

# Transport and Mobility

Prof. Andres Monzon

Transport Reseach Center

Univ. Politecnica de Madrid



ASSESSING SMART CITY INITIATIVES FOR THE MEDITERRANEAN REGION

SMARTGREENS 2015



European  
Investment  
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## 0. ASCIMER PROJECT OVERVIEW

### 0.1 CONTEXT

### 0.2 TEAM

### 0.3 OBJECTIVES

## 1. FIRST YEAR ACTIVITIES

## 2. INTELLIGENT TRANSPORT SYSTEMS

## 3. ITS IN PUBLIC TRANSPORTATION

By 2050 more than  
70% world population  
will live in cities

70% of global GDP  
is generated by  
cities

### Cities Global Challenges:

- Ageing population
- Pollution
- Climate change
- Traffic Congestion
- Lack of affordable housing
- Urban sprawl
- Rising cost of urban infrastructure
- Poverty
- Social Tensions

It is crucial to **manage growing cities** in ways that **support and drive economic growth** and **competitiveness** while **achieving social cohesion and environmental sustainability**

### SOCIO-ECONOMIC ASPECTS

Integral Socioeconomic  
Development

Cross-sectorial ICTs

Public Services and  
Utilities

### INITIAL UE MAIN ACTION FIELDS

Energy &  
Environment

Transport & Mobility

Urban Development &  
Planning

**SMART CITY  
CONCEPT**

## 0.2.- ASCIMER OVERVIEW: Project team



### UPM TEAM ASCIMER TEAM



MSc. Fiamma  
Perez



MSc. Guillermo  
Velazquez



MSc. Victoria  
Fernandez-Anez

### UPM EXPERTISE



Prof. Javier  
Uceda



Dr. Jose Manuel  
Vasallo



Dr. Jose María  
de Lapuerta



Dr. María Eugenia  
López-Lambas



Dr. Manuel  
Alvarez-Campana



Dr. Oscar  
García



Dr. Claudio  
Feijóo



Dr. Sergio  
Ramos

### EXPERT REFERENCE GROUP



Amman (Jordan)  
University of Petra



Helsinki (Finland)  
VTT



Lyon (France)  
ENTPE



Malaga (Spain)  
Municipality



Milan (Italy)  
University



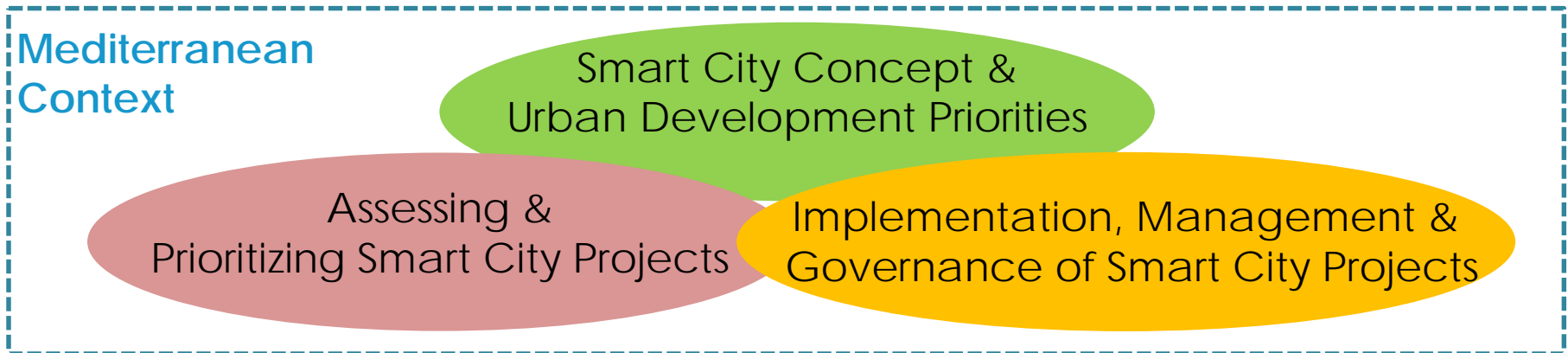
Tangier (Morocco)  
Urban Agency of  
Tangier



Vienna (Austria)  
TUWien



The overall purpose of this project is **to develop** a comprehensive framework to help public and private stakeholders **to make informed decisions** about **smart cities investment** strategies and to help them to **build the skills to prioritize, implement and develop** those strategies.



At the same time, an on-going goal will be **the characterization of Mediterranean City challenges** and the development of a **transferability** strategy of **Smart City projects**

0. ASCIMER PROJECT OVERVIEW

1. FIRST YEAR ACTIVITIES

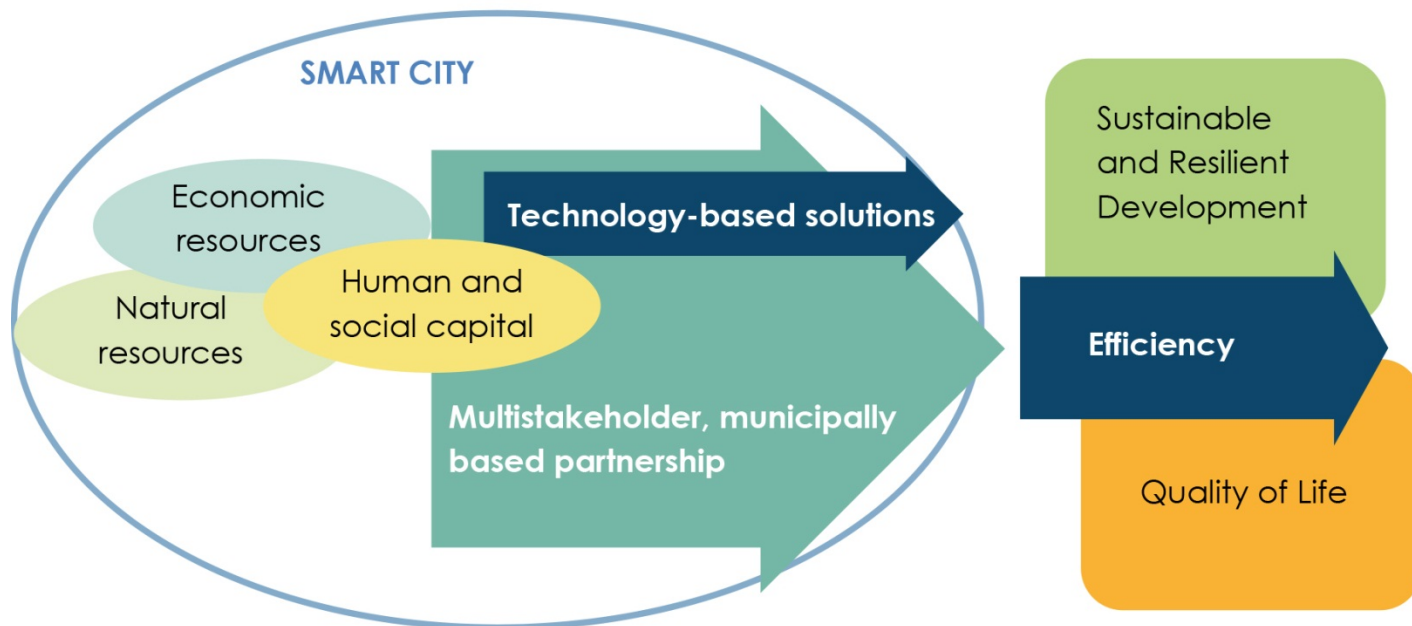
2. INTELLIGENT TRANSPORT SYSTEMS

3. ITS IN PUBLIC TRANSPORTATION

## Working definition:

“A Smart City is an integrated system in which human and social capital interact, using technology-based solutions.

