

# Policy options for Sustainable Adaptation Strategies

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## ■ ***Actor Analysis***

- Actors of climate change adaptation per transport mode
- Networks of actors in key areas
- Actor involvement in the key areas
- Potential conflicts between actors in transport adaptation
- Power and interest of transport adaptation actors

## ■ ***Policy Options***

- Policy-targeted effects and challenges in adaptation
- Adaptation strategies
- Adaptation policy frameworks
- Basic policy instruments to foster adaptation
- Analysis of policy instruments in the transport sector
- Policy instruments and energy efficiency in transport
- Impact of policy instruments on the transport sector
- Applications of policy instruments in transport adaptation

## ■ ***Conclusions***

# ACTOR ANALYSIS

## Actors of climate change adaptation per transport mode

**Maritime Transport:** Ship Owners and Fleet Operators, Shipping Agents, Terminal Managers, Port Operators and Work Enterprises, Port Authorities, Ministries



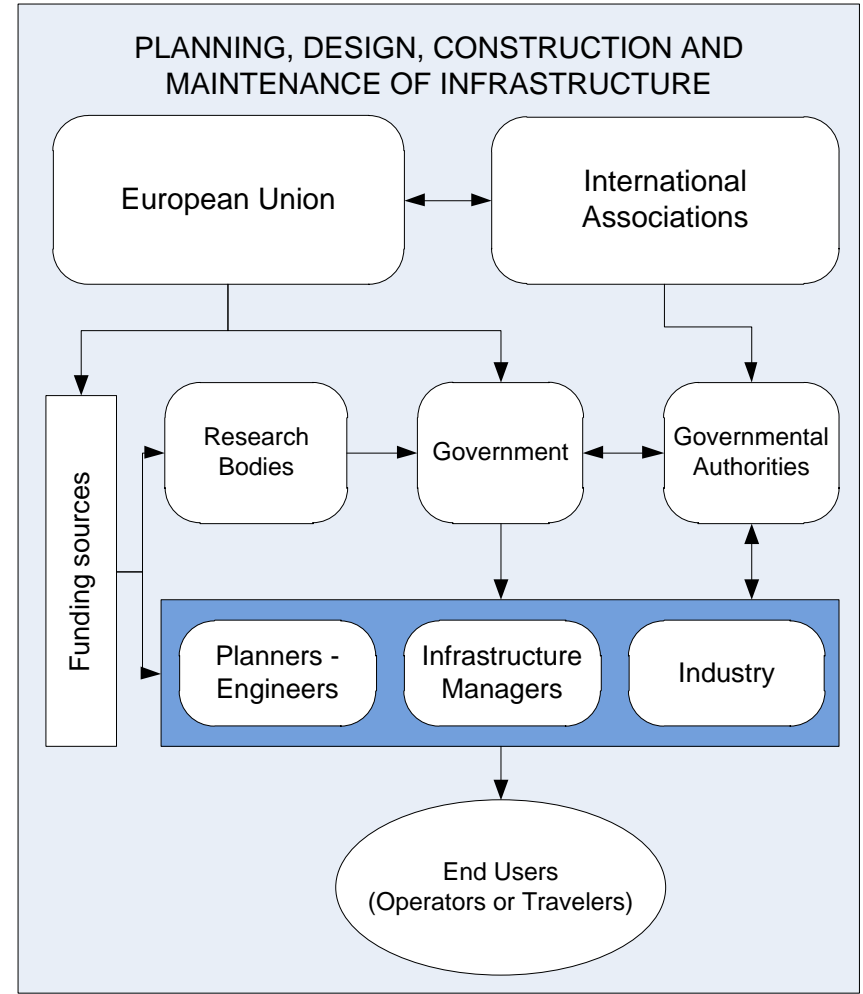
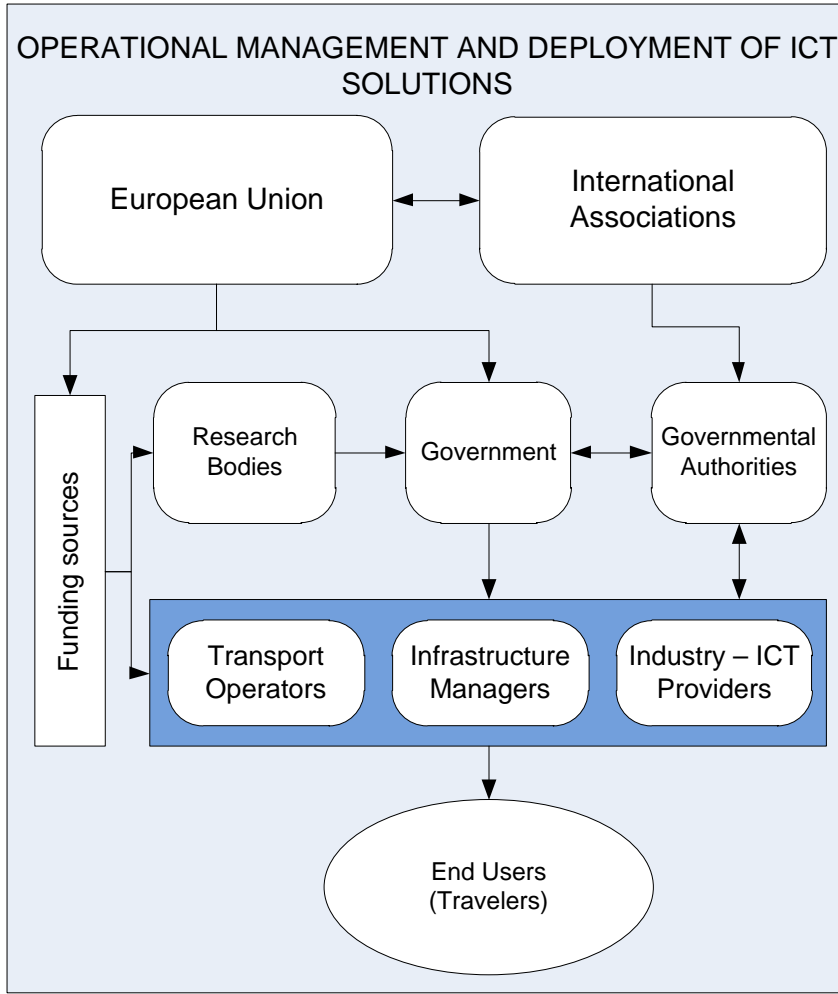
**Land Transport:** Passengers / Travelers, Rail / Road Infrastructure Managers, Rail / Road Transport Operators, Wagon and Car Producers, (National) Regulatory Authorities, Ministries



