

# 'SMART URABANA'

Enabling municipalities  
in five European small and medium cities  
of five countries with  
cyber-physical system instruments  
and business models for  
digital transformation in real time

Project experiment, 10 months in 2017



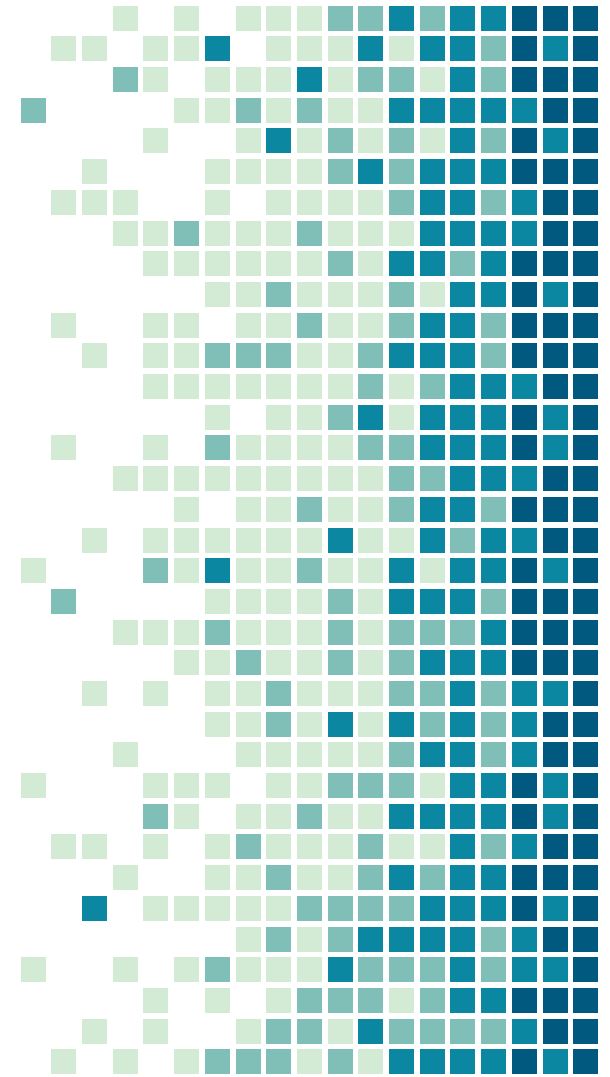
Smart Urbana' CPSE Labs Project. The project "Smart Urbana" has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 644400".  
International Workshop, Vienna, 31.10.2017



1.

# PARTNERS

ASIDEES and 5 different middle- and small- size urban communities in Europe





Alba Iulia, Romania

(74,000 inhabitants)

Calvia, Spain

(50,000 inhabitants)

Faro, Portugal

(64,560 inhabitants)

Nisporeni, Moldova

(11,000 inhabitants)

Volvi, Greece

(24,000 inhabitants)

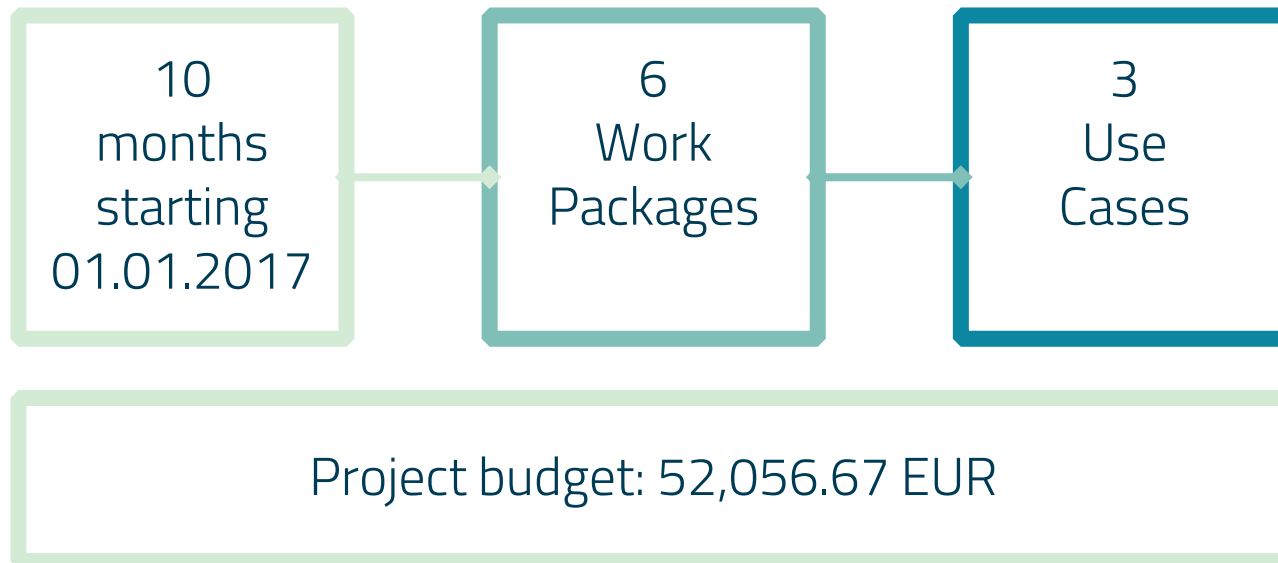


ASIDEES—Association for Sustainable Innovative Development in Economics, Environment and Society, Vienna, Austria w: <http://asidees.org>

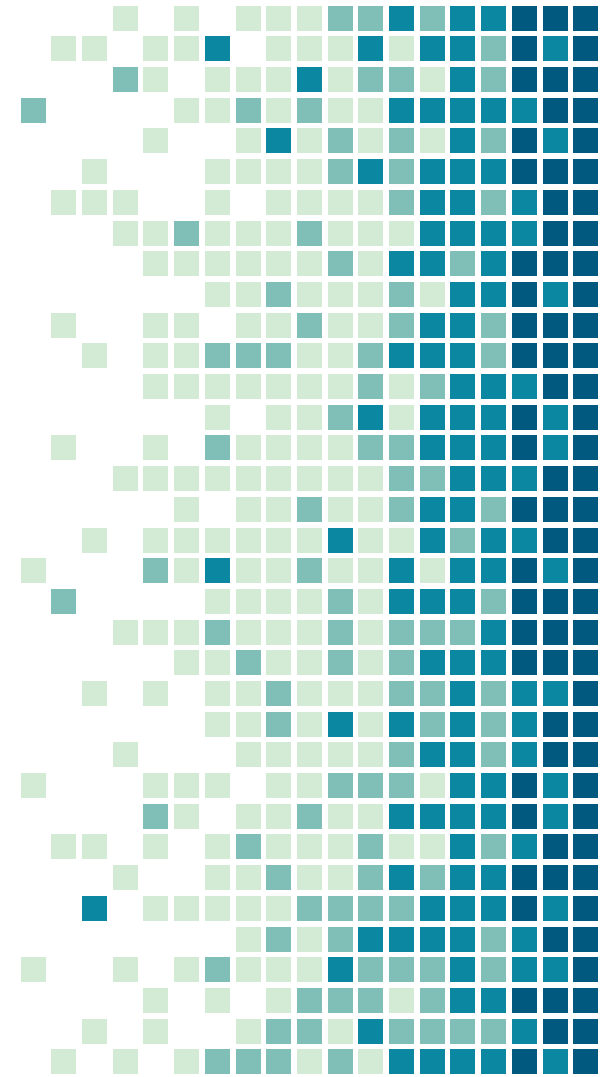
Coordinator of the 'Smart Urbana' project.

# TIMELINE:

5 municipalities and coordinator



# 2. THE IDEA & TECHNOLOGY



# OBJECTIVES

Create high level, mature, open, adaptive, certifiable and cost effective experimental CPS prototypes applicable to different EU cities and capable to generate custom actuations for communities

Integrate heterogeneous sensors and automated systems existing in real cities of EU enabling CPS real time transformation sensor data

Provide and demonstrate actuation options improving quality of life and fostering new local business models in 3 real world use cases

Demonstrate capacity of EU technologies to provide cities with quick practical, operational CPS solution by integrating HLA Smart City Monitor and middleware SOFIA2 enabling digital transformation and sustainability.

