

Public transport research and innovation in Europe



HIGHLIGHTS

- **Public transport** is in the spotlight of EU mobility policies. **114 projects (4.2%)** of all transport-related Horizon 2020 projects included in the TRIMIS database^a focus directly on public transport research and innovation. Their total budget is about **€460 m (6.7%)**.
- Main themes of recent European public transport research and innovation are: **transport planning and management, digitalisation and digital innovations** as well as **emissions reduction** and **electrification** of transport, which is in line with the main objectives of the **EU Urban Mobility Framework^b**.
- **Future initiatives should focus on fostering an inclusive, safe, affordable, sustainable and attractive public transport.** Further works on reduction of emissions in transport and multimodal digital mobility services should strengthen progress towards climate neutrality and contribute to a resilient urban transport, in line with the objectives of the **EU Mission on Climate-Neutral and Smart Cities^c**.

INTRODUCTION

Policy context

The transport sector is responsible roughly for a quarter of total greenhouse emissions. The **European Green Deal^d**, targeting 90% reduction of these emissions by 2050, creates new conditions for the sector. With the **Sustainable and Smart Mobility Strategy^e** and the recently established **Climate-neutral and Smart Cities Mission^f**, urban areas are now the principal focus of these efforts. The new **EU Urban Mobility Framework^b** puts public transport in the spotlight, together with multimodality, active and shared mobility. The main aim is to reduce emissions by improving attractiveness of public transport and inducing modal shift towards the most sustainable transport modes. Improving public transport accessibility and inclusiveness is a key challenge to make public transport a viable alternative to

individual travel. Another challenge is to increase automation and digitalisation towards the seamless integration with Mobility as a Service schemes and active modes.

Public transport in the scope of the new Urban Mobility Framework

The EU Urban Mobility Framework^b contains nine main blocks of desired actions, one of which directly addresses public transport: **Attractive public transport services, supported by a multimodal approach and by digitalisation**. Furthermore, public transport is present in the detailed description of other action blocks. The in-depth review of these action areas enable to identify six main subthemes of research and innovation initiatives which cover public transport from various angles.

Box 1: Main topics in the European public transport R&I initiatives

- **digitalisation and digital innovation** including data collection, management and analysis as well as innovative digital solutions for public transport (e.g. smart ticketing);
- **reduction of emissions** and making public transport environmentally friendly and energy-efficient which covers topics such as electrification, implementation of hydrogen and alternative fuels;
- **public transport planning and management** including accessibility to and by public transport, user experience; inclusiveness of transport systems as well as involvement of various stakeholders into planning and decision-making process or testing via Living Laboratories;
- **connected and automated mobility (CAM)** which covers all topics related to connected and automated transport, e.g. autonomous shuttles, but also users' acceptance or operation systems and models;
- **safety and security** which includes for example systems of sensors and cameras, crash simulation tools and protocols;
- **infrastructure** covers maintenance and inspection, design in particular for needs of particular users, railway tracks, etc.

RESEARCH AND INNOVATION EFFORT

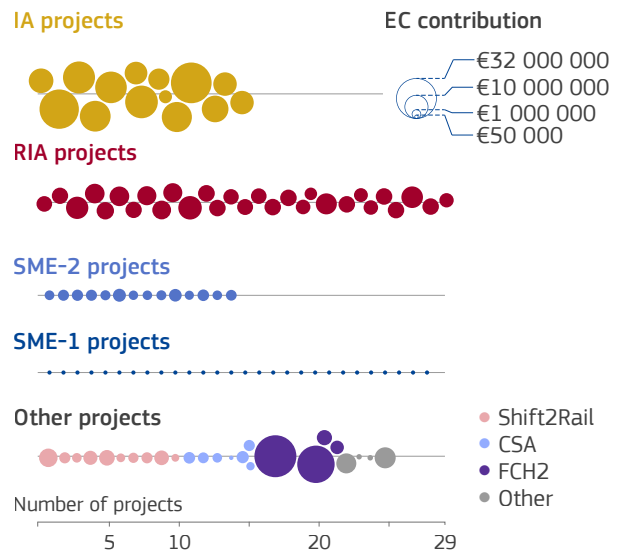
The Transport Research and Innovation Monitoring and Information System (TRIMIS)^a project database contains data on nine thousand research projects including about 2700 Horizon 2020 (H2020) projects. **114** of them **focus directly on public transport** (Figure 1). The **highest number of projects** (29) are funded under the **Research and Innovation Actions (RIA)** funding scheme, while the **highest total European Commission contribution** is granted to projects funded within **Innovation Actions (IA)**. Nearly 25% of all projects (28) are funded under Small and Medium-sized Enterprises instrument phase 1 (SME-1). However, this is a specific funding scheme supporting early stage of potential commercialisation of an innovation.

Organisations from Spain are the most active in European public transport related projects as they participated in and led the highest number of projects (60 and 24, respectively). They also received the highest total European Commission contribution (€58 million, approximately). The other EU Member States leading in public transport research and innovation activities are Italy, Germany and Belgium.

