



**Sustainable, Resilient and Integrated Mobility**

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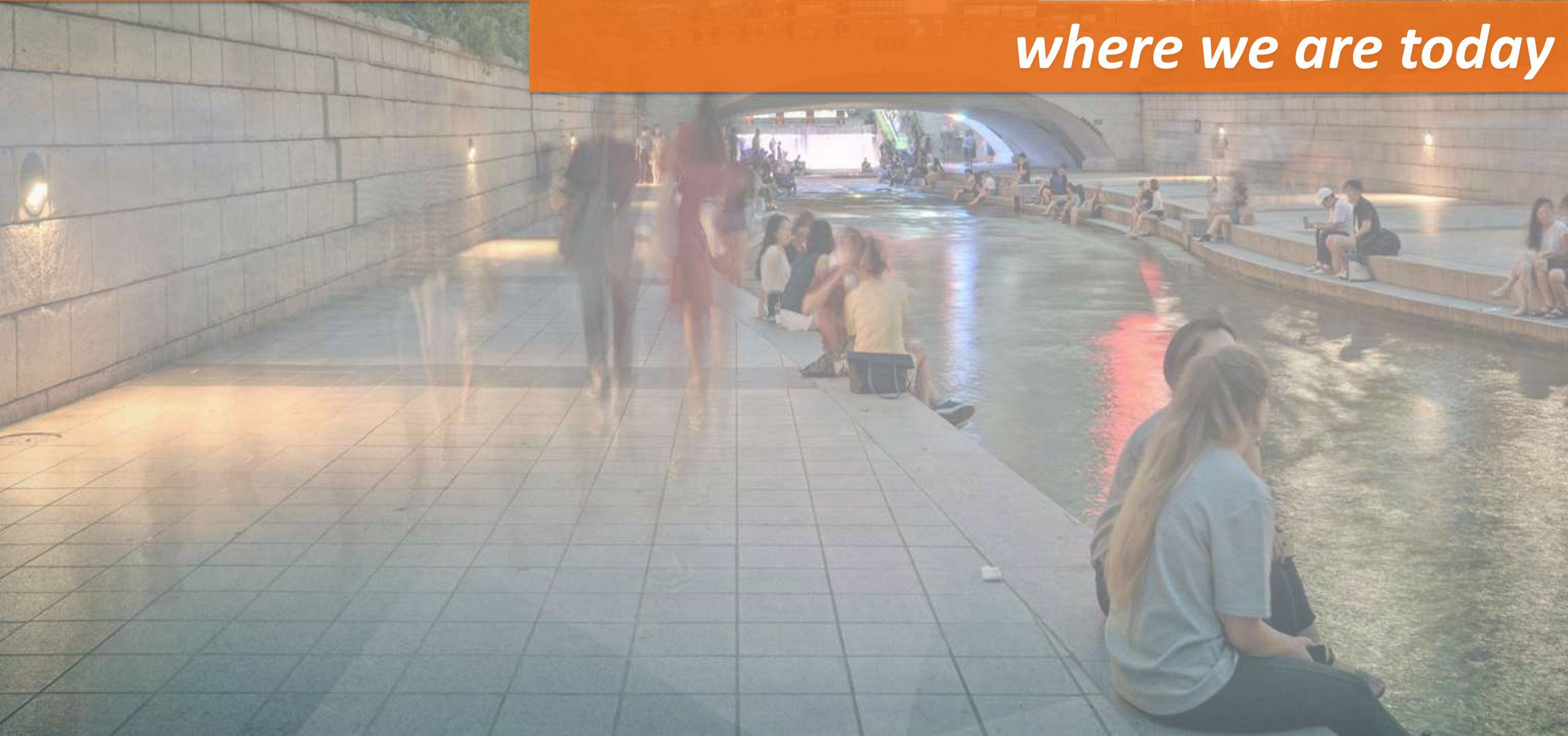




photo by Paulo Pereira

# Smart Cities

*where we are today*





### **Cities: ideal places for knowledge, creativity and innovation**

- Cloaca Maxima in Rome (600 B.C.): an advanced sewage system (water resources management)
- Vitruvius: architecture treatise *De Architectura* (energy efficiency and comfort)
- Renaissance Florence: creativity in arts and architecture