# TECHNOLOGY

## CITIES

Big CPS of CPSs,  
Urban processes, sensors,  
beacons, networks,  
databases, spreadsheets,  
administration and  
management tasks,  
information services for  
citizens and stakeholders,  
business models and apps

## SOFIA2

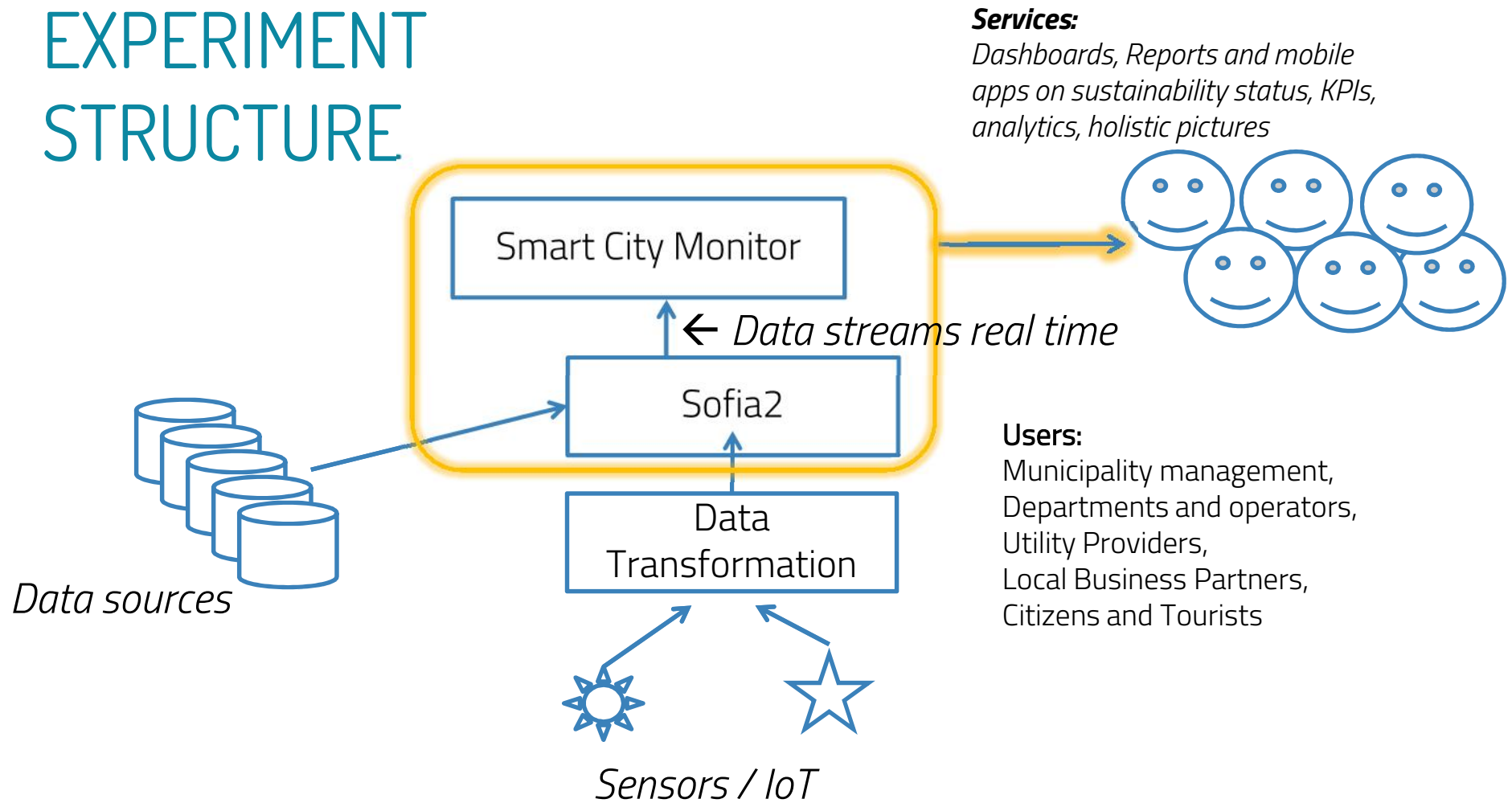
Middleware software  
Smart Objects For  
Intelligent Applications

## SMART CITY MONITOR

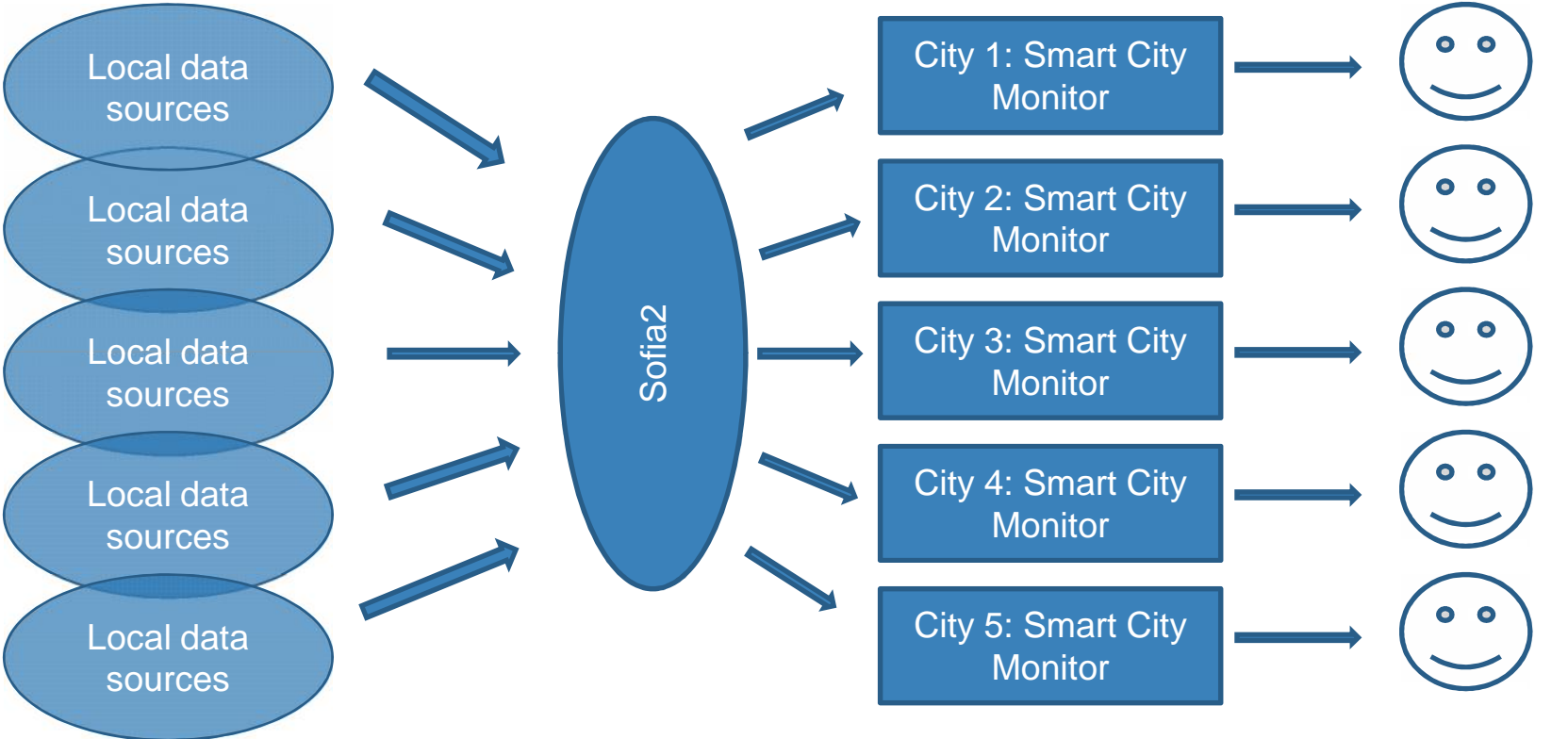
High level application running  
urban model of a real city as  
complex cyber-physical  
system linked to large  
number of data sources and  
its transforming into custom  
information services and  
controls for stakeholders