**Air Transport:** Airline Operators, Airplane Producers, Infrastructure Managers, Ground Handling and Service Providers, (National) Regulatory Authorities, Ministries





## Networks of actors in key areas



# ACTOR ANALYSIS

## Actor involvement in the key areas

Actors group	Financing	Planning	Maintenance	Design and Construction	ICT solutions	Operations and management
European Union	✓	✓			✓	✓
International associations	✓			✓	✓	✓
National governments	✓	✓			✓	✓
Research bodies		✓		✓	✓	✓
Terminal managers	✓	✓	✓	✓		✓
Transport operators	✓	✓	✓	✓		✓
Funding bodies	✓		✓			
Industry and private enterprises	✓	✓		✓	✓	
Users/passengers			✓		✓	
 High involvement / impact  Low involvement / impact						

## Potential conflicts between actors in transport adaptation

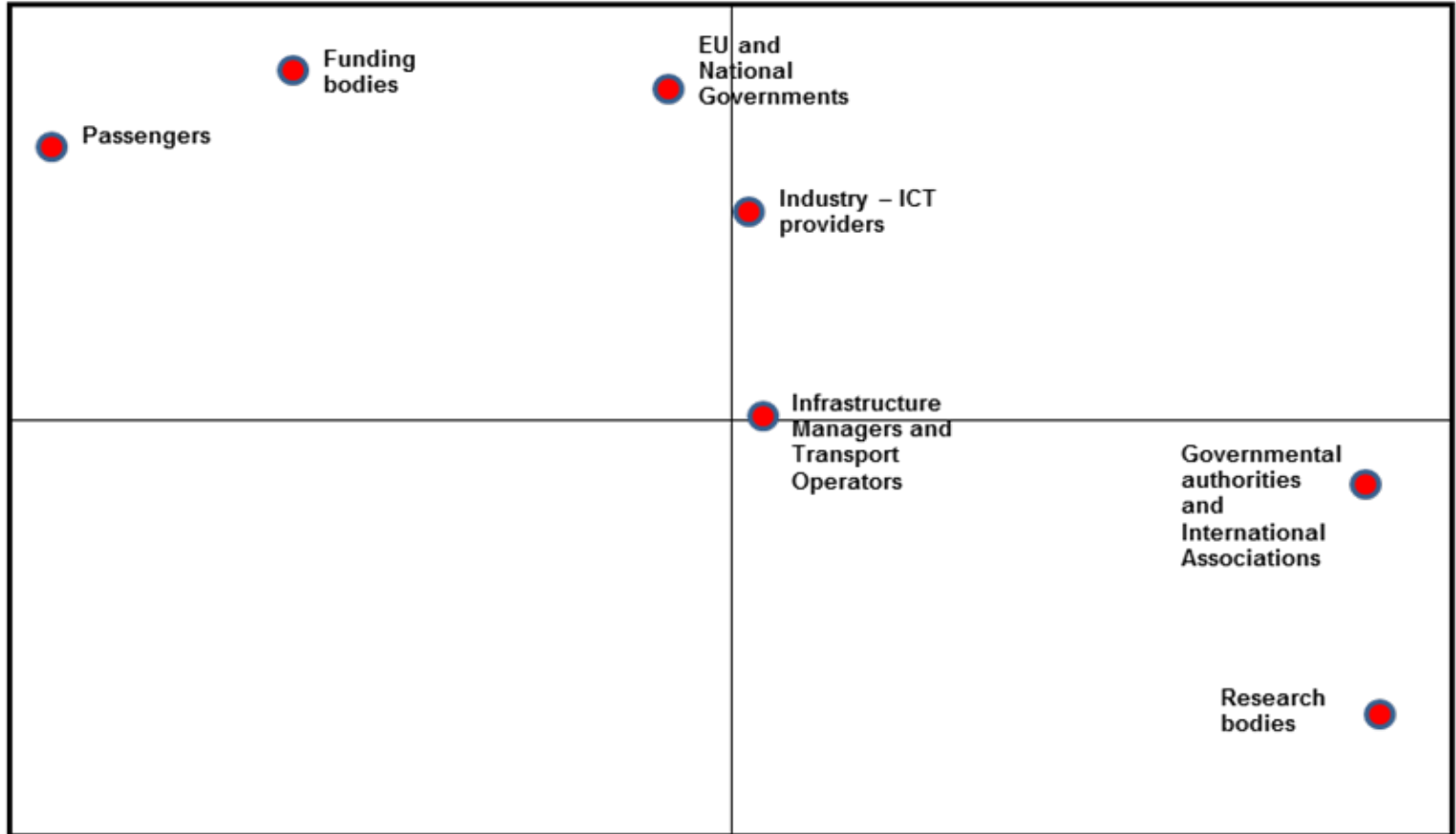
- **Passengers / Users:** With *terminal managers* and *transport operators* in case of delays (due to extreme (weather) events)
- **Industry / Private enterprises:** With *transport operators* in case of inefficient equipment provided
- **European Union / National governments:** With *terminal managers* and *transport operators* in case of enforcing costly adaptation measures
- **International associations / Governmental authorities:** With *terminal managers* and *transport operators* in case of inappropriate guidelines or regulations
- **Terminal managers / Transport operators:** With *governmental authorities* and the *government* in case of law enforcements for adopting expensive and non-viable adaptation measures (especially in case of private enterprises)