It aims to efficiently achieve sustainable and resilient development and a high quality of life on the basis of a multistakeholder, municipality based partnership.”



## SMART CITY GOALS

- Achieve a sustainable and resilient development.
- Increase the quality of life of its citizens.
- Improve the efficiency of the existing and new infrastructure.

## TECHNOLOGY FACTOR

- Use of New Technologies, specially ICT, as a mean to achieve its objectives.  
Technology as tool for the improvement of the city.

## MAIN ACTORS IN SMART CITY PROJECTS

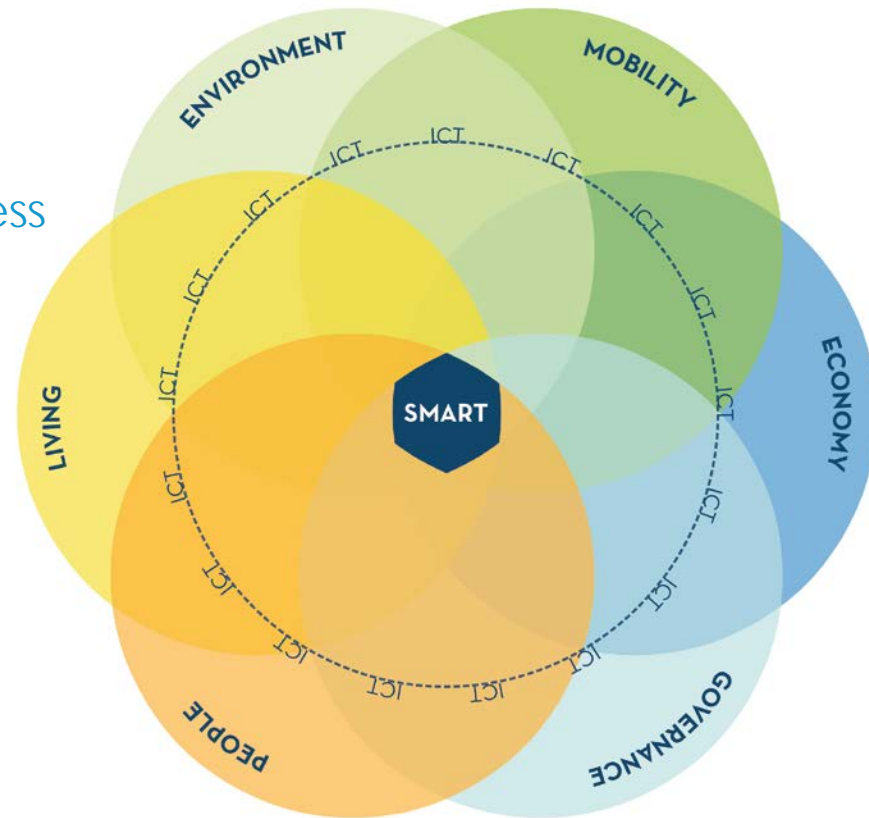
- Government and city authorities: municipally based.
- Public-private partnerships.
- Citizen participation

## SMART CITY AS A SYSTEM

- Holistic approach

- specific aspects of a city
- where Smart Initiatives impact
- Integration to achieve smartness

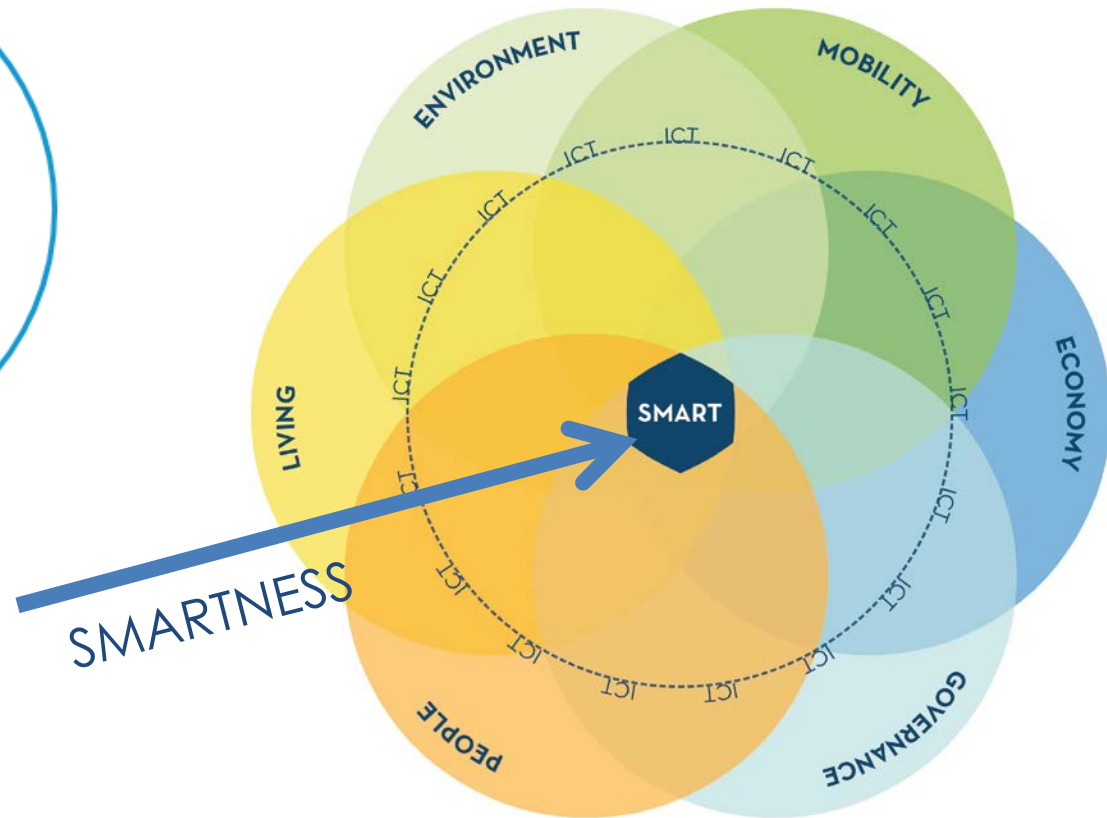
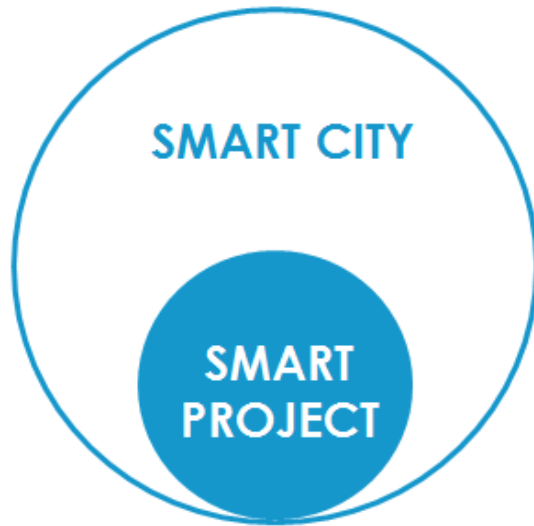
- Smart Governance
- Smart Economy
- Smart Mobility
- Smart Environment
- Smart People
- Smart Living



SMART CITY DIMENSIONS &  
TECHNOLOGY AS COMMON ENABLER

#### Main sources:

European Parliament (2014) *Mapping Smart Cities in the EU*  
Giffinger, R. et al. (2007) *Smart Cities: Ranking of European Medium-Sized Cities*.