# Cities and Territories: Challenges, Threats and Opportunities

## *Cities and Territories as a “living and complex organism”*

*born, grow, renovate, rehabilitate, die and born again, with new entities and faces for welcoming new activities and “new faces”, tomorrow’s citizens.*

- Urbanisation: 54% (today) > **70% (2050)**; 50% settlements <500.000 inhabitants
- **Energy**: 75% (rise of 70%); 75% **carbon emissions** (rise of 50%)
- Food and related carbon emissions
- **Climate change**: resource scarcity; ageing population; social inequality; migrations
- Risks for liveability of today and future generations (**sustainability and resilience**)
  
- **The power of cities**: 80% GDP (rise of 85%, 2050)
- **Great economy**: institutional resources; talent, innovation and creativity hotspots
- **Political power**: “If Mayors ruled the World - Dysfunctional Nations, Rising Cities”, B. Baker; “Global Parliament of Mayors”: a global platform to harness the collective power of cities

## Cities concepts: the focus on smart

### *Digital revolution as an opportunity*

- **ICT infrastructure**
  - **sensorisation**
  - personal technologies
  - big data; storage; processing > **information systems** (data analytics; AI; ML)
- Spread of IoT (objects and networks) and IoE (internet of everything) > IoP
- **Several interconnected layers (city components)**
- A transformation in the modes of governance, empowering citizens, stimulation of innovation and economic growth
- **Development of cyber-physical system** > integration of interacting network of physical and computational elements





# SUSTAINABLE DEVELOPMENT GOALS



- New urban development paradigm: starts with people and human capital
- Human-centred Smart city: co-creation, creativity, learning sharing, collective intelligence

- European Innovation Partnership on Smart Cities and Communities: smart cities combine technology to offer citizens better lives and reduce environmental impact

## UN 2030 Agenda



Making cities inclusive, safe, resilient and sustainable



# The right question

*What would be a good city to live in ... today and tomorrow?*

## An efficient and competitive city

### Transformation of cities into smart and sustainable urban ecosystems

- Efficient and competitive, promoting economic growth
- Attracting new companies and institutions, offering high qualified jobs, attracting **new talents**
- Sound and trustful **governance**
- Promoting **wealth for everyone**, with respect for nature
- Pleasant and healthy (**equilibrium** between the city and the surrounding territory)
- Sound management of the **built environment**, and **smart mobility**

**Competitive and efficient city: requires a digital transformation; a project connecting everything and everyone, with cyber security of systems and people**



# Built environment

*The contribution for an efficient competitive city*

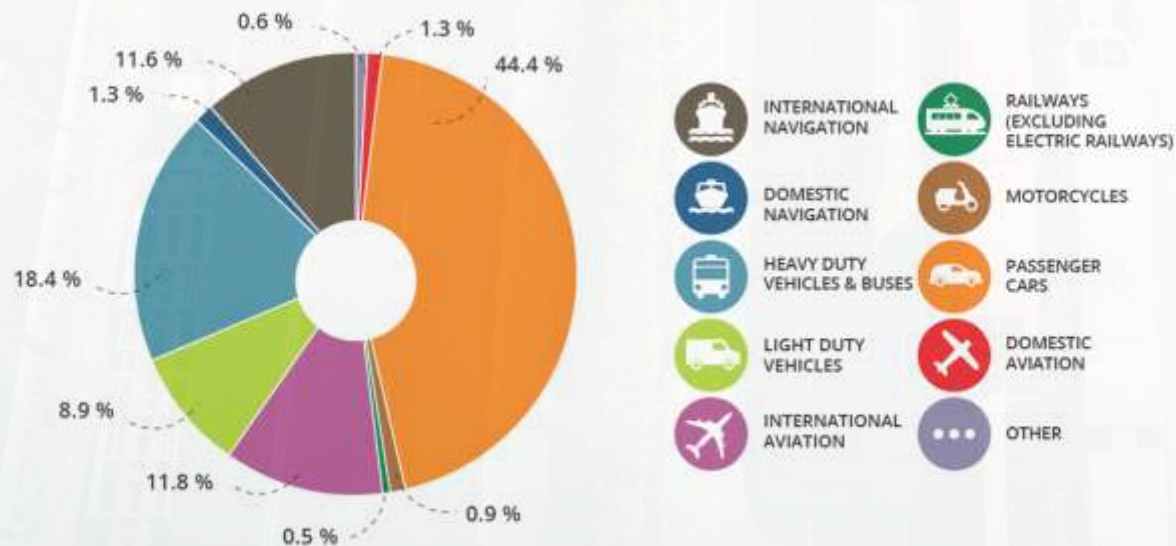
- 
- Buildings
  - Infrastructures (transport; water; energy)
  - Lighting
  - Communications
- 
- Increase productivity and competitiveness
  - Reduction of environmental impact
  - Better welfare for citizens



