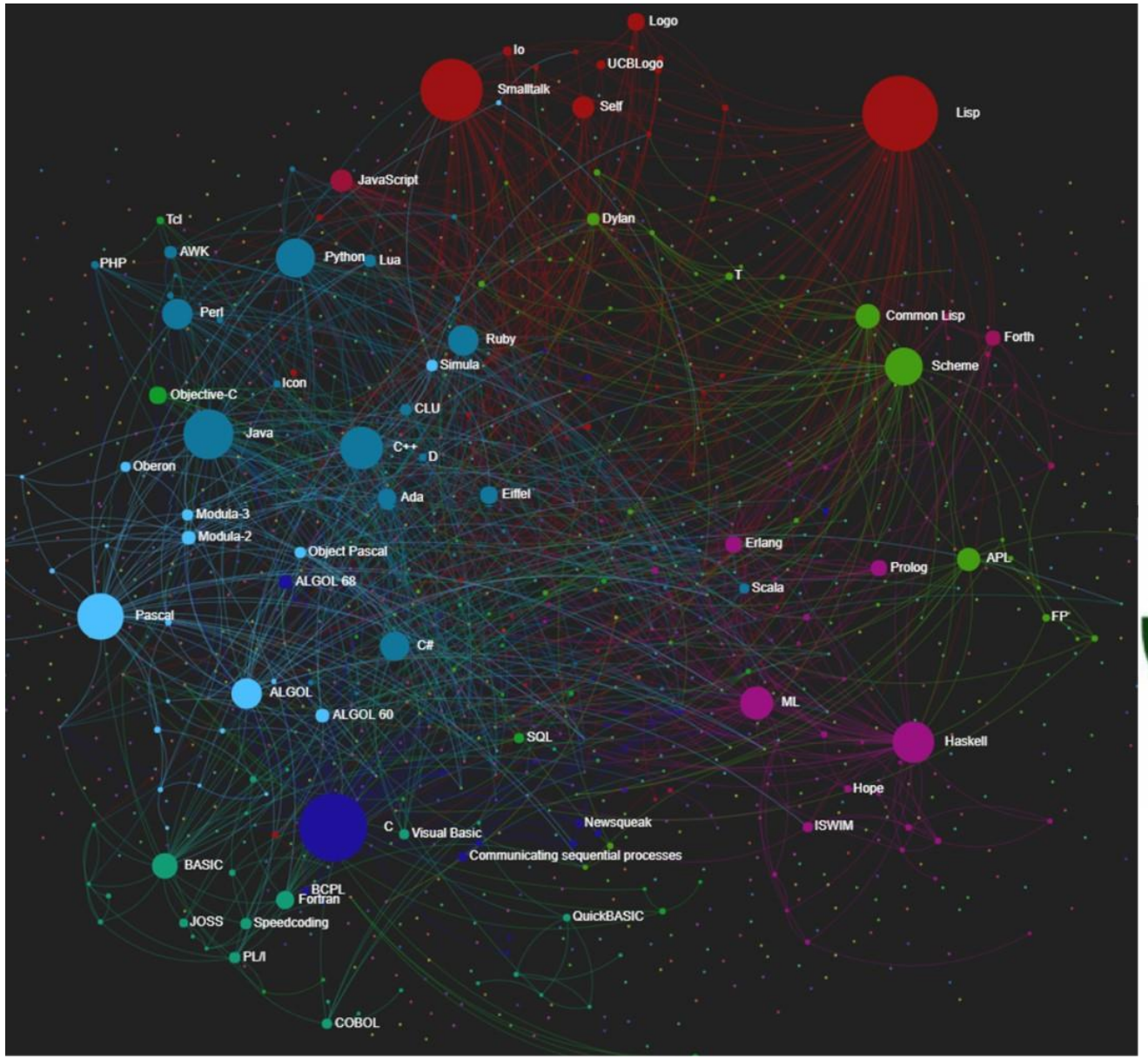
Skills (1): applications design

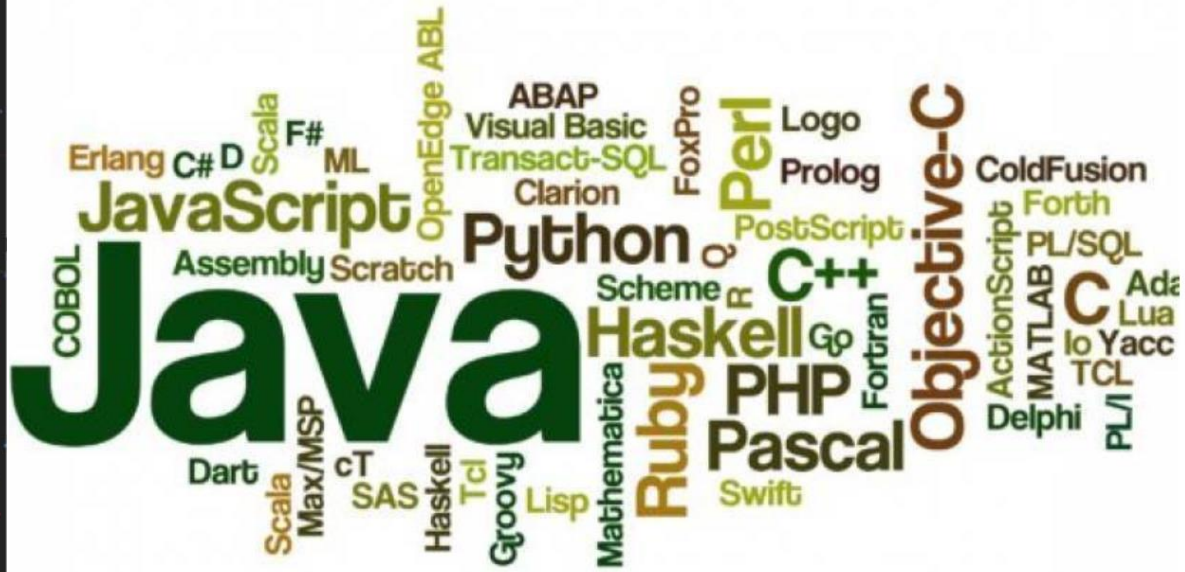






Skills (2): applications programming and development