## What does a project need to be Smart?

# Concept & Challenges: City Challenges



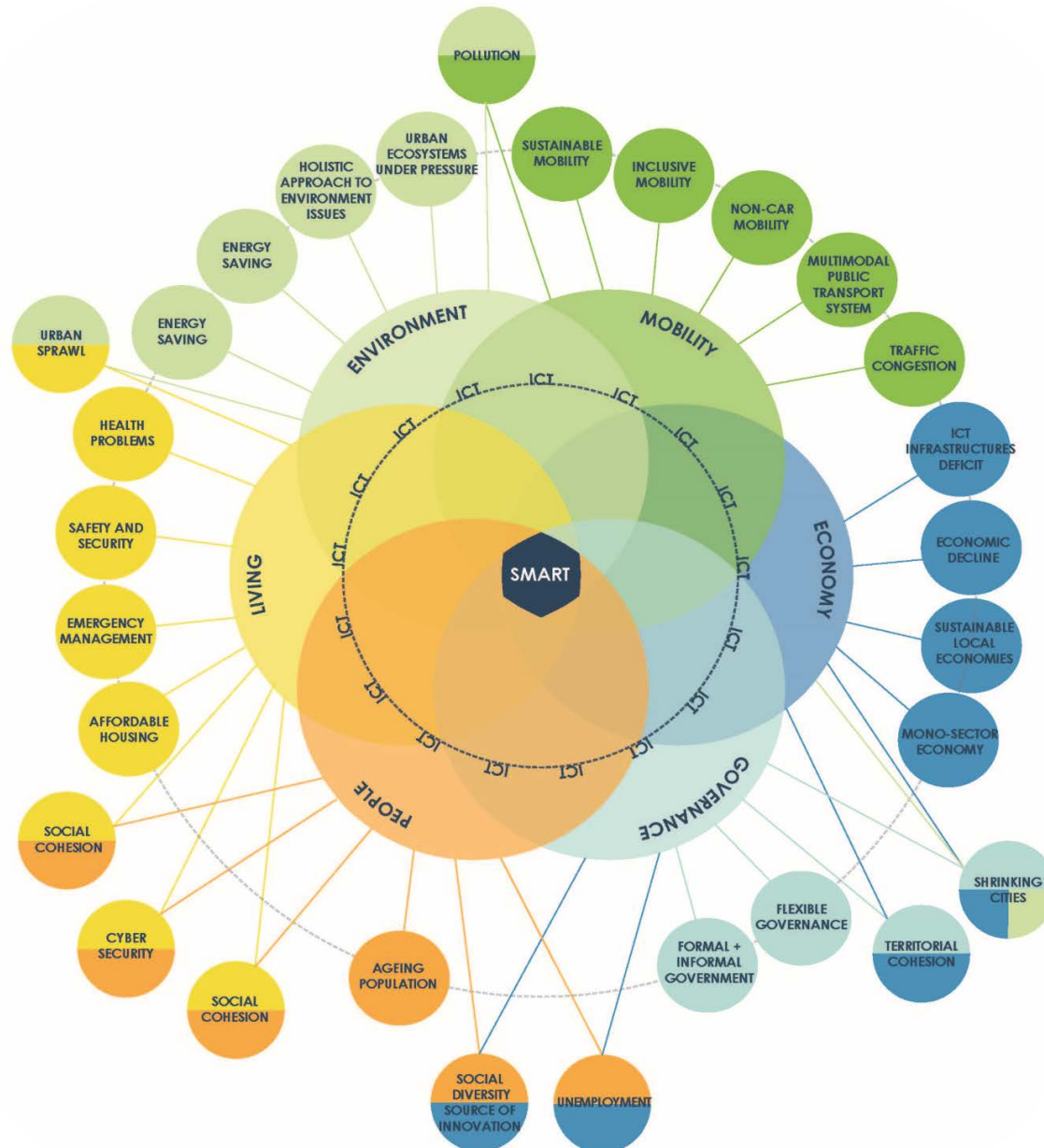
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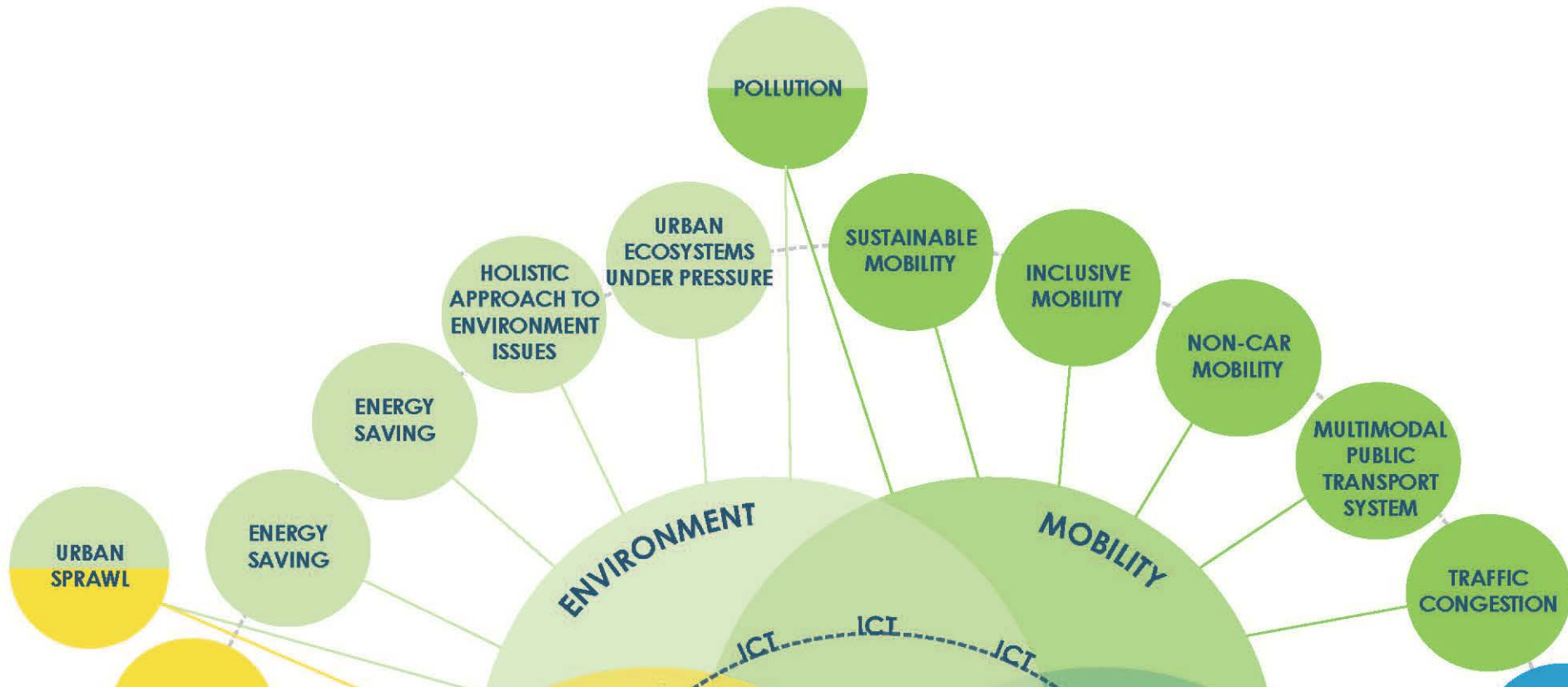
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ASSESSING SMART CITY INITIATIVES  
FOR THE MEDITERRANEAN REGION