<https://pharosnavigator.com>

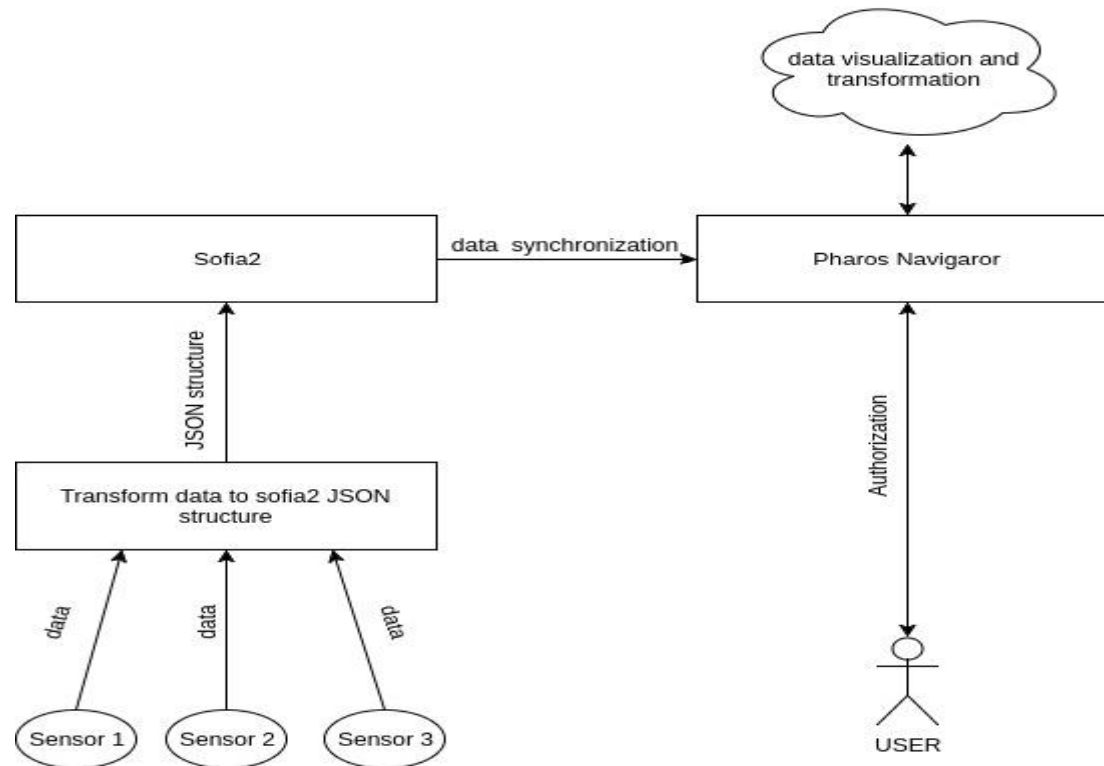
# EXPERIMENT STRUCTURE



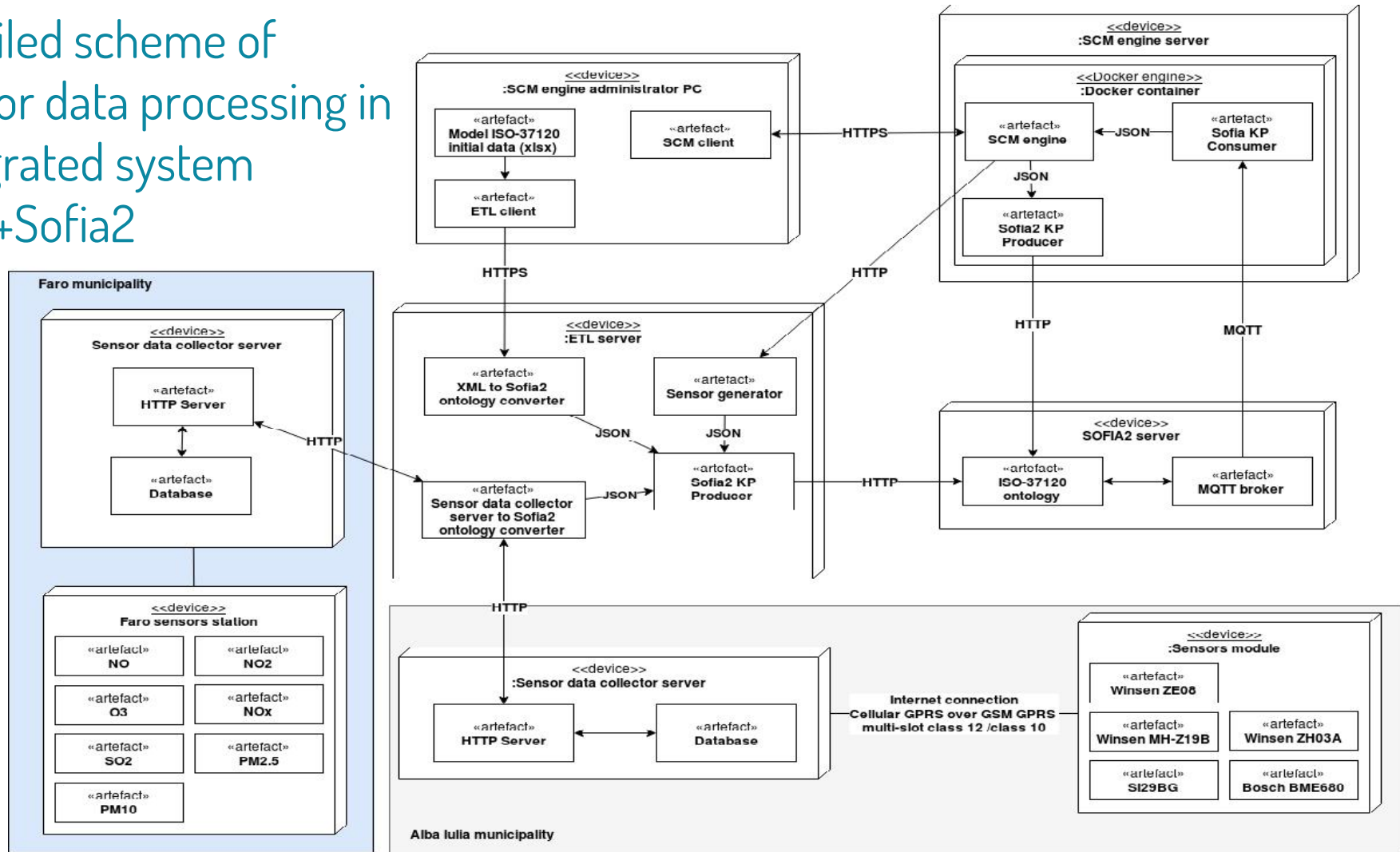
# EXPERIMENT STRUCTURE



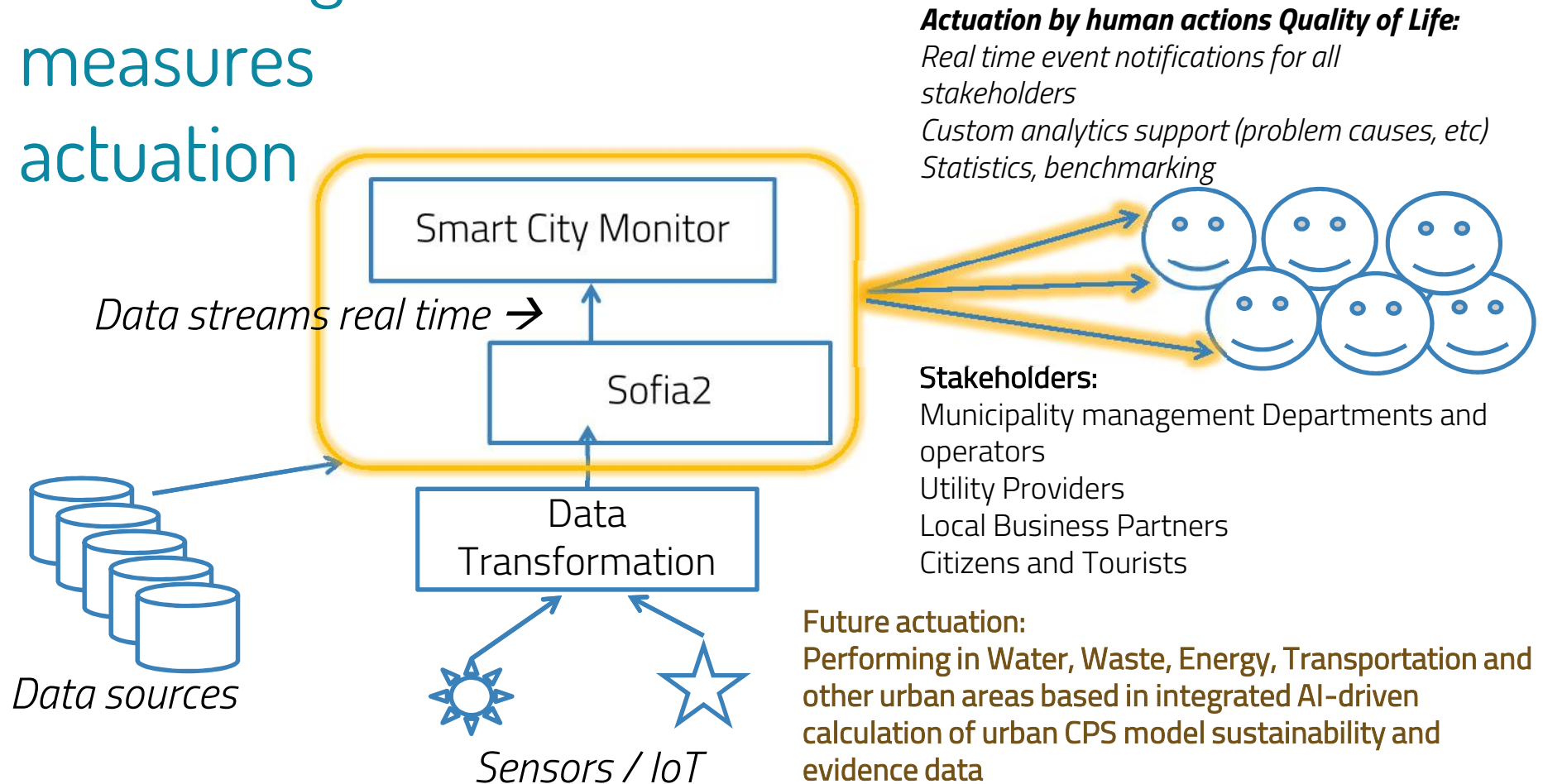
# Data collection and transformation in SCM instance (MQTT implementation)



# Detailed scheme of sensor data processing in integrated system SCM+Sofia2



# Processing measures actuation

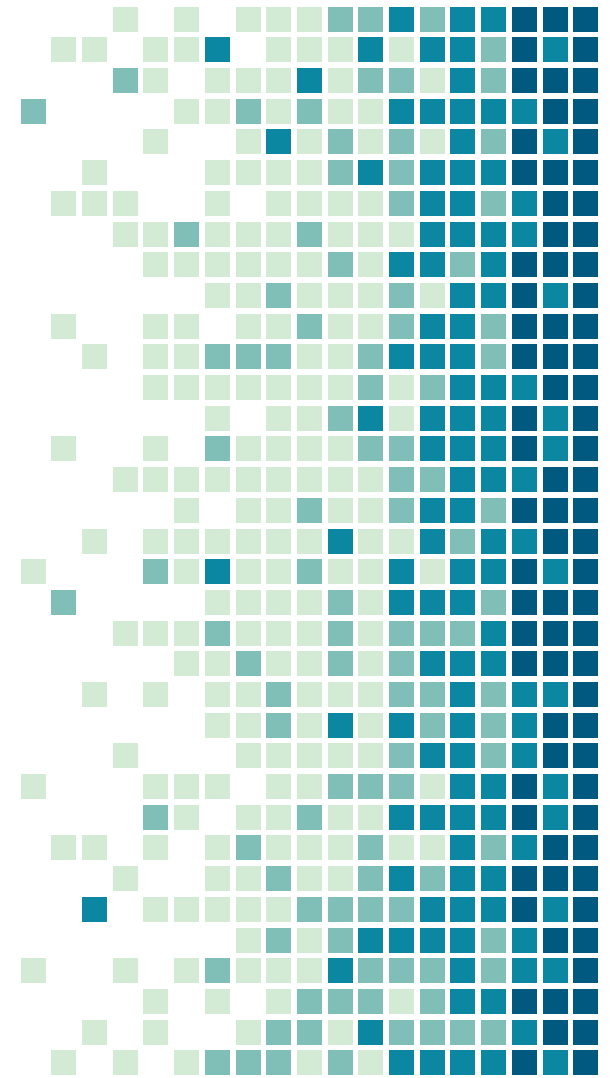


# ACTUATION IN THE FUTURE

Artificial Intelligence driven actuation related to holistic suitability of urban CPS  
Specific urban areas controls defined by urban area providers accordingly to quality procedures (light, energy, water, ...)  
Machine learning analytics of each sensor data stream enabling predictions  
Assistance to human actuation in key management areas based on AI real time analytics, direct controls in focused use cases and applications

Waste  
Water  
Energy  
Transportation  
Health  
etc.