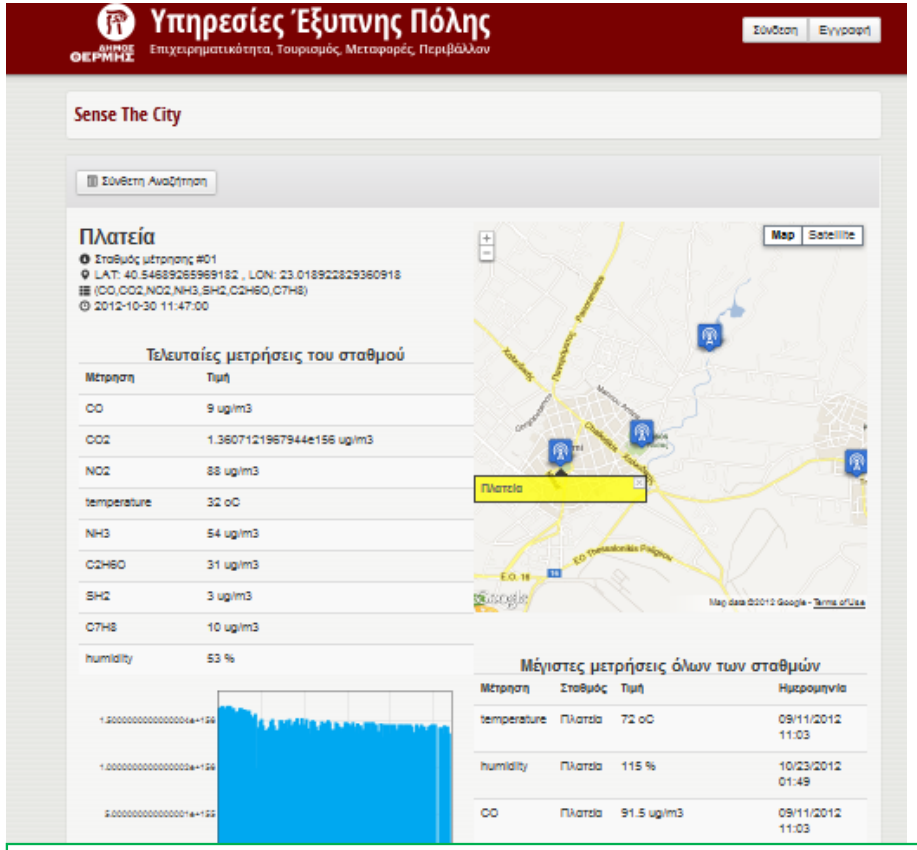
C
Python
Java
JavaScript
PHP

https://exploring-data.com/vis/programming-languages-influence-network-2014/