## Relationship between Smart City Dimensions, South & East Mediterranean Challenges and general City Challenges.



Smart City Projects should help Southern and Eastern Mediterranean cities to **solve their current challenges avoiding the problems that the Northern cities are already facing**

**Sources:**

- State of the art
- Web research
- On-line Survey
- Field Visits

## Smart Governance

- SGo1. Participation
- SGo2. Transparency and information accessibility
- SGo3. Public and Social Services
- SGo4. Multi-level governance

## Smart Environment

- SEn1. Network and environmental monitoring
- SEn2. Energy efficiency
- SEn3. Urban planning and urban refurbishment
- SEn4. Smart buildings and building renovation
- SEn5. Resources management
- SEn6. Environmental protection

## Smart Economy

- SEc1. Innovation
- SEc2. Entrepreneurship
- SEc3. Local & Global interconnectedness
- SEc3. Productivity
- SEc5. Flexibility of labor market

## Smart People

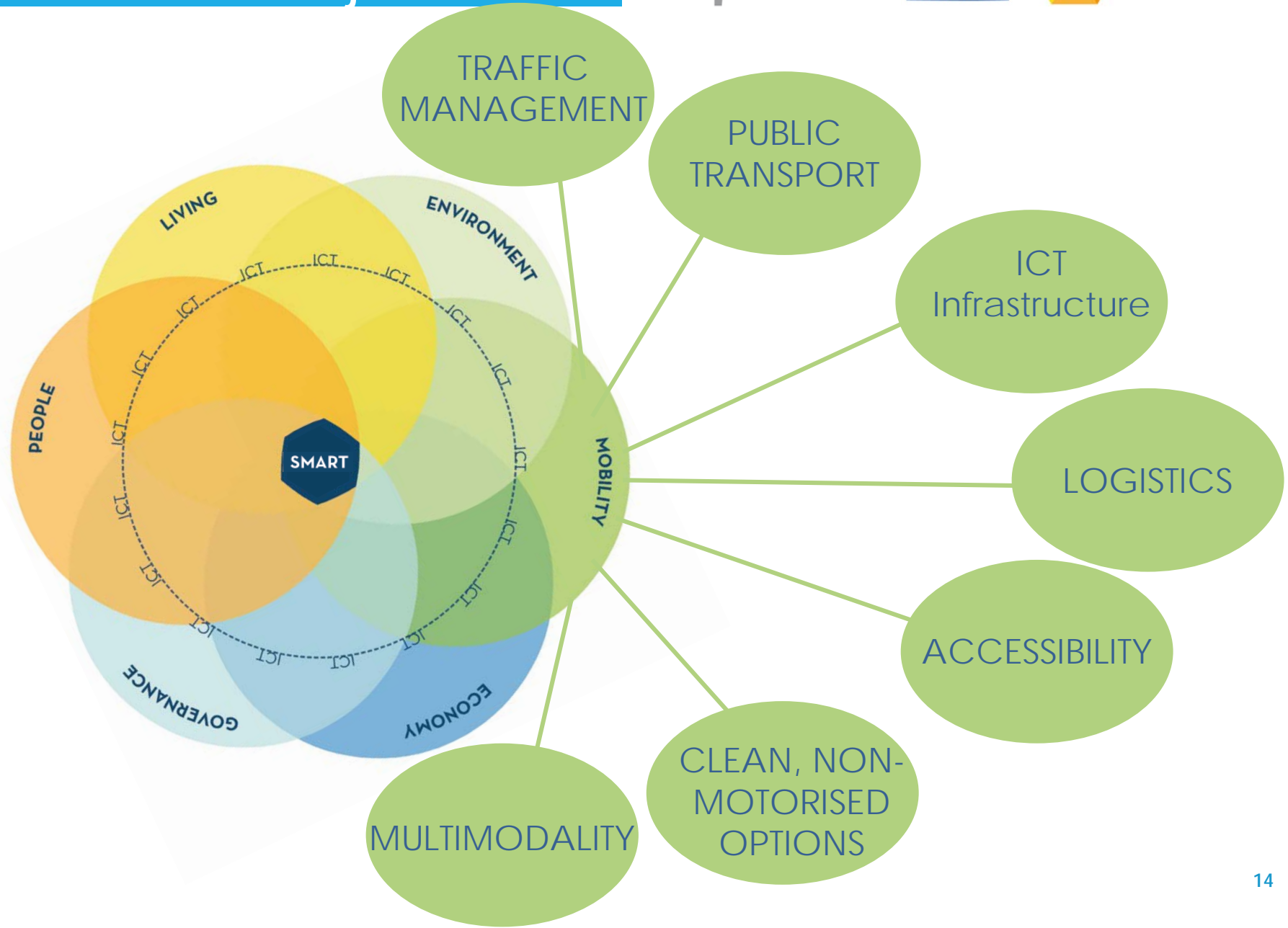
- SPe1. Digital education
- SPe2. Creativity
- SPe3. ICT - Enabled working
- SPe4. Community building and urban life management
- SPe5. Inclusive society

## Smart Mobility

- SMo1. Traffic management
- SMo2. Public Transport
- SMo3. ICT Infrastructure
- SMo4. Logistics
- SMo5. Accessibility
- SMo6. Clean, non-motorised options
- SMo7. Multimodality

## Smart Living

- SLi1. Tourism
- SLi2. Culture and leisure
- SLi3. Healthcare
- SLi4. Security
- SLi5. Technology accessibility
- SLi6. Welfare & Social inclusion
- SLi7. Public spaces management