# 3. USE CASES (EXPERIMENTS)



# 'SMART URBANA' EXPERIMENTS

## USE CASE 1

"New CPS based instruments for Smart Local Governance of quality of life in European Cities in compliance with international standards"  
(*"How are you, my city?"*)

## USE CASE 2

"Management of Quality of Environment and Air with Smart City Monitor"  
(*"Air quality"*)

## USE CASE 3

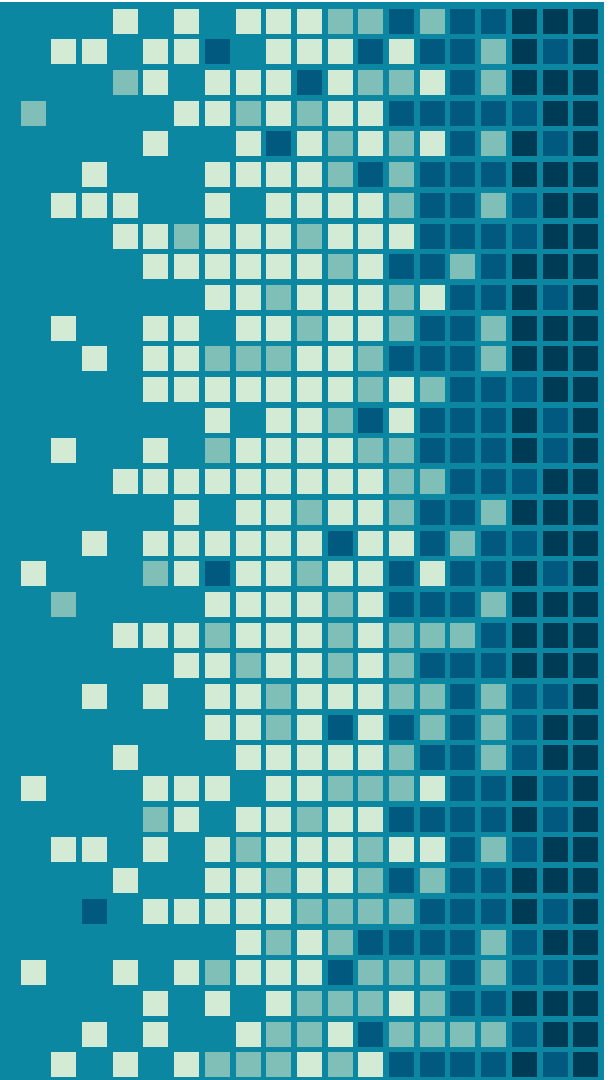
"Management of Solid Waste"



## USE CASE 1

Urban Model & its implementation by ISO 37120

“ ISO 37120 establishes a set of standardized indicators that provide a uniform approach to what is measured, and how that measurement is to be undertaken. (iso.org)



## ISO 37120:2014 Themes

**46 core indicators**

Economy

Education

Energy

Environment

Finance

Fire and Emergency Response

Governance

Health

Recreation

Safety

Shelter

Solid Waste

Telecommunications and Innovation

Urban Planning

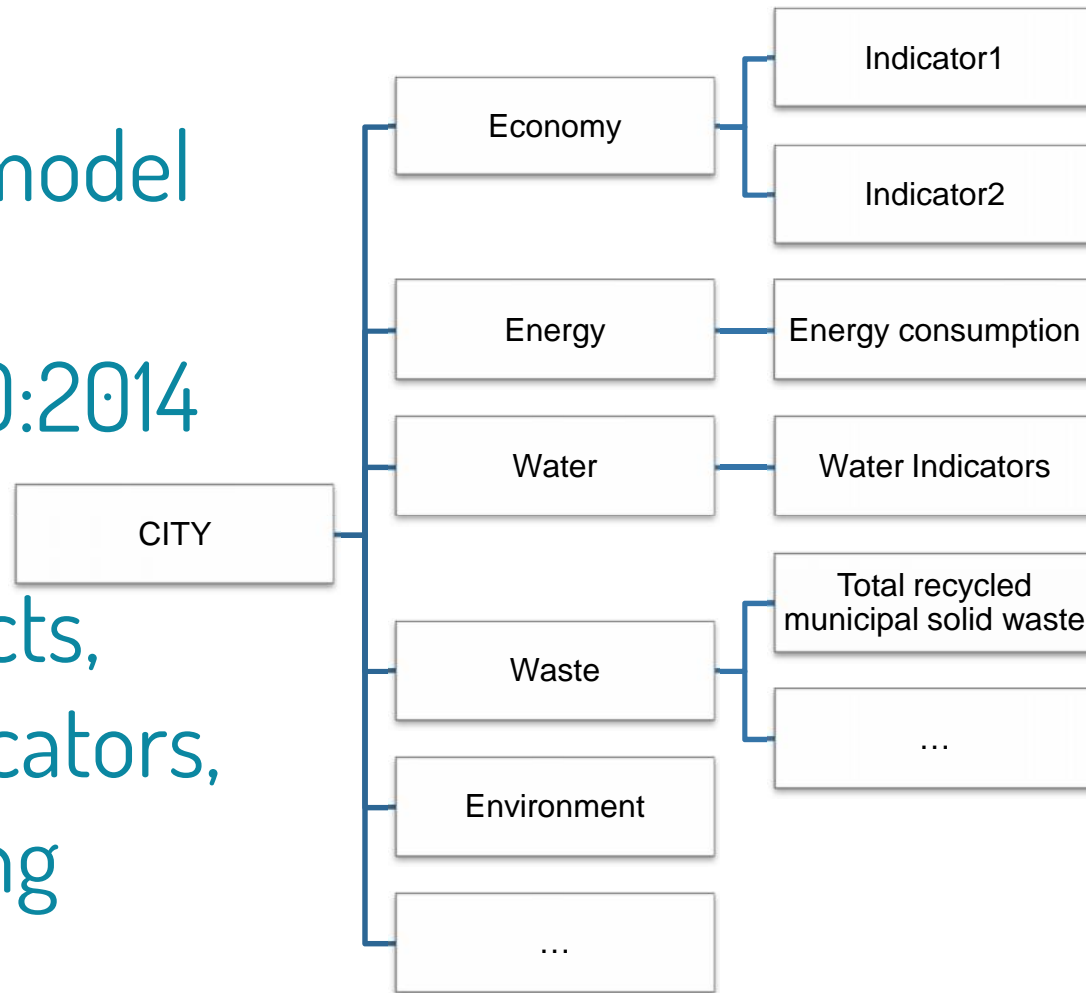
Transportation

Waste Water

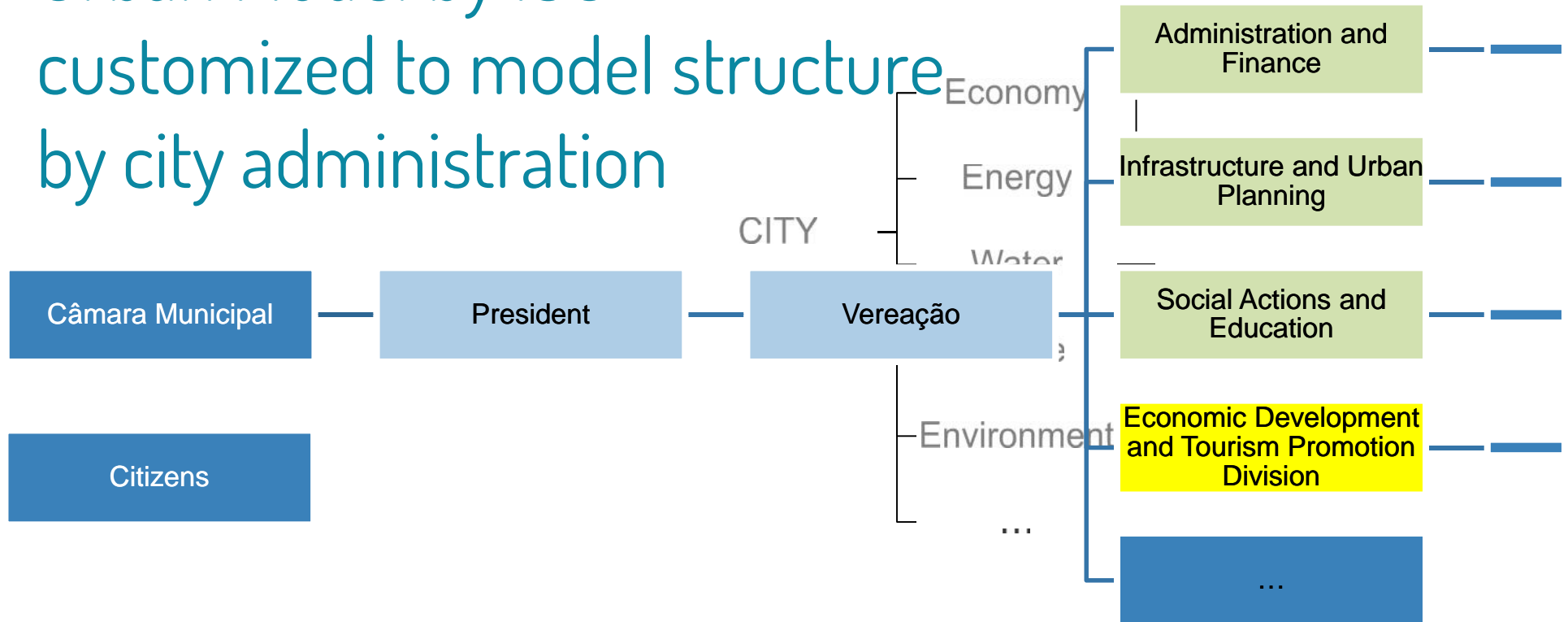
Water and Sanitation

**54 supporting indicators**

Hierarchical  
urban CPS model  
structure  
by ISO 37120:2014  
17 themes  
as CPS objects,  
46 core indicators,  
54 supporting  
indicators