# ACTOR ANALYSIS

## Power and interest of transport adaptation actors

High

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Low

Interest

High

## Policy-targeted effects and challenges in adaptation

### ***Policy-targeted effects:***

- Mitigation of impacts
- Reduction of vulnerability and exposure
- Increasing the resilience by improving the adaptive capacity of (transport) systems at risk

cf. Warren and Egginton, 2008

### ***Challenges:***

- Climate change effects cut horizontally across different policy sectors and
- vertically across different levels of government
- Climate change effects are uncertain and
- concern a broad range of non-state actors who often lack capacities to adapt

Bauer et al., 2011



## Adaptation strategies

### **Technical adaptation:**

- Adaptation of transport infrastructure assets
- Application of safety engineering features
- Requires long-term planning
- Long lifetime of investments

### **Soft adaptation:**

- Adaptation of operations, processes, and organisation
- Application of education and communication
- Short-term planning and implementation
- Requires relatively low investments

### **Anticipatory adaptation:**

- Measures taken in advance of climate change
- Requires foresight (predictions) and planning
- Must cover the broad range of uncertainties

### **Reactive adaptation:**

- Response to real events
- Considers current and past extreme weather events
- Requires no foresight and planning

### **Autonomous adaptation:**

- No conscious response to climate change impacts
- Triggered mainly by changes in natural and human systems

### **Planned adaptation:**

- Result of a deliberate policy decision
- Awareness that conditions have changed or are about to change
- Action is required to return to, maintain, or achieve a desired state

### **Private adaptation:**

- Mainly driven by self-interest of individuals, firms, or organisations
- Decision-maker is the only beneficiary
- Efficient in case net-benefit is maximized
- May produce substantial externalities

### **Joint adaptation:**

- Many beneficiaries of adaptation activities
- Benefits are shared among the decision-makers
- Free rider problem

### **No-regret adaptation:**

- Strategies with a net benefit, independent of climate change
- Address the short-term long-term mismatch and uncertainty

### **Cheap safety margin adaptation:**

- Modifications yielding low-cost "extra" margin of safety
- Not robust if the direction of change is unknown

## Adaptation policy frameworks

Step	Carter et al., 1994	Jones, 2001	UNDP, 2004	Hallegatte et al., 2011
1	Define problem (including study area, its sectors, etc.)	Identify the key climatic variables affecting the exposure units being assessed	Scoping and designing an adaptation project	Construction of climatic and economic scenarios, identification of climate change impacts and adaptation measures
2	Select method of assessment most appropriate to the problems	Create scenarios and/or projected ranges for key climatic variables	Assessing current vulnerability	Screening of identified adaptation measures, taking into account the urgency of their implementation
3	Test methods/conduct sensitivity analysis	Carry out a sensitivity analysis to assess the relationship between climate change and impacts	Assessing future climate risks	Identification of possible adaptation measures, evaluation of their costs and benefits
4	Select and apply climate change scenarios	Identify the impact thresholds to be analysed for risk with stakeholders	Formulating an adaptation strategy	Identification of promising measures
5	Assess biophysical and socio-economic impacts	Carry out risk analysis	Continuing the adaptation process	Selection of measures
6	Assess autonomous adjustments	Evaluate risk and identify feedbacks likely to result in autonomous adaptations		For the selected measures, an adaptation plan must include indicators of their effectiveness and a time horizon
7	Evaluate adaptation strategies	Consult with stakeholders, analyse proposed adaptations and recommend planned adaptation options		Evaluation and adjustment of the effectiveness of the adaptation strategy

### *Steps in general:*

- Impacts of climate change
- Selection of method(s) of analysis
- Future patterns of climate change and impacts
- Identification of promising adaptation strategies
- Evaluation of adaptation strategies

## Basic policy instruments to foster adaptation

### ***Control and regulatory instruments (normative):***

- Appliance standards
- Building codes
- Procurement regulations
- Obligations and quotas

### ***Control and regulatory instruments (informative):***

- Mandatory audits
- Mandatory labeling and certification programs

### ***Fiscal instruments and incentives:***

- Taxation
- Tax exemptions/reductions
- Public benefit charges
- Capital subsidies, grants, subsidized loans

