

RECIPROCITY

D4.1

Report on regulatory & administrative requirements

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Publishable summary

The RECIPROCITY project aims to address the challenges posed by urbanisation, climate change and digitalisation in the field of mobility. The project seeks to create well-connected multimodal and multi-usage nodes for smart and clean mobility in urban and inter-urban areas. While early pilot projects have shown success, there is a gap when it comes to transferring these innovations to different contexts, cities or regions. RECIPROCITY aims to bridge this gap by initiating and supporting replication projects in cities and municipalities of varying sizes, locations and levels of urbanisation.

RECIPROCITY recognises the importance of knowledge and information exchange between cities, municipalities and policy makers to facilitate the widespread replication of successful mobility innovations. As part of this effort, RECIPROCITY developed three position papers on Mobility as a Service (MaaS), drones and hydrogen mobility. These position papers consolidate the key learnings from RECIPROCITY mobility use cases and facilitate knowledge exchange with policy and regulatory stakeholders.

This report further develop this knowledge exchange. It aims to monitoring and assess relevant mobility policies and regulations related to the best practices identified in earlier stages of the project, as well as to provide policy recommendations to policy makers and practitioners. The report also identifies synergies with European funding and financing schemes.

The active involvement of policy-makers at the EU level will create an environment for the replication of successful mobility solutions at local level.

List of abbreviations

BVLOS	Beyond Visual Line of Sight
CAA	Civil Aviation Authority
CCAM	Connected, Collaborative and Autonomous Mobility Partnership
CEF	Connecting Europe Facility
C-ITS	Cooperative Intelligent Transport Systems
EC	European Commission
EU	European Union
e-VTOL	Electrical Vertical Take-Off and Landing
FCCP	Fuel Cell Cargo Pedelecs
FFG	Austrian Research Promotion Agency
FHA	Fundación Hidrógeno Aragón
HRS	Hydrogen Refuelling Stations
İBB	Istanbul Metropolitan Municipality
ISO	International Organisation for Standardisation
ITS	Intelligent Transport Systems
PEM	Proton Exchange Membrane
PPPs	Public-Private Partnerships
RCP	RECIPROCITY project
R&D	Research and Development
RNP	Required Navigation Performance
SME	Small and Medium-size Enterprises
SUMP	Sustainable Urban Mobility Plan
SUMPs	Sustainable Urban Mobility Plans
S3	Smart Specialisation Strategies

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MaaS	Mobility as a Service
TEN-T	Trans-European Transport Network
TEN-E	Trans-European Energy Network
UAS	Unmanned Aircraft Systems
UKOME	Istanbul Metropolitan Municipality's Transportation and Coordination Center

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1. Introduction

The RECIPROCITY project aims to address the challenges posed by urbanisation, climate change and digitalisation in the field of mobility. To this end, the project employs an innovative four-stage replication approach aimed at showcasing and disseminating best practices in urban development and mobility. As RECIPROCITY progresses, it becomes increasingly evident that facilitating a continuous flow of knowledge and information among cities, municipalities, and policymakers is important to ensuring the widespread replication of successful mobility solutions in the future.

One of the core objectives of RECIPROCITY is to stimulate conversations and foster learning between various stakeholders, including cities, municipalities and policymakers. To achieve this, the project implemented a range of strategies, including the organisation of webinars and workshops between cities, municipalities, regions and policymakers.

This report on regulatory and administrative requirements compiles key insights from the RECIPROCITY project, intending to facilitate dialogue with policy and regulation entities. Specifically directed toward local and regional authorities, European Institutions, and mobility providers, this report delivers recommendations for the development of Drones, Autonomous Vehicles, Hydrogen Mobility, Mobility as a Service (MaaS), and Micro-mobility solutions:

1. Drones: RECIPROCITY highlights the importance of regulatory frameworks, sandboxes and financial support to effectively facilitate the seamless integration of drones into urban airspace. It also stresses the importance of launching awareness campaigns to educate communities and promote the benefits and safety measures associated with drone operations. Moreover, RECIPROCITY underscores the necessity of establishing EU partnerships to ensure common standards, regulations, and interoperability, thereby facilitating cross-border drone operations and enabling harmonized and effective integration in European urban areas.

2. Autonomous Vehicles: For autonomous vehicles, RECIPROCITY highlights the significance of targeted deployment, stakeholder involvement, and seamless public space integration. This approach involves identifying key automation areas, fostering operator-citizen collaboration, and addressing critical aspects like parking and charging infrastructure. Additionally, RECIPROCITY suggests harmonizing regulations, data sharing, infrastructure investment, public awareness, and international collaboration for successful autonomous mobility in Europe.

3. Hydrogen Mobility: Regarding hydrogen mobility, RECIPROCITY emphasises local and regional authorities' role in coordinating resources and funding to create a shared vision. It recognizes their responsibility in raising public awareness, investing in education programs, and engaging stakeholders. European institutions are encouraged to consider local needs and develop safety standards for EU hydrogen policies. RECIPROCITY also recommends citizen acceptance, clear funding definitions, and scaling up hydrogen mobility solutions.

4. Mobility as a Service (MaaS): RECIPROCITY calls for measures at local and European levels to seamlessly integrate sustainable transportation options into digital platforms, optimising resource utilisation for a more sustainable and interconnected mobility ecosystem.

5. Micro-mobility: RECIPROCITY highlights recommendations for the integration of micro-mobility into European cities. European institutions are urged to include micro-mobility in Sustainable Urban Mobility Plans (SUMP) and establish standardised guidelines for regulatory clarity and cross-border operations. On the local level, municipalities are encouraged to set operator and vehicle limits, implement special use fees, and mandate specific operational requirements. Public awareness campaigns, especially in schools, are vital, and micro-mobility providers should introduce deterrent measures for violations.

In conclusion, RECIPROCITY recognises the influential role of decision-makers in shaping the future of mobility. RECIPROCITY's reports will as a tool to disseminate project learnings and recommendations for policy, regulation and funding, ultimately aiming to impact smart and clean mobility in European cities positively.

2. Drones

Assessment of Policy (regulatory/administrative requirements)

The use of drones for **passengers and goods transportation** has the potential to revolutionise urban transportation systems. Drones can address many of the current challenges faced by the local transport sector. However, there are several barriers, both legislative and technical, that hinder the development and widespread adoption of drones in Europe. This policy paper aims to address the current challenges in local transportation, explore how drones can overcome these challenges, identify barriers to drone deployment, and provide recommendations to European institutions, local authorities and other stakeholders interested in adopting innovative transportation solutions.

Local transportation systems in urban areas often face various challenges, including traffic congestion, limited infrastructure capacity, high costs and environmental concerns. These challenges lead to inefficient and unsustainable transport networks, resulting in increased travel times, pollution and negative impacts on quality of life.

Additionally, peri-urban and rural areas often lack efficient and reliable transportation options, making it difficult for residents to access essential services such as healthcare facilities, educational institutions and markets. This limited accessibility can significantly impact the quality of life and economic opportunities for individuals residing in these areas. Moreover, roads and public transportation networks might be poorly developed or insufficient, making it challenging to establish efficient and cost-effective transport routes.

Delivering goods and services to remote locations in peri-urban and rural areas can be particularly problematic. Traditional delivery methods may be time-consuming and costly, leading to logistical inefficiencies and delays. This issue is especially critical for urgent medical supplies, perishable goods, and other time-sensitive deliveries.

Drones offer unique capabilities that can help overcome the challenges of local transportation while providing numerous benefits:

- **Traffic alleviation:** Drones can bypass ground congestion, using airspace as a new transportation medium. This can significantly reduce travel and delivery times, particularly for time-sensitive or emergencies.
- **Better connections:** Drones have the potential to connect villages, rural areas and remote regions, increasing accessibility to underserved communities. Make the difference between life and death in case of urgent medical deliveries.
- **Infrastructure flexibility:** Drones do not require extensive ground infrastructure, such as roads or railways, making them adaptable to various terrains and enabling direct point-to-point transportation.
- **Cost-effectiveness:** Drones have the potential to reduce transportation costs by optimising routes and minimising the need for large-scale infrastructure investments. They also have the potential to reduce

costs for ground infrastructure construction and maintenance. However, to fully achieve economic benefits, some operations should be fully autonomous, without requiring a remote pilot. As highlighted by the Flying Forward 2020 project, operators could instead employ fleet managers with greater efficiency.

- **Environmental sustainability:** Electric drones produce zero direct emissions, offering a greener alternative to traditional transportation modes, thereby reducing carbon footprints and improving air quality.

Shifting a portion of urban transportation from ground to air can yield benefits such as reducing greenhouse gas emissions, enhancing personal mobility and logistics, decreasing travel times and congestion, and providing urgent delivery options for goods, including medical supplies. Drones also have the potential to significantly improve monitoring and data collection processes, such as traffic control and pedestrian mobility data gathering. They represent a convergence of artificial intelligence, electric mobility and Mobility as a Service (MaaS).

The European Commission is working to establish regulations¹ for the safe and secure integration of drones into European airspace while promoting innovation, economic growth, and privacy protection.

The European Commission (EC) recognised the emerging trends of digitalisation and decarbonisation in [the Smart and Sustainable Mobility Strategy](#) adopted in 2020. The EC expressed its support for drone deployment as part of the transition to sustainable and resilient mobility. This endorsement was reinforced in [the New European Urban Mobility Framework](#) adopted in December 2021, which emphasised the use of drones in urban logistics systems. Additionally, synergies between civil defence, space industries and drones have been recognised, with flagship actions on EU drone technologies integrated into [the EU Drone Strategy 2.0](#).

The EU Drone Strategy 2.0, adopted in November 2022, envisions the drone ecosystem in Europe by 2030 and includes flagship actions to achieve these objectives. The strategy aims to promote coherent policy frameworks that facilitate the market development of drones and electric Vertical Take-Off and Landing (eVTOL) aircraft. The strategy explores different business models, including commercial operations with small drones, larger drones, and eVTOL for the transport of people and goods. Overall, the EC aims to boost the development of a large-scale EU drone market, ensuring that drones become an integral part of the lives of EU citizens by 2030.

Considering these factors, it becomes imperative for EU institutions, local and regional authorities, and other stakeholders to recognise the potential benefits of drones in transportation and work towards **creating an enabling regulatory environment**. This includes revisiting current restrictions and addressing the legislative, technical, regulatory and financial barriers to drone deployment. By doing so, Europe can capitalise on the **advantages of drones**, unlocking their full potential in transforming urban mobility, enhancing connectivity and promoting sustainable transportation solutions.

Barriers to the development of drones in urban areas

Some drone projects, including pilot programmes and demonstrations, are currently underway in European cities. These projects are typically driven by entrepreneurs, technology startups, national bodies or universities.

¹ The European Commission has established a regulatory framework for drones: the Commission Delegated Regulation (EU) 2019/945 on technical requirements for drones, the Commission Implementing Regulation (EU) 2019/947 on operational requirements for drone operations and operators, the Commission Implementing Regulation (EU) 2021/664 on the regulatory framework for U-Space, and the Commission Implementing Regulation (EU) 2021/664 on U-Space This regulation is important for the development of Urban Air Mobility (UAM) and entered into force on January 26 2023.

AIRTAXI FOR PASSENGERS (AUSTRIA): The Airtaxi for passengers project in Austria aims to implement autonomous air taxis for passenger flights in Linz. The collaboration involves the Austrian companies FACC and LINZ AG, along with EHang from China. Linz was chosen as the location due to its tech-friendly environment and existing technological initiatives. The project envisions drones flying predetermined routes with a capacity for two passengers. The main challenges involve regulatory and bureaucratic processes, and workshops have been conducted to address various aspects, such as business models, public acceptance, ticketing, and safety regulations.

AIRMOUR and CITYAM (FINLAND): Helsinki has embraced drones for various purposes through projects like AiRMOUR and CITYAM. AiRMOUR focuses on sustainable air mobility in emergency medical services, aiming to promote safe, secure, and socially accepted urban air mobility. The project involves real-life demonstrations in multiple locations. CITYAM, on the other hand, aims to prepare cities for urban air mobility through transnational cooperation, addressing challenges related to regulations, city planning and public acceptance.