# Urban Model by ISO customized to model structure by city administration








# Sustainability status Performance Transparency

## USE CASE 1

Applying “Smart City Monitor+SOFIA2” as high level CPS-based tool for generating community specific custom information services and experimenting with local business models to foster digital economy.

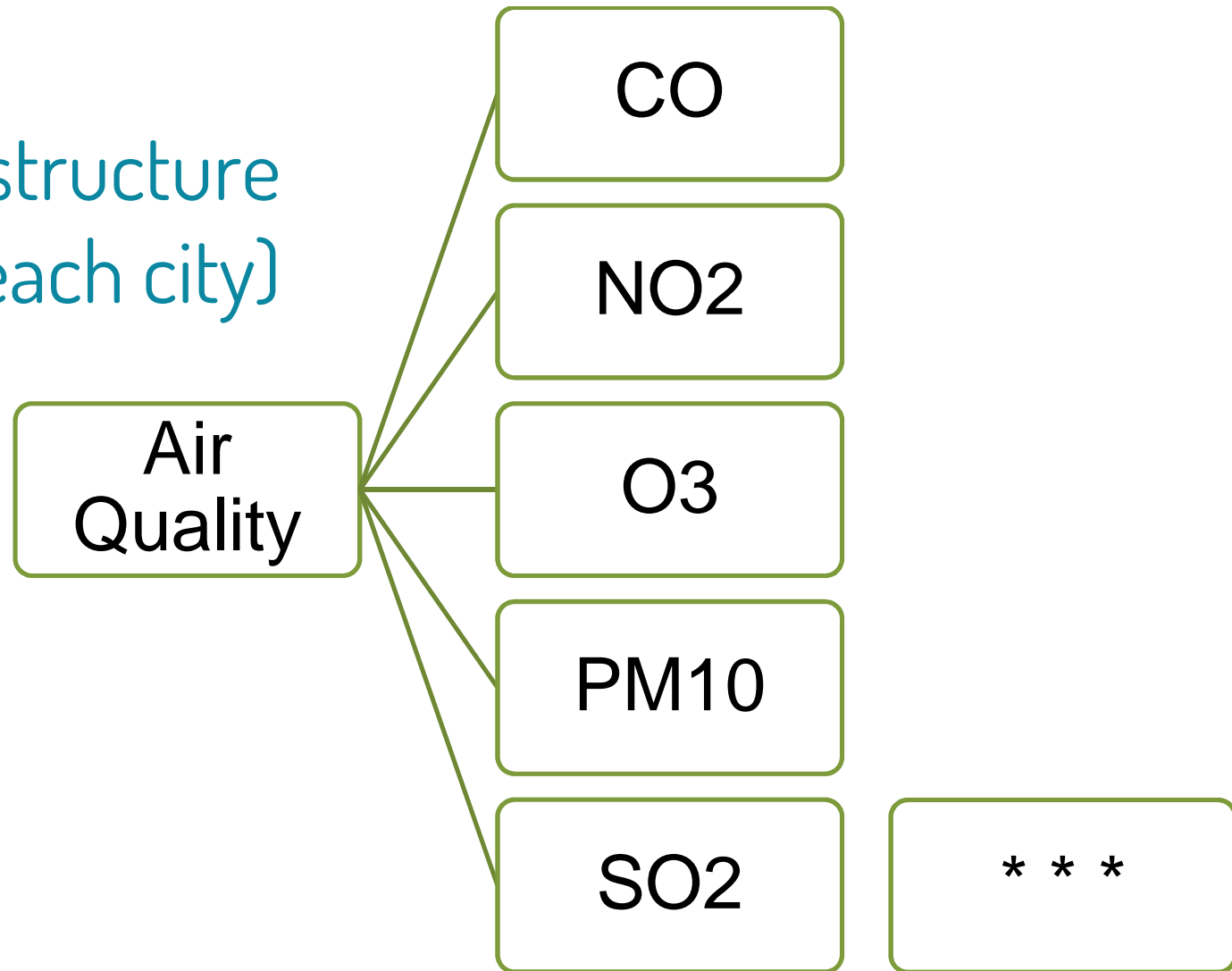
Enabling digital transformation to support best practices and international standards for Smart Local Governance and quality of life in European Cities.

Monitor ISO 37120 ▾	
Object Name	Status
Alba Iulia Smart City	
Finante	?
Economy	
Energy	
Solid waste	?
Transportation	
Wastewater	?
Water and Sanitation	?
Urban Planning	
Safety	?
Health	
Governance	
Fire and emergency response	?
Environment	?
Telecommunication and innovation	
Education	
Shelter	



USE CASE 2  
Air Quality

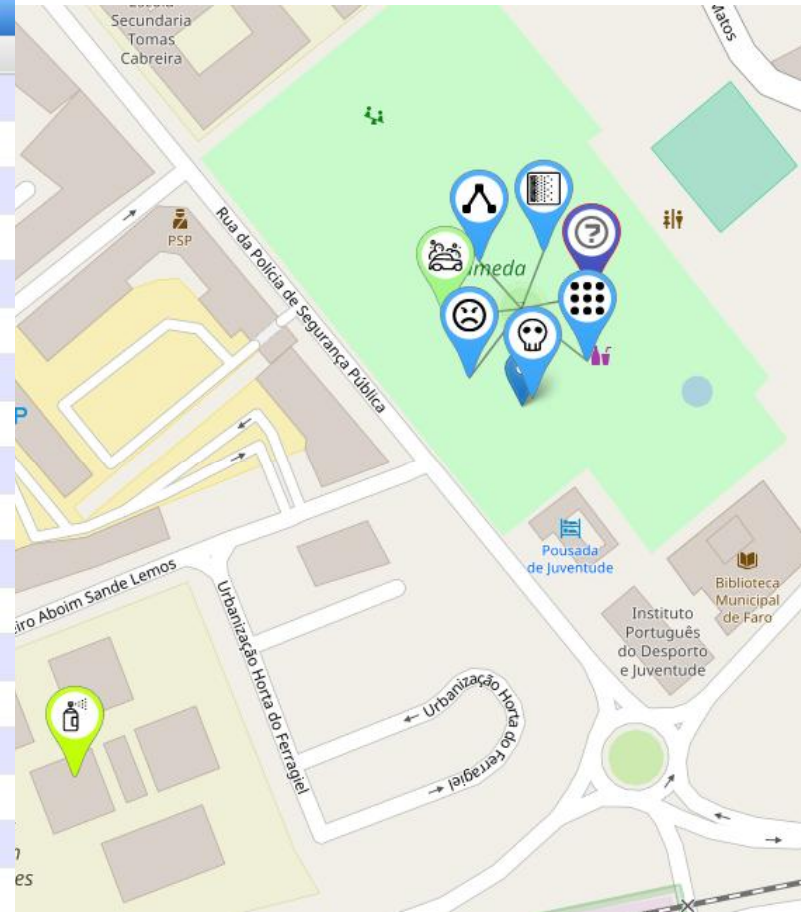
Air Quality  
sub-model structure  
(differs for each city)



