![UPPER - Unleashing the Potential of Public Transport in Europe]

D2.2 Diagnosis of PT in living labs, measures refinement and expected impact

WP2 User needs, baselines definition and project requirements

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List of abbreviations and acronyms

Abbreviation/Acronym	Meaning
AI	Artificial Intelligence
CINEA	European Climate, Infrastructure and Environment Executive Agency
CSA	Coordination and Support Action
EC	European Commission
ECF	European Cyclists' Federation
EIT UM	EIT Urban Mobility
EPF	European Passengers' Federation
IFP	International Federation of Pedestrians
ITS	Intelligent Transport Systems
MaaR	Mobility as a Right
MaaS	Mobility as a Service
NCC	Noleggio con Conducente – car rental with driver
PT	Public transport
SECAP	Sustainable Energy and Climate Action Plan
SULP	Sustainable Urban Logistic Plan
SUMP	Sustainable Urban Mobility Plan

Abbreviation/Acronym	Meaning
UITP	International Association of Public Transport
V2X	vehicle to everything
WP	Work package

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Abstract

This deliverable provides a diagnosis of the mobility system in Living Labs and Twinning sites and detailed specifications of each UPPER measures that will be developed during the project. The initial assessment of the public transport ecosystem was developed using a comprehensive methodology, that involves questionnaires, interviews, and SWOT analysis. This supports the baseline assessment of the role that public transport plays in the mobility ecosystem in each of the Living Labs and Twinning Sites. Furthermore, the deliverable presents a comprehensive and elaborated perspective of the "push and pull" measures that will be tested and demonstrated in the living labs. This measures' overview includes a well-structured plan for implementation and monitoring, expected outputs, measures inter-relations, an initial set of indicators for assessing the progress and success of each measure.

Keywords

Mobility services, public transport ecosystem, SWOT, UPPER measures

Executive summary

The UPPER project has been designed to understand and demonstrate that the public transport systems could be sustainably developed in European cities. In this regard, ten cities and regions across Europe are working together in this process with the aim of providing future insights on how-to re-shape the public transport systems as core of the mobility offer in urban and regional environments.

This document provides an overview of the main characteristics of the transport systems in UPPER sites. A detailed overview of the public transport system in each of the UPPER sites is provided in Annex A. Moreover, an overview of all UPPER measures in each of the sites, is presented in this document and detailed in Annex A.

This document is the result of the collaboration between the lead authors and all consortium members. The lead authors together with the contributing authors have closely worked with all UPPER sites' representatives and their local stakeholders to understand the local current situation and to refine the UPPER measures. The supporting network formed by local site representatives, consultants and research partners have been involved in this process. The entire process has been supervised and managed in direct collaboration with the project coordinator.

The results of the analysis presented in this document indicate that the Sustainable Urban Mobility Plans (SUMP) concept is experiencing a transformation, shifting from a focus exclusively on cities to a more inclusive and interconnected approach in the surrounding regions. It additionally highlights the recognition that challenges, and opportunities related to mobility are not limited to administrative borders, but instead require an integrated and rational approach which includes different geographic dimensions.

The engagement of diverse stakeholders in the planning and the implementation stages of sustainable mobility projects is an essential aspect of sustainable mobility planning. The research identified that the UPPER sites have established diverse forms of collaboration with various stakeholders, including private companies, research and academic institutions, NGOs, and civil society groups, among others. These partnerships have allowed the sites to gain access to valuable information, resources, and feedback, as well as increase the legitimacy and acceptability of their mobility plans and actions.

The study provides an overview of the current public transport situation in UPPER sites, emphasizing the importance of collaboration, innovation, and the integration of sustainability principles across different types of boundaries. The findings can provide valuable insights for policymakers and planners who aim to improve sustainable mobility practices in their respective cities and regions.

How to read this document? The first few chapters of the document contain an overview of the current status of the public transport in the UPPER sites, while Annex A details the situation in each site and presents the set of measures that each UPPER site will implement. This document has been developed by FIT (chapter 1, 2, 3, 4, 5 and 7, Annex A – UPPER sites' overview), with contribution and support from Katholieke Universiteit Leuven and ETRA (chapters 2.2 and chapter 6, Annex A – UPPER measures description, Annex B – UPPER measure template)

The lead authors would like to thank mainly to all UPPER sites' representatives and their local collaborators for their active contribution, interest and information provided throughout the process of collecting and understanding the public transport systems in their cities and regions. Lastly, the lead authors would like to thank everybody who provided input, insights and comments to this document.

1.Introduction

Most of the people nowadays are living in cities and their surrounding metropolitan areas; this is a trend that has been accelerated in the last half of the 20th century. It is estimated that by 2050 almost 70% of the world will live in cities and in metropolitan areas. Cities are not only places where population will continue to physically concentrate, but also key centres for economic production. According to some analyses, by 2030 people living in large cities will account for 81% of global consumption [1].

There is also a new trend of how cities are populated. They attract the most highly educated and affluent populations while the working class and low-income workers and their families are increasingly pushed out of the urban core and further away from the economic opportunities concentrated there. The spatial mismatch between job and residential locations is becoming an increasing problem in cities and metropolitan areas. This puts a lot of pressure on local and regional authorities to develop a functional public transport system that serves the needs of everybody, especially in terms of access to jobs, health facilities, education and leisure. Cities are also tourist and visitor destinations; this causes additional pressure on the city authorities when planning the transportation in a city with historic character and a major tourist potential.

While cities present an important economic and social interest, local authorities are facing many challenges that range from climate change to migration. How cities are tackling these challenges and how they create solutions to address these challenges is of utmost importance; this is reflected in how major policies at local and regional levels, such as transport policy, are created. For cities to address these challenges they need to compete and attract concentration of highly educated workers, high tech, and creative industries. City authorities need therefore to also attract the right combination of skills and talent in their own workforce, allowing them to act as facilitators and supporters of the sustainable development solutions co-created with all the relevant stakeholders and citizens.

The COVID-19 pandemic and movements for just and fair societies have facilitated a new approach for local authorities of how to address the current and future challenges in order to create more resilient and just cities. New ideas are emerging and trying to challenge the traditional urban and transport planning. "Place-making" or "15-minute city" are just a few urban planning solutions that promote walking, cycling and public transport as the prominent modes of transport in a city.

UPPER has a very ambitious goal to promote public transport in 10 cities and regions in Europe. Because of the diversity of the UPPER locations and their typology, authors use the term "sites" rather than "cities" in this document, to correctly reflect this diversity.

UPPER has been designed to develop tools that will support cities in their effort to develop the public transport as the core of the mobility offer. This document intends to offer an image of the public transportation in UPPER sites, their challenges and opportunities, as observed at the start of the project and to offer an image of how concretely UPPER will contribute to the cities' transport policies.

This document is part of a series of reports developed in the first part of the project, designed to provide an overview of the current situation in the UPPER sites, their public transport system, their users, the challenges and the opportunities to improve the transportation system.

2.Methodology

The UPPER project presents this document as a result of several actions that have been developed at the beginning of the project to better understand what the current situation in public transportation in UPPER sites is and how the measures that the sites will implement during the project will contribute to meet the local ambition and collectively the UPPER goals.

To understand the public transport current situation in UPPER sites, FIT Consulting has developed a method to collect the relevant information as explained in chapter 2.1. Complementarily, ETRA and KUL developed a series of actions that allowed to clearly define the UPPER measures, their goals and expected impact (Chapter 6).

The diagram in Figure 1 presents the methods applied by the above-mentioned contributors and highlights the complementarity between the methods. This approach is presented in the following sections.