# Transportation

- One of the major drivers for economic growth
- Efficient and effective transport systems supporting the economy
- **Major impact on the environment and quality of life**
- Land use and urban space (streets and parking)
- Network evolution for a new mobility: a new challenge

GHG emissions from transport in EU-28, 2014 (based on provisional data)



Sources: EEA Indicator TERM01; EEA data based on EEA Report No 15/2016 Annual European Union greenhouse gas inventory 1990-2014 and inventory report 2016

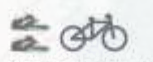
## Transport in cities

Many European cities are rapidly transforming urban transport. However, while cycling and efficient public transport are becoming the norm in some urban areas, Europe's transport sector is still a major contributor to excessive levels of greenhouse gases, air pollution and noise.



Share of all kilometres travelled by:  
**WALKING + CYCLING + PUBLIC TRANSPORT**

Paris	87%	Vienna	71%
Barcelona	82%	Valencia	67%
Amsterdam	79%	Berlin	60%
Helsinki	75%	Seville	60%
Stockholm	75%	Turin	59%
Madrid	74%	Stuttgart	49%
Copenhagen	70%		



Share of all kilometres travelled by:  
**WALKING + CYCLING**

Amsterdam	68%	Helsinki	41%
Paris	55%	Seville	41%
Barcelona	55%	Berlin	39%
Valencia	47%	Vienna	34%
Stockholm	45%	Madrid	34%
Copenhagen	42%	Turin	33%
Stuttgart	29%		

### Exposure to night-time traffic noise



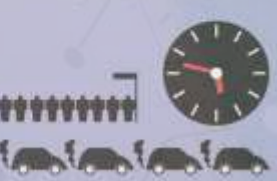
More than a quarter of the population in Sofia, Luxembourg, Paris and Tallinn are exposed to night-time traffic noise above WHO limits, according to a survey of 17 European capitals.

### Exposure to air pollution



Around 90% of Europeans living in cities are exposed to levels of air pollution deemed damaging to health by the World Health Organization's guidelines.

### Commuting time spent in transport



Commuters in London and Budapest are most likely to travel more than an hour to work (23% and 32% respectively), according to a survey of 70 cities in the EU and Turkey.

EEA report 11/2016 TERM0111 - A closer look at urban transport | eea.europa.eu/transport



# Climate emergency

## Pollution and traffic congestion in Europe

- 92% of world population breathing polluted air
- Noise (>85 dBA) is responsible for severe health problems
- Reduction of life expectancy > 100 000 deaths (as deadly as tobacco)
- **Global health threat for the entire human body > 20 million**
- Reduction of productivity (with loss of 725 000 years of activity)
- **Economic impact:** 183 000 M€ (2.9% GDP; transportation 1.0%)

## Plan for 1.5 degree temperature (or 3.0; 2050); zero carbon goal

- Adoption of ZEB buildings and infrastructures and circular economy
- Clean energy and energy efficiency (fuel cells – hydrogen)
- Transportation: infra, shared and soft modes > fewer vehicles on the roads and streets
- Involvement of the entire society (from young to VRU)
- **Education and science, from the beginning > “young climate guardians”**