URBAN AIRPORT COVENTRY (UK): The Urban AirPort Project in Coventry aims to create a small-scale airport using drones and eVTOL aircraft for transportation, logistics, and medical supply distribution. The project, known as Air-One, is a partnership between Urban AirPort, Hyundai Motor Group, Coventry City Council and the UK Government. It involves the establishment of vertiports, rapidly deployable operational hubs, with Coventry serving as the pilot location. The project has provided valuable insights and learnings, attracted potential investors and promoted the city. Collaboration with stakeholders and compliance with regulations has been crucial. The project has the potential to boost the aviation and manufacturing sectors, create jobs, and establish a UK UAM Centre of Excellence.

ZARAGOZA (SPAIN): Project FF2020 has carried out flight demonstration with UAS for transport or surveillance purposes in Estonia, Finland, Italy, the Netherlands and Zaragoza (Spain). The Project has found that to make applications available 24/7 economically sustainable, such as transport of urgent medical material, the flight should be fully autonomous and hence supervised by a Fleet Manager, without requiring a Remote Pilot. Furthermore, the Project has found difficulties, in particular in Zaragoza, in liaising with authorities different from the competent civil aviation authority.

However, despite progress, several significant challenges still need to be addressed in the integration and widespread adoption of drones. One of the primary obstacles is the presence of **legislative and regulatory barriers**. The current regulatory framework in Europe imposes strict limitations on drone operations, particularly in urban areas. Restrictions on airspace usage, flight altitude and beyond-visual-line-of-sight (BVLOS) operations and other factors hinder the widespread implementation of drones for transportation purposes. Issues such as determining drone routes, establishing insurance obligations, pilot certification and training requirements, and defining accountability for drone owners need to be addressed within the regulatory framework.

Moreover, a **lack of knowledge among municipalities** and other stakeholders adds to the barriers to drone development. The roles and responsibilities of cities and other actors in integrating drones into existing traffic management and urban planning frameworks, including the identification of suitable landing sites, are not yet fully defined. Flying drones in urban environments also carries inherent risks, further complicating their integration.

Another challenge is linked to the **public perception** and societal anxiety about automation and drones. Citizens often express concerns about drones' safety and the noise they generate. Public acceptance plays a major role in future drone acceptance.

Environmental concerns also pose challenges. Drones can pose risks to wildlife and generate visual and noise pollution. Therefore, concerns need to be addressed to ensure the widespread use of drones in the future.

Additionally, several **technical obstacles** need to be addressed for the successful integration of drones into urban airspace. These include robust communication networks, effective air traffic management systems capable of handling a large number of drones simultaneously and addressing challenges related to bad weather conditions, obstacle avoidance, accurate drone tracking and limited flight range.

Furthermore, **financial constraints** pose a significant challenge. The high costs – especially the high initial costs – associated with drone development, infrastructure setup and operational maintenance pose significant financial challenges for both public and private entities interested in adopting drone solutions.

Links with EU funding and financing schemes

In the rapidly evolving landscape of drones, Europe has emerged as a significant player in research, development and innovation. To support advancements in drone technology and foster innovation in this field, various European funding schemes have been established:

- **Horizon Europe** plays a pivotal role in driving research and innovation across a multitude of sectors. Within Horizon Europe, several calls and initiatives are dedicated to advancing drone technology. These funding opportunities are designed to promote groundbreaking research and foster collaborations among various stakeholders, including academia, industry and government bodies.
- **EIT Urban Mobility**: Urban Air Mobility represents a significant opportunity for drones to revolutionise transportation within urban environments. EIT Urban Mobility offers various initiatives and opportunities aimed at advancing UAM through drone technology. These initiatives include research projects, innovation challenges, and accelerator programme that aim to propel the development and adoption of UAM solutions, with a specific focus on drones for urban transport.
- **Interreg Programme** aims to foster collaboration among regions, sharing best practices, and harmonising policies. In the context of drones, Interreg programs could provide a unique platform for interregional cooperation on various aspects of drone technology. Interreg programs could facilitate knowledge exchange and joint projects efforts among different EU regions, thereby addressing common challenges in the drone sector. By promoting cross-border cooperation, Interreg could contribute significantly to the development and standardization of drone technologies.

While these European funding schemes offer support for drone-related projects, it is essential to acknowledge that there are still gaps in the development of drone solutions. For instance, the importance of national funding sources in complementing European funding underscores the need for a more comprehensive approach to funding, where both European and national levels work in synergy to nurture and scale drone innovations.

To fully harness the transformative potential of drones, the European Union should consider allocating resources to support drone-related solutions. A holistic approach that combines EU-level funding with national initiatives can help bridge existing gaps and accelerate the adoption of drone technologies across various sectors.

Policy Recommendations

To effectively implement and deploy drones, collaboration and knowledge-sharing among all relevant stakeholders is central. This includes actively engaging with regulatory and governmental organisations to facilitate the scalability of projects and establish a robust drone ecosystem and European market. Sharing best

practices and lessons learned and promoting cross-sector partnerships can accelerate the development and adoption of drone solutions.

- **Regulatory framework:** To enable the safe integration of drones into urban airspace, European institutions should revise and develop regulatory frameworks and sandboxes: a less bureaucratic approach is recommended. This includes allowing beyond visual line of sight (BVLOS) operations, defining clear flight corridors and take-off/landing points, and establishing guidelines for low-altitude airspace management. To fly inside these corridors, drones would need to achieve a standardised Required Navigation Performance (RNP). Standardisation of RNP would greatly reduce the compliance cost for medium and small sized enterprises. It is essential to develop a clear certification timeline, set at the national or EU level, to provide certainty and encourage industry participation. Efforts should be made to digitalise air traffic management and achieve harmonisation at the EU level, finding a way to merge the legacy of conventional aviation with new aviation concepts. By embracing these measures, European institutions can foster innovation, ensure safety, and facilitate the seamless integration of drones into urban airspace.
- **Investment and funding:** To enable the development and deployment of drones, it is crucial for all governance levels to provide financial support and incentives. This can be achieved through various means, such as funding research and development initiatives and offering tax breaks or subsidies for drone manufacturers and operators. Addressing the challenges of funding drone initiatives requires exploring innovative financing models and establishing effective public-private partnerships. It is important to identify the potential economic benefits and employment opportunities associated with the deployment of drones. By doing so, governments can attract investment, stimulate economic growth, and foster the deployment of drone technologies.
- **Infrastructure development and technical obstacles:** Local authorities should collaborate with stakeholders to invest in infrastructure supporting drone operations, such as designated landing zones, charging stations, communication networks and effective air traffic management systems capable of handling the growing number of drones in urban airspaces. Additionally, there is a need to create dedicated test environments where solutions can be showcased, tested, and their impact on people can be assessed. Streamlining the permission process and clarifying responsibilities among regulatory bodies is necessary to reduce uncertainty and enable efficient infrastructure development. By prioritising infrastructure development and addressing technical obstacles, governments can create an enabling environment for the successful integration of drones into urban areas. This will contribute to improved efficiency, safety, and effectiveness of drone operations, unlocking their full potential for various applications and benefiting both public and private sectors.
- **Public awareness and citizens' involvement:** To ensure the success of drone projects, public awareness and citizens' involvement are vital. Authorities should launch public awareness campaigns to address concerns, educate communities about drone operations' benefits and safety measures, and involve citizens in the decision-making process. Public acceptance is a key aspect that needs to be addressed. It is essential to acknowledge and address concerns related to safety, privacy and the potential impact of automation on employment. Engaging with the public and promoting transparency in the use of drones can help build trust and acceptance among communities. By actively involving the public and addressing their concerns, authorities can foster a positive perception of drones and facilitate their integration into society.
- **City-level knowledge exchange:** To address the lack of knowledge among local authorities, it is essential to bridge the knowledge gaps. Local authorities should prioritise the establishment of platforms for collaboration and knowledge exchange. This can be achieved through workshops, forums, and working groups where different actors can come together to share experiences, best practices, and

lessons learned. By actively engaging in these collaborative initiatives, municipalities can enhance their understanding of drone technologies, operational requirements and potential benefits. This knowledge exchange will facilitate informed decision-making and effective implementation of drone operations in urban areas. Furthermore, these collaborative platforms will enable municipalities to stay updated on the latest technological advancements, regulatory developments and industry trends. This ongoing exchange of knowledge will empower municipalities to make informed decisions, adapt their strategies, and effectively address any emerging challenges or opportunities related to urban drone operations.

- **International collaboration:** European institutions should engage in international collaborations to establish common standards and regulations for drones. This would promote interoperability and facilitate cross-border operations.

RECIPROCITY case studies focusing on Drones

Three RECIPROCITY case studies focusing on Drones are analysed to give an overview about the key elements for Urban Air Mobility deployments and good practices.

AIRTAXI FOR PASSENGERS (AUSTRIA)

The Airtaxi for passengers project in Austria involves collaboration between two Austrian companies, FACC and LINZ AG, and [EHang](#) (China) with the aim of implementing autonomous air taxis for passenger flights in Linz (Upper Austria). The choice of Linz as the location for the Airtaxi for passengers project is influenced by several factors. Linz is known as a tech-city, boasting various technological initiatives such as software parks, code schools, and the Ars Electronica centre. This technological environment provides a conducive setting for exploring innovative solutions like autonomous air taxis.

The project envisions drones flying along predetermined routes to and from designated locations, allowing passengers to choose their entry and destination points. Each drone will have capacity for two passengers.

While air taxis are already operational in some countries like China, the main challenges lie in **the regulatory and bureaucratic processes** for testing such solutions in Europe. Workshops have been conducted to address various aspects, including business models, public acceptance, ticketing, and safety regulations. Linz AG and FACC are currently awaiting a permit to conduct drone tests without passengers in a restricted area. Once these tests are completed, further planning and workshops can proceed.

Currently, in April 2023, there are still many regulatory questions that need to be resolved by local and EU authorities to obtain the necessary testing permit. FACC and Linz AG are actively engaging with relevant stakeholders and providing the required information and tests to meet the regulatory requirements.

AiRMOUR (FINLAND)²

From 2020 to 2022, Helsinki has embraced drones for various purposes, showcasing their versatility and potential. Key use cases include inspections of rooftops and construction sites by Stara, the city's logistics and maintenance company; fire assessments and search and rescue missions by Rescue Services; environmental monitoring tasks such as inventorying invasive plants and mapping storm damage by the Environmental

² <https://airmour.eu/>

Department. Helsinki has also explored drones for 3D modelling, traffic counting, pharmacy product delivery, emergency medical services, meal deliveries in partnership with Google Wing, and law enforcement operations.

The city is actively involved in EU-funded projects, including AiRMOUR for sustainable air mobility in emergency medical services and CITYAM for preparing cities for urban air mobility. These initiatives highlight Helsinki's commitment to innovation, efficiency, and sustainability through the use of drones.

The CITYAM project aims to promote responsible and sustainable urban air mobility in the Baltic Sea Region through transnational cooperation. It addresses challenges related to regulations, city planning, and public acceptance. The project provides tools and strategies to integrate drones into traditional urban mobility systems and enhance sustainability. By sharing knowledge and best practices, CITYAM aims to lead the way in shaping a responsible and sustainable use of air in cities. The project is funded by the Interreg Baltic Sea Region.

The AiRMOUR project (Enabling sustainable AiR MObility in URrban contexts via emergency and medical services) is dedicated to researching and validating innovative concepts and solutions that promote safe, secure, quiet, green, more accessible, affordable and socially accepted Urban Air Mobility (UAM).

The project, coordinate by Teknologian Tutkimuskeskus VTT OY (Finland), aims to address the needs of cities in integrating air mobility into their urban planning processes and equipping them with suitable tools. By engaging urban communities, operators, regulators, academia, and businesses, AiRMOUR seeks to enhance the understanding and implementation of near-future actions in the realm of UAM.

The project conducts real-life demonstrations in Stavanger (Norway), Helsinki (Finland), and the North Hesse region (Germany), along with simulation exercises in Luxembourg, to test and validate personal air vehicles for doctors and medical supplies.

The project's main deliverables include the UAM Guidebook, which provides valuable insights for cities, operators, and other stakeholders; the UAM GIS Tool, designed specifically for urban planners; and the UAM Training Programme and Masterclasses. With the aid of these tools, local aviation and urban clusters across Europe can effectively support their own UAM implementation efforts.