R4. Data collection, storage, and open access

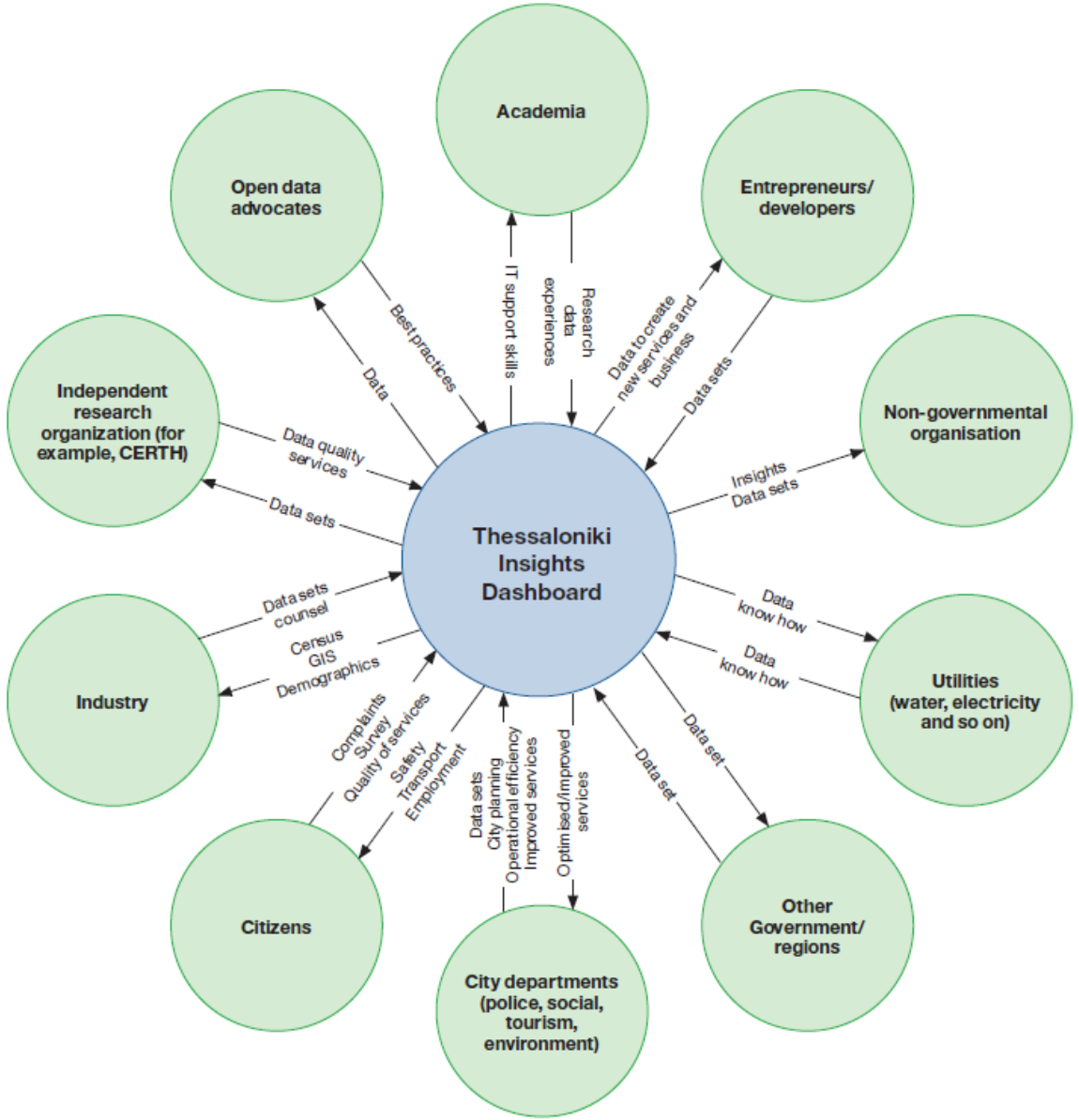
The functioning of cities and city ecosystems generate volume data