Figure 1 – European projects and their European Commission contribution by type of action

RIA scheme funds the highest number of public transport projects while **IA scheme** contributes the most

Number of projects by type of action. Rows are arranged from the highest to the lowest total EC contribution. Each dot represents one project. Size of a dot reflects EC contribution.

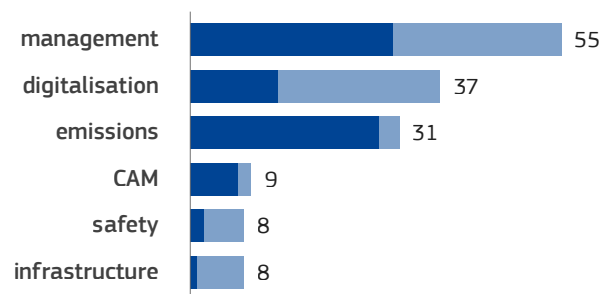


EC - European Commission; IA - Innovation Actions; RIA - Research and Innovation Action; SME - Small and Medium-sized Enterprises Instrument; Shift2Rail - Shift2Rail Joint Undertaking; CSA - Coordination and Support Actions; FCH2 - Fuel Cells and Hydrogen Joint Undertaking 2;

Source: Stepniak et al. 2022^f

Figure 2 – Main trends in European public transport R&I

Number of European projects identified in TRIMIS with and without synergies with another subtheme

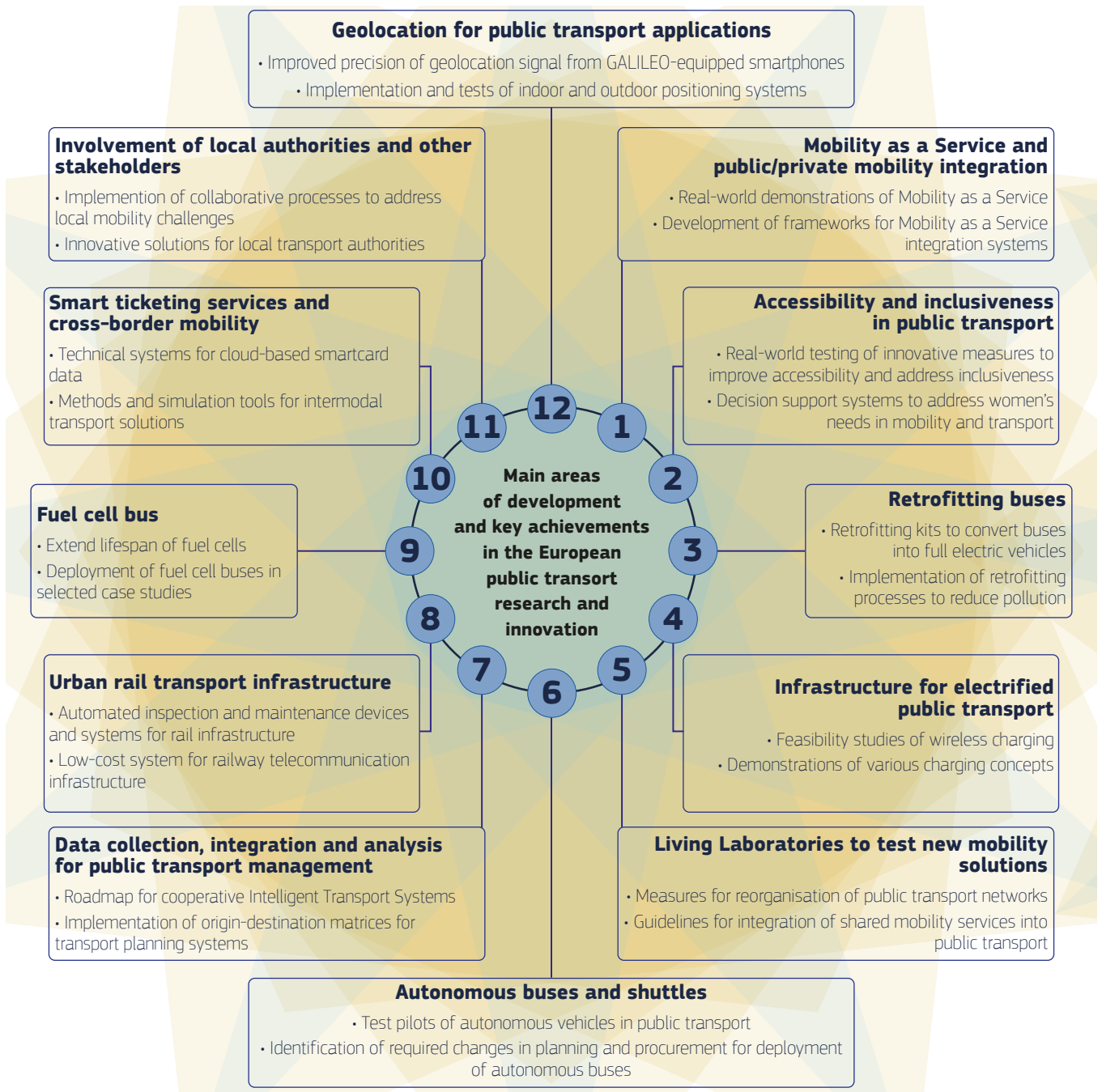


Numbers indicate total number of projects (with synergies).