URBAN AIRPORT COVENTRY (UK)

The Urban Airport Project in Coventry, West Midlands (UK), is an innovative initiative focused on utilising drones and electric Vertical Take-Off and Landing (eVTOL) aircraft, to create a **small-scale airport** that can be deployed in **urban areas**. The project aims to support **transportation and logistics** operations, serve as a freight hub, and facilitate the distribution of medical supplies or parcels using autonomous drones.

The project, known as Air-One, is a partnership between Urban AirPort, Hyundai Motor Group, Coventry City Council, and the UK Government. It aims to showcase the concept of a pop-up airport and the supporting technology, with Coventry serving as the pilot project location. Air-One was successfully launched in April 2022, demonstrating the capabilities of vertiport technology for drones and eVTOL aircraft.

Urban Air Port has ambitious plans to establish over 200 vertiports globally within the next five years. These compact and rapidly deployable operational hubs will provide essential services such as aircraft command and control, charging/refueling facilities, and cargo and passenger loading capabilities.

The project has provided valuable insights and learnings, including the benefits for Coventry City Council, attracting potential investors, and promoting the city as a business destination. The funding for the project comes from the UK government's Future Flight Challenge, amounting to £1.2 million.

To reduce overall costs, the project explores the possibility of resource-sharing with various organisations such as emergency services, medical organisations, logistics operators, local authorities. **Engaging with stakeholders and authorities, including legal and civil aviation entities**, has been crucial to ensure compliance with regulations and operate safely in an urban environment. **Citizen engagement** has been an integral part of the project, with Coventry University conducting public engagement activities that received positive feedback from over 15 000 visitors.

The Urban Airport Project has the potential to attract customers, boost the aviation and manufacturing sectors, create new jobs, advance environmental goals, and establish a UK Urban Air Mobility (UAM) Centre of Excellence. It aims to drive innovation, improve connectivity, productivity, and transform cities.

Nevertheless, **the current regulations and policies in the UK impose restrictions on drone flights**, requiring them to be within visual line of sight (VLOS). **Collaboration with authorities such as the Civil Aviation Authority (CAA) and airports** is necessary to develop flights for beyond visual line of sight (BVLOS) operations.

For replication, it is important to engage with local authorities, interested operators, and airspace users to minimise conflicts. Collaboration with end users and urban planners can aid in integrating the development seamlessly into the urban environment.

3. Autonomous vehicles

Assessment of Policy (regulatory/administrative requirements)

Autonomous vehicles represent a revolutionary shift in mobility solutions, holding the promise of increased safety, efficiency and reduced traffic congestion. However, their deployment necessitates comprehensive regulatory and administrative frameworks to ensure public safety, data privacy and harmonised operations across the EU.

Automation and digitalisation also offer avenues to address pressing challenges in the mobility landscape:

- **Emissions reduction:** Real-time monitoring and the integration of intelligent infrastructure contribute to the enhancement of the overall traffic system. This, in turn, supports predictive driving strategies that optimise traffic flow and reduce emissions.
- **Safety enhancement:** Intelligent Transport Systems (ITS) and cooperative communication mechanisms contribute to improved traffic safety by preventing collisions involving vulnerable road users such as cyclists.

The European Commission's [General Safety Regulation](#) is a milestone in shaping the regulatory landscape for autonomous vehicles. Effective since July 2022, this regulation introduces mandatory advanced driver assistant systems to bolster road safety while establishing the legal framework for approving automated and fully driverless vehicles in the EU. This initiative holds the potential to significantly enhance the safety of passengers, pedestrians and cyclists across the EU, with projections indicating the potential to save over 25 000 lives and prevent at least 140 000 serious injuries by 2038.

Thanks to the regulation, the Commission could define technical rules for the approval of fully driverless vehicles, positioning the EU as a pioneer in this domain. These developments not only align with the EU's strategic focus on fostering connected and automated mobility systems but also underscore the benefits that automation can bring to the realm of emissions reduction and safety enhancement. By setting a robust regulatory framework, the EU aims to harness the potential of autonomous vehicles while ensuring the highest standards of safety and efficiency.

Based on the mobility solutions encountered in RECIPROCITY activities, this section assesses the policy landscape in Austria, highlighting their approaches.

The Austrian approach toward automated mobility

The future of mobility is undergoing a profound transformation, marked by the convergence of electrification, automation, shared mobility, cooperative systems, and digital connectivity. Austria has embraced this paradigm shift by adopting a comprehensive strategy that not only navigates the evolving mobility landscape but also ensures sustainability, resilience and effective incorporation of digitalisation. This approach is characterised by strategic planning, policy formulation, regulatory initiatives, establishment of test environments, and collaborative endeavors aimed at integrating automation and digitalisation into Austria's mobility ecosystem.

At the core of Austria's approach lies the Mobility Master Plan 2030, which serves as both a roadmap and compass guiding the transition into new mobilities. Grounded in the principles of climate action, this plan advocates the shift toward sustainable modes and the optimisation of the transport system for efficiency.

Austria's commitment to automated mobility is evident through a range of policy documents and strategic roadmaps:

- *Action Plan on Automated Driving (2016-2018) which defines use cases, national strengths and top priorities.*
- *Action Programme on Automated Mobility (2019-2022) which outlines 34 distinct measures and focuses on building blocks, such as dedicated test centers, legal frameworks and pilot projects. The programme's emphasis on traffic safety, citizen engagement and the development of cooperative intelligent transport systems (C-ITS) underscores an inclusive approach to automation.*
- *Action Plan on Digital Transformation in the Mobility Sector: Recognising the potential of digitalisation, Austria has established an action plan dedicated to the digital transformation of the mobility sector. This action plan provides 16 actions, with a primary focus on the development of legal frameworks that facilitate digital transformation. Additionally, the plan emphasises optimal utilisation of mobility data, the multi-modal traffic management and the promotion of sustainable transportation modes.*

The Austria's example shows that the realisation of successful technology relies on the presence of test environments. Key aspects include:

- **Infrastructure:** *The existence of both physical and digital infrastructure facilitates secure and controlled testing of automated driving technologies, ensuring the safety and reliability of testing scenarios.*
- **Simulation and validation:** *Simulation technologies play a key role in transforming testing and validation procedures. Innovations like digital twins enable the simulation of real-world scenarios, offering more efficient development processes.*
- **Research and development (R&D):** *Ongoing R&D remain essential. Focus areas include software refinement and the optimisation of human-machine interactions.*
- **Test vehicles:** *Dedicated test vehicles and controlled environments provide invaluable insights into the real-world performance of automation technologies.*

Links with EU funding and financing schemes

The European Union recognises the importance of financially supporting innovation in the mobility sector, including autonomous vehicles. To address this transformative challenge, the EC has defined specific support in the **Horizon Europe programme** where the **Cluster 5 'Climate, Energy and Mobility's**, and particularly the Destination 6 dedicated to 'Safe, resilient transport and smart mobility services for passengers and goods', supports the test and deployment of innovative autonomous vehicles solutions. These funding schemes aim to support collaborative projects that address technical challenges, regulatory obstacles and infrastructure requirements.

Horizon Europe's **Connected, Collaborative and Autonomous Mobility Partnership (CCAM)** regularly launches calls for proposals to support the achievement of these objectives. These funding topics, exemplified by the 2023 calls, are diverse in scope and ambition, reflecting the nature of connected and autonomous vehicles technologies and their potential impact on mobility.

Additionally, the digital part of the **Connecting Europe Facility (CEF Digital)** programme is designed to boost digital connectivity infrastructure investments between 2021 and 2027, targeting both public and private sectors. It focuses on key activities such as deploying high-capacity networks, including 5G, in areas with significant economic activity (5G for Smart Communities); ensuring 5G coverage along major transport routes (5G cross-border corridors), and developing digital infrastructure for cross-border transport and energy projects. Calls for proposals are issued annually, with the next one, the 5G for Smart Communities third call for proposals, set to run from October 2023 to February 2024. To access to funding opportunities and technical assistance, the [5GSC Support Platform](#) offers a range of resources to stakeholders.

Policy Recommendations

The practical realisation of automated mobility is evidenced by **the deployment of automated shuttles within predefined areas**.

In this context, **urban and peri-urban centers** serve as focal points for the implementation of automated mobility. To effectively embrace these changes, cities can adhere to the following guiding principles:

- **Identifying hotspots for implementation, as well as target groups (use cases):** *Identifying key urban/peri-urban areas and locations, as well as potential users, as focal points for automation efforts allows for targeted deployment. Which mobility services or transport segments will benefit from automation? What options for (public) space reuse could be generated? What will be the impact of new services on urban structures and functionalities?*
- **Stakeholder integration:** *Collaborative efforts involving stakeholders, including operators and citizens, ensure successful deployment and foster acceptance.*
- **Integration in public spaces:** *Successful implementation involves integrating automation technologies into public spaces, with aspects including parking management, charging infrastructure, and curbside utilisation.*
- **Optimising processes and urban structures:** *The optimisation of processes and urban/peri-urban structures to align with the demands of evolving mobility solutions is pivotal for effective implementation.*
- **Systematic experimentation:** *Establishing a framework for systematic experimentation allows cities to learn from real-world outcomes and fine-tune their strategies accordingly.*
- **Capacity building:** *Enhancing the understanding of technological aspects among relevant stakeholders through capacity-building initiatives fosters informed decision-making.*
- **Integration in mobility goals:** *Seamlessly integrating automation into existing mobility goals, encompassing areas such as pricing, accessibility, and fleet management, enhances the overall success of the transformation.*
- **Defining operational design domains:** *Defining clear operational design domains for automated drivability ensures a systematic and organised deployment of automation technologies.*
- **Operational Safety:** *Stricter operational safety requirements, including provisions for remote-operator capabilities, are crucial to ensure safe operations.*

- **Data Monitoring:** Continuous monitoring of safety, operations, and mobility-related issues ensures ongoing compliance with established standards.

To facilitate the successful integration of autonomous vehicles into EU Member States' mobility systems, several **national and European public authorities** need to:

- **Harmonise the regulations:** Member States should collaborate with the European Commission to standardise technical requirements and safety regulations for autonomous vehicles. This approach ensures consistency and interoperability across borders.
- **Data sharing protocols:** Establish guidelines for data collection, sharing and protection to ensure data privacy while enabling efficient vehicle-to-vehicle and vehicle-to-infrastructure communication.
- **Infrastructure investment:** National authorities, in direct contact with regional and local authorities, should prioritise infrastructure upgrades, such as smart traffic management systems and dedicated lanes, to accommodate autonomous vehicles' unique needs.
- **Public awareness campaigns:** National and European educational initiatives must inform the public about the benefits and limitations of autonomous vehicles, fostering acceptance and trust in the technology.
- **Pilot programmes:** Encourage national and European pilot programmes in partnership with industry stakeholders to gather real-world data and insights, aiding in the refinement of regulations and technology.
- **European and international collaboration:** Collaborate with international bodies and other European regions, Member States and stakeholders (e.g. academia, industry) to share best practices, align standards, and facilitate cross-border mobility.
- **Definition of areas for efficient and value added autonomous transportation through local living labs and transfer of international knowledge and experience :** Istanbul BRT can be given as a typical example. A patented solution for a wheeled metro line which allows the shortest possible distance between the BRT busses increases the efficiency considerably as studied by Istanbul Okan University and eliminates also accidents improving safety of the BRT. Such applications must be carried out through appropriate funding.

4. Hydrogen Mobility

Assessment of Policy (regulatory/administrative requirements)

In the context of widespread electrification and the transition to greener energy, the production, storage and distribution of energy has become a strategic challenge for the transition to a greener energy future. As a key driver for economic growth, the hydrogen sector is likely to play a crucial role in decarbonising the mobility sector.

The European Commission (EC), as well as several countries and regions, has recognised the importance of hydrogen in its EU strategies. In 2020, the EC adopted a dedicated strategy on hydrogen as part of the European Green Deal. Additionally, the EC's REPowerEU plan, published in 2022, aims to implement the EU Hydrogen Strategy to reduce the dependence on Russian fossil fuel imports.