Figure 1 Methodological approach for diagnosis of public transport system and measures refinement in UPPER sites
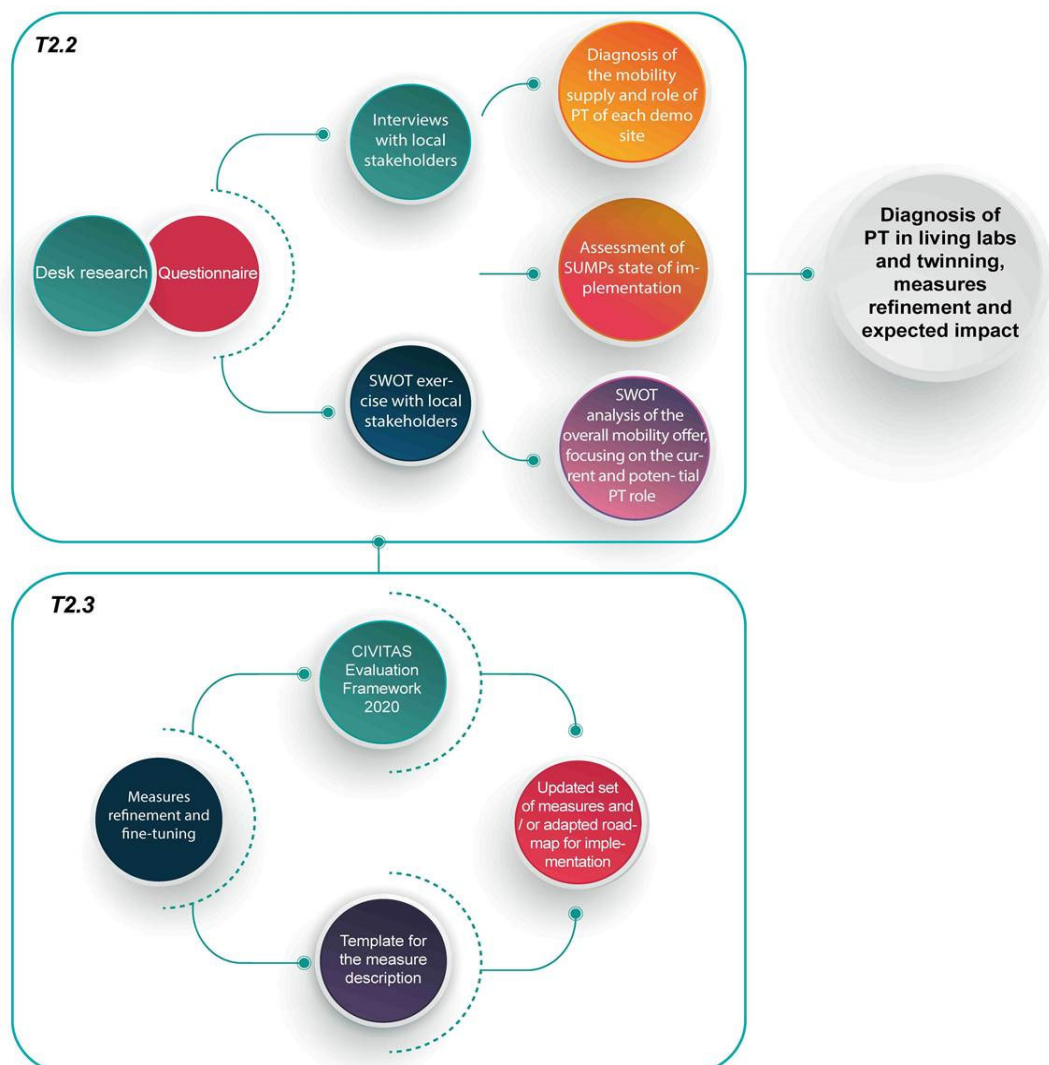
This approach has also facilitated a growing interest from the sites' representatives and their local partners in the project, its goals and how it will contribute and support their local efforts. Moreover, the methods used have facilitated the interaction and an early engagement between city authorities and public transport operators, along with other local, metropolitan and region levels stakeholders. This was seen as a positive action since the outset of the project.

2.1. Methodology for the diagnosis of the public transport system in UPPER sites

Understanding the public transport system in the UPPER sites involved conducting a comprehensive survey and interviews to gather valuable insights into mobility services and practices, decision-making mechanisms, and the capacity for implementing sustainable mobility measures and climate-neutral policies in the ten cities and regions involved in the UPPER project.

To initiate data collection, a questionnaire was developed, focusing on various aspects related to mobility supply, the role of public transport (PT), the state of implementation of Sustainable Urban Mobility Plans (SUMPs), and the relationship between current SUMPs and the planned UPPER measures in each demo site. The questionnaire was designed to provide a holistic understanding of the mobility landscape in the participating cities and regions.

The questionnaire emphasized the collaborative nature of the research, encouraging participants to consult their colleagues and relevant organizations to ensure comprehensive and accurate responses. Recognizing the effort required, we expressed our gratitude in advance for the support and thoroughness with which the questionnaire was completed.

To facilitate coordination and streamline communication, participants were requested to fill in the questionnaire in a collaborative manner. Each UPPER site authority acted as facilitator of the dialogue between local UPPER partners and providers to collect the relevant information to answer the questionnaire. This approach aimed to ensure efficient data gathering and avoid duplication of efforts among different organizations. Moreover, this approach facilitated the active dialogue between all relevant local partners with immediate result in an early engagement and increased interest in the expected project's results.

While the questionnaire formed the primary data collection tool, an extensive desk research has been done to better understand the context of the information provided by cities through the questionnaire. Additionally, interviews with cities' representatives and their local stakeholders have been conducted. They were organised as on-line workshops that served two purposes: filling in any unanswered questions from the questionnaire and obtaining further insights into the participants' perspectives. Additionally, the interviews probed participants' agreement with the SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis developed based on the questionnaire responses.

In the context of public transport diagnosis in UPPER sites, the SWOT analysis helped to evaluate the current situation, major observed problems and future opportunities. The scope of the SWOT analysis was to engage multiple actors from each city to reflect on the following issues:

- **Strengths:** What are the advantages of public transport over other modes of transportation? What are the unique features or benefits that public transport offers to customers, employees, stakeholders and society?

- **Weaknesses:** What are the challenges or limitations that public transport faces? What are the areas that need improvement or innovation? What are the factors that reduce customer satisfaction or loyalty?

- **Opportunities:** What are the external trends or changes that create new possibilities or demand for public transport? What are the gaps or niches that public transport can fill or exploit? What are the potential partnerships or collaborations that can enhance public transport's performance or reach?

- **Threats:** What are the external risks or threats that can negatively affect public transport? What are the competitors or substitutes that can reduce public transport's market share or profitability? What are the regulatory or environmental issues that can constrain public transport's operations or growth?

This SWOT analysis helped to identify the internal and external factors that affect the performance and potential of public transport in UPPER sites. However, simply listing these factors was not enough to create a comprehensive image of how to successfully implement strategies for a better public transport. The scope of this extended SWOT analysis was to identify several strategies that help in consolidating the public transport UPPER sites. This approach allowed cities representatives to reflect on the:

- **Acceleration strategies** – strategies that identify actions that aim to increase the speed and effectiveness of achieving the desired objectives. They use the strengths and opportunities identified by the SWOT analysis.

- **Improvement strategies –** strategies that aim to understand the weaknesses, try to change them in order to reduce their potential negative impact and to potentially transform them in strengths.

- **Resilience strategies –** strategies that identify actions that use strengths to minimize threats. This approach could help cities authorities to better understand the resilience pathways and how they could be enhanced, and how to potentially reduce the impact of the obstacles.

- **Intervention strategies –** strategies that aim to turn the weaknesses into advantages and to minimize the threats by exploiting them. These strategies could be risky because they involve significant investments, uncertainties, and trade-offs, but they also have the potential to transform the mobility landscape and achieve our sustainability goals.

The combined approach of the questionnaire and interviews provided a comprehensive understanding of the mobility landscape, decision-making processes, and readiness for sustainable mobility and climate neutrality in the UPPER sites. The insights gathered through this methodology formed the basis for further analysis and recommendations aimed at advancing sustainable mobility practices and achieving climate neutrality in urban transport systems.

The results of the diagnosis for each UPPER site can be found in **Annex A**.

2.2. Methodology for measures refinement

The aim of the UPPER project is to implement and demonstrate about 80 push and pull measures in 10 pilot and twinning sites, with the goal of unleashing the potential of public transport. These measures were identified during the proposal stage, but not described in detail at that point. This section outlines the methodology used to develop a comprehensive and detailed description of the push and pull measures to be piloted and demonstrated in the living labs and twinning sites, including the implementation plan, anticipated outcomes, and an initial set of indicators to monitor the progress and effectiveness of each measure.

The UPPER **measures description** is based on the CIVITAS Evaluation Framework 2020, which aims to clarify the objectives and outputs of the measures. This framework allows for an understanding of how the measures are implemented, their level of success, and their contribution to the desired impact. It also facilitates an understanding of the interconnection and dependence of various measures on each other in cities or regions working towards similar goals. The framework enables a comprehensive evaluation of the measures' effectiveness and their role within the broader mobility landscape.

The template for the measure description was developed by ETRA and KU Leuven, with review from Transport and Mobility Leuven (TML has important CIVITAS evaluation expertise). The template was shared and explained by

ETRA in a meeting with all pilot sites for the UPPER project. Following this meeting, a separate meeting for pilot site Local Evaluation Managers was organized by KU Leuven, with TML. In this meeting, the measure description templates were presented in detail in order for the pilot sites to understand how the measure descriptions would ultimately link to measure evaluation and impact assessment for the UPPER project.