# **Sustainable, Resilient and Integrated Mobility**



*photo by Paulo Pereira*



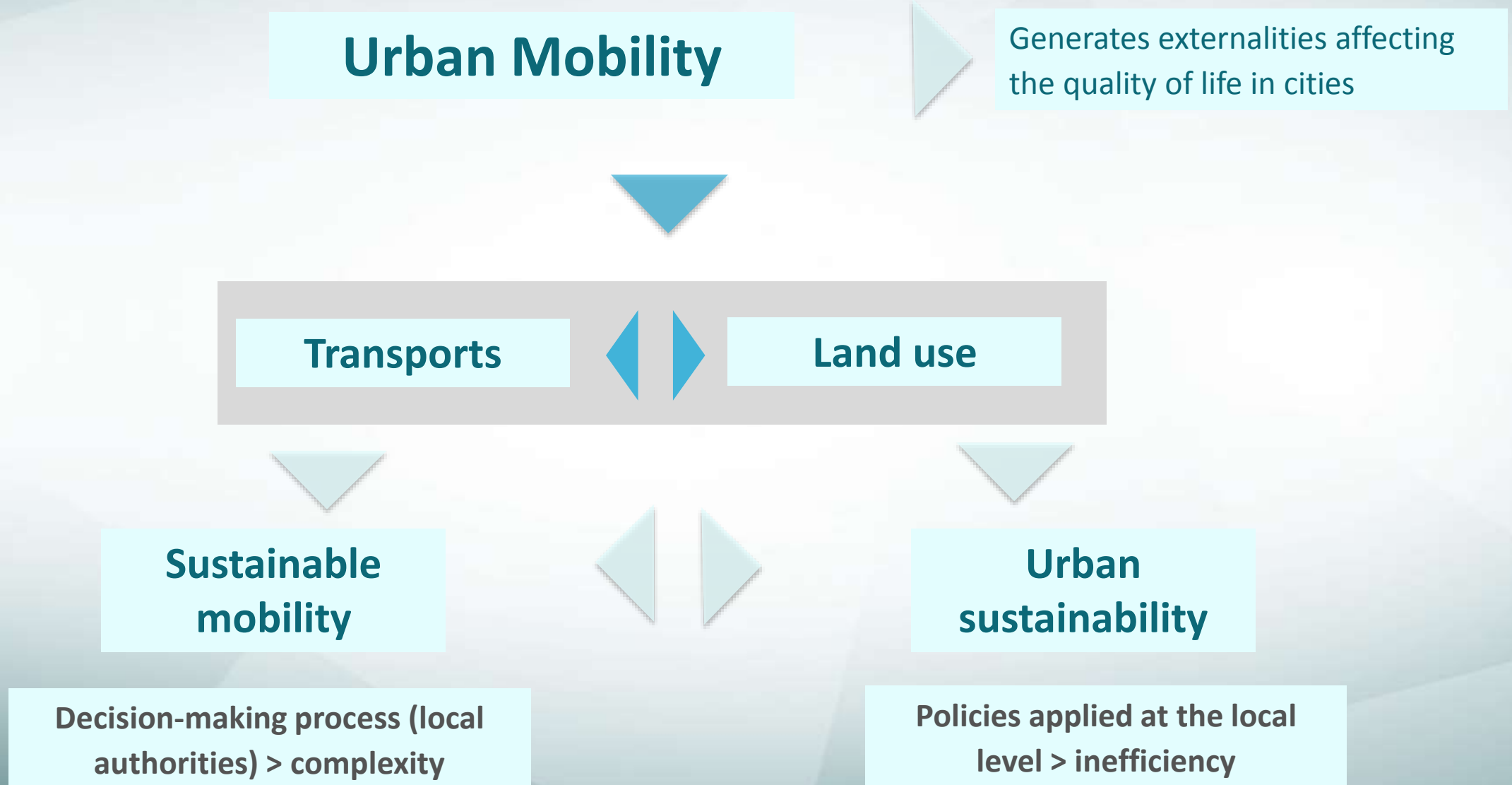
## A common challenge to cities

Promoting a more rational and balanced development

**SUSTAINABILITY**


How can this be ensured?