# Projects Catalogue: Project & Challenges



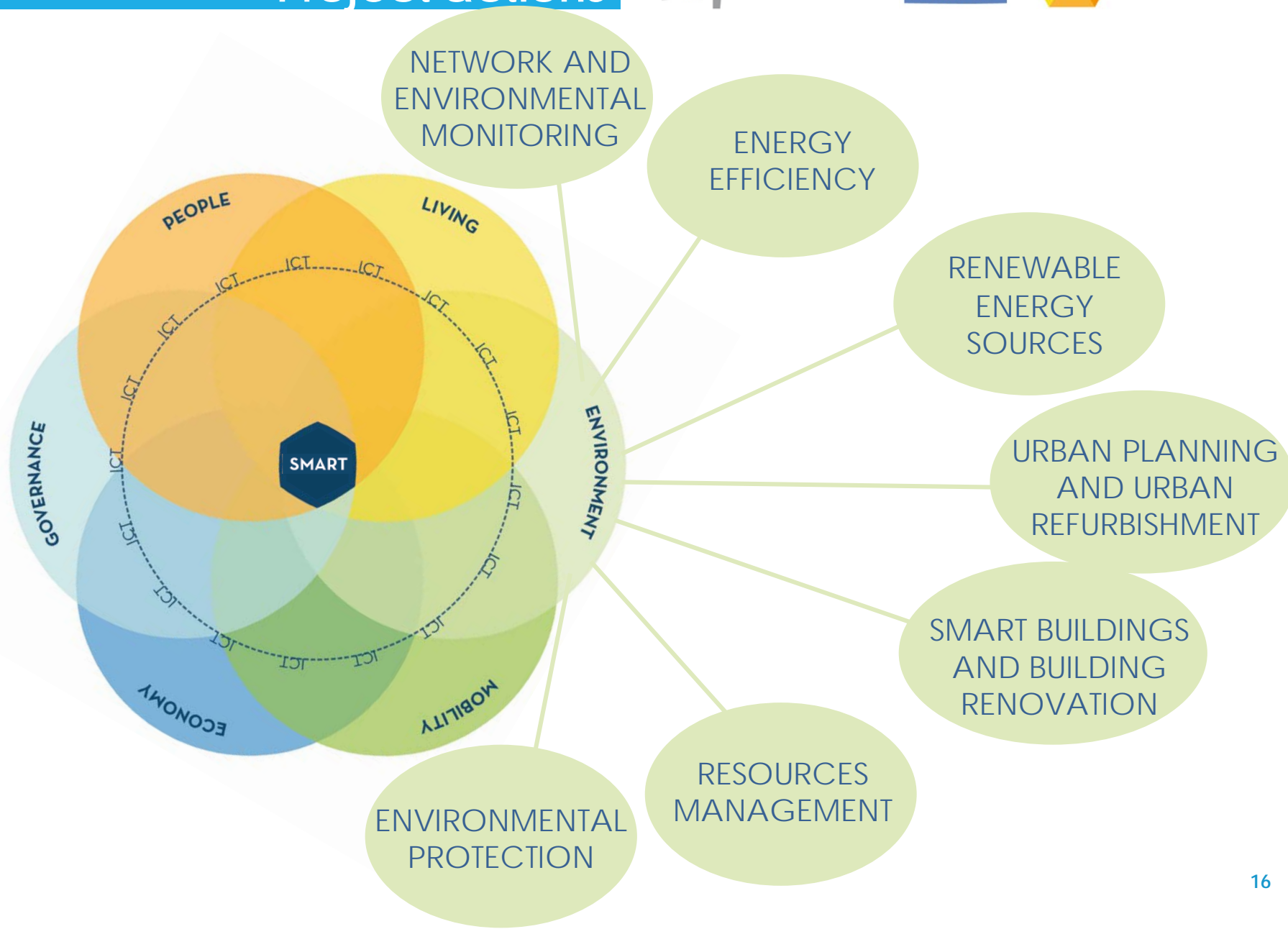
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		Smart City Project Actions						
		SMo1. Traffic management	SMo2. Public Transport	SMo3. ICT Infrastructure	SMo4. Logistics	SMo5. Accesibility	SMo6. Clean and non-motorised options	SMo7. Multimodality
European City Challenges	Sustainable mobility							
	Inclusive mobility							
	Multimodal public transport systems							
	Pollution							
	Traffic congestion							
	Non-car mobility							



		Smart City Project Actions						
		SEn1. Network and environmen tal monitoring	SEn2. Energy efficiency	SEn2. Energy efficiency	SEn4. Urban planning and urban refurbishment	SEn5. Smart buildings and building renovation	SEn5. Resources management	SEn6. Environmental protection
European City Challenges	Energy saving							
	Shrinking cities							
	Holistic environmental and energy issues							
	U. ecosystem pressure							
	Climate change effects							
	Urban sprawl							

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**ITS = ICT applied to Transport**

## **Intelligent Transport Systems (ITS)**

*“advanced applications which without embodying intelligence as such aim to provide innovative services relating to different modes of transport and traffic management and enable various users to be better informed and make safer, more coordinated and ‘smarter’ use of transport networks”*

*(DIRECTIVE 2010/40/EU)*

- ITS → contribute to build a truly integrated and user-friendly transport system

## Directive 2010/40/EU on the framework for the deployment of ITS in the field of road transport and for interfaces with other modes of transport



### OBJECTIVES

- Establish a Framework
- Setting common priorities
- Development of specifications and standards

## Directive 2010/40/EU on the framework for the deployment of ITS in the field of road transport and for interfaces with other modes of transport

### Specifications

- Aims: compatibility, interoperability and continuity of ITS solutions
- Binding measures (requirements, procedures, or any other relevant rules)
- Functional, technical, organisational, service - provisions issues
- Based on existing standards (where appropriate)



## Directive 2010/40/EU on the framework for the deployment of ITS in the field of road transport and for interfaces with other modes of transport

- 4 Priority Areas

(I) Optimal Use of  
Road, Traffic and  
Travel Data

(II) Continuity of  
Traffic and Freight  
Management

(III) Road Safety and  
Security

(IV) Linking Vehicle  
and Transport  
Infrastructure

## Directive 2010/40/EU on the framework for the deployment of ITS in the field of road transport and for interfaces with other modes of transport

- 6 Priority Actions
  - a) the provision of **EU-wide multimodal travel information** services;
  - b) the provision of **EU-wide real-time traffic information** services;
  - c) data and procedures for the provision of **road safety** related **minimum universal traffic information** free of charge to users;
  - d) the harmonised provision for an **interoperable EU-wide eCall**;
  - e) the provision of **information** services for **safe and secure parking places** for trucks and commercial vehicles;
  - f) the provision of reservation services for safe and secure parking places for trucks and commercial vehicles



**EU-wide Multi-Modal Travel Information**



**EU-wide Real-Time Traffic Information**



**Free Safety-Related  
Minimum Traffic Information**



**Interoperable EU-wide eCall**



**Information Services and Reservation  
Services for Truck Parking**



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Public transport:  
penetration vector  
of ITS technologies  
in cities

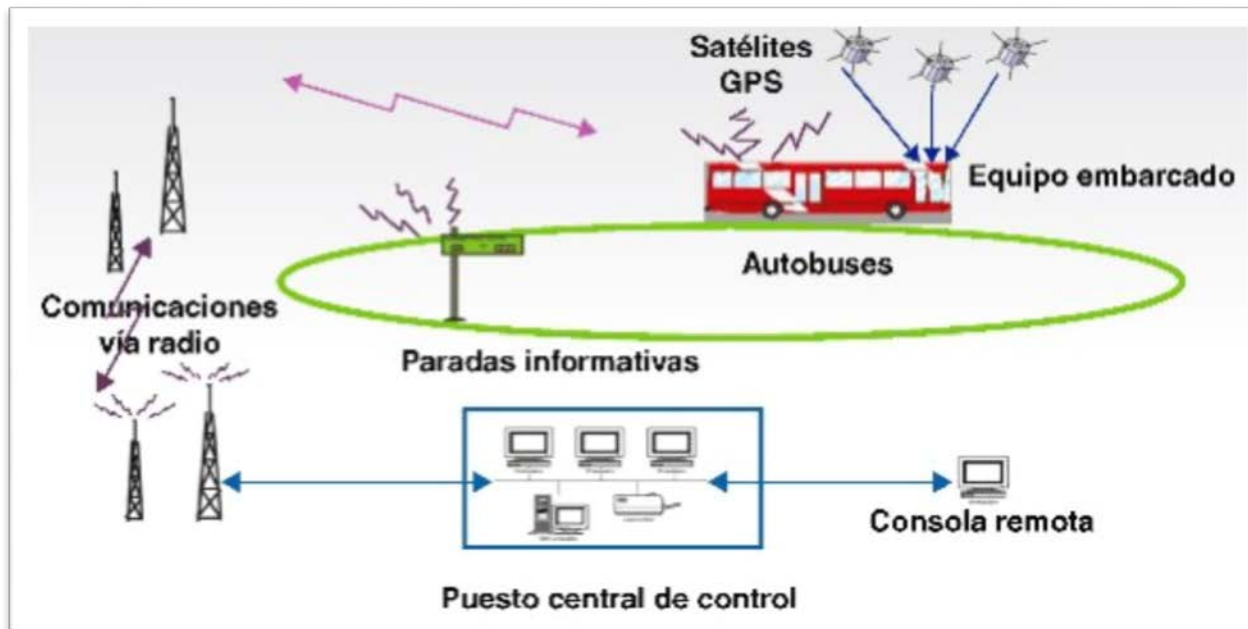




- Fleet management
- Integrated management of traffic and PT
- Multimodal travel planners
- Intermodal services coordination and interchanges facilities
- Ticketing
- Real time information

## FLEET MANAGEMENT (I)

- Operation through a centralized control centre
- based on a two-ways communication protocol: the vehicle provides real time information to the control centre (via AVL system) which in turn produces guidance instructions to each bus.
- Different EDI (Electronic Data Interchange) protocols support this continuous communication.