Crucially, the Commission's initiatives extend to investment support through Important Projects of Common European Interest (IPCEIs), with "IPCEI Hy2Tech" and "IPCEI Hy2Use" focusing on innovative technologies, infrastructure development, and sustainability integration. Moreover, the Clean Hydrogen Partnership, established in November 2021, plays a pivotal role in advancing research and innovation within the hydrogen ecosystem.

In addition to these initiatives, the Commission introduced two delegated acts in June 2023, clarifying the criteria for renewable hydrogen and setting emissions reduction thresholds, ensuring alignment with the 2018 Renewable Energy Directive. The REPowerEU plan, unveiled in May 2022, adds further momentum to these efforts with the concept of a "hydrogen accelerator" designed to scale up renewable hydrogen deployment, with a goal of producing and importing 10 million tonnes by 2030, fostering its adoption in challenging sectors such as transport and energy-intensive industries.

In parallel, a growing number of Member States have adopted national strategies, roadmaps and regulations focused on hydrogen. Austria, for example, published its Hydrogen Strategy in 2022, prioritising hydrogen in aviation, shipping, long-haul trucks and buses. It is worth noting that most of these strategies consistently emphasise the use of renewable hydrogen, also known as green hydrogen, aligning with the goal of achieving sustainable transportation solutions.

Hydrogen can play a crucial role in both urban and rural mobility of the future for several reasons. Firstly, it offers a significant **reduction in emissions**. When used as a fuel in fuel cell vehicles, hydrogen produces only water as a byproduct, resulting in zero greenhouse gas emissions. This contributes to mitigating air pollution and combating climate change.

Secondly, hydrogen provides an **extended driving range**. Hydrogen-powered vehicles typically have longer ranges compared to many battery-electric vehicles, making them well-suited for long-distance journeys or areas with limited access to electric charging infrastructure, such as rural areas.

Another advantage is the **rapid refuelling time**. Hydrogen refuelling times are comparable to conventional fuelling, unlike battery charging, which often takes longer. This ensures quick refuelling, enhancing operational efficiency and reducing wait times compared to battery charging.

Moreover, hydrogen offers **versatility**. It can be produced from various renewable energy sources, such as solar or wind power. This enables the utilisation of **local renewable energy resources** and **reduces dependence** on fossil fuels. Additionally, hydrogen can be utilised in other sectors beyond transportation, such as stationary power generation for buildings and industrial applications, increasing its versatility and potential applications. Utilising renewable energy sources for hydrogen production can reduce reliance on oil and gas imports, contributing to energy security and diversification.

Lastly, there are **economic benefits** associated with hydrogen mobility. The adoption of hydrogen mobility creates economic opportunities, including job creation in hydrogen production, infrastructure development and hydrogen vehicle manufacturing.

Despite the paramount importance that hydrogen may have in urban and rural mobility, driven by its emission reduction capabilities, extended driving range, rapid refuelling, versatility, and economic advantages, there are still barriers that impede the development of hydrogen mobility at the local level:

- **Infrastructure:** The hydrogen refuelling infrastructure is still lacking in many European cities and regions. It is necessary to build conveniently accessible and well-distributed hydrogen refuelling stations to enable a widespread use of hydrogen vehicles. Without a sufficient number of refuelling stations, potential customers are reluctant to purchase hydrogen vehicles. Conversely, without a substantial customer base, companies are hesitant to invest in building refuelling stations. In Austria, for instance, there are only seven HRS due to the lack of demand. The installation of these infrastructures requires significant investments and cooperation between governments, energy companies, and refuelling station operators.
- **Costs:** Currently, hydrogen vehicles are generally more expensive compared to gasoline or electric vehicles. The prices of hydrogen vehicles are primarily influenced by the technology still under development and small-scale production. Additionally, hydrogen itself can be costly to produce, especially if not produced using renewable energy sources.
- **Hydrogen production:** Hydrogen production requires energy, which can come from renewable or non-renewable sources. If hydrogen is produced using non-renewable energy sources, such as natural gas, it could potentially reduce the overall environmental effectiveness of hydrogen mobility. Therefore, it is important to develop efficient and economically sustainable methods for producing green hydrogen from renewable sources.
- **Safety:** Hydrogen is a highly flammable gas that requires special precautions for its handling and storage. The safety of hydrogen refuelling stations and vehicles themselves is crucial to ensure public confidence in the use of hydrogen mobility.
- **Awareness and public acceptance:** Many consumers may not be aware of hydrogen vehicles or their potential benefits. Education and public awareness are important to promote the adoption of hydrogen mobility. Additionally, some people may be reluctant to use hydrogen vehicles due to safety concerns or limited refuelling options available. Addressing this challenge has wider implications as, in a decarbonising economy, the availability of green energy is likely to lead to the relocation and re-industrialisation of energy-intensive industries and the development of sustainable urban and rural mobility. Objections to renewable energy sites to produce hydrogen and hydrogen end-uses in the regions could have far greater consequences: rejecting additional local hydrogen projects and solutions also means rejecting opportunities for diversification and resilience.
- **Regulatory barriers:** The hydrogen regulatory framework is still evolving, and some stakeholders are not sufficiently connected to the underlying rules and information on rules improvement. It is complex

for local companies (e.g. SMEs, start-ups) to gather information at both national and European levels. The speed of rules development is too slow compared to the development of hydrogen projects and technologies, which can lead to the bankruptcy of start-ups/SMEs. At present, many regulatory experts are gaining experience in permitting procedures, but the availability of expert personnel is limited, and the workload is heavy.

- **Lack of skills:** Another key challenge is the need to increase the skills of both the local industry and universities, and to improve cooperation between these actors. Hydrogen mobility involves complex technologies and systems that require specialised expertise. However, there is often a shortage of professionals with the necessary skills and knowledge in these fields.

Links with EU funding and financing schemes

At European level, several funding sources are available to finance Hydrogen mobility projects. The [Clean Hydrogen Partnership](#) regularly issues calls for project proposals, including opportunities to participate in initiatives like "Hydrogen Valleys," which can incorporate fleets of Fuel Cell Buses (FCBs). The same is found with the [Innovation Fund](#), which gives funding for demonstrating innovative low-carbon technologies. Additionally, there are other potential funding streams, including cross-border cooperation opportunities within the INTERREG programme, which offers regional activities like those in the [North Sea region](#). There are also various programs available under the [European Structural and Investment Funds](#) umbrella: Just Transition Fund, European Regional Development Fund and Connecting Europe Facility.

As the transition from project funding to regular financing progresses, support from the [European Investment Bank](#) (EIB) is anticipated to become more prominent. It's likely that national and local banks will also play a role in providing support. Private investments could also be seek on the [Hy24](#) joint venture.

Policy Recommendations

The development and deployment of hydrogen mobility requires a robust regulatory framework that meets regional needs, promotes innovation and ensures the competitiveness of hydrogen as a clean energy solution.

Based on discussions with experts and stakeholders, this set of policy recommendations aims to provide guidance to local and regional authorities and European institutions in shaping and implementing enablers for the establishment of hydrogen mobility, including regulatory and financial frameworks.

Through a series of meetings, including the RECIPROCITY Mobility Assembly, Mobility Missions and Workshops³, key insights and perspectives were gathered from experts in the field. In addition, [ERRIN's Input Paper on European Roadmap on Hydrogen Valleys](#) and the valuable input received from various member regions have shaped the development of these policy recommendations. The S3 Hydrogen Valley Partnership

³ The document includes the outputs from the following project activities: [RECIPROCITY Mobility Assembly in Brussels](#) (30/11/2022-01/12/2022); RECIPROCITY Workshop: [RECIPROCITY Workshop: "From learning to replicating: Hydrogen in Mobility"](#) (26/06/2023); [RECIPROCITY Paris Mobility Mission](#) (22-24/06/2022).

position paper⁴ has also served as a valuable reference, providing insights into regional strategies and collaborative approaches to hydrogen deployment.

For local and regional public authorities:

- **Coordinating activities, resources and funding:** Local and regional authorities need to have the capacity to play an active role in coordinating actors, activities, resources and funding in the local and regional innovation ecosystem. Regions can create a shared vision for the deployment of hydrogen solutions by developing a regional hydrogen roadmap or strategy that outlines the key development actions and policy support needed in the near future.
- **Engaging stakeholders:** Local and regional authorities need to establish a local hydrogen ecosystem involving all the relevant stakeholders, including government authorities, industry (e.g. large industry active in the local landscape, SMEs, start-ups - suppliers, consultants, technicians), research institutions and local communities. This is crucial for the successful implementation of hydrogen strategies and projects on the ground.
- **Public awareness and acceptance:** Public authorities should contribute to promoting public awareness and acceptance of hydrogen as a viable and sustainable energy solution. Through targeted activities, they will be able to raise public awareness of the benefits and value of hydrogen solutions for local society and the environment. Citizen involvement activities on hydrogen policy should be mainstreamed. In addition, public authorities responsible for public education need to invest in the needs of the wider hydrogen ecosystem through education programmes and support for innovation hubs in the region.
- **Infrastructure development:** Establishing a robust and extensive hydrogen infrastructure network is crucial. Addressing the challenges associated with infrastructure development, including cost, scalability, safety, and compatibility with existing energy systems, is essential. Local authorities need to act in line with the infrastructure plans being drafted at the EU level.

For European public authorities:

- **Tailor policies to local needs:** EU hydrogen-related policies should consider the specific characteristics and needs of different regions. Recognising regional diversity in energy resources, industrial sectors and infrastructure requirements are important for developing targeted policies that can effectively drive hydrogen deployment at the local level. This can be achieved through flexible policy frameworks that allow for adaptation to regional contexts.
- **Align with existing policies:** Ensure that the regulatory framework for hydrogen mobility aligns with existing policies such as the Trans-European Transport Network (TEN-T) and Trans-European Energy Networks (TEN-E). Coherence and integration across different policy areas will enhance the effectiveness and efficiency of hydrogen deployment efforts.
- **Develop a common safety regulation:** Strict standards and regulations are necessary to ensure the safety of infrastructures and vehicles, as well as public acceptance.
- **Guarantee mechanisms:** Recognise the challenge of the infrastructure/demand dilemma and take comprehensive measures to address it. The EU and national authorities could establish guarantee

⁴ [S3 Partnership publishes position paper for a dedicated roadmap for Hydrogen Valleys | ERRIN Website](#)

mechanisms to incentivise private sector investments in hydrogen infrastructure, ensuring that investments remain financially viable even in the early stages when demand is limited. Additionally, extend application deadlines for EU funding calls related to hydrogen infrastructure projects, allowing investors and developers more time to plan and implement projects in alignment with market demands. Consider offering risk assumption mechanisms to share the financial burden between public and private stakeholders, fostering greater confidence in hydrogen projects.

- **Make hydrogen accessible and competitive:** Create market conditions that make hydrogen an economically viable and attractive option. This involves federating the industrial offer, reaching sufficient scale and encouraging massification to lower costs. It is crucial to invest in R&I&D to address challenges related to materials, recycling and cost reduction. The competitiveness of hydrogen will be a key factor in its success as an energy transition solution.
- **Foster citizen acceptance and ownership at EU level:** Promote wide public awareness and understanding of hydrogen technologies and their benefits at European level. Ensuring citizens are well-informed and engaged is crucial for the acceptance and adoption of hydrogen mobility solutions.
- **Regional representation in governance structures:** Ensure that regional and local authorities have a seat at the table in relevant governance structures and decision-making bodies related to hydrogen policy and funding. This includes participation in the governance of EU initiatives like the [Clean Hydrogen Partnership](#). Regional representation including the regional and local authorities in these governance structures will allow the representation of diverse perspectives, expertise and local priorities in EU funding and decision-making processes.

By implementing these policy recommendations, European institutions can create a supportive regulatory framework that facilitates the deployment of hydrogen mobility while considering regional needs, driving innovation and ensuring public acceptance.