### ***Support, information and voluntary action:***

- Voluntary certification and labeling
- Voluntary and negotiated agreements
- Public leadership programs
- Awareness raising, education, information campaigns
- Detailed billing and disclosure programs

### ***Economic and market-based instruments:***

- Performance contracting
- Cooperative procurement
- Certification schemes

cf. Köppel and Ürge-Vorsatz, 2007

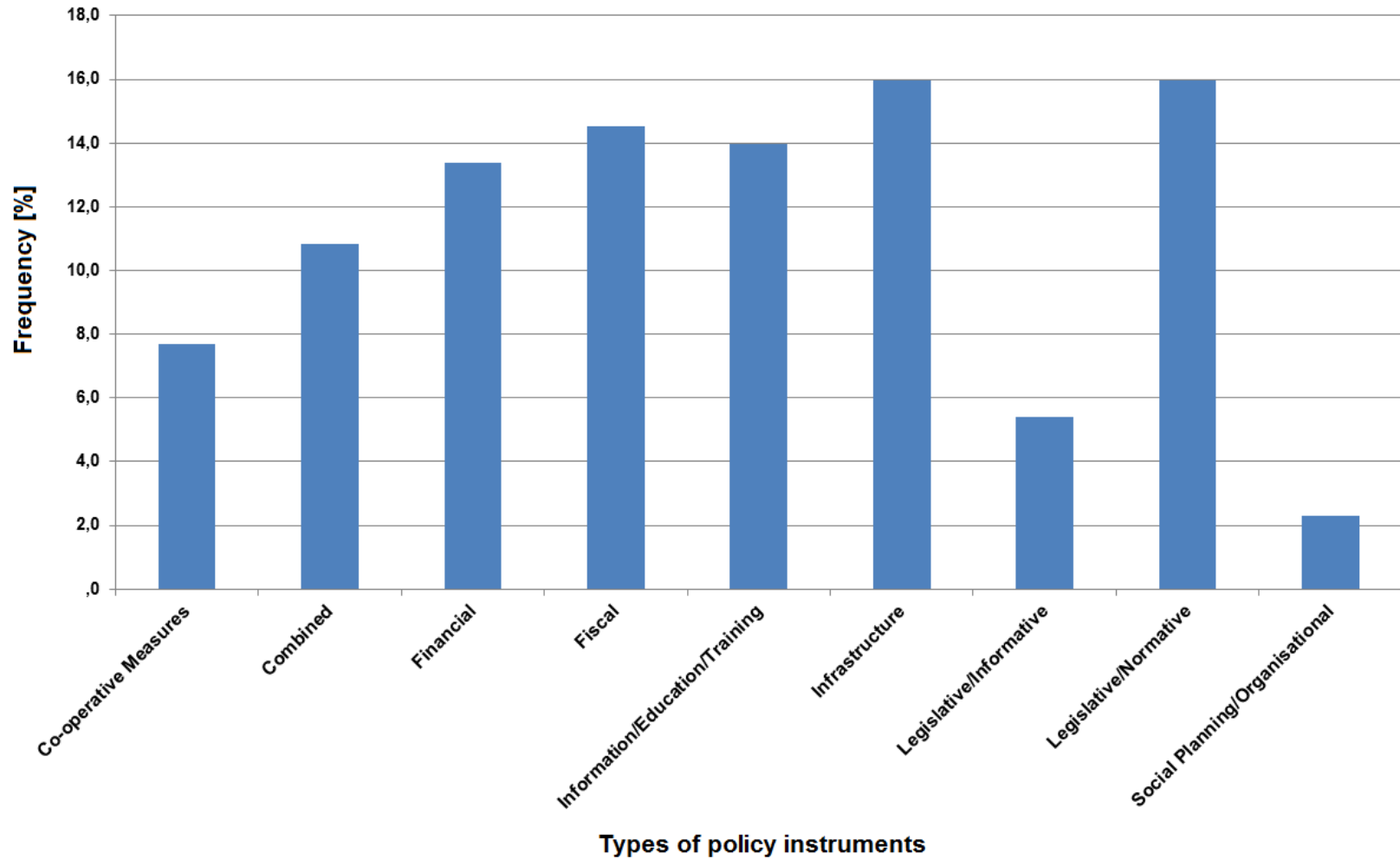
## Analysis of policy instruments in the transport sector