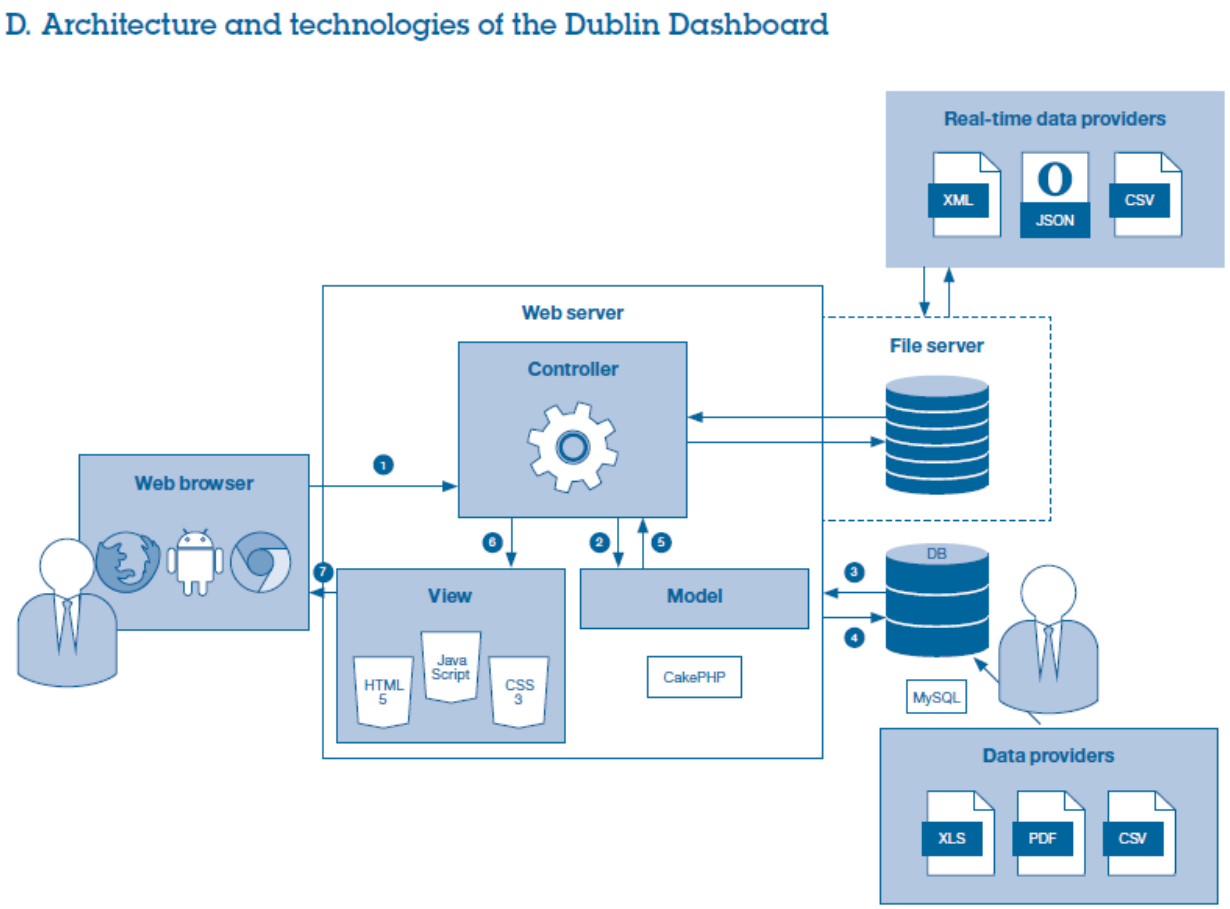
The city becomes a measurement system: Data -> Modeling -> Forecasting