The measure description process included the following steps. At each stage, the results were made available for all cities to stimulate learning from each other:

- V0.1 – After the initial introduction of the measure description templates, pilot sites were asked to fill in the templates. During this time, KU Leuven met with each pilot team to clarify the measure and address any questions about filling in the templates.

- V0.2 – Pilot sites sent their initial measure descriptions to ETRA (and a limited number to KU Leuven), who performed a detailed review of all measures and provided feedback. ETRA had follow-up meetings where risks were detected. The review carried out by ETRA had a deep focus on the content of the measures, their scope and link to the UPPER goals. The resulting measure descriptions V0.2 were shared with all the cities, to stimulate learning from each-other.

- V0.3 – Based on the revisions suggested from ETRA, pilot sites provided a revised version of the measure descriptions. The resulting measure descriptions V0.3 were shared with all the cities, to stimulate learning from each-other.

- V0.4 – Version 0.3 was reviewed by TML and KUL to refine the objectives and outputs with a focus on evaluation. Comments were provided to pilot sites.

- V1.0 – The pilot sites addressed the comments provided in V0.4 and developed the final version of the measure descriptions (V1.0).

The refined and detailed measures description for each site can be found in **Annex A** and the template for the measures' description is available in **Annex B.** It provides clear guidelines on how to complete each field and includes examples to assist the pilot sites in describing their measures. The template aims to facilitate the process by offering a structured format that ensures consistency and coherence in the description of the measures.

3.   Mobility in the UPPER sites

As previously mentioned, UPPER sites have different characteristics which are clearly described in the **Annex A**. This section however offers a synthesis of a few key factors that facilitate the understanding of the current mobility system in UPPER sites.

3.1 Modal share in the UPPER sites

Public transport plays a crucial role in the UPPER sites, with modal shares ranging from 14% to 47.32%. This indicates a significant reliance on public transport services, including buses, metro, trams, and trains. The cities recognize the importance of providing efficient, affordable, and accessible public transport options to meet the mobility needs of their residents.

Private motorised transport, primarily consisting of cars, is commonly used in these sites with modal shares ranging from 31.8% to 61.6%. This high reliance on individual vehicles highlights the ongoing challenge of managing traffic

congestion and reducing emissions associated with private car use. Another cause of the high usage of the private cars is that the modal share analysis is done in UPPER sites that have different characteristics; some of the UPPER sites are cities, some of them are regions or some of them are clusters or associations of municipalities. This difference could be observed in the way the car usage is reflected in the modal share. In cities where population densities and public transport offer are significant, there is also a generous offer for active and shared modes of transport and the car usage is lower compared to the suburban and rural areas, where the population relies more on the car usage.

Active modes of transportation, such as walking and cycling, have an important presence in UPPER sites. Modal shares for walking range from 4.5% to 33%, indicating that this is rather an important mode of transport. The explanations for the higher values range from the urban space configuration to specific characteristics of a city, such as tourist/historic city or important pole of interest in the region. Cycling also plays a noteworthy role, with modal shares ranging from 1.7% to 20%. These sites recognize the health, environmental, and congestion-reducing benefits of promoting active modes of transportation, encouraging infrastructure development and initiatives to make walking, and cycling safer and more attractive options.

Additionally, the sites acknowledge the presence of other transport modes, albeit with relatively lower modal shares. These include motorcycles, taxis, and other alternative options, which cater to specific needs and or provide additional transport choices for residents.

In summary, the UPPER sites have a diverse mobility landscape with a significant reliance on public transport, substantial usage of private vehicles, and promotion of active modes of transportation. Efforts to improve public transport systems, reduce private vehicle usage, and enhance walking and cycling infrastructure reflect their commitment to sustainable mobility and for addressing the observed urban transportation challenges.

3.2 Mobility offer in the UPPER sites

Across all UPPER sites, public transport plays a significant role in providing transportation options to the residents and visitors. This includes a comprehensive network of buses, trams, trains, and metro, providing convenient and easily accessible modes of transport. Additionally, taxi services are widely accessible, offering door-to-door transportation. The rise of ride-hailing platforms such as Uber and Bolt has revolutionized the customised travel. These services provide passengers with the flexibility to request rides conveniently through mobile applications, enhancing accessibility and convenience. In multiple sites, car sharing services are also available, allowing individuals to share cars for their transportation needs. This approach promotes resource efficiency and reduces the reliance on individual car ownership. These services are present in many of the UPPER sites (Figure 2).

Figure 2 Mobility offer in UPPER sites
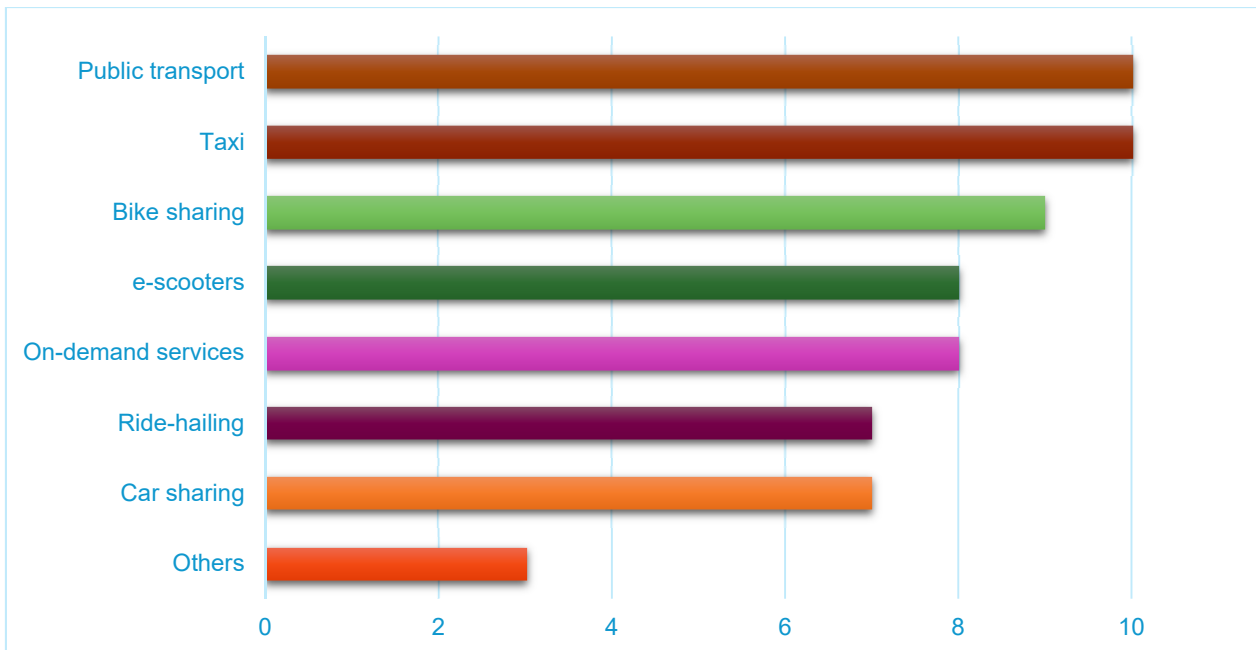
Furthermore, many sites have introduced on-demand services that address specific transportation needs. These services offer flexible and personalized solutions, continually adapting to the evolving demands of passengers. This type of service is mainly observed for some suburban and regional areas, where conventional public transport services are limited.

In some sites, e-scooters have emerged as an alternative mode of transportation for short-distance/last mile travel. These electric scooters provide a convenient and eco-friendly option, particularly suitable for urban areas. However, there is less evidence for their regulation or integration with other modes.

Bike sharing schemes have also gained popularity. These initiatives encourage active travel, promote physical well-being, and contribute to reducing congestion and pollution in cities. It is notable to mention that this is a preferred mode of transport even in those sites that have a touristic character and attract many tourists and visitors.

There are other modes of transport mentioned by several UPPER sites, such as e-moped, bike leasing or NCC (car rental with driver). They are specific for the site that mentioned them and included in their general transport plans.

Together, these diverse mobility services aim to enhance transportation options for passengers. They prioritize convenience, sustainability, and efficiency in urban mobility, promoting the use of shared resources and reducing the dependency on private cars. By offering a variety of choices, cities are striving to foster more accessible, environmentally friendly, and people-centric transportation systems that benefit residents and visitors alike.

3.3 Area of service

The findings reveal the extent of coverage for each service and highlight the diverse geographical areas served, as shown in Figure 3. Each mobility mode is shown in a colour, and the graph values show the number of UPPER sites who said the given mode is available at the area of service shown. The innermost ring does not always match the corresponding number shown in Figure 2 as respondents could skip answering when they did not regulate the given mode.

Public transport is the most extensive service in all UPPER sites, having the highest coverage, from the city limits to the regional area. All sites have public transport service at city level and for majority of the UPPER sites it covers the functional urban area and regional area as well.