# Air quality:

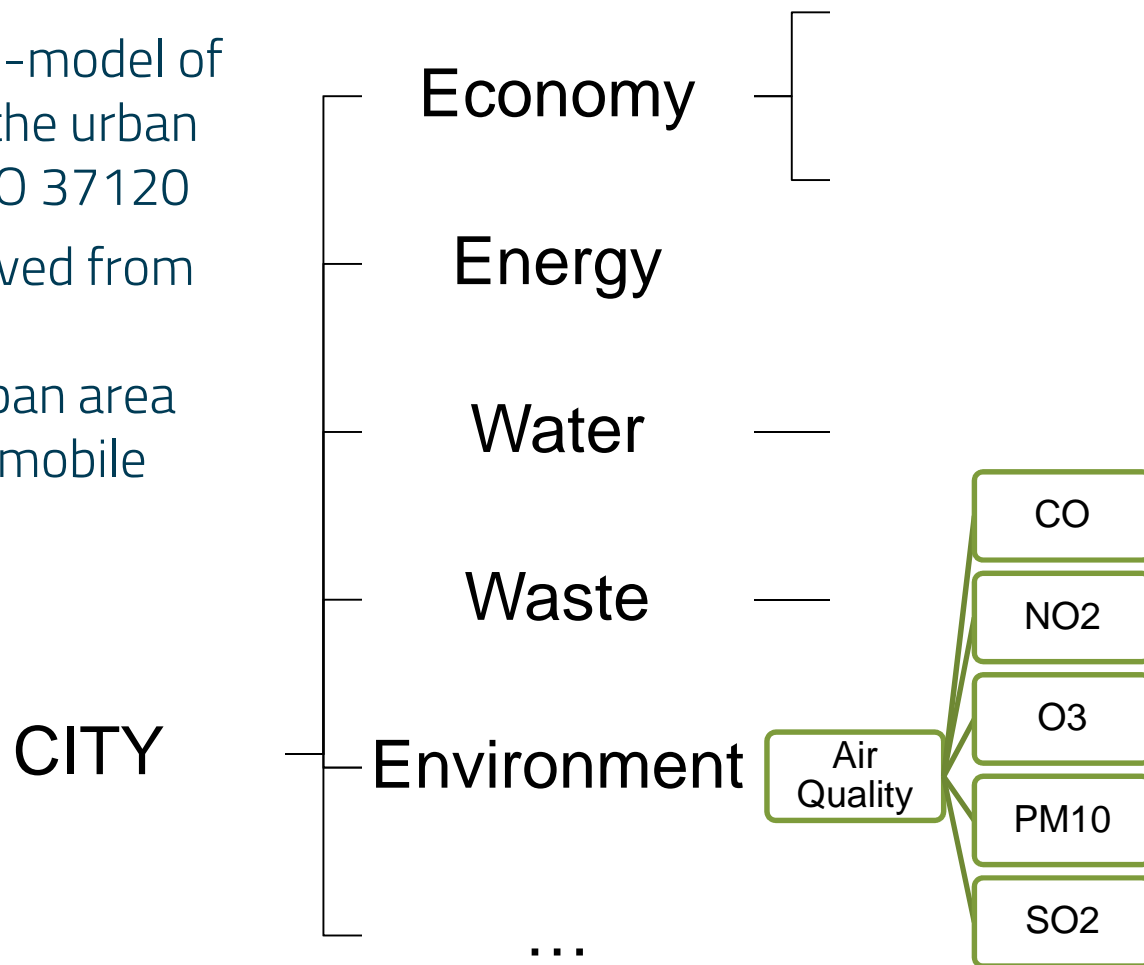
Providing citizens with air quality information in real time by individual indicators and integrated status for specific location

Monitor	ISO 37120
Object Name	Status
Air Quality Faro	
Faro Smart City	
Wastewater	
Health	
Economy	
Urban Planning	
Telecommunication and innovation	
Water and Sanitation	
Safety	
Transportation	
Shelter	
Fire and emergency response	
Solid waste	
Energy	
Environment	
Education	
Finance	
Governance	



Air Quality is sub-model of Environment in the urban CPS model by ISO 37120

The data is received from multiple sensors distributed in urban area and installed on mobile vehicles





USE CASE 3  
“Management of Solid Waste”.

Municipality of Volvi has 38 settlements

Waste is collected by several trucks owned by municipality waste company

The weight of collected waste is registered by each truck and day of collection

The results are recorded in MS Excel spreadsheets and used for reporting

.



Day of collection,  
Waste weight,  
GPS, Truck number



Day of collection,  
Waste weight,  
GPS, Truck number



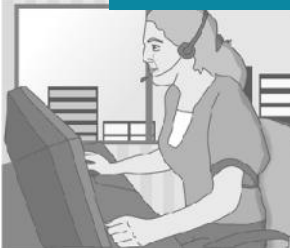
Day of collection,  
Waste weight,  
GPS, Truck number



~23 times



Day of collection,  
Waste weight,  
GPS, Truck number



Day of collection,  
Waste weight,  
GPS, Truck number



## Smart Urbana Use Case 3:

Automation of data collection from multiple databases (spreadsheets, etc)

Employees prepare data in common tables

Results are saved in shared locations Google drive, Dropbox, etc

Data is imported from any number of spreadsheets daily

Saves vast amount of non-productive work in municipalities

Free municipality employees for more effective work

Minimizes errors and maximizes trust

Transparency or results

Results are promptly available online for

Administration

Operators

Finance and accounting

Drivers

Citizens

Imports the data from spreadsheet file, saves it local copy in the database

Calculates weight (and other optional indicators) for each truck & analyses each value against planned operational targets

Calculates total collected weight (and other optional indicators) per day for the whole municipality (Solid Waste theme-object by ISO 37120)

Analyses all waste results (and other optional indicators) against planned targets for the solid waste

Presents results for Solid Waste for all stakeholders according to municipality policies



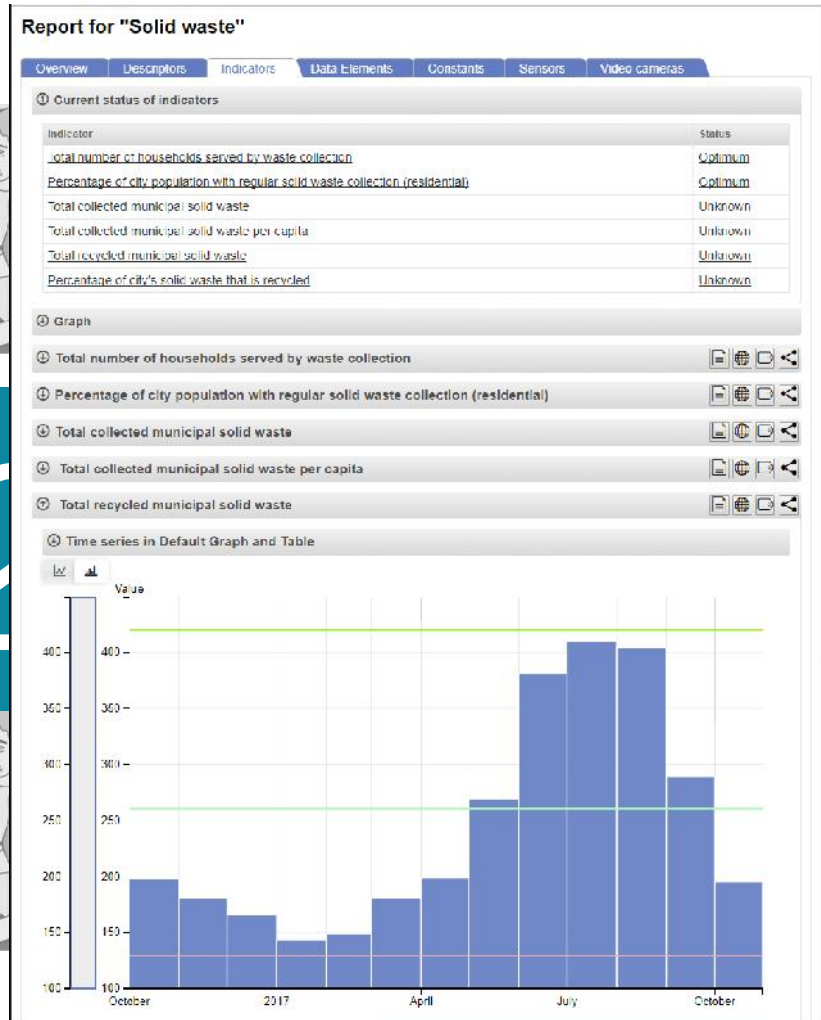
Day of collection,  
Waste weight,  
GPS,Track number