Funding-related recommendations:

- **Defining synergies:** Facilitate synergies between European, national and regional funds to support all aspects of hydrogen projects, with a particular focus on hydrogen mobility.
- **Developing funding schemes for hydrogen vehicles:** Currently, EU funding instruments such as Connecting Europe Facility (CEF) and its Alternative Fuel Infrastructure Facility (AFIF) are not supporting the regional and local authorities in acquiring hydrogen vehicles for urban, local and regional mobility. Addressing the funding gap is crucial for scaling up hydrogen mobility solutions from research and development to market deployment.
- **Supporting skills development:** Allocate funding through programmes such as Erasmus+, as well as European Partnerships like Clean Hydrogen Partnership to scale up projects focused on developing skills related to hydrogen, such as the Green Skills for Hydrogen initiative.
- **Funding for communication and public acceptance:** Provide funding for communication and public acceptance activities to engage citizens and ensure their active involvement in the transition to hydrogen mobility.

- **Public-Private Partnerships (PPPs):** Encourage collaborative initiatives between the public and private sectors to leverage public funding and private investment. PPPs can help share risks, combine resources, and drive the development of hydrogen projects through a shared funding approach.

RECIPROCITY case studies focusing on Hydrogen Mobility

Three RECIPROCITY case studies focusing on hydrogen mobility are analysed to give an overview of the key elements for hydrogen deployments and good practices at local levels.

H2 ABERDEEN (UK)⁵

Aberdeen City Council has taken big steps forward in embracing hydrogen as a renewable energy solution for public transport, recognising the need to diversify from its oil and gas-dependent economy.

With over a decade of experience in utilising hydrogen, the city has established itself as a pioneer in the field. Indeed, a significant portion of the UK's oil and gas workforce possesses transferable skills that can be harnessed in the renewable hydrogen sector. Aberdeen aims to capitalise on this potential by promoting hydrogen as a key driver of the energy transition.

The journey towards hydrogen mobility in Aberdeen began in 2013 when regional and local authorities made a deliberate decision to accelerate hydrogen use cases. Since then, the entire hydrogen ecosystem in North East Scotland has witnessed substantial growth, accompanied by numerous projects and demonstrations. Notable milestones include:

- The official **Hydrogen Strategy** in 2015.
- The creation of the “**H2 Aberdeen**” brand to structure its local hydrogen ecosystem and drive its renewable hydrogen agenda.
- The participation in the **first Europe's largest hydrogen bus trial**, which provided valuable insights and served as a successful use case for hydrogen mobility. While the buses have since been repurposed for training purposes, the project highlighted the unique challenges and opportunities associated with hydrogen adoption.

Aberdeen currently operates **two hydrogen refuelling stations (HRS)**, capable of delivering 130 kg/day and 360 kg/day, respectively. These stations support the refuelling needs of cars, vans, buses and larger vehicles, all powered by hydrogen derived from renewable sources. However, as the HRS approach the end of their lifespan, significant investments are required to replace crucial components, such as electrolyzers, with estimated costs ranging from £1.2 million to £1.5 million.

Moreover, the city has been a test case for the world's first hydrogen-powered double-decker buses, with 15 currently in service and ten more expected soon. While the project has been well-received by the community,

⁵ <https://www.aberdeencity.gov.uk/services/environment/h2-aberdeen>

ensuring sufficient hydrogen availability for the buses remains a challenge, further emphasising the critical role of infrastructure development.

Additionally, Aberdeen has implemented the “H2ICED Vehicles” program, converting diesel trucks to hydrogen fuel use and reducing CO2 emissions by up to 40%. This initiative enables the city to explore additional use cases for hydrogen and aims to retrofit 35 vehicles in 2023, contributing to a total fleet of approximately 100 vehicles.

Thanks to its extensive efforts, Aberdeen now boasts **one of the largest hydrogen fleets in Europe**. **Collaborating with various local partners**, such as the post office and health and social care organisations, Aberdeen has integrated hydrogen-powered vehicles into diverse sectors. The fleet includes road sweepers known for their reliability, efficiency, and quiet operation, as well as public-use cars and larger trucks. Moreover, the city has actively participated in research and development initiatives, such as the HECTAR Interreg project, and has even introduced hydrogen-powered cargo bikes to support clean last-mile deliveries.

Looking ahead, Aberdeen has exciting plans for further advancements in hydrogen mobility. In 2023, the city entered into a joint venture with BP, establishing the “**Aberdeen H2 Hub**”. This ambitious endeavour aims to provide low-cost green hydrogen refuelling stations by early 2025, facilitated by a large solar plant and wind farms for renewable energy generation. The project also envisions expanding hydrogen adoption to include trains, trucks, marine applications, and even the local heat network, ultimately positioning Aberdeen as a hydrogen exporter to the world.

To ensure continued progress, Aberdeen aims to strategically position itself to **deliver on regional and national ambitions**. The city intends to adopt **a regional approach to maintaining and developing hydrogen infrastructure**, enabling local hydrogen supply to support other regions, and facilitating regional demonstrations. Furthermore, Aberdeen seeks to foster collaborations and attract future projects.

With 89% fleet compatibility with zero-emission vehicles, of which 57% electric vehicles and 32% fuel cell vehicles by 2030, Aberdeen will play a crucial role in shaping the future of sustainable transportation. By leveraging its expertise, investing in infrastructure, and fostering collaborations, the city is paving the way for a greener and hydrogen-powered future.

HYCENTA (AUSTRIA)

HyCentA, Hydrogen Research Centre Austria, founded in 2005, is an independent research centre in Graz, Austria, based at the Graz University of Technology. It operates one of the most modern hydrogen research infrastructures in Europe with laboratories, test benches and hydrogen refuelling facilities and has comprehensive know-how in the field of safety, testing, approval, certification and legal frameworks of hydrogen technologies. The focus is on the production of renewable hydrogen by means of electrolysis and the storage of electricity surpluses in the event of a temporal and/or local oversupply of renewable energies (power-to-X).

Furthermore, work is being done on innovative storage technologies and fuel cells for the energy and fuel sector and on sustainable drive solutions for mobility with new fuel cells and storage systems. The topic of circular economy of hydrogen technologies and technological system optimisation for the use of renewable hydrogen is also a focus.

In addition, HyCentA also support politics and business in the preparation of concept and strategy analyses in order to efficiently translate complex issues into solutions and successfully position them on the market. HyCentA had and has several projects going on in the following fields:

- *Electrolyse and Power-to-X*
- *Green energy and industry*
- *Green mobility*
- *Circularity and system optimization*

At the beginning of 2023, HyCentA was promoted from a COMET project to a COMET centre in the COMET funding programme of the Austrian Funding Agency FFG. The COMET competence centres are financed by the federal government - specifically by the Ministry of Climate Protection (BMK) and the Ministry of Economic Affairs (BMAW) - and the federal states of Styria, Upper Austria, Tyrol and Vienna.

Further information about HyCentA can be found on their website: <https://www.hycenta.at/en/hycenta-austria>.

HY2.ZERO INNOVATION NETWORK (GERMANY)

The HY2.ZERO Innovation Network is accelerating the industrialisation of hydrogen and fuel cell technologies through new and improved solutions. This R&D initiative supports the transition towards greener alternatives and meet ambitious climate protection goals.

As the world strives to reduce CO₂ emissions, particularly in the transport sector, the need for alternative technologies has never been more pressing. By 2030, the goal is to cut CO₂ emissions in the transportation industry by 40% compared to 1990 levels. Achieving this target relies on the integration of alternative drives and energy sources, with hydrogen fuel-powered fuel cell vehicles emerging as a compelling solution.

The HY2.ZERO network unites experts from diverse fields in collaborative research and development (R&D) projects aimed at developing innovative solutions. These projects revolve around three main development topics:

1. **Fuel Cell Production Technologies:** Focuses on advancing the production of fuel cells, making them more efficient and cost-effective.
2. **System Components for Fuel Cells:** Concentrates on developing essential components that enhance the performance and durability of fuel cell systems.
3. **On-Site Hydrogen Generation Technologies:** Explores solutions for producing hydrogen on-site, addressing the challenge of hydrogen infrastructure.

The HY2.ZERO initiative actively promotes R&D projects by facilitating collaboration among experts and organisations. Its key activities include organising workshops, fostering the exchange of knowledge, technology, contacts, and ideas, conceptualising project ideas, forming project consortia, identifying suitable funding sources, coordinating with funding agencies, supporting ongoing projects, and providing direct access to cluster members and partners. The network also encourages joint application and demonstration projects to fast-track the development and deployment of hydrogen technologies.

In addition, to raise awareness and promote the adoption of hydrogen and fuel cell technologies, HY2.ZERO employs various marketing and public relations strategies:

- **Online Presence:** Articles about the network are featured on its website, social media platforms, flyers, newsletters, and relevant media outlets.
- **Industry Engagement:** The initiative actively participates in trade fairs, hosting workshops to engage with potential users and partners.
- **Networking Events:** HY2.ZERO organises networking events to foster collaboration and innovation within the hydrogen ecosystem.
- **Job Market Support:** The network utilises the online job market and the TechBase's Job Wall to connect talent with opportunities in the hydrogen sector.
- **Podcast HY2.ZERO:** A network podcast provides a platform for discussing the latest developments and insights in the world of hydrogen and fuel cell technologies.

FUEL CELL CARGO PEDELECS (FRANCE)

The rise of e-commerce has transformed the last-mile delivery landscape, with more people ordering goods online and receiving frequent but smaller parcels at their doorsteps. Cargo pedelecs, electric bicycles with cargo capacity, have emerged as a solution for last-mile delivery.

However, conventional batteries have limitations in terms of energy supply and performance at low temperatures, limiting the potential of cargo pedelecs. In contrast, zero-emission fuel cell technology offers greater energy capacity even in cold temperatures, fast refuelling, and improved durability at comparable costs. By replacing internal combustion engine vehicles, a fuel cell cargo pedelec (FCCP) can reduce CO₂ emissions by 5.5 tons annually.

[The Interreg North-West FCCP project](#) aims to harness the potential of FCCPs by developing an innovative logistics concept tailored to their performance characteristics, fuel cell technology advancements, and urban freight transport needs. The involvement of the cities is essential for the success of the project. Ultimately, the project seeks to integrate emission-free FCCPs into delivery chains, promote sustainable urban development, and provide valuable information to cities and the transport sector to reduce CO₂ emissions in European cities.

Issy-les-Moulineaux is a pilot partner in the project and is involved in the implementation and testing of two different fuel cell cargo pedelecs. These bikes have a storage capacity of around 1.5m³ and can carry loads of up to 250kg, making them a faster and more efficient means of transport. The city has equipped one of the bikes with a hydrogen system, extending its range and significantly reducing refuelling time to around 10-15 minutes. This initiative is in line with the wider objective of reducing emissions in the city's urban logistics and creating France's first hydrogen district.

GetHyGA (SPAIN)

[The GetHyGA initiative](#) is an action plan emerged from the Aragon Hydrogen Master Plan. Its objective is to create an industrial ecosystem, or Hydrogen Valley, in Aragon. It has been promoted by the Department of Industry, Competitiveness and Business Development of the Government of Aragon through the Foundation for the Development of New Hydrogen Technologies in Aragon (FHA).

It details actions that are based on the objectives of decarbonisation or electrification of those sectors that need to reduce or eliminate the carbon footprint of their activities and processes.

GetHyGA focuses on public-private cooperation and foresees a collaborative development through multiple partnerships between the actors involved (companies, energy and hydrogen sector, education and training institutions, R&D&I, public administrations, etc.). In particular, the project is expected to involve all parts of the value chain of the Aragonese industrial environment, from the production, transport and storage, to its final use as an energy vector for mobility or industrial purposes. The five main areas of GeTHyGA are energy and environment, reindustrialisation and industrial conversion, promotion of R&D&I, training, skills and talent, and definition of regional policies.

GetHyGA contributes to rebalancing economic activity and employment, reversing the trend of population decline in certain areas of the region and involving other regions and other EU countries.

The total budget of all the initiatives that constitute GetHyGA is 2,354 million euros, with an expected economic impact of 10,865 million euros over the next 15 years.

The GetHyGa initiative was launched in July 2021. This is the result of a year's work to define and evaluate each of the projects proposed by each of the companies. All these projects are defined in the project report, together with the main contacts of all the participating entities.

The main result achieved so far is the commitment of several entities (78) to the initiative, which is the basis for the development of a complete hydrogen ecosystem in Aragon.