Car sharing services exhibit a wide range of coverage, extending from specific districts, neighbourhoods, and city centres to broader areas such as city-wide coverage and functional urban areas. This implies that car sharing options cater to both localized and broader transportation needs within the cities.

Taxis offer coverage across entire cities, ensuring convenient point-to-point transportation for residents and visitors. In some instances, specific districts or neighbourhoods are also served, providing more localized options.

Ride-hailing services show varied coverage, including city-wide areas, functional urban areas, and regions. This indicates their flexibility and availability in different geographical contexts, catering to a broader range of transport demands.

On-demand services have diverse coverage, encompassing district/neighbourhood areas, city centres, and city-wide coverage. Additionally, these services extend their reach to functional urban areas and regions, providing flexible and personalized transportation solutions tailored to specific needs.

E-scooters have coverage in various areas, including city centres, district/neighbourhood locations, and city-wide reach. This suggests that e-scooters are available for short-distance travel across different parts of the cities.

Bike sharing services cover a range of areas, from city centres and district/neighbourhood locations to city-wide coverage and functional urban areas/metropolitan areas. This indicates the availability of bicycles for rent in different parts of the cities, promoting eco-friendly and active transportation options.

Overall, these mobility services aim to provide comprehensive transportation solutions across different areas, addressing the diverse needs of residents, tourists, and visitors in each site. By offering extensive and overlapping areas of coverage, they contribute to enhancing accessibility, convenience, and sustainable mobility within the cities. The interaction between the modes themselves, as well as the individual choices of the customers who use them, depend on a wide array of factors, which include service area coverage, also service flexibility, availability and pricing.

Figure 3 The mobility services in UPPER sites by the type of area covered (number of sites)
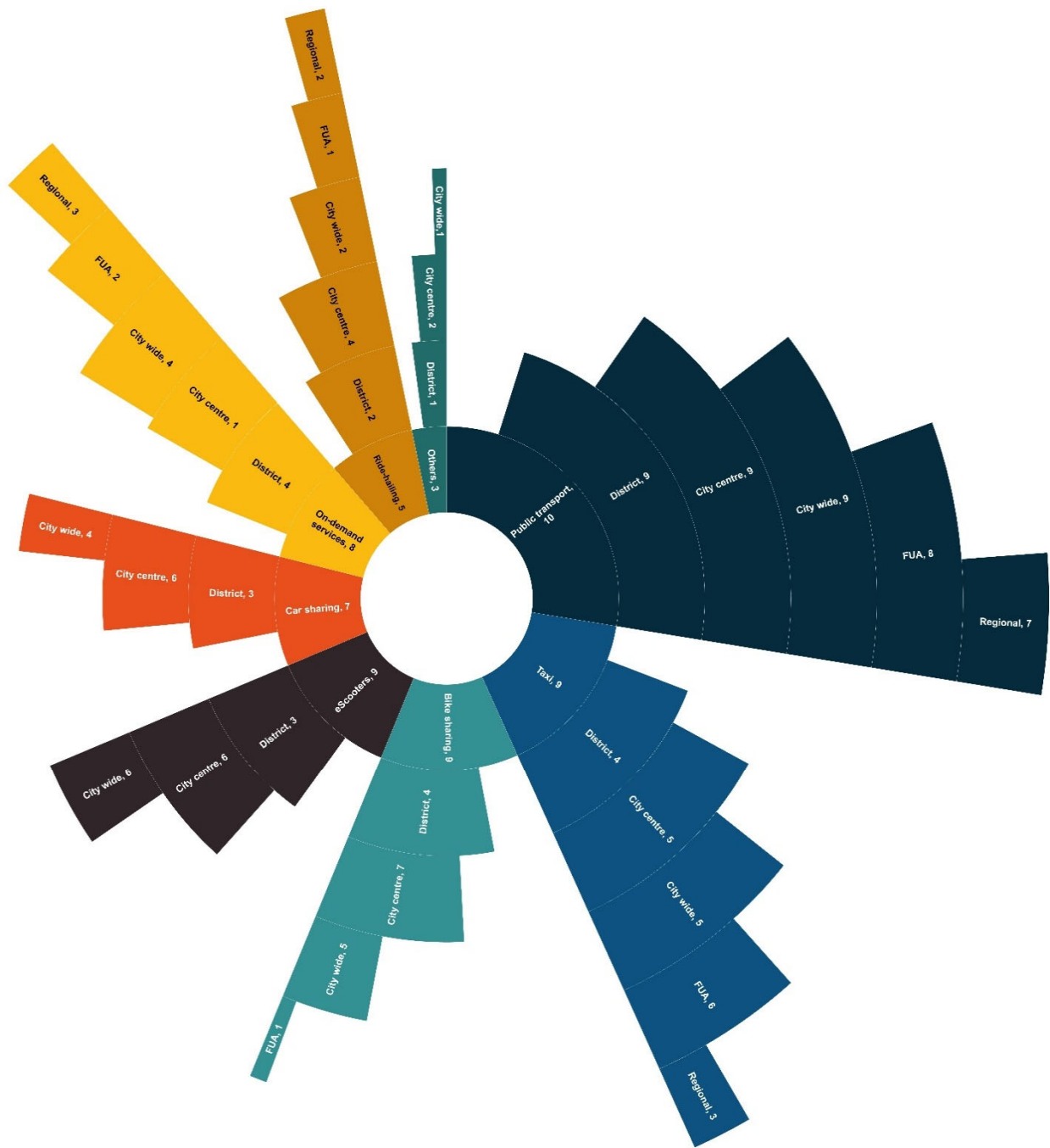
3.4 Integration of mobility services

There are many levels of integration observed and declared by UPPER sites representatives (Figure 4), such as infrastructure, ticketing and payment system. There are also mentioned as an integration form a more elaborated mobility service, relying on advanced technology, such as MaaS.

Figure 4 The stated level of different types of integration measured in all of the 10 UPPER sites (as declared by the UPPER sites' representatives)

Many UPPER sites declared the importance of the integration based on the infrastructure; this is the most common form of integration between public transpor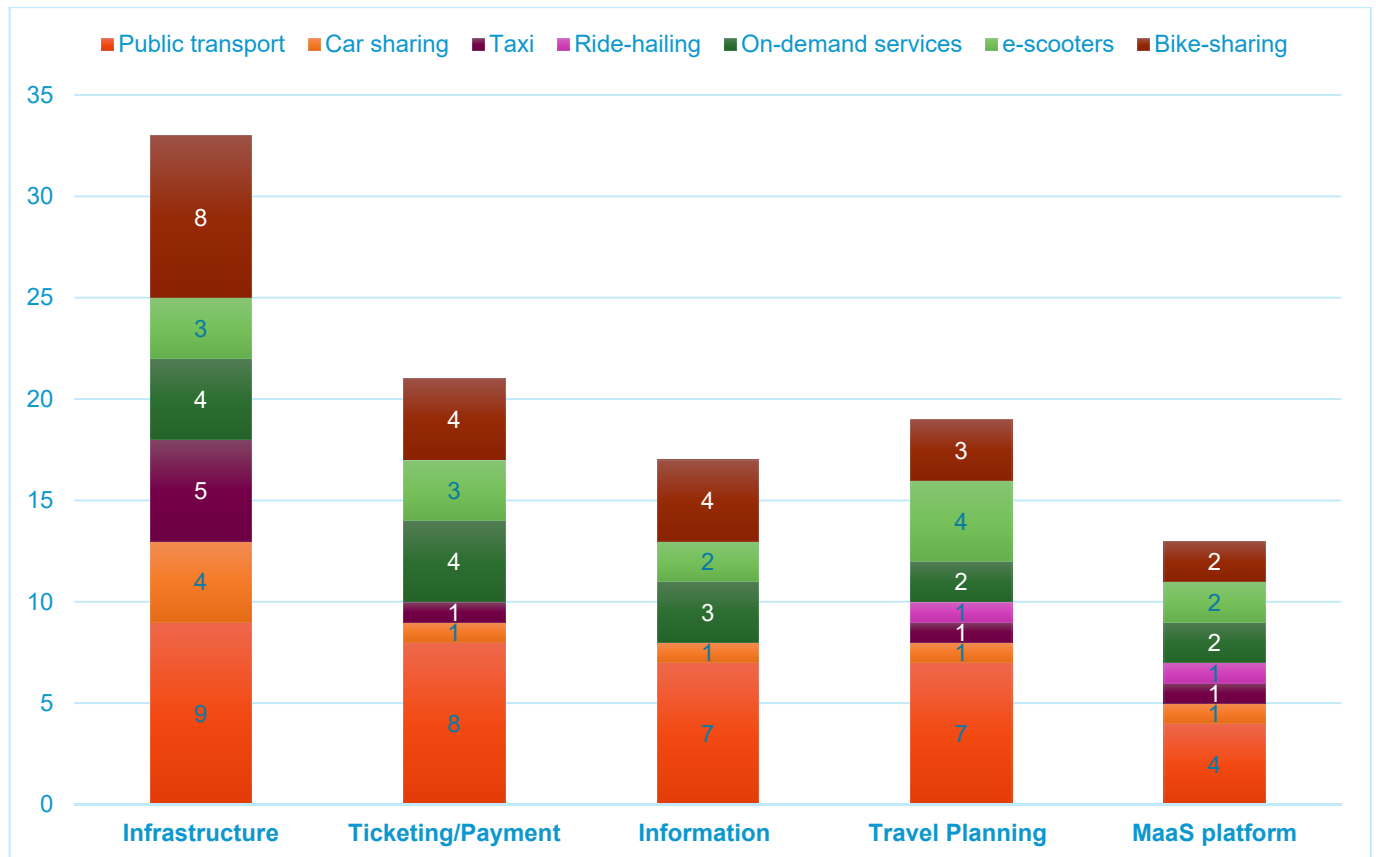t and other modes of transport. Integration at this level likely involves the establishment of mobility hubs or shared infrastructures, supporting seamless connections between different modes of transport.