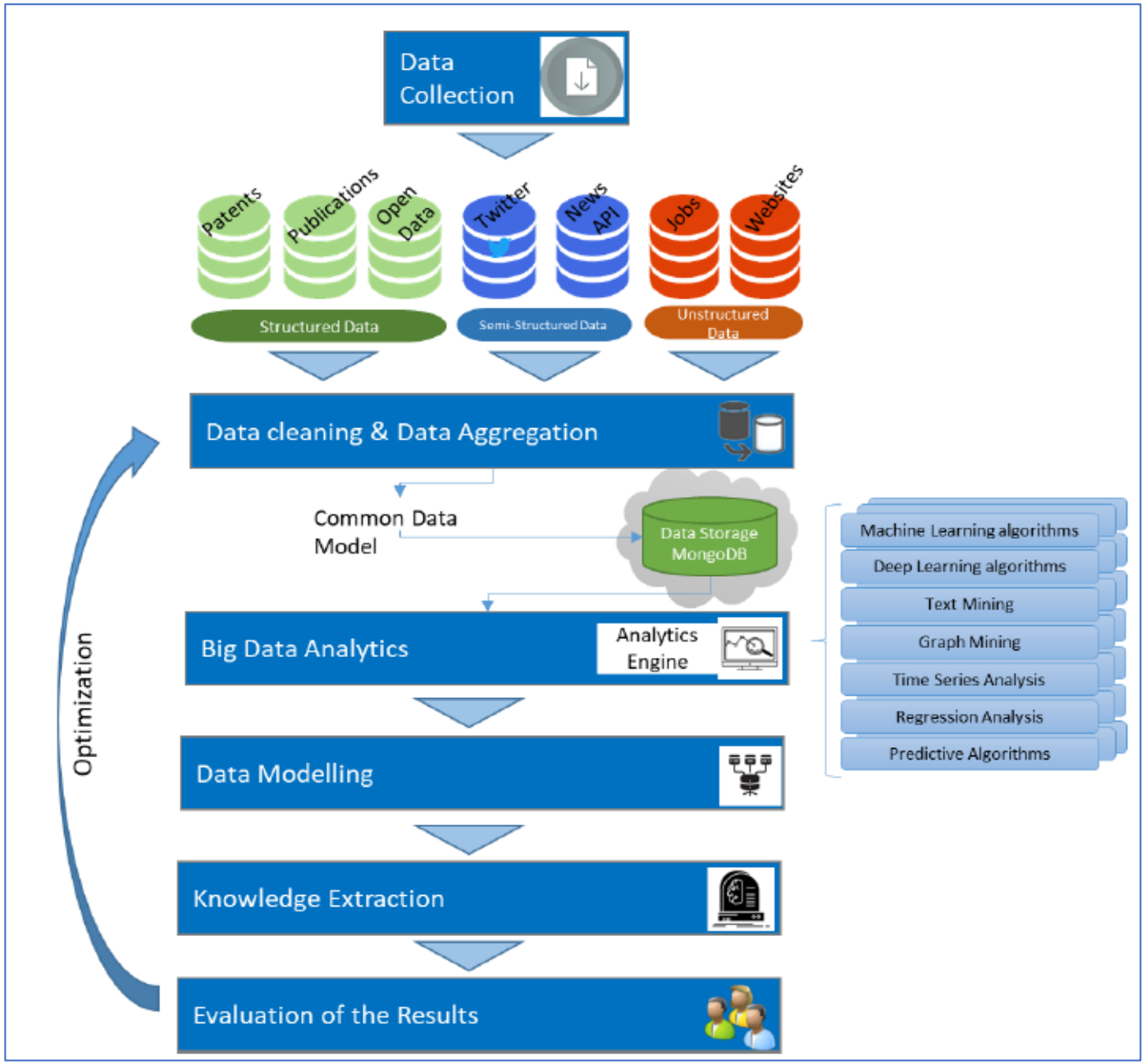
Information service based on a **network of wireless sensors** (Libelium) that measure air pollution (CO2, nitrogen oxides, microparticles, pollen) and send measurements to a central hub. Data are presented on digital and physical displays, pc, and smart phones.