H2PiyR (FRANCE & SPAIN)

[The H2PiyR](#) is a demonstration project that aims to connect the Pyrenean regions of Spain and France to central and northern Europe through a hydrogen refuelling infrastructure.

To this end, four topics have been analysed: the existing types of hydrogen refuelling stations (HRS), two types of on-site electrolyzers (alkaline and PEM), the possibility of supplying these electrolyzers with renewable energy, and finally, the deployment of two HRS in Huesca (Spain) and Pamiers (France). Two hydrogen fuel cell electric vehicles and ten hydrogen fuel cell electric bicycles are being refuelled in both HRS.

H2PiyR has adopted a working methodology with the aim of achieving its introduction in the regions concerned and ensuring its continuity in the short term. Firstly, in the planning phase, the project carried out an in-depth analysis of the constraints that represent a barrier or, on the contrary, an opportunity in the H2PiyR regions and that affect the construction of the HRS. Secondly, the construction of the HRS was initiated. Finally, the demonstration and implementation of HRS and hydrogen vehicles was carried out.

The impacts of the project were quantified in environmental and socio-economic terms. The main stakeholders and beneficiaries of this project were the entities in the regions involved that gained experience in hydrogen infrastructure, as well as the regions themselves, which deployed their first HRS and hydrogen vehicles deployed.

H2PiyR is a successfully implemented project (1.6 million euros) that can serve as a model for developing and expanding hydrogen infrastructure and mobility in other regions. The methodology, results and lessons learnt from H2PiyR can be transferred to other regions that are in an initial phase of HRS infrastructure deployment or even in a higher penetration phase. The technical validation results can serve as a starting point for decision

making in HRS deployment projects. In addition, the impact reports provide a basis for learning about the nature of mobility, its technical feasibility and its positive environmental impact.

5. Mobility as a Service (MaaS)

Assessment of Policy (regulatory/administrative requirements)

As outlined in the [European Commission's \(EC\) New Urban Mobility Framework](#), cities still face major challenges to further improve mobility and transport system and their negative impact on the environmental quality and attractiveness of cities.

Traffic congestion is a significant challenge in urban and peri-urban areas, with clogged roads causing delays and stress for drivers. According to the EC's Directorate-General for Mobility and Transport (2019), the delay costs caused by road transport in the EU-28 amounted to some 271 billion € in 2016, with 74% of these costs related to road passenger transport. Additionally, the heavy use of conventional vehicles contributes to **air pollution and greenhouse gas emissions**, which have a negative impact on the environment and human health. It is estimated that 23% of transport CO₂ emissions occur in cities⁶. Moreover, the **accessibility and inclusion** of mobility services are crucial issues, as individuals with reduced mobility and other vulnerable groups may face difficulties in accessing public or private transport options. Also, the **inefficient use of transport resources**, such as underutilised vehicles and wasted energy, poses economic and environmental challenges. Finally, **the lack of integration between different modes of transport** further exacerbates the problem, making it challenging for users to plan multi-modal trips efficiently.

Innovative solutions are required to promote the use of sustainable means of transport by the citizens, encouraging vehicle sharing, improving accessibility also from peri-urban areas and facilitating multimodal journey planning.

Mobility as a Service (MaaS) aims to address those challenges and contribute to the EC Urban Mobility framework's objective of "Attractive public transport services, supported by a multimodal approach and by digitalisation" by shifting from personally owned modes of transport towards mobility provided as a service. This approach has garnered support from various stakeholders throughout the European Union, as it offers a potential solution to improve accessibility, sustainability and the overall quality of urban and peri-urban mobility services.

Through **the integration of various transport modes into a single digital platform**, MaaS provides users with a wide range of transport options, allowing them to easily plan and book tailored multimodal journeys according to their needs.

⁶ "The first and last mile – the key to sustainable urban transport. Transport and environment report 2019", EEA Report, No 19/2019 <https://www.eea.europa.eu/publications/the-first-and-last-mile>

This promotes the **more efficient use of transport resources** by reducing the number of vehicles on the road and alleviating traffic congestion.

Furthermore, MaaS encourages the adoption of **more sustainable means of transport**, such as electric or low-emission vehicles, thereby helping to reduce air pollution and greenhouse gas emissions, in line with the EU Green Deal, which aims to make European climate, energy, transport and taxation policies fit for the purpose of reducing net greenhouse gas emissions by at least 55% by 2030.

By facilitating access to diverse transport options, MaaS also improves **accessibility and inclusivity**, enabling people with reduced mobility or disabilities to benefit from transportation solutions that meet their specific needs.

Finally, MaaS facilitates **the planning of multimodal routes**, allowing users to efficiently combine different modes of transport, reducing travel times and improving the overall travel experience.

Mobility as a Service (MaaS) integrates different transport modes and services into a seamless and on-demand mobility experience. It is built around a single account that allows users to access information, make reservations and purchase tickets across different modes. MaaS combines public transport, ride-sharing, bike-sharing and more, providing a comprehensive view of options through a digital platform. It offers a user-centric approach and simplifies the management of transport demand for a more convenient travel experience.

MaaS in Europe has gained significant momentum and interest in recent years. Some cities and regions have implemented pilot projects and MaaS services⁷ to provide integrated transport solutions to their citizens:

- **Regiomove** in Germany aimed to connect public and private mobility service providers through a single app, allowing passengers in the Karlsruhe region (Baden-Württemberg) to plan, book and pay for various transport options, while also establishing a legal framework and creating mobility hubs.
- The **DOMINO project** in Austria focused on developing an integrated and accessible mobility system that supports the public sector's climate goals, with a focus on user needs, cooperation between sectors and the integration of rural mobility services.
- The **Trento and Rovereto Viaggia Play&Go** project in Italy incentivised sustainable mobility by creating a game-based app that tracked and rewarded users for their integrated and multimodal trips, resulting in over 240,000 sustainable kilometers covered.

However, despite progress, there are still significant challenges related to the integration and widespread use of MaaS. One of the main obstacles is the **fragmentation of services and transport providers**. Integrating different transport modes requires collaboration and cooperation among public and private operators, which can be challenging to achieve.

Another key barrier to MaaS adoption is the **lack of quality, limited functionalities and generic offerings**. This can be addressed by providing multiple interoperable offerings tailored to customers' needs. Analysing mobility patterns and segments helps to fulfil the specific requirements of user groups and improve the overall customer experience, driving acceptance of the MaaS concept.

Additionally, there are issues related to **data and payment system standardisation**, which need to be resolved to ensure a seamless MaaS experience. Some users may be hesitant to adopt MaaS due to a lack of awareness, preference for personal modes of transport, or concerns about **data security and privacy**. Furthermore, MaaS

⁷ See Annex - RECIPROCITY Case studies focusing on MaaS.

may not be **economically accessible** for all, with subscription or usage costs that can be a barrier for some individuals.

Overcoming these issues requires political commitment and adequate regulation to foster service integration, data openness and economic accessibility. At the same time, it is crucial to educate and engage users, providing clear information about the benefits of MaaS and data security while ensuring privacy protection.

Linkages with EU funding and financing schemes

Investments in MaaS solution still need public funding either through federal/national funding programs focusing on cooperative projects or on sustainable mobility shift, or through EU funding program. Historically, the primary provider of EU funding for sustainable local transportation initiatives has been the European Structural and Investment Funds (ESIF), including the [European Regional Development Fund](#) and the [Cohesion Fund](#).

For the 2021- 2027 period, at least 8% of ERDF will be allocated to sustainable urban development projects based on cities' development strategies and their trajectories towards a climate-neutral economy. Cohesion Fund's flagship support areas include supporting intermodality and strengthening urban and regional public transport, where the deployment of MaaS solutions perfectly fits. As part of the ERDF, the Interreg instrument allocated resources to EU cross-border projects and territorial cooperation. Interreg encompasses a range of initiatives, referred to as "strands," which include activities such as facilitating cross-border mobility between adjacent regions. These efforts aim to foster cohesive and integrated regional development among neighboring territories, both on land and in maritime border areas, constituting part of Interreg A and accounting for 72.2% of the total available resources. The co-financing rate for each Interreg program level is capped at a maximum of 80%, with the possibility of reaching up to 85% for outermost regions. Other program such as Interregional Innovation Investment (I3), or the European Urban Initiative calls for proposal could also support the deployment of MaaS projects.

A part of the capital costs is usually covered by private investment from the solution providers.

Policy Recommendations

As MaaS continues to gain momentum and become an integral part of the mobility landscape, it is important to ensure that it is implemented in a way that **benefits both users and providers**.

Policy recommendations have been developed through discussions with MaaS experts who are aware of the challenges and opportunities associated with the implementation of MaaS solutions. By taking into account different perspectives and experiences⁸, these recommendations provide a comprehensive set of guidelines for

⁸ The document includes the outputs from the following project activities: [RECIPROCITY Mobility Assembly in Barcelona \(16/11/2022\)](#); [RECIPROCITY Webinar: Mobility as a Service \(MaaS\) \(27/06/2022\)](#); ERRIN Transport Working Group Meeting on Multimodal Digital Mobility Services (MDMS) (23/01/2023); [RECIPROCITY Capacity Building Workshop – Linz Mobility Mission \(30/03/2023\)](#).

local and regional public authorities, European institutions and MaaS providers to create an environment that fosters sustainable and innovative mobility solutions.

For local and regional authorities:

- Include **the right set of mobility policies and regulations** within a broader mobility vision to facilitate the deployment of MaaS.
- Ensure that MaaS services are **accessible to all**, including people with disabilities, low-income communities and those living in remote areas (e.g. peri-urban and rural areas).
- Encourage the adoption of MaaS by offering **incentives and subsidies** for their use to encourage behavioural change and reduce reliance on private vehicles.
- Develop a **framework for data privacy, protection and exchange** to ensure that users' personal information is not misused.
- **Invest in infrastructure**, such as mobility hubs, to enhance multimodal customer accessibility and experience.
- Consider the **environmental impact of MaaS services** and aim to minimise their local carbon footprint.
- **Collaborate with the private stakeholders** to develop innovative business models and new services based on the users' needs (e.g., by establishing a legal framework between the local authority, the transport operators, the customers, and mobility service providers).
- **Avoid bottlenecks and monopolies** and the development of closed systems.

For European Institutions:

- Establish clear regulations for **the quality and safety** of mobility services offered through MaaS platforms.
- Establish a **supportive framework for the development and replication** of MaaS solutions at the local and regional levels.
- **Harmonise regulations and standards** across different European countries to enable interoperability and seamless cross-border mobility.
- Provide **financial support and incentives** for the implementation and replication of MaaS projects. In particular, provide some of the **initial investment** needed to kick-start the ecosystem, taking into account equity, sustainability, the benefits to the local and regional economy and job creation benefits that MaaS deployment will bring.
- Facilitate **data sharing** and **collaboration among different stakeholders** to promote MaaS innovation and improve user experience.
- Foster **research and development** in MaaS technologies and solutions to drive continuous improvement and innovation in the sector.

For MaaS providers:

- Adopt a true **need- and experience-based approach**: Customers' needs should be understood and taken into consideration in order to improve the customer experience and encourage the adoption of the MaaS concept.
- Include in the app/platform the **one payment system** for all the transportation modes and allow a **single account** for multimodal bookings. **Adapt pricing models** to align with the flexible and multimodal nature of MaaS services.
- **Collaborate** with other transport providers to offer integrated and seamless mobility options.
- **Invest** in the necessary infrastructure and technologies to support MaaS integration. Budget the costs associated with **digitalisation** and implement it incrementally to support the deployment and operation of MaaS services.
- Engage with MaaS providers and participate in **pilot projects** to gain insights and experience in delivering integrated mobility services.
- Include **parking**, as well as park and ride options, in the MaaS system.
- Incentivise MaaS behaviour through **gamification and nudging**.

It is essential for all stakeholders to work collaboratively and proactively to address the challenges and embrace the opportunities of Mobility as a Service. By implementing these policy recommendations, it will be possible to create a sustainable and user-centred mobility ecosystem that benefits individuals, local communities and the environment.

RECIPROCITY case studies focusing on MaaS

Three [RECIPROCITY case studies](#) focusing on MaaS are analysed to give an overview of the key elements for MaaS deployments and good practices.