- Promoting a cleaner and healthy environment
- Promoting inclusive and balanced welfare
- Not compromising economic development and competitiveness






## 'Streets for people' approach principles & Sustainability



Design and manage individual streets, contributing to different components of sustainability  
Overall promotion of greater sustainability



Encouraging the appropriate mix and levels of social and economic activities for an area, while minimising environmental damage

### Addressing the design of urban streets

- Accessibility for a wide range of users
- Streets as a destination for social and economic activity; as a means of providing accessibility
- Promotion of 'greener' modes - bearing in mind not only immediate emissions but also long-term environmental consequences
- Minimization of the environmental impacts (including accident risk and loss of amenity) due to motor traffic

## 'Streets for people' approach principles & Sustainability

A people-centred approach



Need for a better way of accommodating and trading-off between different people using a street

Vehicles vs Pedestrians





# Challenges for transportation

## Future of transport

- Developing systems more focused on citizens (VRU)
- Reducing environmental impact and pollution (fuel; electric)
- Improving quality of life in cities
- **Urban pavements: vast and expensive asset**
- **LCA, Perpetual and Functional Pavements** (economy; environment (3R); sustainability & resilience)

## Integration of transport infrastructure and digital technologies

- Intelligent infrastructure to collect data
- Autonomous vehicles will create more free space
- **Efficient Asset Management** (risk-based approaches; network resilience)

## Less

- Fossil energy consumption
  - **Environmental pollution**
- Private transport
  - **Traffic congestion**

## More

- Shared and soft transportation
- Soft and electric modes (hydrogen)
- System efficiency
  - **Sustainability and health**

# Mobility and Transport System

## Mobility flows

- **Proxy for understanding human activity in urban space**
- **Prime driver for sustainability**
- Main integrator of the flow of objects and people
- Support for the flow of information

## Nuclear duty of Transport System

- **Timely and safe mobility, under environmental protection**
- New Mobility challenges: integrating different users' expectations and evolution (VRUs)
- **Transition to mixed traffic environments:**  
*Coexistence of present vehicles and future CAVs*



# Challenges and opportunities from Connected and Automated Vehicles CAVs

## Positive impact from CAVs for sustainability and safety

EU: achieve 2050 goals of reducing GHG emissions by 60%

Vision Zero: ZERO fatalities in transportation

Acceptance, trust and reliance on automation  
The role of humans in emergency situations



**CoEXist:** Transport models and **road infrastructure** evolution for the coexistence of automated and conventional vehicles

**CAVSAFETY:** Improve the **safety** of present and future mixed-traffic environments for vulnerable road users (VRU's) (pedestrians and cyclists) and occupants of CAVs

**5G-MOBIX:** *Cooperative and Connected Automated Mobility 5G* for cooperative & connected automated Mobility on **border corridors** (use of simulators)

## Continuous increase of cities in size & Population diversity

▶ Increase in vulnerability to extreme future events and disasters (climatic conditions, tsunamis, earthquakes, hurricanes, fires)

## POLICY RESPONSES

▶ Linked to local conditions

▶ Provide tools and instruments to achieve sustainable and resilient urbanization

▶ Maximize benefits of agglomeration economies

▶ Minimize negative impacts and externalities

## Cities must become smarter

▶ Deal with challenges arising from urbanization  
▶ Improving the conditions underpinning urban resilience  
▶ Supporting the recovery of impacts from extreme events



## Urban mobility resilience

Capacity of urban transportation and mobility systems to:

- identify the characteristics of the event
- reduce the impacts arising from disturbances,
- adapt to change and transform systems