## FLEET MANAGEMENT (II)

- Benefits:
  - Optimization of bus operation
  - Maintain **headways** between vehicles
  - Alert any **incidents** in the service: quick actions can be taken
  - Deliver **real-time information** to travellers at bus stops, via web or via smartphone.
  - Improvement of quality of service
- Very common in large cities, with big fleets



## FLEET MANAGEMENT – Examples

- Craiova (RO):

- PT system: 3 trolley tram lines and 17 bus lines
- Introduction of **Infomobility tools for fleet management**
  - Implementation of AVL system on 80 buses and 27 trams and installing **20 info panels** for travelers in the main station and in several bus stops.
  - It enables: monitor **schedule adherence** of bus in service; monitor **fuel consumption**; Real time inform drivers about advance/delay at each bus stops; set up of a data base with records of bus service to verify the quality of service
  - Benefits: increase the **reliability** of the PT system, provide better access to **real time route information**, improve the company **management** and optimise the **energy consumption**.





## FLEET MANAGEMENT – Examples

- San Sebastian (SP):

- CTSS-DBUS operates a fleet of 120 buses over 27 regular routes (plus night and special services)
- New expert planning and fleet management system
  - HSDPA-3G communication technology for the data exchange between the buses and the central information system.
  - optimises the number of buses and drivers required in each case, while providing **optimal working conditions** for drivers.
  - Results: drivers' planning timetables now more optimized; reduction of operating costs by 2,5%
  - Installation of **22 security cameras** in the buses, connected to an advanced onboard computer, improving the security and the physical integrity of drivers and passengers.

## INTEGRATED MANAGEMENT OF TRAFFIC AND PT

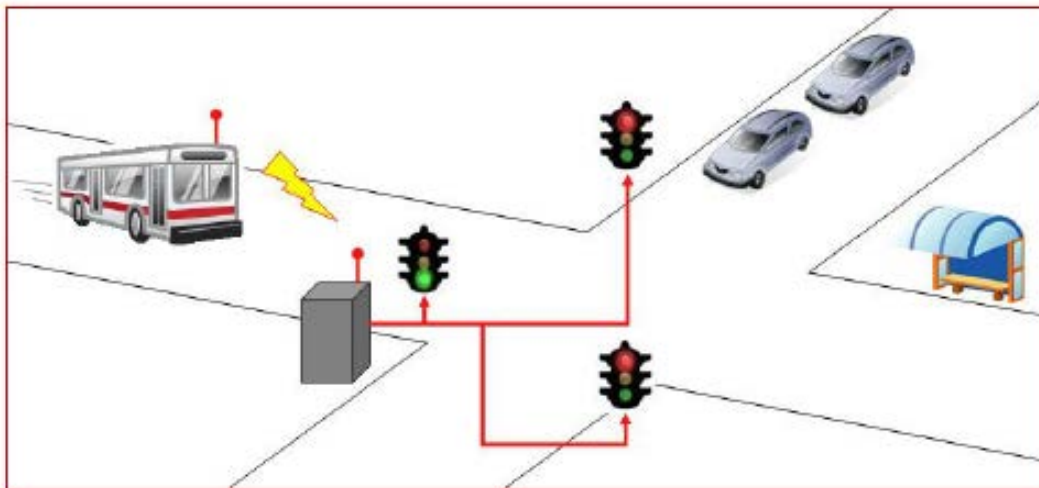
- Coordination of ITS systems for controlling bus services and traffic.
- Needs a common platform where traffic and PT control centres are linked and coordinated.
- Main benefits:
  - Promotes **reliability** in bus services (priority in traffic lights, and bus lanes)
  - Anticipating information on congestion or incidents on bus line to allow changing itineraries
  - Improve the quality of service



## INTEGRATED MANAGEMENT OF TRAFFIC AND PT - Examples

- **Toulouse (Fr): Bus priority system**

- PT network: 77 urban bus lines, 2 underground lines, a tramway line and a bicycle rental scheme in the city
- Objective: improve the **competitiveness and the attractiveness** of the Bus Network towards the Car use
- Equipment of 2 bus lines with a **priority request system** (radio priority system). It gives green light to the arriving bus.



### Results:

- Improved regularity and journey time
- Reduced average bus waiting time at traffic lights by 52% (9" less)

## INTEGRATED MANAGEMENT OF TRAFFIC AND PT - Examples

- **Edinburgh (Sc): Greenways scheme**
  - PT network: 110 bus lines and a tram system to the airport
  - Problem of **traffic congestion**
  - **Greenways scheme** to restore the balance of car use and PT.
    - Bus lanes painted green, highly visible
    - Large explanatory road signs
    - An electronic detection system at 25 traffic signals, giving **buses priority** at traffic lights
    - New parking and loading bays established
    - More cycle lanes provided (priority for cyclists at traffic lights)
    - More bus shelters and bus stop information
    - More pedestrian crossings and raised level crossings, together with traffic calming measures



### INTEGRATED MANAGEMENT OF TRAFFIC AND PT - Examples

- **Madrid (Sp): CITRAM**
  - Management Centre for the Madrid Public Transport
  - **supports decision-making** and public transport **coordination**
  - It helps to achieve **technological integration** and guarantee **interoperability** between the different systems and operators.

#### GOALS

- **Coordination** among all modes of PT in major events
- **Intermodal information** in real time to PT clients.
- Technological integration and information management to support decision-making.
- Continuous **monitoring** of the status of the PT system.

## SGRAF • Supervisor gráfico Graphic supervisor



- ▶ Localización de vehículos en tiempo real  
*Vehicle real time location*
- ▶ Instalaciones georeferenciadas  
*Georeferenced facilities*
- ▶ Representación gráfica de incidencias  
*Graphic representation of incidents*

## CCTV • Supervisor intermodal Intermodal supervisor



- ▶ Integración de sistemas de CCTV  
*CCTV systems integration*
- ▶ Supervisión simultánea de centros intermodales  
*Simultaneous supervision of multimodal station*
- ▶ Video embarcado  
*Onboard video*

## GEIS • Gestor de incidencias Incident manager



- ▶ Gestor de incidentes basado en web  
*Web-based incident manager*
- ▶ Información de afecciones al servicio  
*Information of services disruptions*
- ▶ Gestor de quejas y sugerencias  
*Complaints and suggestions manager*

## SIGI • Sistema de Gestión Intercambiadores Interchanges Management System



- ▶ Alarma estado de las instalaciones en tiempo real  
*Facility status alarm in real time*
- ▶ Seguimiento de tráfico y ocupación de dársenas  
*Monitoring of traffic and platform occupation*

## SGIP • Información al usuario Passengers Information System



- ▶ Información multimodal al usuario  
*Users multimodal information*
- ▶ Gestión de paneles de todo el sistema  
*Screen management of the whole system*

## GES • Gestión de la seguridad Security/Safety management



- ▶ Gestión automática de alarmas  
*Alarm automatic management*
- ▶ Mayor seguridad para clientes y conductores  
*More security for customers and drivers*

# CITRAM: Public Transport Management Centre in Madrid



### MULTIMODAL TRAVEL PLANNERS

- There is a need for further integration of the different modes of transport to make mobility more efficient and user-friendly.
- Key pillar of the ITS Action Plan: optimal use of travel and traffic data to foster multimodal travel
- It seamlessly integrates information for different modes: comprehensive door-to-door information for users enabling well-informed travel decisions.
- Front-end-back-end computer systems which provide a traveller the best itinerary.
- They supply timetable, routing and other travel information.