Trento and Rovereto viaggio Play & Go (ITALY)⁹

Getting around Trentino is a **child's game**, according to the application's website: "Play&Go - High School Challenge" is a competition between high school classes (third, fourth and fifth) as part of the **Trento and Rovereto Play&Go** sustainable mobility campaign.

In order to participate in the game, the students download the **Viaggia Play&Go app**, register themselves and create their own teams in order to track their sustainable travels and receive green leaves points. The team with the highest number of Green Leaves points, calculated as an average value over the team members, wins. The

⁹ <https://www.smartcommunitylab.it/playgo-high-school-challenge/> ;
<https://play.google.com/store/apps/details?id=it.smartcommunitylab.viaggiatrento.playgo&hl=fr&gl=US>

winning team have the chance to play a match with a local top-level sports team. All students of the 2020 winning team **received free season tickets for provincial public transport** for the 2020/2021 school year.

It is important to mention that **Trento and Rovereto Play&Go** is a game based on the use of an App that allows tracking the movements made in **integrated and multimodal mobility hubs** (car, bus, train, bike, walking and combinations of these) and assigns points and prizes based on the movements correctly recorded. In order to enable the game to take place, it is necessary **to collect and process the information** on planned and saved trips, the tracking of trips made via the **Viaggia Play&Go** app and the results of the game. Personal data are processed in **full compliance with current privacy legislation**. The Municipality of Trento, with the support of the Bruno Kessler Foundation (FBK), organised the game as an effort to promote the sustainable mobility campaign led by the municipality.

The game results in numbers: The '**Trento and Rovereto Play&Go**' app recorded over 240,000 sustainable kilometres between 26 October 2019 till 15 May 2020 (8 months). FBK announced on their website¹⁰ that “Trento and Rovereto Play&Go had a setback between mid-March and mid-June due to the limitations imposed by the Covid emergency. The numbers, however, confirm the interest in the game: 738 registered users, 505 active ones, 55,506 total valid trips, and 240,009 sustainable kilometres covered throughout the province. Of these, there were 50,963 km by bike, 13,459 journeys by bike, 65,813 km by bus, 11,153 journeys by bus, 66,929 km by train, 3,352 journeys by train, 56,304 km by foot, 26,753 journeys by foot, 475 km per active user (there were 426 in the previous edition). The greatest number of kilometres was travelled in the pre-lockdown period (201,028 km, 678 registered users, of which 477 were active).”

The municipality of Trento, with the support of FBK, succeeded in **incentivising MaaS behaviour** through **Gamification and nudging**, which are examples of motivational techniques to be used with rewards as an incentive for recognised good travel behaviour.

Regiomove (GERMANY)¹¹

Regiomove¹² aims to connect public and private mobility service providers to enable passengers to benefit from a homogeneous chain of mobility services over the Karlsruhe region, integrated into one unique source. It provides a bunch of mobility services connecting 7 cities in the region and, for instance, allows to identify alternative solutions when there is an accident. In other words, passengers are able to make itinerary planning, reservation and payment through one single app: the **Regiomove App!**

The development of **Regiomove** relied on 3 pillars:

The PACT: establishing the **legal framework** between the city/the transport operator, the customers and the Mobility service providers. The PACT also includes the payment system and the IT service provider to define which tariff can be implemented in the platform.

The development of the **Regiomove app Platform** includes multimodal real-time information, a single account for multi-modal booking, and one payment for all services.

¹⁰ <https://magazine.fbk.eu/en/news/trento-e-rovereto-playgo-oltre-240-mila-km-sostenibili/>

¹¹ <https://www.kvv.de/mobilitaet/regiomove.html>

¹² <https://www.regiomove.de/fuer-kommunen>

The creation of the Regiomove Ports, which are mobility hubs where passengers have a variety of choices when it comes to transportation means in one single place. The **Regiomove** ports integrate different services, for example, it might have information terminals, electric charging stations, bicycle service stations or conditioning stations - everything is conceivable.

The state of Baden-Württemberg (Germany) and the European Regional Development Fund (ERDF) funded the Regiomove project with its three pillars as a lighthouse project of TechnologieRegion Karlsruhe GmbH with around 4.9 million euros.¹³

DOMINO (AUSTRIA)¹⁴

The main objective of the **DOMINO** research project is **to develop an integrated, publicly accessible mobility offer**. It can be used by all users with as few barriers as possible and, at the same time, supports the mobility and climate goals of the public sector.

In three pilot regions, new offers have been created based on user needs and existing services to be integrated into a "MaaS made in Austria" system.

To achieve these goals, DOMINO relies on three innovation fields:

- 1. Social:** The needs of mobility users are in the focus and the starting point for designing the offer.
- 2. Institutional and organisational:** New forms of cooperation between the public sector and players in the private sector will be defined and regulated.
- 3. Technical:** The focus is on the integration of rural mobility services (micro-transit, ride-sharing, etc.), the development of intermodal traffic **management** and the development of algorithms to ensure a "mobility service guarantee".

¹³ <https://www.kvv.de/mobilitaet/regiomove/zum-projekt-regiomove.html>

¹⁴ <https://www.domino-maas.at/de/projekt-domino>

6. Micro-mobility

Assessment of Policy (regulatory/administrative requirements)

REGULATORY FRAMEWORK:

The existence of different regulations on micro-mobility across countries poses significant challenges. **The lack of harmonisation** makes it difficult to effectively regulate micro-mobility services and create a cohesive framework for their operation. Each country has its own set of rules and requirements creates complexities for service providers and users, impeding seamless operations and cross-border mobility.

Standardised guidelines would not only simplify the regulatory landscape but also foster trust and confidence in micro-mobility services. They would ensure that providers and users understand the rules and expectations, promoting compliance and responsible usage of these modes of transportation.

Moreover, standardised guidelines would enable better cooperation and knowledge sharing among member states, allowing for the exchange of best practices and lessons learned. This **collaborative approach** would contribute to developing effective regulatory frameworks and support the growth of sustainable and innovative micro-mobility solutions across Europe.

6.1.1.1. e-scooters market entry

The absence of a common regulation specifically for e-scooters providers to enter cities poses a significant challenge. Currently, each city and municipality has the autonomy to determine its own approach, which creates difficulties, particularly for smaller and medium-sized cities lacking the necessary experience. Consequently, these cities often rely on the decisions made by e-scooter providers regarding market entry. Although providers can voluntarily sign a self-commitment declaration, its non-binding nature renders it more of a discretionary gesture rather than a substantial requirement. Addressing this issue is crucial to establish a more structured and consistent framework that ensures fair and transparent processes for MaaS providers across all cities.

The case of Germany: The current regulatory framework in Germany allows scooter providers to deploy their services in cities without sufficient means to regulate or control their presence. This lack of oversight creates challenges, as seen in cities like Konstanz, where an excessive number of scooters were introduced, leading to dissatisfaction among providers, the city and its citizens. Such situations undermine efforts to foster acceptance and trust in micro-mobility solutions. It is essential to address this issue by implementing robust regulations that balance accommodating micro-mobility services and ensuring their responsible deployment, ultimately enhancing acceptance and trust among all stakeholders involved.

The case of the UK: In the UK, the regulation of micro-mobility is more advanced and beneficial for both cities and providers. Cities have a structured approach, launching a call for tenders that allows them to set specific requirements, such as a maximum number of scooters per square kilometer or a limit on the number of providers in a city. This approach gives cities greater control over micro-mobility operations. At the same time, it offers advantages to providers by providing them with a sense of security and predictability in their planning processes. This balanced regulatory framework fosters collaboration between cities and providers, enabling effective micro-mobility management while ensuring a conducive environment for sustainable urban transportation.

The case of Turkey

In Turkey, bicycles have been used as a means of transportation for years. In 2019, the Ministry of Environment and Urbanisation published the 'Bicycle Paths Regulation,' thus establishing the legal framework for bicycle paths. However, the demand for e-scooter usage emerged with the entry of the first vehicle-sharing service company into the market in 2019. In response, the Ministry of Transport and Infrastructure, Environment and Urbanisation, and the Ministry of Interior published the 'Electric Scooter Regulation' in the Official Gazette. This regulation includes speed and age limits, parking and traffic rules, and requirements for shared e-scooter operations, authorisation certificates, and permits.

Additionally, local authorities have the authority to establish their own rules. For instance, the Istanbul Metropolitan Municipality's Transportation and Coordination Center (UKOME) reduced the speed limit within Istanbul from 25 kilometers per hour to 20 kilometers per hour as of December 1, 2022. Furthermore, the Istanbul Metropolitan Municipality (İBB) announced on April 3, 2023, that a new action plan regarding e-scooter usage will be implemented. According to this new e-scooter action plan, areas with heavy pedestrian traffic will be designated as 'sensitive zones,' the speed limit in these areas will be set at 12.5 km/h. Additionally, 1,500 parking areas will be established in various locations in Istanbul, and users will be exempt from the initial fee when they leave their e-scooters in these designated areas, allowing them to benefit from discounted payments. Users will also receive training from operators every two months, and operator mobile applications will integrate with IstanbulKart, facilitating integration with public transportation solutions over time.

6.1.1.2. Parking areas

The lack of designated parking for e-scooters and bicycles in cities poses several problems. Without dedicated parking spaces, these micro-mobility vehicles often end up scattered across sidewalks, blocking pedestrian pathways and causing inconvenience to pedestrians and other road users.

The Istanbul Metropolitan Municipality has developed an exemplary application in this regard. In the pilot district of Kadıköy, they designed 52 parking areas. As a result of the efforts, four streets in Kadıköy were identified as pilot parking areas where scooter usage is concentrated. A total of 52 parking areas were established, with 17 on Bağdat Avenue, two on Tütüncü Mehmet Efendi Street, seven on Ethem Efendi Street, and 26 on Fahrettin Kerim Gökay Avenue. However, these parking spots have somewhat deviated from their purpose and have started to be used as locations where companies providing e-scooter-sharing services store their vehicles. When looking at any parking spot, it can be observed that it is almost filled with these companies' vehicles at all hours of the day.

The absence of proper parking infrastructure leads to irregularly parked e-scooters and bicycles, resulting in visual clutter and **potential safety risks**.

Furthermore, the absence of designated parking areas makes it challenging for users to find available spaces to park their e-scooters or bicycles properly. This can **discourage individuals from using these sustainable modes of transportation**, as the uncertainty of finding suitable parking areas **undermines the convenience and efficiency of these mobility options**.

The lack of parking areas also hampers the possibility for cities to manage and regulate micro-mobility services effectively. Without clearly defined parking zones, it becomes difficult for city authorities to enforce parking regulations, monitor compliance, and address issues related to improper parking.

Moreover, the lack of clear rules and guidelines for reporting and punishing violations related to micro-mobility creates several problems. Without well-defined procedures in place, there is confusion and inconsistency in how these violations are handled, leading to a lack of accountability and enforcement.

One of the main issues is the **difficulty in reporting violations**. The absence of a standardised process makes it challenging for individuals to report incidents such as improper parking, reckless riding, or other infractions related to micro-mobility. This lack of clarity can result in frustration and a sense of helplessness among citizens who witness or experience these violations.

Additionally, the absence of clear rules for **punishing violations** hampers the effective enforcement of regulations. Without established penalties and consequences for misconduct, there is little deterrent to prevent individuals from engaging in irresponsible behaviour while using micro-mobility vehicles. This can lead to increased risks for both users and other road users, compromising safety in urban environments.

The absence of clear rules regarding reporting and punishment also undermines the perception of fairness and justice, potentially leading to challenges in garnering public acceptance of these sustainable modes of transportation.

SOCIETAL ASPECTS:

The lack of proper awareness among citizens on the correct usage of micro-mobility vehicles poses several problems. Without adequate information, individuals may not be aware of the guidelines for safe and responsible use of e-scooters and bicycles.

One issue is the potential for **accidents and injuries**. Without proper guidance, users may not understand the importance of following traffic rules, yielding to pedestrians, or wearing appropriate safety gear. This can result in a higher risk of accidents, both for the riders themselves and for others sharing the road or sidewalk.

Another problem is the negative impact on the overall **perception of micro-mobility**. Irresponsible behaviour, such as riding on sidewalks, ignoring traffic signals or parking inappropriately, can create conflicts and tensions with pedestrians and other road users.