R4: Development of data repositories, collecting & redistributing data



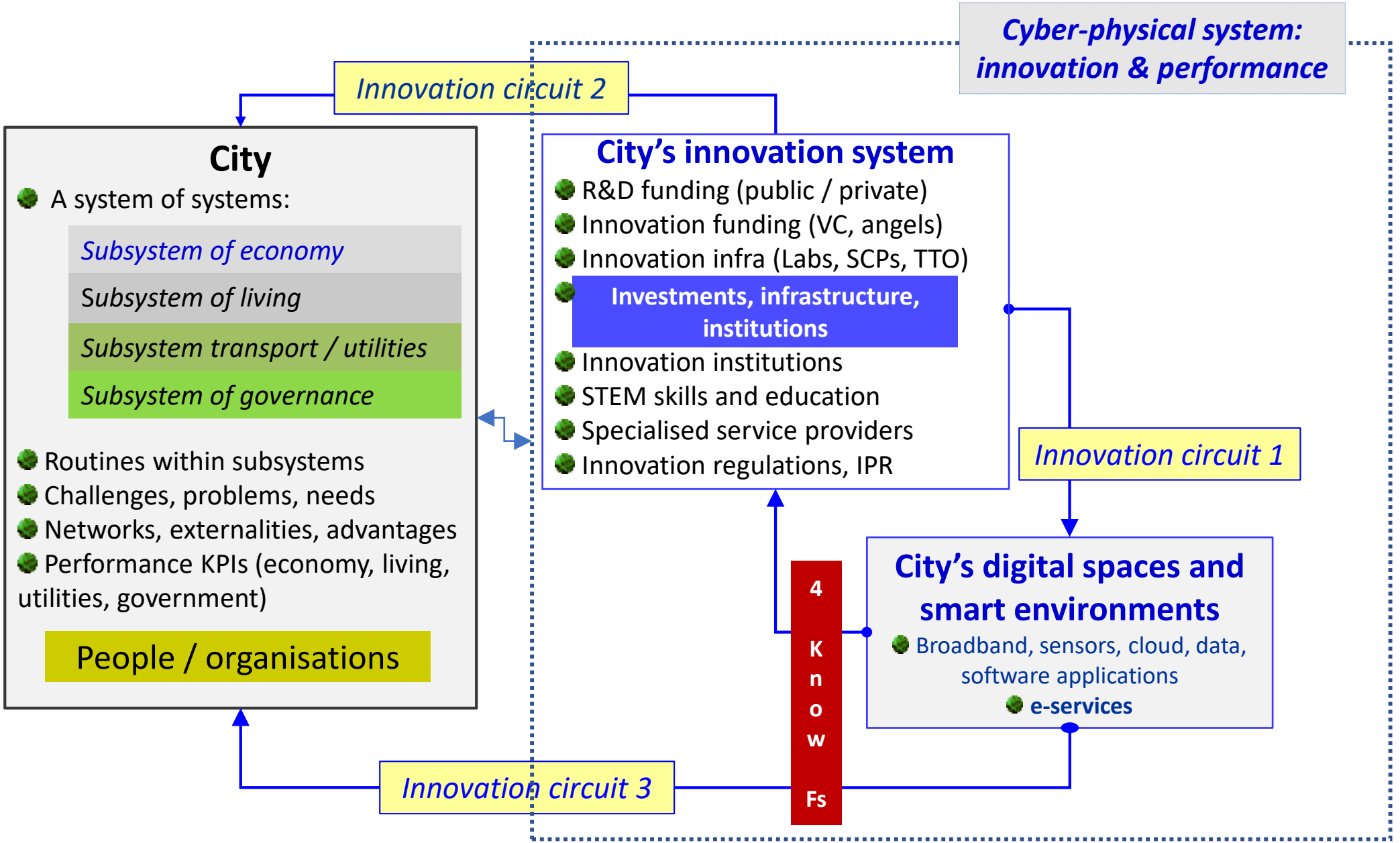


Skills: Data science, analytics, AI-based prediction and optimisation



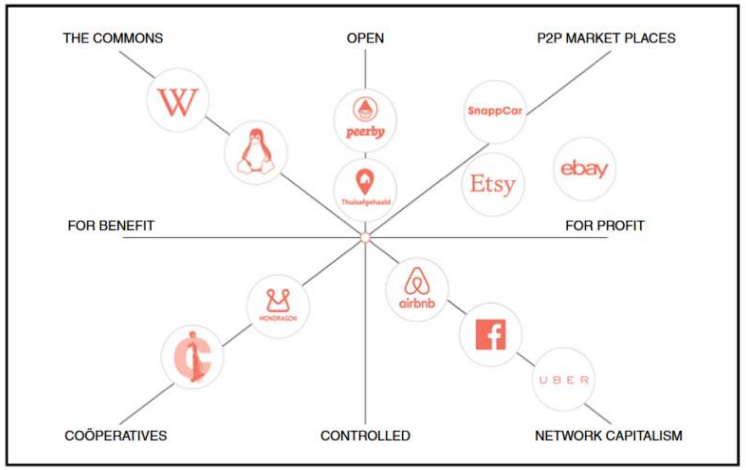
R5. Governance of operation and impact

Governance requires understanding how smart cities work