Source: Stepniak et al. 2022^f

The identified projects are grouped based on the main topic they focus on (Figure 2). The dominant scope of those projects shows, that the **main R&I effort is in line with the main objectives of the EU Urban Mobility Framework.**

Figure 3 – Main achievements of European public transport R&I



Recent research progress and main trends

The in-depth analysis of all projects' achievements enable to identify twelve main areas of development. Within each of them, main achievements are identified, outlining the recent progress in European public transport research (Figure 3).

RESEARCH NEEDS AND POLICY IMPLICATIONS

Ongoing adoption of intelligent transport systems supported by innovative information and communication technologies, new business models and evolving transport management systems have changed public transport considerably. The new EU Urban Mobility Framework^b sets a new political direction, including for public transport. In light of the main

achievements of European projects and looking at future transport priorities, the following areas should be reflected in future research and innovation initiatives:

- **Ensure inclusive, safe, affordable and sustainable public transport for all transport users.** Past research includes a collection of best practices and gathering experiences from real world testing. Future works should identify specific mobility needs of women, children and teenagers, the elderly and people with disabilities. Their needs should be addressed within public transport policy frameworks involving wide range of diverse actors into planning and decision-making processes. The collaborative public transport planning and co-creation processes already proved that they can help

in properly addressing local mobility challenges. Future research should collect and share best practices, defining standards and providing guidance to local authorities.

- **Putting passengers at the heart of planning.** In recent years, we can observe a bigger focus on accessibility in urban mobility planning, linked with more emphasis on public transport and active modes. Future research should aim at further exploiting data collection and analysis methods to better match passenger demand, and support local authorities in adopting this approach in practice. This should particularly address seamless integration of public transport and active travel modes, as well as the best use of multi-modal hubs, and focus on accessibility to jobs and services.
- **Standardise the seamless integration of new and shared mobility services.** Micro-mobility, car-pooling or real-world demonstrations of Mobility as a Service solutions showed their important role in widening mobility options, improving accessibility and reducing emissions. However, successful implementations are hardly used as a point of reference for cities. Thus, there is a need to collect good practices and to prepare standardised procedures to help local authorities seamlessly integrate new and shared mobility services in their transport systems.
- **Continue progress in collection, storage and analysis of public transport data and the use of emerging digital tools for the benefits of public transport.** Public transport planning and management is already taking advantage of the emergence of new data sources and increased capabilities for data analysis, including geo-located data. It is also experimenting with implementation of artificial intelligence and digital twins¹ into transport planning decision making. Future studies should support data collection standards, which would cover different transport user groups, looking at their specific mobility patterns, behaviours and needs. Standardisation and facilitated access to mobility data is necessary to develop a common planning and monitoring system. It would support the evaluation of progress towards more resilient and sustainable public transport systems, increasing users' satisfaction and their quality of life. Finally, future research should further explore potential of artificial intelligence and digital twins for the benefit of public transport and its users.
- **Public transport should reinforce integration between cities and their suburbs and surrounding areas.** Existing research focuses on the most densely

populated city centres or on specific areas, like business parks, industrial areas or tourist destinations. Future research should concentrate on widening sustainable options for mobility beyond cities and on facilitating connectivity, affordability and accessibility of mobility services for urban and their surrounding suburban and rural areas as well as in cross-border settings. This should also include works on digital solutions and methods for evaluation of transport services particularly in those areas. Finally, the potential of new and shared mobility services, such as demand-responsive public and collective transport solutions, in rural or non-densely populated areas should also be further investigated.

- **Widen electrification and test and deploy automated and connected buses.** Solutions should be tested under different environmental, infrastructure and social conditions to provide guidance for local authorities for their efficient implementation. Those actions should help cities to reduce emissions and become climate neutral, supporting the Climate-Neutral and Smart Cities EU Mission. The works should increase the attractiveness of public transport, while ensuring that technical solutions make it more sustainable, resilient and energy-efficient.

REFERENCES

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- ^f Stepniak, M., Gkoumas, K., Marques dos Santos, F., Grosso, M., and Pekár, F., 2022, Public transport research and innovation in Europe. An assessment based on the Transport Research and Innovation Monitoring and Information System (TRIMIS), EUR 31091 EN, Publications Office of the European Union, Luxembourg, doi:10.2760/18036.

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This document is based on the JRC Science for Policy Report: Stepniak, M. et al. 2022^f

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¹ Digital Twins are virtual representations of the real world that allow for example a more efficient development of innovations or an optimisation of processes. <https://publications.jrc.ec.europa.eu/repository/handle/JRC129319>