**Operational  
evaluation tool**

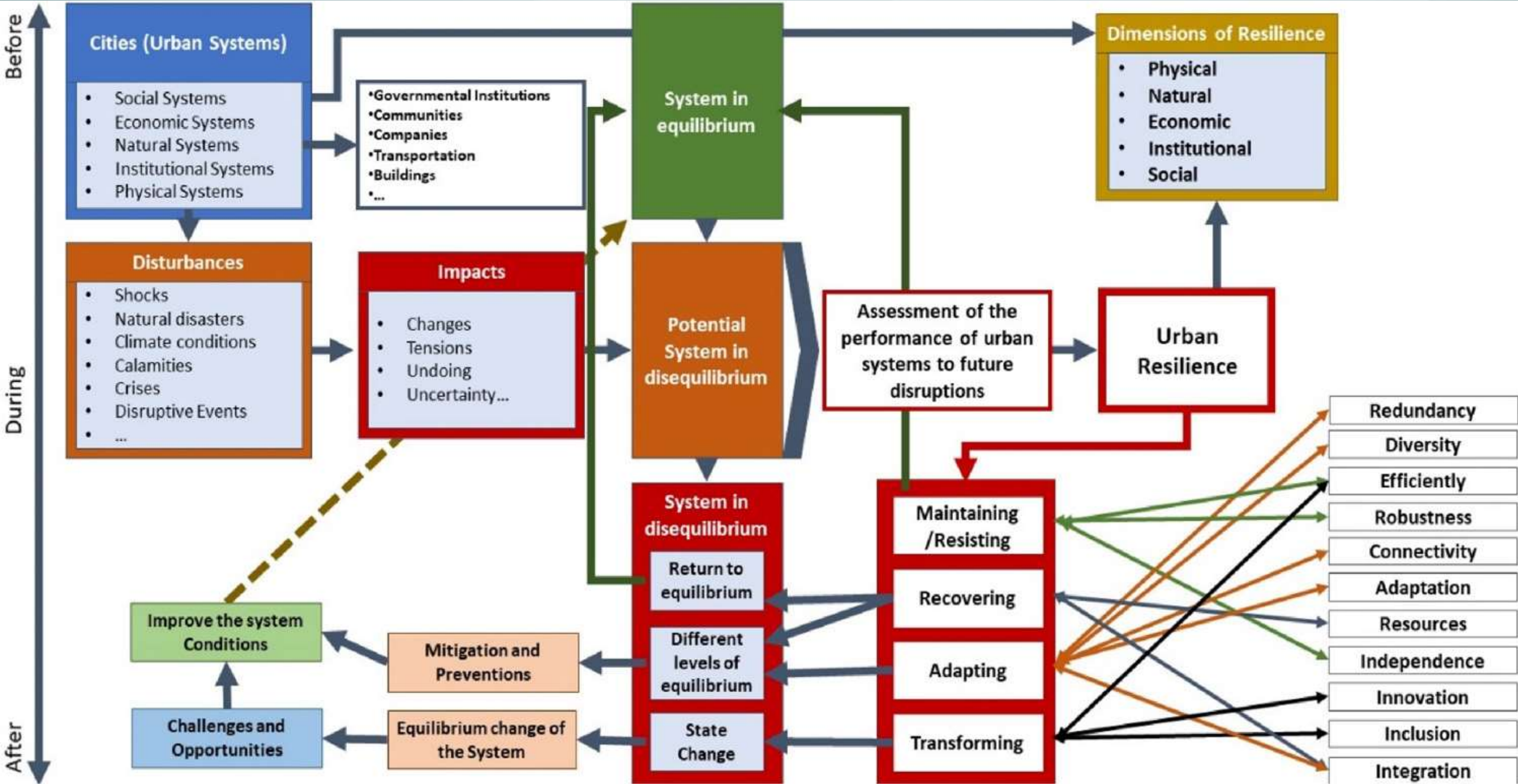
**Dimensions**

**Physical, Natural, Economic, Institutional & Social**

**Basic  
Characteristics**

**Redundancy, diversity, efficiency, robustness,  
interdependence, adaptability, resources,  
independence, ingenuity, inclusion, integration**

# Challenges and opportunities of the Urban Mobility Resilience





**Territories: reveals great disparities regarding the actual degree of integration**

**City centres**



advantages of the digitalisation potentialities



access to services



access to transportation

**Peri-urban & Rural areas**



**Integrated mobility approach:** offer accessibility to all transportation modes, delivering the necessary conceptual and practical tools for a better inclusion of people

# Development of a global system of information of transport and mobility infrastructure components

## Capture relevant and updated data

- Innovative digital technologies
- Rising **data acquisition** capacity and intelligence of vehicles
- Movements of vehicles, users and people
- **Multidisciplinary environment**