## MULTIMODAL TRAVEL PLANNERS – Examples

- **Transport Direct (UK):**
  - **Online** journey planner and information services, covering travel by both **car and PT** throughout England, Scotland and Wales. Also includes car park finder, cycle planner and domestic flight times.
  - 160 million travel information requests and helped spectators plan their routes to the London 2012 Olympic Games.
  - 2004-2014
  - **timetable data freely available** to web developers – emerged a number of journey planning websites, offering similar services to Transport Direct:
    - ❖ AA route planner (for car journey planning); Cyclestreets (for cycle journey planning); National Rail enquiries (for train journey planning); RAC route planner (for car journey planning); walkit.com (for planning walks)

## MULTIMODAL TRAVEL PLANNERS – Examples

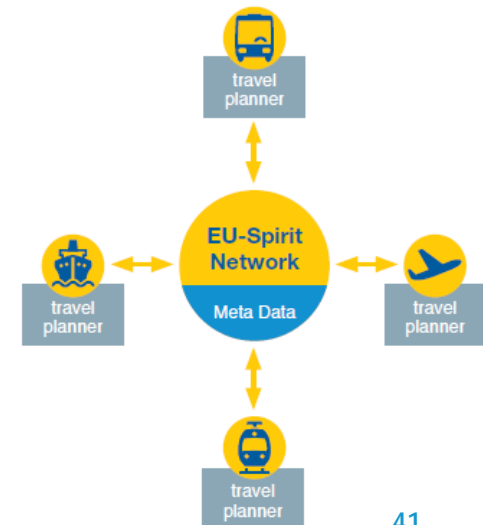
- Wisetrip (<http://wisetrip.travel>) :
  - EU project (FP7)
  - Main goal: develop and validate an **innovative mobility service platform**, which provides multi-modal travel information sourced from various connected journey planners and is accessible by travelers before and during the journey at any place and time through various mobile or fixed devices.
  - Features:
    - easy and flexible interface
    - personalized trip services
    - Carbon footprint of trips

<http://wisetrip.travel/enwisetrip/index.html>



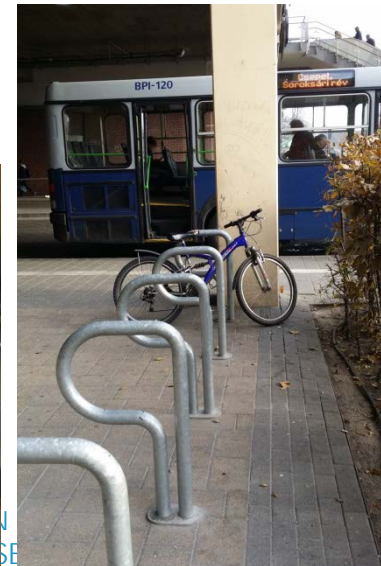
## MULTIMODAL TRAVEL PLANNERS – Examples

- EU Spirit (<http://eu-spirit.eu>) :
  - International door-to-door travel planner
  - based on existing local, regional, and national travel information systems which are interlinked via technical interfaces.
  - calculation of an **itinerary** between stops, addresses or points of interest in different European regions.
  - Also, total **travel times**, information about **fares** and links to additional important local information sources



## INTERMODAL SERVICES COORDINATION AND INTERCHANGE FACILITIES

- Passenger Intermodality: use of different modes of transport in a combined trip chain with a seamless journey
- Coordination of different PT modes and operators is enhanced by the employment ITS
- Not only infrastructure solutions (Interchanges or intermodal centres), but also operational control
- Integration of alternative modes with other



## INTERMODAL SERVICES COORDINATION AND INTERCHANGE FACILITIES – Examples

- MUGI service - Gipuzkoa (Spain):
  - Integrated fare system, 2013
  - Includes all PT modes within the region of Gipuzkoa
  - Users of the transport card MUGI can access the bicycle service (Dbizi) in San Sebastian
  - MUGI users can access the car-sharing service within the municipality of Elgoibar (electric vehicles)



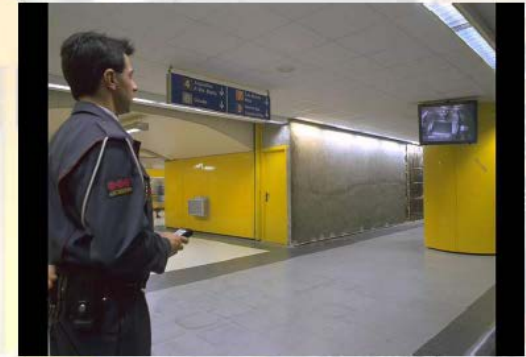
## INTERMODAL SERVICES COORDINATION AND INTERCHANGE FACILITIES – Examples

- Madrid Interchanges (Spain):
  - Four basic principles

Trasbordos



Seguridad



Información



Gestión y explotación



## INTERMODAL SERVICES COORDINATION AND INTERCHANGE FACILITIES – Examples

- **Madrid Interchanges (Spain):**
  - CCTV for registration number recognition (bus identification)
  - GPS and WIFI for services locating, controlling and informing.
  - Passenger counting for mobility control (CCTV in real time)
  - CCTV cameras for safety and security
  - Automated systems for security, traffic control and maintenance.
  - Communication networks own designed.
  - CITRAM

## INTERMODAL SERVICES COORDINATION AND INTERCHANGE FACILITIES – Examples

- **Call a bike (Germany):**
  - innovative **bike hiring service** offered by German Railways
  - designed for **one-way trips** (they can be integrated in a trip chain with long distance rail or regional and urban PT)
  - Discounts for DBCard owners
  - Started in Munich (2001), now also in Berlin, Cologne, Frankfurt, Stuttgart
  - Advanced **returning process**: users can leave the bike where they want and only have to inform the service by mobile



## TICKETING

- Fare integration is a key issue for reaching a seamless transport system
- Integrated ticketing = multimodal ticket for a journey, regardless the number of transport modes used
  - ✓ attractive and user-friendly multimodal transport system
  - ✓ Incentive to encourage travellers to combine several forms of transport
- Renewal of existing ticket validation systems: new forms of electronic ticketing on mobile devices (smart cards, mobile phones...)
- Provision of very useful information to managers and planners

# TICKETING

- **Smart card - Bolzano (Italy):**
  - PT network: consists of bus, rail and cableways
  - a contactless card (the AltoAdige Pass) introduced in 2012
  - The more they travel on PT, the less they pay: fidelization
  - Travelled kilometres counted from the check-in to the check-out. One km travelled on PT can cost:
  - New functionalities added to the card: people travelling with a bicycle or with an animal can pay the corresponding additional fee by selecting the relative option during the check-in.
  - People and users have positively reacted to the new system



### TICKETING

- Interoperability card – Andalusia (Spain):
- Since 2006, the possibility of using the travel card in all Andalusian metropolitan areas.
- Common technology for taking advantage of scale economies .
- Integrated Fare System which allows savings between 25-40% for transport card users over single ticket users.