Monitoring the impact: new models of growth, living, and sustainability

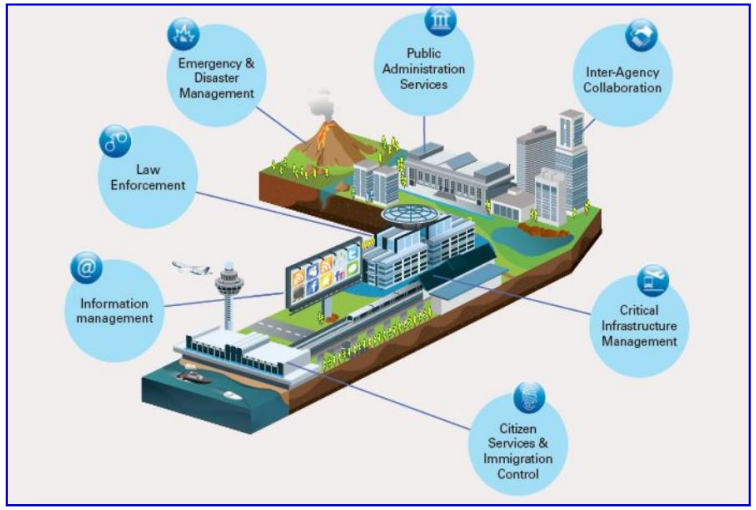
SHARED SPACES
Disruptive Innovation



Πηγή: Oskam, J., & Boswijk, A. (2016)

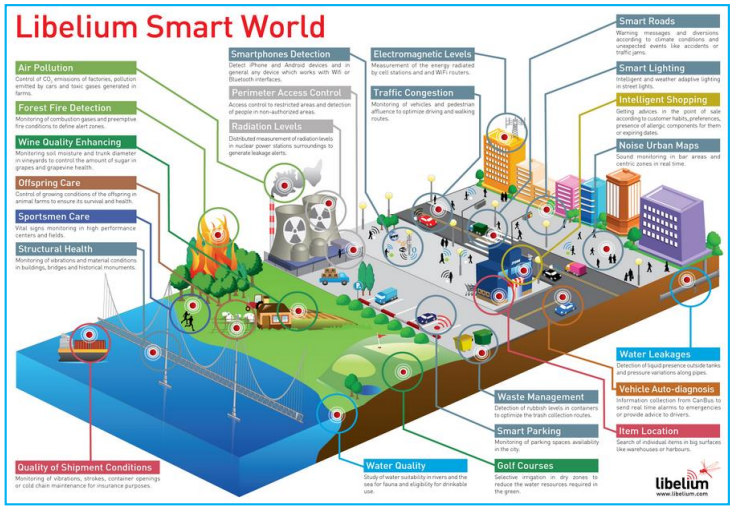
- **Sharing economy – New growth models - Smart growth**
- Business growth platforms
- Business over Business
- P2P production, demand driven