Certain sites focus on ticketing/payment integration; in these cases, they have integrated ticketing and payment systems across all public transport services, as the first step of integration for public transport systems. This level of integration not only simplifies the payment process for passengers, but it makes it more convenient and efficient. Moreover, in several sites the ticketing platforms integrate bike-sharing or car sharing services.

Information integration is observed in several sites, where they have integrated information platforms. These platforms provide real-time updates, schedules, and other relevant information to passengers, allowing them to make informed decisions and plan their trips more effectively.

Travel planning integration is implemented in specific cities, where travel planning tools are integrated with their public transport services. This integration helps passengers with route planning, navigation, and finding the most efficient and optimal travel options within the city.

One of the UPPER sites (Lisbon) has integrated multiple mobility services, such as public transport, taxi, ride-hailing, e-scooters, and bike-sharing into a comprehensive MaaS-like platform. This integration aims to provide a seamless and unified experience for users, allowing them to access and utilize different modes of transport through this single platform. Other UPPER sites declared that the national authorities are preparing the implementation of MaaS platforms at national level.

Regarding each mobility service, the data shows that public transport has the highest level of integration with and among most services, especially infrastructure, ticketing/payment, information, and travel planning. This suggests that public transport is the backbone of the mobility system and provides a convenient and accessible option for the wider public. Public transport also supports other modes of transport by offering mobility hubs, where users can exchange different modes easily.

Bike-sharing has relatively high levels of integration with infrastructure and information services, indicating that they are suitable for short-distance trips and complement public transport. However, they have low levels of integration with ticketing/payment and travel planning services, which may limit their usage and convenience.

Car sharing, taxi and ride-hailing have low levels of integration with most services. This means that they are mainly used as standalone options or as alternatives to public transport. They may also have higher costs and environmental impacts than other modes of transport. On-demand services have relatively low levels of integration with all services. This implies that they are niche options that provide to specific needs or preferences of travellers.

Overall, the data reveals that there is room for improvement in the integration of different modes of transport and services, especially for those that are not public transport. A more integrated mobility system could offer more choices, convenience, and efficiency for travellers, as well as reduce congestion, emissions, and costs.

The overarching goal of these integration efforts is to enhance the connectivity and convenience of mobility options. By integrating different modes of transport and related services (applications, platforms, etc), cities strive to provide residents and visitors with integrated and efficient transportation solutions, ultimately improving the overall quality of urban mobility.

3.5 Ownership and governance aspects

The regulation of mobility services in the UPPER sites varies depending on the specific service (Figure 5). Public transport services are predominantly publicly owned. Car sharing services, on the other hand, are primarily privately owned, as this is the case of seven out of ten sites. Taxis are also predominantly privately owned, in eight out of ten UPPER sites. Ride-hailing services, such as Uber or Lyft, are mainly provided by private entities in six UPPER sites. E-scooters are primarily privately owned. Bike sharing schemes are also mainly private owned schemes as it is the case of eight out of ten UPPER sites. However, many of these private-owned schemes are encouraged and formally supported by the local authorities. In general, the number of different mobility modes and schemes present in a location, especially if it has a private ownership, implies the need for a good collaboration between the city authority and the private providers. There are situations when these mobility schemes are regulated by the local authorities, sometimes not; there are many pressures on local authorities to regulate some of the mobility schemes, for many reasons. In some cases, these reasons are related with the safety and security of both end-users and providers. Sometimes the regulations should be made in order to preserve the character of a certain area, such as a historic city centre or a local interest point.

Irrespective of the level of regulation, local authorities need to preserve a good dialogue and a good level of collaboration with all mobility providers. The perceived cooperation between mobility service providers and local authorities varies. In UPPER sites the cooperation with public transport providers is generally perceived as good, or very good. This indicates that in all UPPER sites, there is a positive cooperation between public transport providers and local authorities. Sometimes this is a result of a long-time relationship between local authority and different partners, or, sometimes, a well-established governance. The majority of the UPPER sites' representatives declared that they have a good collaboration with the bike sharing schemes providers, which suggests that these services have established a strong relationship with the authorities and have aligned their goals and interests. In general, the collaboration with car-sharing schemes, the taxi or ride-hailing services are perceived less positive in most of the sites. A possible recommendation based on this observation is that there is a need to improve the communication and collaboration between authorities and mobility service providers, and to conduct more comprehensive and transparent assessments of the cooperation level using multiple sources and criteria.

Figure 5 The ownership of mobility modes in all UPPER sites
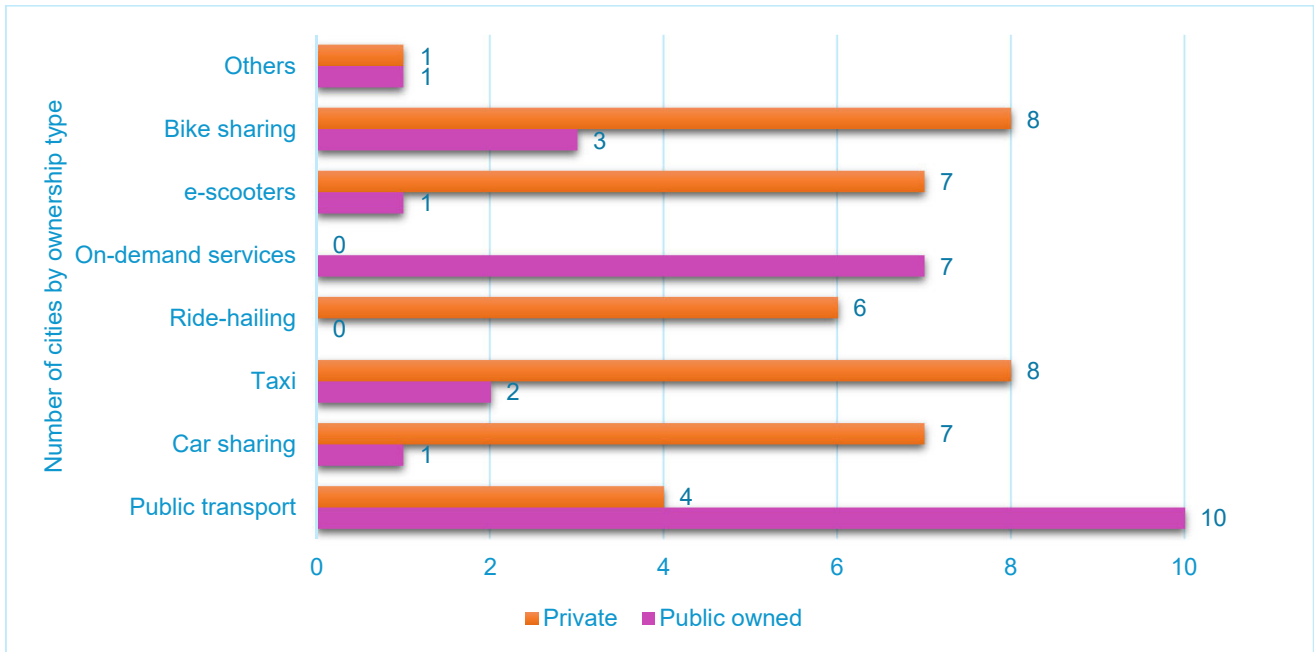
In conclusion, there are varying perceived levels of satisfaction and relationships between authorities and mobility service operators across different UPPER sites and mobility services providers. These variations may be influenced by factors such as regulatory frameworks, collaboration efforts, service quality, and the alignment of goals between authorities and service providers. Understanding and addressing these aspects can help authorities foster better collaboration, improve service quality, and create more sustainable and integrated mobility systems in their respective cities.

