Planning transport infrastructure: perspectives, challenges and approaches

Pierluigi Coppola
Università di Roma Tor Vergata

Patras (Greece), 20 September 2019
1. perspectives
<table>
<thead>
<tr>
<th>Drivers of Change</th>
<th>TRANSPORT EXTERNALITIES</th>
<th>CULTURAL AND SOCIO-ECONOMIC</th>
<th>TRAVELLERS PREFERENCES AND BEHAVIOUR</th>
<th>INNOVATIVE TECHNOLOGIES</th>
</tr>
</thead>
</table>


- **TRAFFIC CONGESTION**: every year nearly 100 billion euros, or 1% of the EU's GDP, are lost to the European economy as a result of the congestion

- **ROAD SAFETY**: one in three fatal accidents now happen in urban areas, and it is the most vulnerable people, namely pedestrians and cyclists, who are the main victims

- **AIR QUALITY AND GREENHOUSE GAS EMISSIONS**: urban traffic is responsible for 40% of CO2 emissions and 70% of emissions of other pollutants arising from road transport
DRIVERS OF CHANGE

INDIVIDUAL OWNERSHIP

COLLABORATIVE CONSUMPTION

CULTURAL AND SOCIO-ECONOMIC

Demographic growth
Urbanisation
Population ageing
Sharing economy
Digital-oriented lifestyle


- DEMOGRAPHIC GROWTH: an overall increase in the world population is expected in the coming years. However, this phenomenon follows very different trends from region to region (actually Europe will suffer a slight decline in population)

- URBANISATION: at present 55% of the World’s population lives in urban areas; in 1950 the share was at 30% and today’s predictions estimate an increase up to 68% by 2050

- POPULATION AGEING: in 2050 the global population aged 60 years or over will be twice as much as today’s (in absolute terms)
DRIVERS OF CHANGE

Sharing travel experiences

- e.g. BlaBlaCar
- waze

USER PREFERENCES AND TRAVEL BEHAVIOUR

- Increasing travel demand and new trip-chain patterns
- Multimodal trips
- Service Customisation
  - Door-to-door
  - On-Demand
- Shared mobility

more complex trip chains
• Electro-mobility is seen as a key component of the agenda for sustainable mobility
• By 2050, Internal Combustion Engine Vehicles (ICEVs) are expected to be banned from cities, giving way to Electric Vehicles (EVs), i.e. **Plug-in Hybrid Electric Vehicles** (PHEVs) and **Battery Electric Vehicles** (BEVs)
• The use of **renewable energy sources** in the electricity production mix is important towards decarbonisation of the whole cycle
**DRIVERS OF CHANGE**

**Connected Vehicles (CVs)**: vehicles equipped with advanced communication technologies that allow the exchange of information between the various elements of the transportation system.

**INNOVATIVE TECHNOLOGIES**
- Electrification
- Connectivity
- Automation
- Digital Infrastructure (e.g. Smart road)
DRIVERS OF CHANGE

Digital Infrastructure: monitoring traffic condition, exchanging information among users and service providers, increasing road safety and enhancing driving comfort.

INNOVATIVE TECHNOLOGIES

- Electrification
- Connectivity
- Automation
- Digital Infrastructure (e.g., Smart road)
DRIVERS OF CHANGE

TRANSPORT EXTERNALITIES
- Traffic congestion
- Road safety
- Air quality (PM10, PM2.5, NOx, O₃, C₆H₆)
- Climate-altering gases (CO₂, N₂O, CH₄, HFC, PFC, SF₆)

CULTURAL AND SOCIO-ECONOMIC
- Demographic growth
- Urbanisation
- Population ageing
- Sharing economy
- Digital-oriented lifestyle

TRAVELLERS’ PREFERENCES AND BEHAVIOUR
- Increasing travel demand and new trip-chain patterns
- Multimodal trips
- Service Customisation
  - Door-to-door
  - On-Demand
- Shared mobility

INNOVATIVE TECHNOLOGIES
- Electrification
- Connectivity
- Automation
- Digital Infrastructure (e.g. Smart road)

- Demand vol.
- Modal share
- Needs
  - service
  - Infrastructure
- Consumptions
- ...
EXAMPLE: future mobility solutions

- Public Transport
- Shared Mobility
- AMoD

MaaS

- EV
- CV
- AV

E-CAV

- Smart Roads
- Digital Infrastructure
EXAMPLE: E-CAVs deployment - factors of uncertainty

• Supply-side factors
  - vehicles performances in promiscuous traffic situations,
  - vehicle sensors to respond to unexpected situations
  - Costs and maintenance needs
  - ...