ENGAGEMENT SPACES
Social Innovation



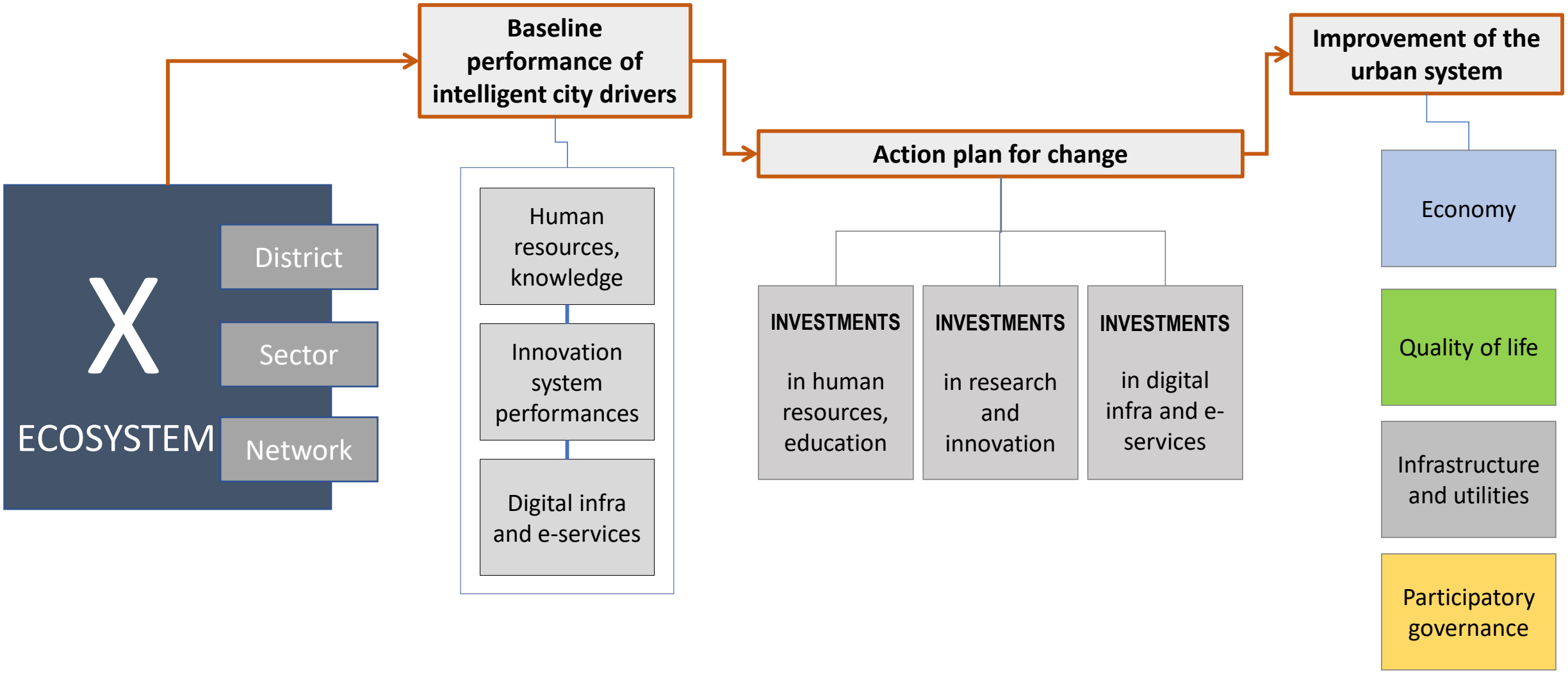
- **Social innovation and citizen non-profit networks**
- Mapping and motivation for participation and change
- Real-time safety and security systems in the public space of cities

AWARENESS SPACES
Innovation for Sustainability



- **Sensor networks, real-time alert**
- Behaviour adaptation to external conditions
- Awareness and solutions about the environment, pollution, energy saving, CO2 emissions, climate change

R5: Measurement, assessment, feed-back



Requirements
are driven by the interoperability and integration of heterogeneous urban, innovation, and digital systems

Skills
at the crossroads of engineering, information technology, and social sciences