- A quantitative review of 351 policy instruments (MURE II database) aimed at fostering energy efficiency in transport has been conducted to identify instruments also relevant to transport sector adaptation
- Instruments in the MURE II database have been already assessed by experts distinguishing between low, medium and high semi-quantitative impact
- Scientific rationale for the review: the assessed instruments are related to energy efficiency but contain also conclusions about the general efficacy of certain types of policy instruments in the transport sector



Results of the review can give useful hints at promising instruments to foster climate change adaptation in the transport sector

## Policy instruments and energy efficiency in transport



Frequency of policy instrument types applied to foster energy efficiency in transport (Source: MURE II database, [www.mure2.com](http://www.mure2.com))

## Impact of policy instruments on the transport sector

Type	Semi-quantitative impact						Total N
	High		Medium		Low		
	N	%	N	%	N	%	
Co-operative Measures	1	4	13	48	13	48	27
Combined	15	<b>39</b>	8	21	15	39	38
Financial	9	19	15	32	23	49	47
Fiscal	17	<b>33</b>	19	37	15	29	51
Information/Education/Training	8	16	16	33	25	51	49
Infrastructure	11	20	16	29	29	<b>52</b>	56
Legislative/Informative	2	11	6	32	11	58	19
Legislative/Normative	19	<b>34</b>	13	23	24	43	56
Social Planning/Organisational	1	13	1	13	6	75	8
Total	83	24	107	30	161	46	351

Source: MURE II database, [www.mure2.com](http://www.mure2.com)

- 28 of the combined instruments include information / education / training, infrastructure and / or social planning / organisation
- Approximately 73 % of combinations including information / education / training, infrastructure and / or social planning / organisation were assessed as high or medium impact instruments
- Combining different types of policy instruments is more effective than applying just one
- Combinations including support, information and voluntary action are most effective (in line with WEATHER WP 4 findings)

## Applications of policy instruments in transport adaptation

### ***Control and regulatory instruments (normative):***

- Building codes for transport infrastructures considering long-term climate change
- Procurement regulations for vehicles and equipment considering meteorological parameters
- Obligations and thresholds concerning the maximum level of weather-induced delays per transport mode

### ***Control and regulatory instruments (informative):***

- Mandatory data mining systems for weather-induced delays
- Mandatory certification and labeling related to extreme weather events and reliability/safety of certain transport systems
- Common risk management procedures

### ***Fiscal instruments and incentives:***

- Tax exemptions / reductions in case of verified transport adaptation activities
- Public benefit charges in case of absent of transport adaptation activities
- Capital subsidies, grants, subsidized loans to support certain adaptation activities

### ***Support, information and voluntary action:***

- Awareness raising, education and information campaigns considering climate change in planning, operating and using transport systems
- Information / training on driving behavior under extreme weather conditions
- Training / education of staff
- Incorporating extreme weather events into emergency and risk management in transport system operations
- Voluntary certification and labeling related to extreme weather events and reliability/safety of certain transport systems
- Improving the knowledge about impacts of extreme weather events on transport via data collection and research

## ***Transport planning and general protection:***

- **Main actors:** European Union, national governments and funding bodies
- **Appropriate policy instruments:** Control and regulatory instruments (normative) accompanied by support, information and voluntary action

## ***Infrastructure investments and technology:***

- **Main actors:** Operators and managers of transport infrastructures
- **Appropriate policy instruments:** Control and regulatory instruments (normative) accompanied by fiscal instruments and incentives

## ***Vehicle and information technology:***

- **Main actors:** Industry (ICT providers and manufacture companies)
- **Appropriate policy instruments:** Support, information and voluntary action accompanied by control and regulatory instruments (informative)

## ***Transport service operation:***

- **Main actors:** Operators and managers of publicly owned transport infrastructures, PPP projects
- **Appropriate policy instruments:** Support, information and voluntary action in addition to control and regulatory instruments (normative / informative)



# Thank you for your attention!

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