The assessment of the collaboration between local authorities and the providers of mobility products and services needs to be developed. In the context of UPPER project, this collaboration is very important to provide the solid grounds for a reliable public transport service and integration with other modes of transport, especially the active modes. This approach will facilitate a good, reliable, and just mobility offer for all residents, tourists and visitors in UPPER sites. The UPPER tools and instruments should ensure that the major mobility providers are engaged since the beginning in the design and implementation of these tools at local level.

3.6 Data management system

Transport/traffic data collection is a crucial component of urban planning and management, as it provides insights into the mobility patterns, travel behaviour, and transportation needs of the population.

Overall, the information collected from UPPER sites indicates that most of them have established data collection systems for general traffic, public transport, and alternative mobility services (Figure 6). However, data collection specifically for goods delivery is less common, with only one site mentioning it. Additionally, some sites have data collection systems for other purposes like parking monitoring. These data collection systems play a crucial role in understanding and improving transportation systems in these cities.
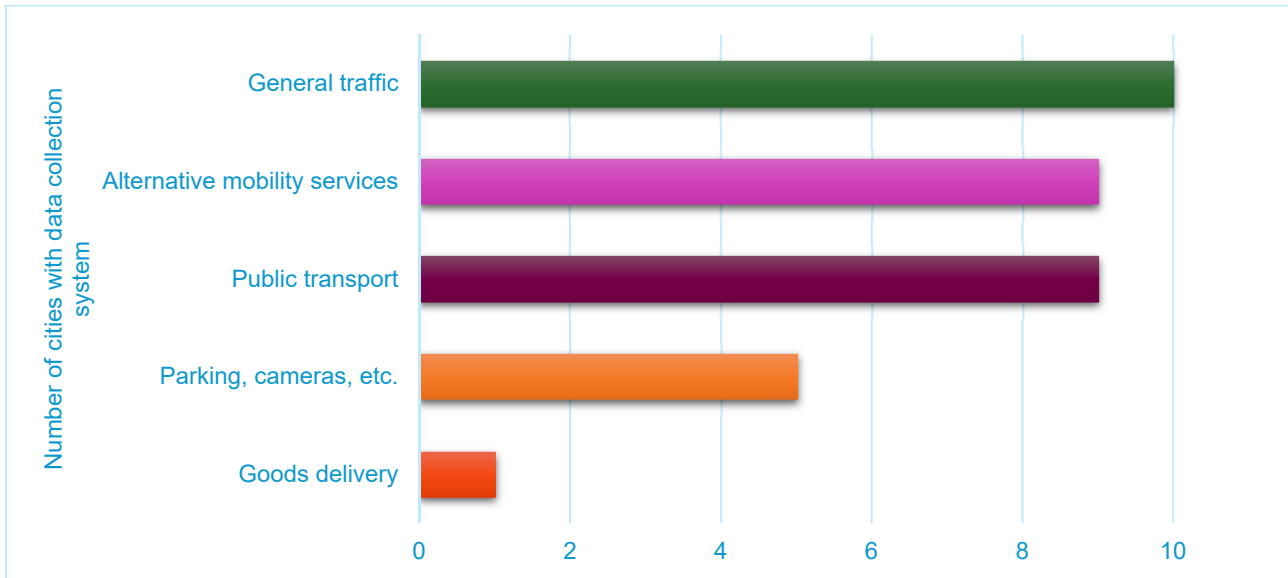
Different sources of data (Figure 7) can offer different perspectives and levels of detail on the transport/traffic situation in a site, and thus it is important to use a combination of methods and tools to obtain a comprehensive and reliable picture.

Among the data sources declared, the annual travel survey and the real-time traffic data are the most important ones. Through the annual travel survey, information from a representative sample of households or individuals about their travel habits, preferences, and opinions is collected. This data can help to understand the travel demand, mode choice, trip purpose, trip frequency, trip duration, and trip satisfaction of the residents. Through the real time traffic data, information about the traffic conditions on the road network such as speed, volume, density, congestion, and incidents are captured. This data can help to monitor the traffic flow, identify bottlenecks, optimize traffic signals, and provide valuable information to the authorities and users.

The census and the traffic survey carried out on a regular basis are also important sources of data. While it may not be specific to transport/traffic data collection, census can still offer valuable insights for urban planning. This data can help to understand the population characteristics, distribution, and trends that affect the transport/traffic system. Through the traffic survey carried out on a regular basis, information from a sample of vehicles or road segments about their traffic characteristics, such as speed, volume, classification, origin-destination, and occupancy are collected. This indicates that the UPPER sites prioritize collecting updated information for planning local transport policies.

The public transport real time position system and the automated fare collection are also relevant sources of data. They allow for better public transport planning and to provide accurate information to users.

The accidents and abnormal situations in real time and the parking data are also useful sources of data. This type of data reports the occurrence and impact of any events that disrupt the normal operation of the transport/traffic system, such as crashes, breakdowns, road closures, or weather conditions. This information can assist with emergency response management, mitigating adverse effects, and informing travellers. The parking data can help to regulate the parking supply and demand, enforce the parking rules and fees, and influence the travel behaviour.

Figure 7 Sources of data used for transport policies in all UPPER sites
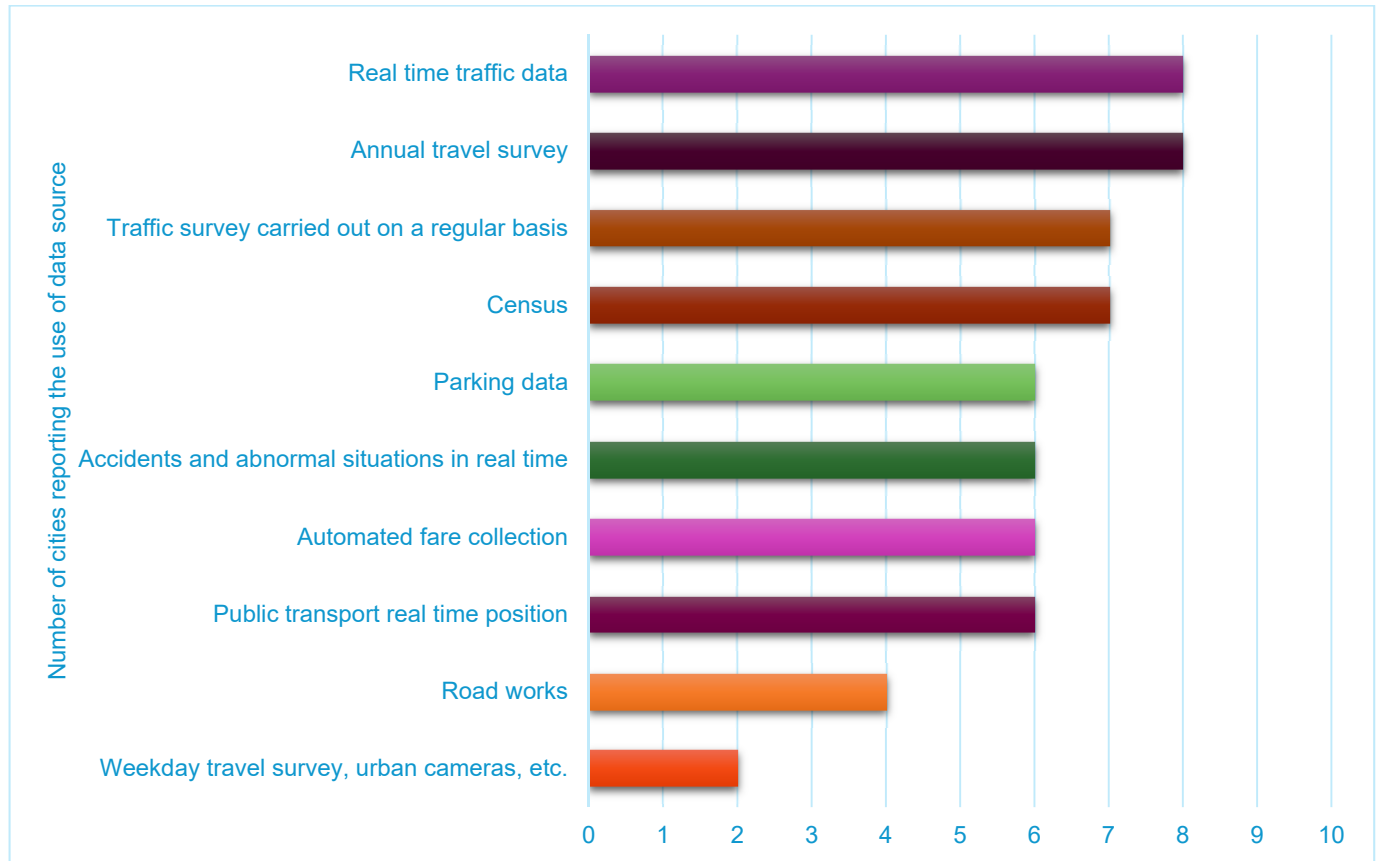
UPPER sites also have traffic flow management and public transport management systems, as the most common ITS platform in use. However, there is variability in who operates these platforms. For example, traffic flow management is mostly operated by local authorities in half of the UPPER sites, and private/public transport operators, research, or other public entities in the rest. Public transport management systems are mostly operated by transport authorities and other public entities, mainly public transport operators. Digital twin and parking management are less common ITS platforms used in UPPER sites, and if they exist, they are mostly operated by local authorities. The data collected about the intelligent transport systems in UPPER sites shows that there are several cases where ITS platforms are not available in some of the UPPER sites, which indicates a potential gap for improvement.