## Production of information

### Development of Key Performance Indicators (KPI)

## Integrated management and decision-making

- Supporting the **decision** in several fields, in **real-time**
- **Optimising** the global mobility and transport system
- Developing **alerts** under severe scenarios of unpredicted threats

**Transport**

Different transportation networks

## INTEGRATION

**Land use**

The city and its surroundings

**PROMOTE**

- Balanced
- Efficient
- Inclusive
- Safe

- Public and shared transport
- Sustainable modes of transport

**MOBILITY**

Reducing the externalities of mobility for people and environment

Promoting quality of life and wellbeing for all (VRU)



## A new approach to Urban Mobility Policy

**Accessibility** is the objective and **Mobility** is the instrument

- Mobility: integrate the radical changes brought about by the industry and market
  - **Integration of city & metropolitan areas**
  - Subsidising companies > subsidising citizens
  - **Transport modes: mobility centred on public and shared transport**
- 
- **Analyse user sociocultural characteristics** (age, gender, social class)
  - Integrate a cultural change (real vs virtual world)
  - Integrate the logic of the new generations (from ownership to use)
  - **Data confidentiality > sharing of data use**
  - **Real-time, customised information**

# Integrated, Intelligent, Inclusive and Safe Mobility

## Key factors

addressed, identified, studied and analysed

- **People** (young, active, elderly, VRU)  
(sociodemographic characteristics, social and economic vulnerability, needs and digital competences concerning mobility and transportation)
- **Territory** (cities centre , peri-urban and rural areas)  
(development level, forms of administration/governance, sector of activity, historical and political key features for urban and rural areas)
- **Transport systems** (motorized and soft modes)  
(supply and demand of all types of transportation modes and its degree of social inclusiveness and digitisation)
- **Digital solutions** (digital platforms - MaaS)  
(digital solutions: respond to societal needs and expectations > bootstrap innovative, efficient transports (urban and peri-urban areas))

# Inclusive, digitally interconnected transportation

**Citizens**  
Active agents of  
territorial development

## DIGITAL SOLUTIONS

Identify **people's** usages  
and needs concerning  
design of digital tools

## MaaS

user-centric model of  
information for transportation

- Reduce the tendency to **depopulate rural** territories
- Increase **inclusion** and opportunities for all

## Develop innovative forms of mobility

- Enhance social cohesion
- Foster sustainability
- Augment the quality of life



**Inclusive, digitally  
interconnected transportation**

**INTEGRATED  
MULTIDIMENSIONAL  
ANALYSIS**

Digitisation trends in  
transport systems

Citizen's views, needs and  
expectations

Governance and regulatory  
transportation models

**all mobility players**

**Integrated,  
Intelligent, Inclusive and Safe Mobility**

# Integrated, Intelligent, Inclusive and Safe Mobility

## Global Solution

**new mobility approach** integrating different transportation networks and modes, as well as different age groups

- Analyse characteristics of the **transportation networks** > **sound asset management**
- Analyse features of different **transportation modes** > **optimising mobility**
- Identify different needs and expectations of **citizens** (VRU)
- Develop innovative digital solutions: meet the diversity of **citizens' demands**, under **co-creation methodologies** > **promote inclusiveness**
- Promote **engagement of people** in the **adoption and appropriation of digital solutions** > **Llabs**
- Develop **recommendations for policy makers** and practical applications for the design of an **inclusive digital transport system** in **all types of territories**
- Develop and implement **communicative strategies**: reach **public awareness** for a new mobility

# Conclusions







*photo by Paulo Pereira*

### Smart and Livable Cities

- Integration and convergence of **digital and physical** infrastructures
- Participation of **citizens** on governance
- Reliable **built environment** coupled with a safe intelligent city network
- **Energy efficiency** and decarbonisation for quality of life

### Sustainable, Resilient and Integrated Mobility

Promote equity, cohesion and sustainability across smart cities and communities

Digitally interconnected transportation, with an multidimensional approach:

- **Transport modes** (motorized (clean fuels) and non-motorized)
- **Territory integration** (cities centres and peri-urban areas)
- **Citizen's views**, needs and expectations (young, active, elderly and VRU)
- **Mobility players** (citizens; decision-makers; transport companies)

**Thank you for your attention**