Transport Resilience: Research & Innovation for EU Policy

Objective

Transport resilience policy in the EU

Trans-European Transport Network:
- infrastructure investment in networks and nodes;
- towards seamless multimodal connection throughout the EU.

Sustainable and Smart Mobility Strategy:
- leveraging technology for smart intermodal transport.

European Climate Law:
- climate-proofing physical infrastructure.

Contingency plan for transport:
- crisis management.

Cybersecurity Act:
- protection of digital operations.

Resilience of Critical Entities act:
- protection of critical infrastructure.

Common objectives

Free, safe, and sustainable movement of people and goods in the EU.
- **Resilience of the transport system as the ability to rebound and adapt to disruptions**, whether they are natural or human-made.
- Leveraging technology and enabling innovative business.

Study objective

- Provide an overview of European R&I activity on transport resilience, including trends and achievements.
- Examine alignment with transport policy.
- Provide suggestions for future research orientations.

Research and innovation (R&I)

Adapted funding schemes for:
- fundamental science and bottom-up research (MSCA);
- industrial and research collaboration (Calls);
- large scale public-private partnerships (Partnerships);
- support to innovative start-ups and scale-ups (SME).

Relevant resilience calls:
- sustainable and smart transport;
- secure societies;
- digital Europe sky;
- clean aviation;
- Europe's rail;
- digital information and communication technologies (ICT).

Approach

TRIMIS database

- Over 8 700 transport research and innovation projects from Europe and beyond.
- Essential data, including description, timeframe, funding source, budget, participating entities.

Theme: Transport Resilience

TRIMIS Knowledge Management Framework

Project identification

- Text mining, including keyword search and snowballing, keyword frequency analysis and weighted ranking to filter the database.
- Manual expert review and project selection validation.

Project classification & clustering

- Breaking down the complexity with relevant classifications, including R&I domain, transport mode, technology readiness, corresponding policy text.
- Allowing for quantitative analysis.

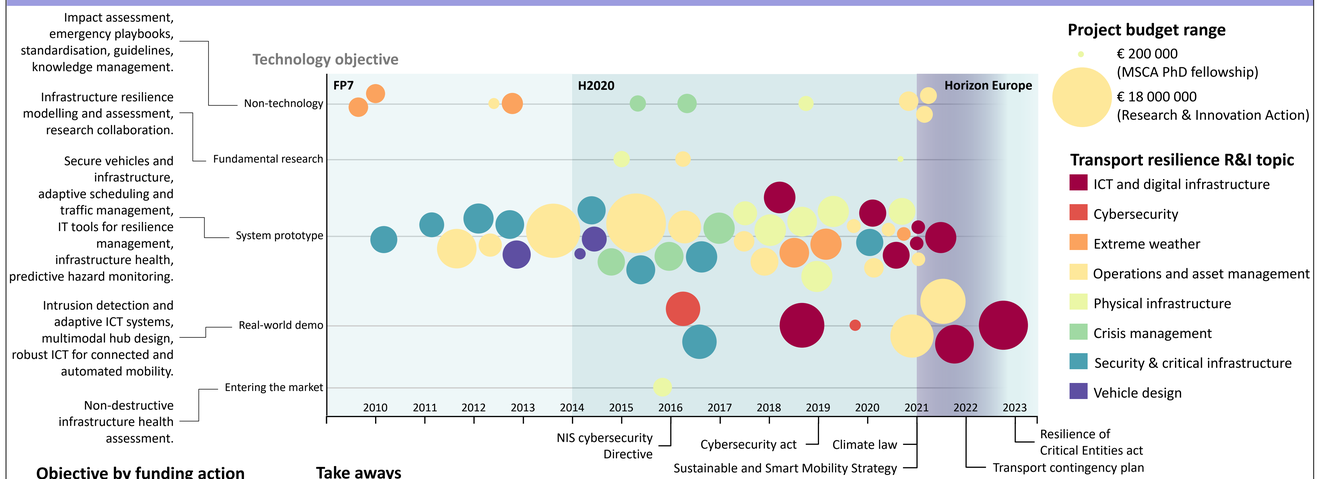
Analysis

- Project by project expert review to identify the developed innovations, challenges and achievements.
- Quantitative analysis and data visualisation to provide overall trends.

European Commission, Joint Research Centre, Cheimariotis, I., Stepniak, M., Gkoumas, K. et al., Research and innovation in transport safety and resilience in Europe – An assessment based on the Transport Research and Innovation Monitoring and Information System (TRIMIS), Publications Office of the European Union, 2023

Result: Science for Policy report

Overview of EU transport resilience R&I trends from 51 identified projects



Objective by funding action

Non-technology	Coordination and Support (CSA)
Fundamental research	Marie Skłodowska-Curie (MSCA)
System prototype	Research and Innovation (RIA)
Real-world demo	Innovation (IA)
Entering the market	Small-Medium enterprises (SME)

Take aways
- Research and innovation activities cover policy priority areas, at times in anticipation of the policy text.
- Most technology projects target system prototypes up to TRL6, effort is required for bridging the readiness gap towards deployment.
- With a single SME support project, transport resilience appears to be potentially challenging as a market prospect.

Key R&I developments & future orientations

Vehicle operation with advanced cockpit and bridge design, pilot and crew navigation aids, and early warning and information systems for extreme weather and other disruptions.

Rolling stock and fleet management with non-destructive vehicle state of health monitoring, modelling, and predictive maintenance.

Scheduling and traffic management with algorithms and AI to anticipate, identify and predict the course of disruptions, real-time planning and information systems, minimising impact and recovering faster from disruptions.

Surface physical infrastructure with sensor and monitoring systems for the infrastructure state of health, predictive maintenance, warning systems and flow redistribution after a disruption.

Digital infrastructure with robust sensor and communications, cloud-computing and human machine interfaces, integrated traffic management for automated road transport.

Critical infrastructure and cybersecurity risk assessment methods and ICT tools, intrusion detection techniques, robust and adaptive ICT systems and reaction strategies against human-made threats, both physical and cyber.

Urban mobility with holistic transport system planning and monitoring, and cross-stakeholder collaboration and knowledge management.

- **Vehicle and asset design** with an increased operational envelope, ensuring passenger safety, health and thermal comfort.
- **Digital twins of transport systems** and virtual experimentation of disruptive events, predicting the system response, and how resilience management measures can preserve and restore operation.
- **Data-driven resilience** with indicators to gauge the fragility of transport systems, extent of disruptions, and response efficiency. Data acquisition and quantification contribute to a better understanding and operationalisation of resilience.

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TRIMIS: Transport Research and Innovation Monitoring and Information System
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