The transport authorities are primarily responsible for operating the ITS platforms (Figure 8) related to public transport management, traffic/transport simulation, and automated fare collection systems. The city or municipal authorities also play a significant role in operating the ITS platforms for traffic flow management, digital twin, and parking management.

It is worth noting that some ITS platforms may have multiple entities involved in their operation, indicating collaboration between different stakeholders to ensure effective transportation management and services in the cities. As such, the total number of entities involved in the operation of the different types of transport platforms differs from the number of UPPER sites.

Figure 8 The types of organisations responsible for providing/operating intelligent transport platforms in all UPPER sites
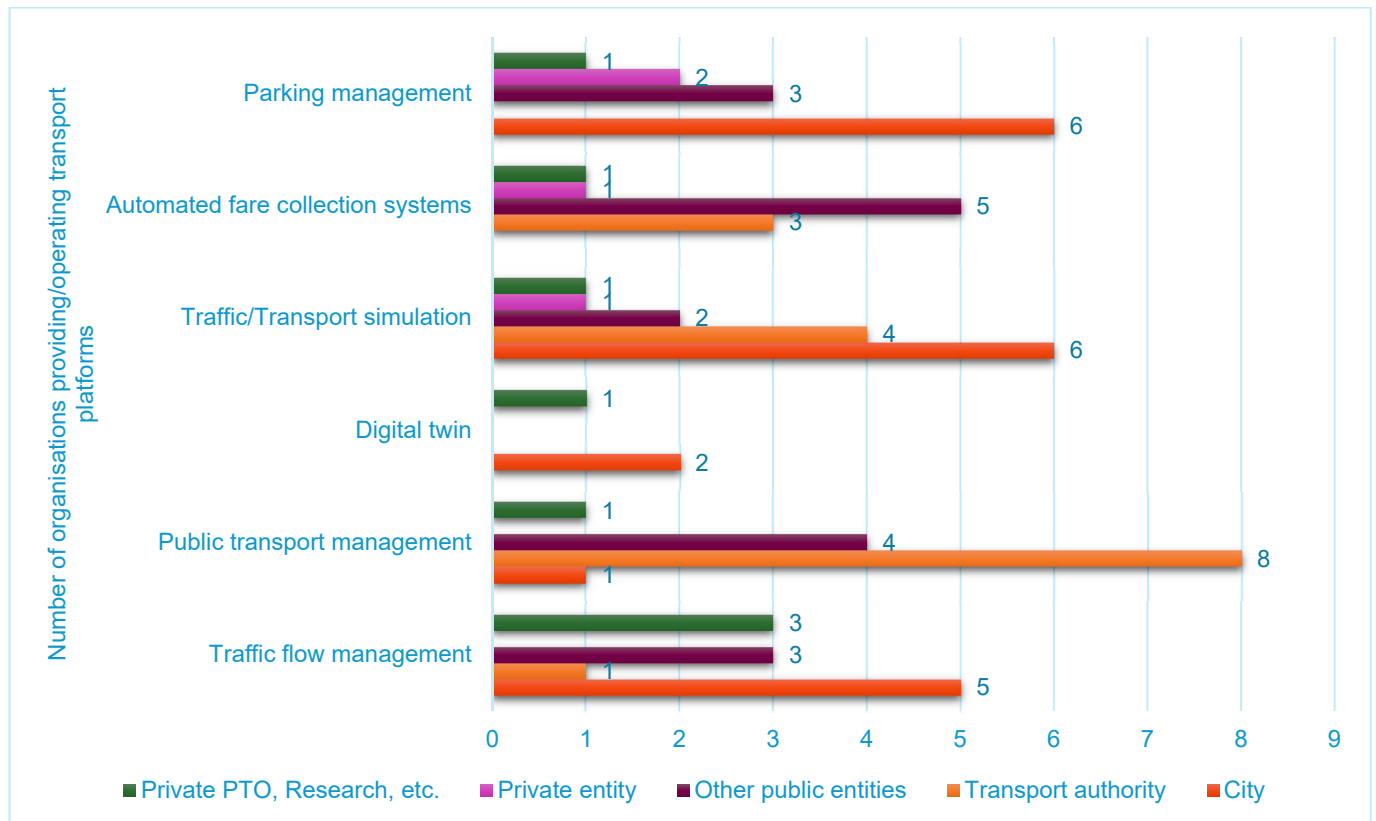
3.7 Logistics – first and last mile delivery

The UPPER sites have different characteristics in terms of types of settlements and the respective population densities. The goods delivery and logistics therefore play a very important role in the overall local transport system. While the organisation of the goods delivery systems is different from one site to another, many commonalities could be observed.

The technology development, the adoption of different work-related arrangements (working from home or from third places, etc) are only a few of the trends observed that may influence new lifestyles. All UPPER sites have developed in the recent years a series of services to address the new lifestyles. Different delivery trends have been also observed and influenced by new working methods, such as flexi time or working from home, massively observed, especially during and after the COVID-19 crisis. These new developments could not have been possible without the massive advancement of the internet and communication technologies. New delivery systems and methods have been matured. It is interesting to observe that sometimes the local authorities do not have an integral role in this development; it is largely the result of how businesses are responding to consumers' needs. Despite this fact, local authorities play a massive role in accelerating the take-up of sustainable solutions, by providing facilities to those interested to develop such sustainable logistic solutions.

Logistic schemes, such as self-pickup, are hugely popular nowadays and could offer the possibility to reduce unnecessary trips. However, the traffic created by the deliveries to these self-pickup points should be monitored and the usage of sustainable or zero-emissions vehicles encouraged.

The existence of consolidation centres, located in strategic places could potentially contribute to the reduction of many unnecessary trips with positive consequence on the reduction of pollution and congestion in urban environments.

Home deliveries are seen yet as a very popular solution; the delivery options, either by a van or using active modes ((e) bike and walking) are present in many of the UPPER sites (Figure 9).