Day of collection,  
Waste weight,  
GPS,Track number



Day of collection,  
Waste weight,  
GPS,Track number

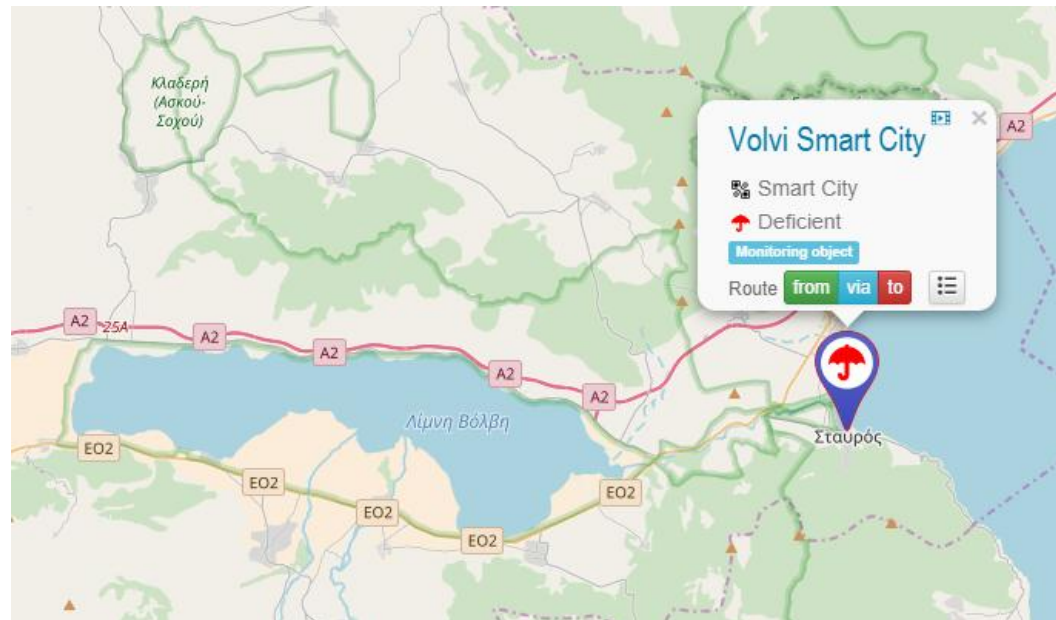


# Waste management and city status:

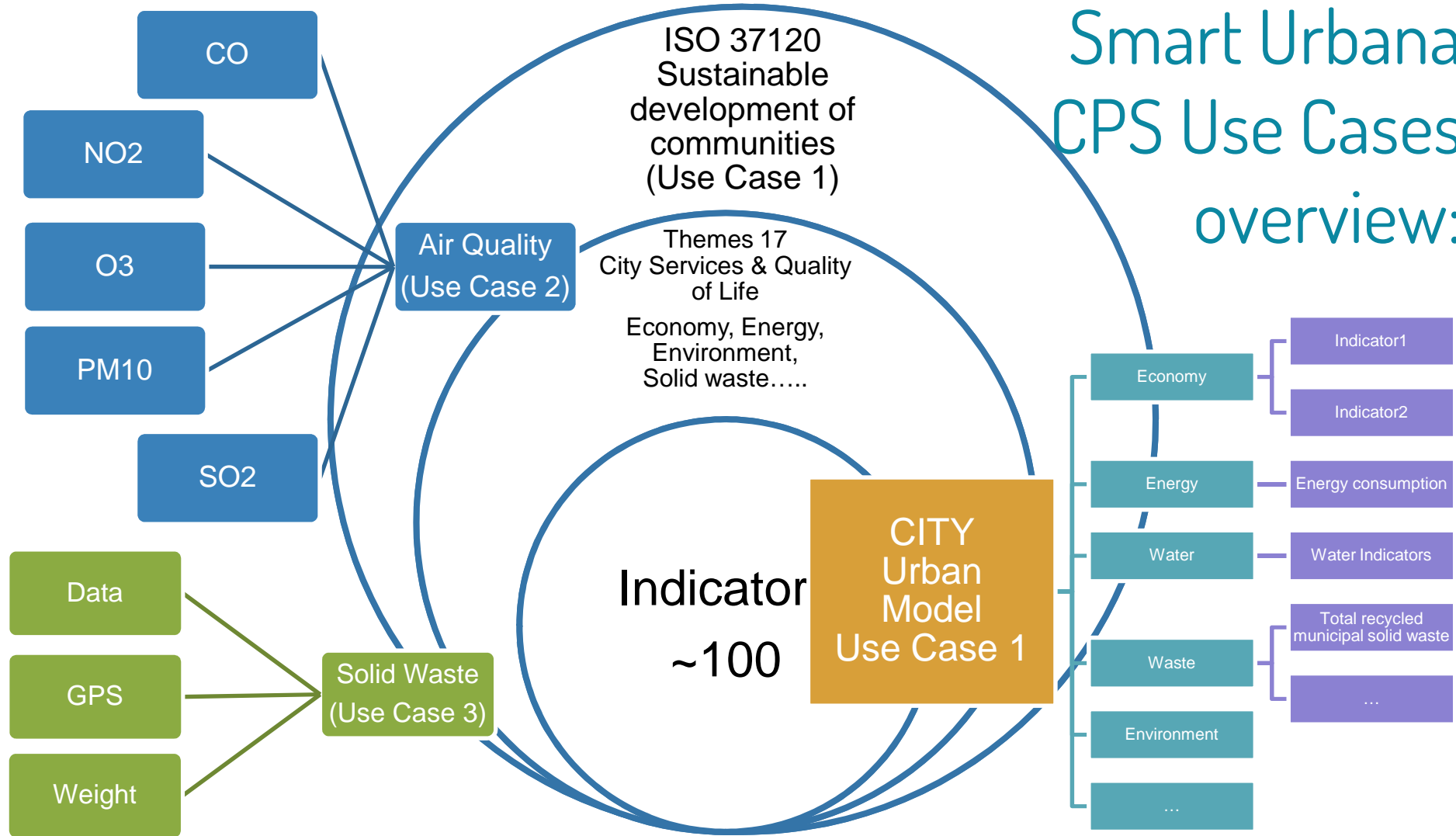
## USE CASE 3

We have a city as a complex cyber-physical system where the urban environment integrate people, processes, places and technologies.

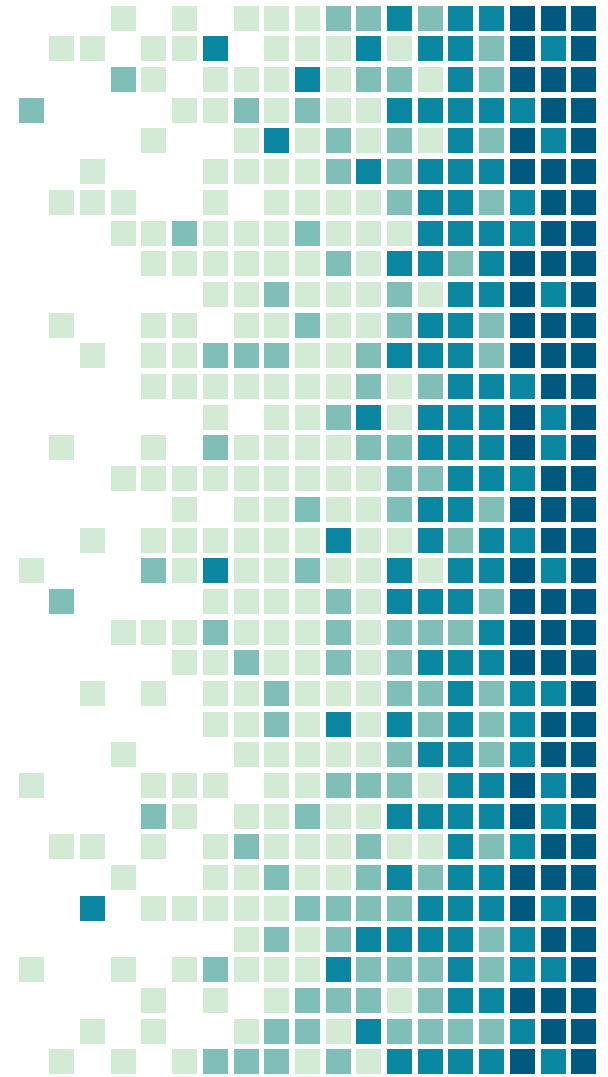
This ecosystem, if developed further, using AI-driven support will be able to self-organize itself and react in order to adapt to the continuously changing surrounding situations.



# Smart Urbana CPS Use Cases overview:



# 4. Exploitation Plan



The value chain of a Smart City begins where the data is generated. By connecting different stakeholders of the city in order to centralize all the data we can turn it into added value.

'Smart Urbana' experiment made possible collection of data from different sources and using CPS based approach for a city to turn these into real time knowledge and value.

This gives a holistic vision of reality in a city; facilitates decision-making based on evidence as a results transparent governance; and provides a way for the inter-connected efficient services which can be improved further understanding; share resources and reduce costs and make the whole CPS system sustainable and resilient

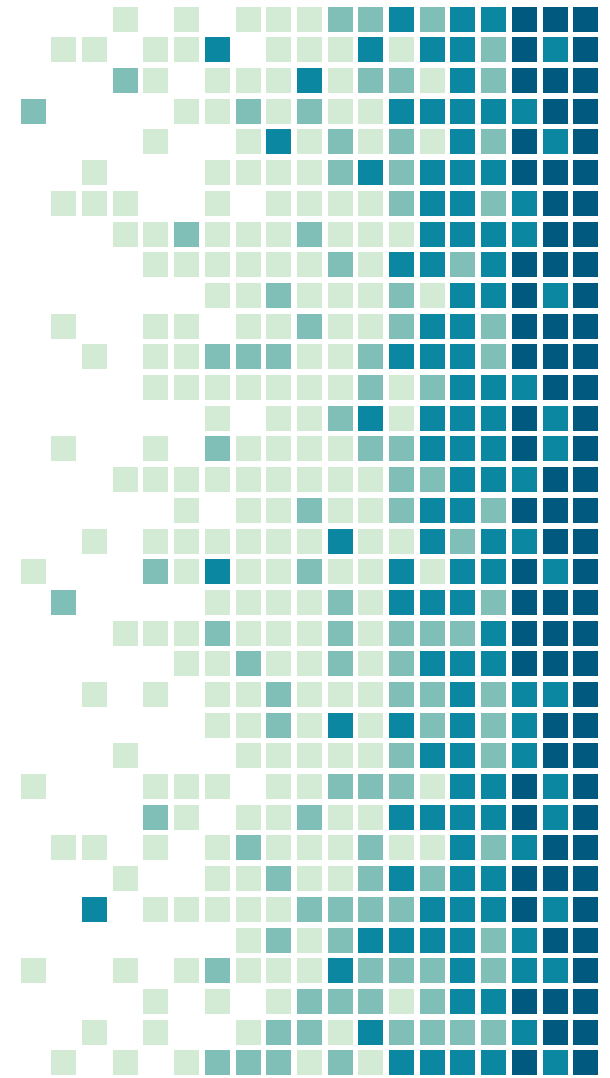
Cities as project partners received integrated operational solution that works and open for further exploitation in water, waste, energy and other management areas of smart city governance