Additionally, **users as well as decision-makers may not be aware of the environmental benefits and the importance of sustainable transportation**. They may not understand the role of micro-mobility in reducing congestion, improving air quality, and promoting a greener city. This lack of awareness hampers efforts to encourage the adoption of these sustainable transportation options.

Links with EU funding and financing schemes

See Chapter 5 “Mobility as a Service (MaaS)” – sub-chapter “Linkages with EU funding and financing schemes”.

Policy Recommendations

For local and regional authorities:

- Municipalities should establish maximum thresholds for the **number of operators** and vehicles operating within their jurisdiction.
- Local authorities can consider implementing a policy requiring operators who provide services under their own account to pay special use **fees**. These fees can contribute to the sustainable management of micro-mobility operations within the city. However, in the case of subsidised offers aimed at promoting affordability and accessibility, the obligation to pay special use fees could be avoided. This approach strives to strike a fair balance between the financial sustainability of micro-mobility services and the facilitation of subsidised initiatives that benefit the community.
- Local authorities should mandate operators to fulfil **specific requirements** contributing to the effective and responsible operation of micro-mobility services. These requirements include:
 - Provision of real-time data: Operators must be obligated to share real-time data on vehicle availability, locations and usage patterns. This enables transparency and facilitates better urban planning and mobility management.
 - Compliance with response times for reports of incorrectly parked vehicles: Operators should be required to promptly address reports of improperly parked micro-mobility vehicles. Defined response times will help ensure timely resolution, maintain pedestrian safety and reduce obstruction.
 - Free hotlines in local languages: Operators must establish free hotlines accessible in local languages, allowing users and the public to report issues, seek assistance, and receive relevant information. This ensures effective communication channels for addressing concerns and providing support to users.

Parking areas:

- To effectively manage e-scooter and bicycle parking, it is recommended to implement different strategies for the city centre and the rest of the areas. While a free-floating approach is the best solution throughout the city, in city centres, it is crucial to designate spacious parking areas to ensure optimal functionality, considering the potential limitations of GPS signals in crowded urban environments. These parking areas should be properly marked and signposted, following standardised guidelines. (e.g. Cities like Göppingen, Marburg, and Tuttlingen in Germany have successfully implemented such designated parking areas in their city centres.)



Figure 1 - RECIPROcity Helsinki Mobility Mission - © Anne Häner

- Integrating bicycle and e-scooter parking within the same designated areas has proven to be a successful approach. This consolidation promotes efficient use of available space while enhancing user convenience. To maintain the advantages of e-scooters, it is recommended to have a parking area available every 100-150 meters within city centres. This distribution ensures that users can easily locate and park their vehicles without compromising the accessibility and benefits offered by e-scooters.



Figure 2 - Dockless Scooter Station Sign © NPS Photo

Reporting and punishing violations:

- To ensure efficient handling of parking offences, it is essential for public local authorities to establish a **standardised process for reporting and punishing such violations**. A key aspect is the implementation of a direct communication channel between citizens and e-scooter/bicycle providers to streamline the reporting process. This direct line of communication will eliminate delays associated with reporting through the city and enable swift action to address parking offences.

- To ensure a fair and effective enforcement process, it is recommended to **establish a standardised approach for handling penalties in the micro-mobility sector**. Currently, providers face challenges in forwarding parking tickets to users due to the lack of address collection during registration. To address this issue, it is recommended that providers implement a penalty system that holds users accountable for their parking violations. To ensure a level playing field and facilitate address collection, all micro-mobility providers should be required by regulation to collect users' addresses during the registration process. This would eliminate the competitive disadvantage faced by individual providers, who would ask during registration for more detailed contact data, and enable penalties issued for the purpose of collecting funds to be rightfully passed on to the individuals responsible for the violations.

Public acceptance and awareness:

- It is essential to prioritise citizen awareness regarding the proper use of micro-mobility vehicles, especially when it comes to parking or driving. Educational campaigns involving schools can provide guidance on safety practices, traffic rules, and responsible behaviour.
- By fostering a culture of informed and responsible micro-mobility use through communication campaigns, cities can enhance safety, minimise conflicts and promote a positive perception of these sustainable means of transportation.

Safety:

- To increase the societal acceptance and usage of micro-mobility systems, enhancing the perception of safety regarding these vehicles is essential. Micro-mobility vehicles lack protective environments like the body of motorized vehicles, which means that accidents involving them can result in much more severe consequences. When they share sidewalks with pedestrians, their speeds are significantly higher than those of pedestrians, increasing the risk of interaction and accidents. Therefore, these vehicles must have dedicated paths to reduce the risk of accidents.
- It is also crucial to make various protective equipment mandatory to enhance the safety of micro-mobility systems. Reflective clothing, especially during evening hours, can increase drivers' visibility using these vehicles, reducing the risk of accidents. Equipment such as helmets, knee pads, elbow pads, and wrist guards will also reduce the severity of potential consequences in case of an accident.

For European Institutions:

- Integrate micro-mobility into **Sustainable Urban Mobility Plans (SUMP)**s as an enabler for creating cleaner, less congested, more inclusive and livable cities.
- By implementing **standardised guidelines at the European level**, many current difficulties could be overcome. A unified approach to regulating micro-mobility would provide clarity and consistency for all stakeholders involved. It would facilitate cross-border operations, enhance interoperability and promote a more integrated and efficient mobility ecosystem throughout Europe.

e-scooters market entry:

- It is strongly recommended that EU institutions take proactive steps to **address the lack of EU-wide regulation regarding the establishment of e-scooter businesses in cities and municipalities**.

While acknowledging the autonomy of cities in making their own decisions, it is essential to provide guidelines on "how to enter a city's e-scooter market." These guidelines would offer recommendations to cities on managing the situation, including the selection of providers and related considerations.

- Moreover, it is crucial to **involve regional and local authorities but also scooter service providers** in the formulation of these guidelines through collaborative efforts with policymakers.
- By publishing these guidelines, EU institutions can ensure transparency, consistency, and fairness in the e-scooter market, promoting sustainable and harmonious urban mobility across the European Union.

For micro-mobility providers:

Reporting and punishing violations

- Providers should introduce measures such as a point system, penalty deductions from users' accounts, or temporary account suspensions as deterrents for repeated offences. However, it is important to note that providers should bear the responsibility of paying the penalties initially, at least proportionally, as the vehicle owners.

Data sharing

- Providers should be encouraged to share usage data collected from their systems with central and local governments and research institutions. It will enable more efficient efforts to improve the transportation system's performance.

7. Annex – European funding schemes for mobility

CONNECTING EUROPE FACILITY (CEF)

The CEF is a key EU funding instrument to boost investment across the EU in transport, energy and digital infrastructure projects for greater connectivity. The programme also aims to contribute to an efficient, interconnected and multimodal TEN-T network and infrastructure for smart, interoperable, sustainable, inclusive, accessible, safe and secure mobility.

[CEF](#) provides funding for projects aimed at improving the European transport infrastructure, including intelligent transport systems (ITS) and the development of autonomous and connected vehicles. This programme aims to enhance the efficiency and safety of transportation networks.

In addition to grants, the CEF offers financial support to projects through innovative financial instruments such as guarantees and project bonds. These instruments create significant leverage in their use of EU budget and act as a catalyst to attract further funding from the private sector and other public sector actors.

HORIZON EUROPE

The EU's flagship research and innovation programme, which included funding opportunities for projects related to autonomous vehicles and intelligent transport systems. It supports collaborative research and development projects, often in partnership with industry stakeholders:

- EU's key funding programme for research and innovation (TRL 2-8).
- It tackles climate change, helps to achieve the UN's Sustainable Development Goals and boosts EU competitiveness and growth.
- Three main types of projects: RIA (TRL 3-6), IA (TRL 5-8), Coordination & Support Actions (CSA).

Horizon Europe Cluster 5, which focuses on 'Climate, Energy and Mobility', is dedicated to accelerating the shift towards environmentally friendly and digitally advanced solutions. This effort involves various collaborative partnerships in the field of transport, including co-programmed partnerships such as 'Connected, Cooperative and Automated Mobility'.

Notably, the EU Missions represent a novel approach within the EU's research and innovation programme. One of these missions is 'Climate-Neutral and Smart Cities,' which engages local authorities, citizens, businesses, and investors in the ambitious goal of establishing 100 climate-neutral and smart cities by the year 2030. To support this Mission, the Mission Platform will provide essential technical, regulatory, and financial assistance

to cities. This assistance will include investments in research and innovation endeavours spanning mobility, energy, and urban planning.

INTERREG PROGRAMMES

Through the different [Interreg programmes](#) (€8.1 billion (2021-2027, MFF)) it is possible to finance transport mobility projects, especially those developed in TRLs 6-7.

The financial instruments for these programmes, which are part of the Regional Development Fund, are grants and the co-financing rate at each Interreg programme level is set at a maximum of 80%, with up to 85% for outermost regions. Of these, the cross-border (60 programmes) and transnational (15 programmes) cooperation programmes are the most suitable for working on mobility projects close to the market.

Interreg projects often serve as test platforms for innovative solutions in the field of infrastructure and establish interesting public-private partnerships.

INTERREGIONAL INNOVATION INVESTMENTS INSTRUMENT

The [Interregional Innovation Investments Instrument](#), as part of the European Regional and Development Fund (ERDF), aims at supporting interregional innovation projects in their commercialisation and scale-up phases giving them the tools to overcome regulatory and other barriers and bring their project to investment level.

The European Commission will implement two call strands. However, the first of which will enable the funding of real mobility investment projects:

1. Financial and advisory support for investments in interregional innovation projects;
2. Financial and advisory support to the development of value chains in less developed regions.

Investment projects may include test-bed and post-prototyping activities, validation and testing in a real environment, as well as commercialisation activities leading to innovative ideas and products.

Projects can receive a budget of €10 million euros with 70% co-financing, and must be in line with the S3s of the participating regions.

INNOVATION FUND

The [Innovation Fund](#) fills the funding gap often encountered in research and development (R&D) projects typically supported by programmes such as Horizon 2020 or Horizon Europe. This funding bridge helps emerging technologies, such as autonomous mobility and drones, to move from early-stage development to commercial viability.

These are real investment projects with significant innovation and capital investment. The formation of a consortium is not mandatory, but remains an option for applicants. The primary focus of the Innovation Fund includes:

- Demonstration of innovative low-carbon technologies.

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- Supporting projects with a Technology Readiness Level (TRL) of 8 or higher, which fund the initial industrial application of a technology (often referred to as "first-of-a-kind" projects) or technologies that have not yet reached commercial availability.
- The Innovation Fund provides financial support of up to 60% of the costs associated with innovation activities. The funding rate depends on the expected emission reductions.

The Innovation Fund conducts multiple calls for proposals on a regular basis:

- Large-scale projects with a capital expenditure (CAPEX) exceeding €7.5 million: The first call was launched on 3 July 2020, and subsequent calls will be launched in the second half of each year.
- Small-scale projects with CAPEX less than €7.5 million: The first call was launched on 1 December 2020, and new calls will be opened by the European Commission (EC) in the first half of each year.

EUROPEAN INVESTMENT BANK (EIB)

The EIB has a specific [line](#) for financing transport projects, including urban transport, aviation and innovative mobility.

The goal of the EIB is to accelerate the adoption of sustainable transport solutions by attracting private investment while ensuring balanced regional development. In addition to financing, the EIB provides technical assistance and advice.

The EIB supports projects through loans (min. €7.5 million (typically > €25 million), guarantees and quasi-equity and covers infrastructure and asset costs (e.g. vehicles), project preparation and implementation costs.

Through the [Cleaner Transport Facility](#) (CTF) initiative, EIB specifically supports the deployment of cleaner transport vehicles and related infrastructure needs, such as charging and refuelling.

RECIPROCITY (Replication of innovative concepts for peri-urban, rural or inner-city mobility), coordinated by R-Tech Regensburg (Germany), involves 10 partners including clusters, regional development agencies, innovation accelerators and universities. The project started in February 2021 and will run for 32 months.



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[RECIPROCITY project](https://www.linkedin.com/company/reciprocity-project)



www.reciprocity-project.eu



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