## TICKETING

- Via-movil in Tenerife (Spain):
- new app to travel by tram and bus
- enables to pay and validate (fares adapted to users mobility needs).
- Payment at anytime, anywhere ... all under fully secure payment platform



id frequencies

<http://www.via-movil.es/>

### NFC (Near Field Communication) TECHNOLOGY

- Technology that enables smartphones and other devices to establish radio communication with each other by touching them together or bringing them into proximity, typically a distance of 10 cm or less.
- It provides the ability to read tags (SIM with NFC), accessing different services:
  - Ticket validation
  - Contactless payment: online recharging
  - Check number of trips available, expiration date
  - Real time information
  - Incidents within the PT network
  - calculating the most effective route
  - Other (non-PT services): Buy tickets (museums, cinema...); weather information; parking services



### NFC (Near Field Communication) TECHNOLOGY

- NFC in Valencia (Spain):
  - first Spanish city to use mobile phones to access public transport: payment with smartphone since 1<sup>st</sup> July 2014 in urban buses (EMT) and FGV railway operators.
    - Orange and Vodafone: mobile operators (Movistar in process)
    - La Caixa: financial institution
    - PT operators: EMT and FGV
    - Compatible mobile
- <https://www.youtube.com/watch?v=W8fkj-p1U4w>

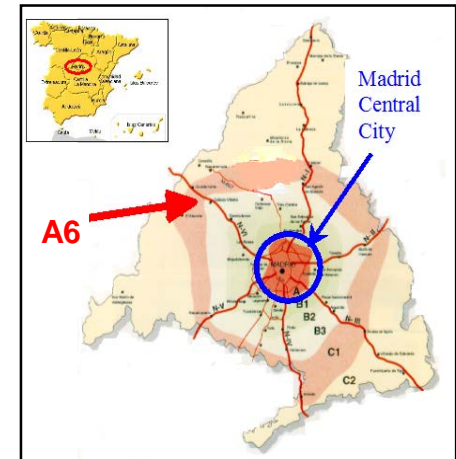
## REAL-TIME INFORMATION

- Providing travellers with accurate information before and during the journey will not only benefit individuals; it will also lead to efficiency gains for transport operations and for the transport network as a whole.
- One of the features most valued by users: big expansion in recent years
- Information provided:
  - Waiting time for the next service
  - Other PT services in correspondence to a k
  - Reports on incidents
- Transport authorities make all existing data on PT a
- general public, especially developers: expansion of
- <http://opendata.emtmadrid.es/>



## REAL-TIME INFORMATION

- **Multimodal real-time information in Madrid (Spain):**
- PT system in Madrid region consists of 5 modes: metro, urban buses, metropolitan buses, light rail and commuter railways; 5 main intermodal hubs connecting these modes
- Objectives of the measures implemented (within the EBSF project):
  - To promote the PT use and help the user on the modal choice (bus or train) by providing **multimodal real time information** to the users, along the A6 corridor in:
    - ✓ the bus stops
    - ✓ on board the bus
    - ✓ the web and the mobile via SMS
  - Underground vehicle location using radiofrequency systems (WiFi) as support for the advanced traffic management in the interchange station.



## REAL-TIME INFORMATION

### • Multimodal real-time information in Madrid (Spain)

#### Devices to provide real time info to users

- 4 panels (screens) on 4 different stops in Majadahonda
- 1 more stop-provided with Bluetooth
- screens in the interchange

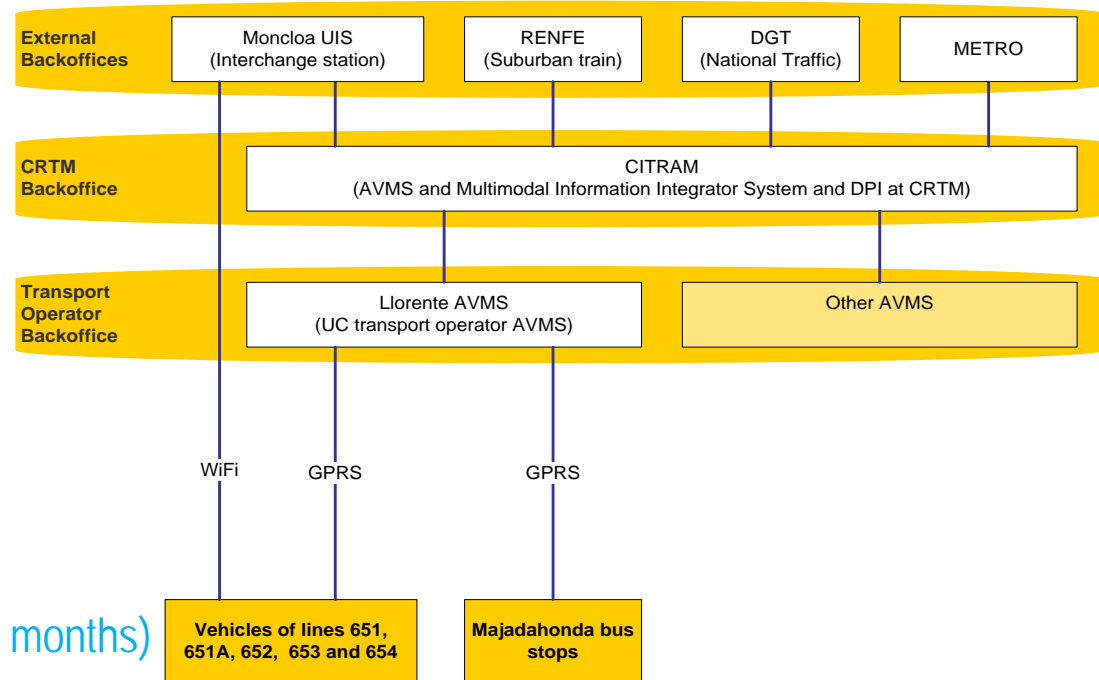


#### Buses

- more than 30 buses equipped

#### Backoffice

- multimodal integrator center
- integration with highway info
- integration with suburban railway info
- integration of incidents information



Test: October 2011 – March 2012 (6 months)

## REAL-TIME INFORMATION

### • Real time countdown system in London (UK):

- Countdown service providing real time bus information for all 19,000 London's bus stops, being the largest system in the world
- Information available via internet, smartphones, text messages
- Information about: Bus arrival time, service disruption and links to London Underground services
- Signs at bus stops comply with disability guidelines
- Together with the iBus system (AVL system installed in all London's 8000 buses to provide passengers with audio visual announcements and to trigger priority at traffic junction)
- Benefits: Reduction of the operational costs, more reliable transfer of bus information, greater accuracy of information (95% accurate)



## REAL-TIME INFORMATION

- **VAO, Traffic Information Austria:**

- high-quality, Austrian-wide, intermodal traffic information system
- One traffic information service for all instead of many different ones
- Information about: car routing, public transport routing, bicycle routing, Bike & Ride, Park & Ride, hire bikes, car sharing etc.
- VAO supports its users in the choice of transport mode, information about traffic obstructions, traffic jams and road works and includes these in the route calculation.
- Project VAO 2 already in progress: include flight data & additional sharing concepts (car sharing), and additional end-user services

<http://www.verkehrsauskunft.at/>



# ¡THANK YOU FOR YOUR ATTENTION!

Andres Monzon  
[andres.monzon@upm.es](mailto:andres.monzon@upm.es)