• Demand-side factors
  - user acceptance
  - users’ willingness to pay
  - ...

• Governance factors
  - Liability
  - Regulation
  - ...

2. challenges
SOME POLICY CHALLENGES

• To better plan investment
  - Improve transportation system adaptability

• To anticipate the impacts of technological disruptions

• To stop the growth of transport CO2 emissions
  - Avoid un-necessary demand
  - improve transport efficiency
Challenges for planners

**How to take the right decisions about investment for the future?**

**How to drive the change towards sustainability?**

**What planning instruments?**
3. Assessment tools
Integral assessment: the three spheres of sustainability

- **Social**
  - Standard of Living
  - Education
  - Community
  - Equal Opportunity

- **Environmental**
  - Natural Resource Use
  - Environmental Management
  - Pollution Prevention
    - (air, water, land, waste)

- **Economic**
  - Profit
  - Cost Savings
  - Economic Growth
  - Research & Development

**Sustainability**

![Diagram showing the three spheres of sustainability](image)

- **Social-Environmental**
  - Environmental Justice
  - Natural Resources Stewardship
  - Locally & Globally

- **Environmental-Economic**
  - Energy Efficiency
  - Subsidies / Incentives for use of Natural Resources

*Adopted from the 2002 University of Michigan Sustainability Assessment*
Energy transition

• **Electro-mobility** is seen as a key component of the agenda for sustainable mobility: by 2050, Internal Combustion Engine Vehicles (ICEVs) are expected to be banned from cities, giving way to Electric Vehicles (EVs)

• insufficient advances in **Air and Sea transport**

• electricity or hydrogen **zero-carbon footprint** will require zero–carbon generation of electricity and hydrogen power
Strong growth in freight transport

Freight volumes may triple between 2015 and 2050

- modal share of Sea may further increase from current 70% to future 74%
- growth rate of Air is expected higher than others mode

Co2 emissions are projected to growth by 225% by 2050

Source: ITF Outlook 2019
TRANSPORT AND LAND-USE

• Territorial Impact Assessment (TIA)
• Transit Oriented Development (TOD)
• Accessibility Planning

Is there a problem of mobility?
or:
Is there a problem of accessibility?
WIDER ECONOMIC IMPACTS

• Jobs Productivity and Labor Force participation
  effects arising from markets enlargement

• Competitiveness
  effects arising from markets competition, which may be positive but also negative, the weaker may succumb
• **Transport Equity Assessment**

  *methods with the potential to shape transport decision-making processes, thus allowing for the adoption of more equitable transport solutions*

  ✓ *Efficientarism vs. sufficientarism*

• **Liability issues**

  *in the era of the digital revolution and self-learning systems, human-machine interaction raises new ethical questions:*

  ✓ *Principles and priorities*
  ✓ *Data storage, protection and sovereignty*
CONCLUSIONS

• Vision
In the long term, a widespread adoption of new technologies (e.g. E-CAV) will enable Innovative Mobility Solutions (e.g. vehicle sharing, AMoD, ...) and new roles for transport planners/operators/...

• Uncertainty
Policies must be anticipatory despite uncertainty of the future, in order to get greatest benefits in terms of environmental, social and economic sustainability
CONCLUSIONS

- **Holistic**
  
  Integral assessment tool for the simulation of future scenarios is key to support correct investment decision and to design and implement mobility policies driving change towards sustainability

- **Participatory**
  
  New form of planning approaches (including bottom-up exploration of policies) could represent an opportunity for more effective planning processes and mobility solutions
Thanks for attention!

Pierluigi Coppola

coppola@ing.uniroma2.it