<b>Key Partners</b> <ul style="list-style-type: none"> <li>• Municipality</li> <li>• Waste management Company (Municipality owns it)</li> <li>• CERTH (as IoT developer)</li> <li>• Truck and containers provider (Municipality bought recently new containers)</li> <li>• Citizens</li> <li>• ASIDEES</li> <li>• SOFIA2</li> <li>• GOLEM IMS GMBH</li> <li>• Biogas equipment providers (Municipality aims to generate energy through biogas).</li> </ul>	<b>Key Activities</b> <ul style="list-style-type: none"> <li>• Waste collection</li> <li>• Management of information collected by sensors through the integrated solution <u>Smart City Monitor + SOFIA2</u></li> <li>• Waste processing</li> <li>• Biogas production</li> <li>• Recycled waste sales</li> </ul>	<b>Value Proposition</b> <ul style="list-style-type: none"> <li>• Improvements in quality service for waste collection at lower economic costs and less environmental impact,</li> <li>• Real-data information and timely decision making</li> <li>• Efficient control of the available resources</li> <li>• Holistic vision of the impact of waste on the city as a whole ecosystem</li> <li>• Efficient management and performance improvement in city management and waste management</li> <li>• City mobile application for waste management which is available also for the citizens</li> <li>• All data is controlled and owned by the municipality</li> </ul>	<b>Customer Relationships</b> <ul style="list-style-type: none"> <li>• Citizens, tourists and other stakeholders dispose waste in containers</li> <li>• The Municipality</li> <li>• Immediate feedback from all stakeholders if anything requires attention</li> </ul>	<b>Customer Segments</b> <ul style="list-style-type: none"> <li>• Citizens</li> <li>• Utility providers,</li> <li>• Private companies</li> <li>• Tourists</li> <li>• All other users</li> <li>• Stakeholders who are interested in buying recycled waste</li> <li>• Transparency of processes and its economics</li> </ul>
<b>Cost Structure</b> <ul style="list-style-type: none"> <li>• Salaries</li> <li>• Trucks (maintenance costs, fuel) and Containers (maintenance costs)</li> <li>• Sensors (IoT devices) and CERTH infrastructure services (as sensor producer)</li> <li>• Waste and biogas processing plant and equipment's</li> <li>• Licenses and subscription fee for integrated solution (Smart City Monitor + SOFIA2)</li> <li>• Initial investments in sensors and other infrastructure e.g. <u>LoraWan</u> stations</li> </ul>	<b>Revenue Streams</b> <ul style="list-style-type: none"> <li>• Collected taxes</li> <li>• By using biogas energy costs to energy providers will be reduced</li> <li>• Sales from recycled waste</li> </ul>			
<b>Social &amp; Environmental Costs</b> <ul style="list-style-type: none"> <li>• Energy consumption but biogas plant and separated waste collection will reduce it.</li> <li>• CO2 impact from truck will be reduced due to efficient logistics.</li> </ul>	<b>Social &amp; Environmental benefit</b> <ul style="list-style-type: none"> <li>• Job creation with high qualifications (there is college with the IT faculty on in the municipality)</li> <li>• Lower waste collection services costs allow tax reduction (for Greece it means a lot)</li> <li>• Smart business ecosystem development in the municipality</li> <li>• A clean municipality which is during the summer is tourist destination</li> <li>• Greener eco-friendly environment for citizens and tourists</li> </ul>			

## Business Model for waste management

There is only one real barrier for immediate implementation of 'Smart Urbana' integrated solution in EU cities : Availability of sufficient number of data sources in concrete urban areas such as sensors, smart meters and databases by utility service providers and public organisations responsible for various services for citizens (health, education, economics, jobs, etc). While access to existing databases and automated systems presents mainly organizational and legal challenges, the implementation and maintenance of smart meters and sensors and green technologies in necessary quantities constitutes a major part of the Smart City costs.

5.  
'Smart Urbana'  
CHALLENGES



Access to existing data sources (sensors, meters, automated systems, databases, mobiles)

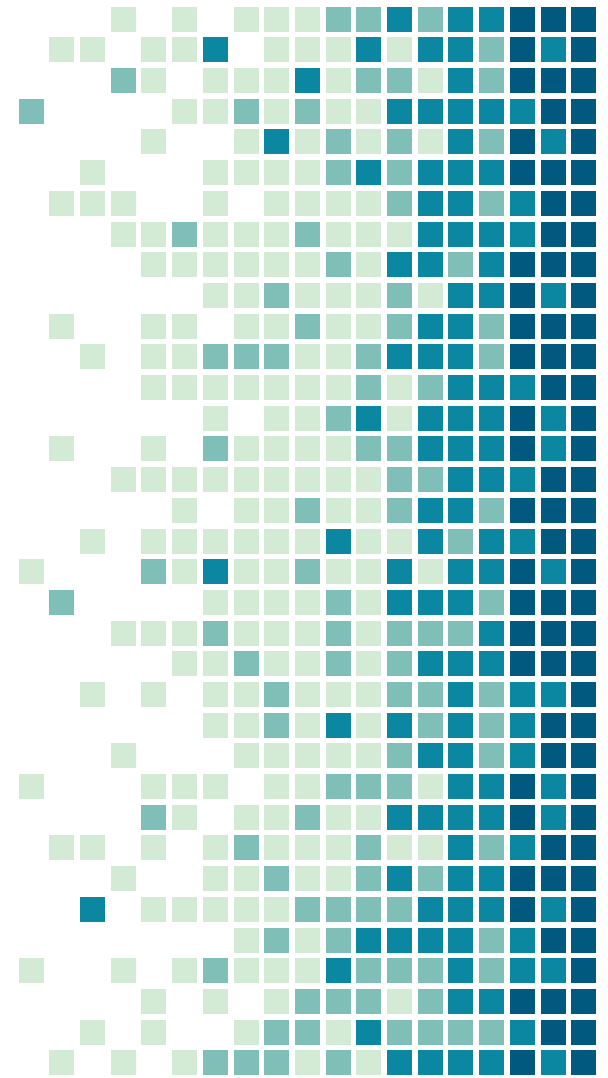
Utility providers are not always ready to work with a municipality even when municipality owns or have a share in the business enterprise

Lack of sensors and automated systems in cities

Technology and innovations foster smart management of cities but a courage and political will is required to work with resistance to change

Data ownership = Right to reuse data in other projects

6.  
'Smart Urbana'  
TAKEWAYS



Even in a short-term project and tight budget can be sufficient to achieve highly innovative objectives when project partners take proactive roles

Prior to any smart city project it's necessary to have a positive attitude by as many stakeholders as possible

Project partners received working platform for further exploitation e.g. water, waste and other management

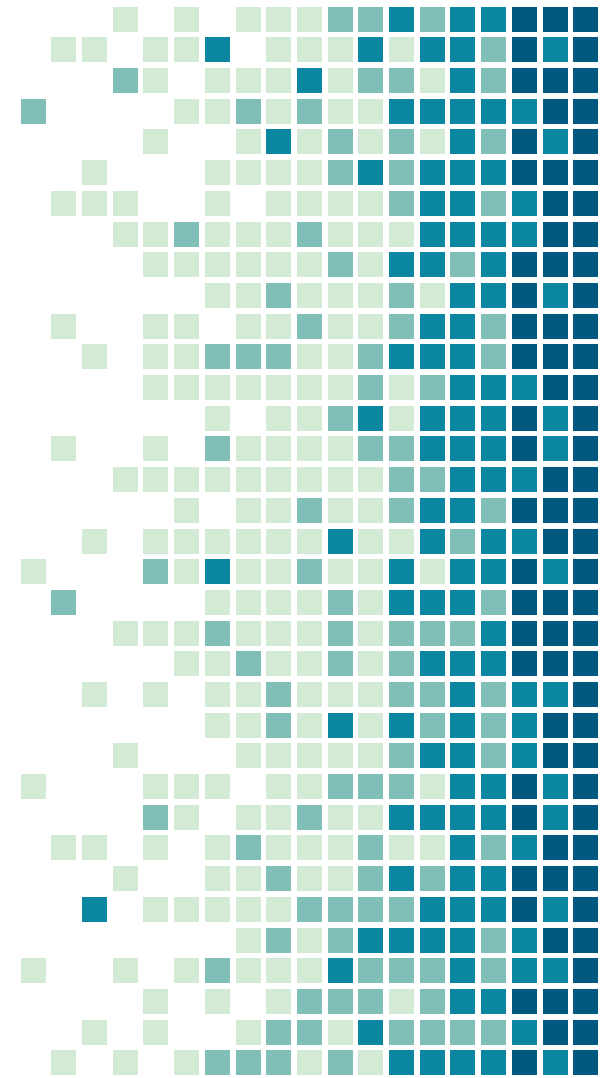
Partners have better understanding of sensors needed for digital transformation in their cities

Innovation is cost-effective for small & mid-size cities

7.

'Smart Urbana'

What's next



Continuing cooperation with the project partners;

Business cases for waste/water/energy management, Circular economy;

Dissemination activities plan is developed and partners will act accordingly;

Aiming to make city's digital twins which are exact cyber world copies of relevant physical city infrastructure that truly representative with all its functionalities of the physical world.

Enable effective interactions between the worlds supported by AI-driven prediction analytics

# THANKS!

Interested to use 'Smart Urbana'  
experiment results? Have collaboration  
offers?

You can find us by:

[info@asides.org](mailto:info@asides.org)

Facebook @ASIDEES

[asidees.org](http://asidees.org)

# CREDITS

Special thanks to all the people who made and released these awesome resources for free:

Presentation template by [SlidesCarnival](#)

Photographs by [Unsplash](#)

Photographs from the municipalities sites.

This presentation uses the following typographies and colors:

Titles: **Dosis**

Body copy: **Titillium Web**

You can download the fonts on these pages:

<http://www.impallari.com/dosis>

<http://www.campivisivi.net/titillium/>

Pastel green #d3ebd5 • Green #80bfb7 • Teal #0b87a1 • Navy #01597f • Dark navy #003b55