Figure 9 The types of delivery options in all UPPER sites
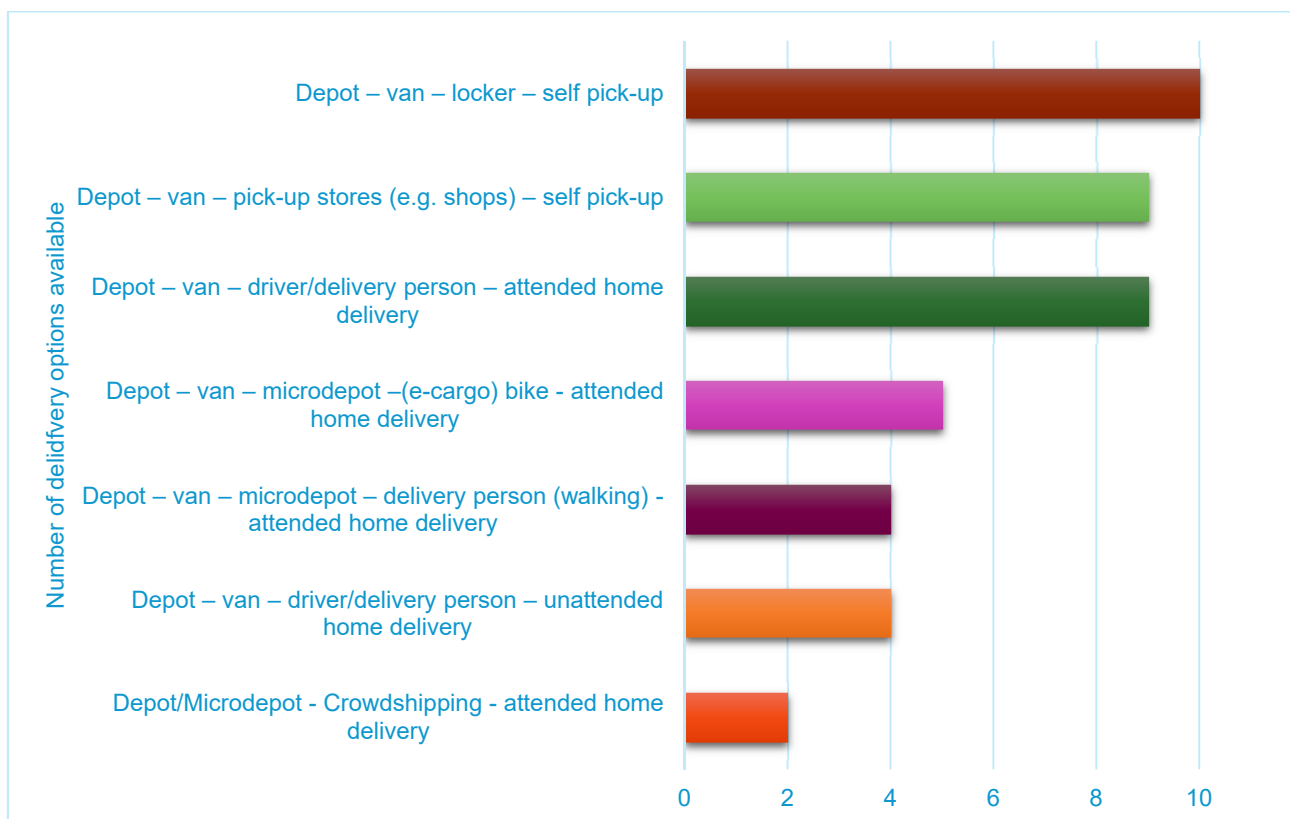
In conclusion, the current observed urban freight has few characteristics:

- It is an important traffic component in the road ecosystem

- The load factor for delivery vehicles could be an important factor to observe when redesigning new logistics schemes in UPPER sites

- The contribution to the urban pollution (including noise) is still very high, despite the efforts to create more sustainable delivery schemes

- An interesting particularity to observe is the number of the delivery companies and their business models; some operate with only few drivers, while a small share operates at large scale, in urban and regional and even at national levels.

Local authorities should rethink their role in local logistics; they could become facilitators of new practices and supporters of new approaches. Local policies should be developed considering how the road ecosystem will be influenced in the future [2]. The increased urbanisation and the change in the lifestyle, the frequency and the

reliability of the deliveries, the increased competition for the limited infrastructure in the road ecosystem are only few of the factors that could be taken into account when analysing future logistic schemes in urban and regional areas.

3.8 Decision-making system and existing competencies at local level for delivering a sustainable mobility

The local governance for transport and mobility plays a crucial role in designing and implementing effective mobility solutions at the local level. Various local stakeholders are involved in this process that creates a very complex and dynamic collaboration environment. The responsible entities for sustainable mobility planning differ among sites, with city administrations, metropolitan/regional authorities, national authorities, public transport operators and authorities taking a central role in different contexts. Moreover, the urgency of climate neutrality planning creates new responsibilities and need for integration and collaboration with the existing structures. Many of the UPPER sites have already successfully started to integrate transport in the climate decision-making structures.

All UPPER sites have adopted or are in the process to update or develop relevant local and regional strategic documents and policies to guide their sustainable mobility and climate neutrality planning. These documents vary from one site to another depending on local particularities and governance practice and culture, but they mainly are: Sustainable Urban Mobility Plans (SUMPs), Sustainable Urban Logistic Plan, Sustainable Energy Action Plans, Smart City initiatives, and Climate-neutral/Climate neutrality action plans. The development of these plans is overseen by specific departments such as mobility departments and climate neutrality departments. It is worth noting that these strategic documents are still produced in isolation, with valuable resources being consumed to preserve this style of development. Besides this, there is little evidence of the integration of actions regarding mobility projects across these documents. They could be complementary, focusing on different aspects; however, the impact of their foreseen actions, measures and projects could be better corelated and integrated for more rapidly and efficiently achieving the high-level goals sought at local and regional levels.

Specialized departments dealing with sustainable mobility or climate neutrality are present in some sites, indicating that all UPPER sites are well prepared to address any issues in these areas. However, when developing sustainable mobility and climate neutrality planning documents, cities and authorities face several perceived barriers. These perceived barriers include lack of expertise and knowledge, political support, the lack of local policy tools and procedures, organizational fragmentation, and difficulties in engaging various stakeholders such as transport companies (both public and private), economic and business groups, NGOs, citizens, and civil society, as a whole.

By addressing these barriers and leveraging the involvement of relevant stakeholders, UPPER sites can overcome challenges and create more sustainable transport systems. It is crucial that local authorities encourage collaboration and coordination among stakeholders that could contribute to the successful implementation of mobility solutions.

The perceived factors that could contribute to a better implementation of a sustainable mobility system in UPPER sites are quite similar with the perceived barriers. This demonstrates that local authorities have identified the key factors for development of a good, efficient, sustainable mobility system, but they are very much aware about the deficiencies or slow performance of these factors.

The vast majority of the UPPER sites consider the alignment between the political, professional, and public acceptance as the major factor to successfully implementing urban mobility policies. This is a very significant observation that supports some of the UPPER tools to be developed, especially those that address the mobility behaviour and the mind-set change.

An equally important factor to develop sustainable urban mobility systems identified by the UPPER sites is related to the existence of efficient and sufficient funding mechanisms. All sites acknowledge the need for continuous and sufficient funding streams, but some sites declared that sometimes is not a problem about funding, but on the way

the funding sources could be accessed or locally administered. Therefore, the key aspect of the ability to mix and match the available funding sources to implement sustainable mobility measures is considered very important.

The increased level of knowledge about sustainability of mobility professionals and users, puts pressure on developing systems to collect relevant data that could support the decision system. Moreover, the local politicians' approach has been developed in the recent decades to successfully offer facts and evidence for the policies developed and implemented. This proves a better collaboration with the research and state of the art technology providers, but also a gaining of momentum of trust received from the end-users for the projects implemented, rooted in a good understanding of the users' needs. Moreover, the data-driven decision-making system could allow for the dynamism of the actions taken at local level, mainly in the case of unexpected situations or crisis.

However, such a system and approach will not likely be successful unless there is a very good collaboration and agreement between all the necessary actors in the urban mobility system, and, of course, the acceptance of the public. Six sites indicated that the decision-making process primarily occurs at the executive level, where decisions are made. However, they also mentioned that relevant stakeholders are consulted during this process. This suggests that while the ultimate decision-making authority lies with the executive level, these sites recognize the importance of involving stakeholders and seek their input before finalizing decisions. On the other hand, three sites highlighted that there is wide consultation before any decision is made, and all contributions from stakeholders have an influence on the final decision. This implies that these sites prioritize extensive engagement with stakeholders, valuing their inputs and actively incorporating them into the decision-making process.

Overall, these responses demonstrate that cities adopt different approaches to integrating stakeholder engagement actions in their decision-making processes. While some cities primarily consult stakeholders during the decision-making process, others prioritize wider consultation and emphasize the influence of stakeholders' contributions on the final decisions. These approaches reflect the cities' commitment to inclusive governance and recognizing the value of stakeholder perspectives in shaping urban policies and decisions.

The engagement efforts should increase, and UPPER sites recognise this by creating specialised departments or employing support in facilitation of the collaborative schemes for designing and implementing sustainable urban mobility solutions. This shows that local authorities understand and acknowledge the capacity needed, both in terms of relevant and sufficient staff with skills and level of knowledge required to support the current and future transport policies development and implementation.

In conclusion, managing and developing a sustainable mobility system in cities and regions in UPPER require complex processes involving and affecting many actors. Local authorities face increasingly challenging goals in relation to climate and society. As lead authors observed in another EC report [3], reaching these goals requires strong commitment and collaboration from all those involved, such as providers of mobility services and products, technicians, politicians, and general public. In these conditions, involving and collaborating with all relevant stakeholders is crucial for local authorities to successfully achieve their goals; to this extent, they must have a clear vision derived from a robust strategic planning process. An effective stakeholder engagement activity helps translate stakeholder's needs into organisational goals and creates the basis of an effective planning strategy. Discovering the point of consensus or shared motivation helps a group of stakeholders take decisions and invest in a meaningful outcome. Indeed, without internal alignment one cannot build an effective strategy or implement change.

Establishing long standing, effective partnerships between government organisations and stakeholders will result in a greater sense of ownership and an improved uptake of services as they are tailored to the unique aspirations of the community.

3.9 Is the urban mobility system in UPPER sites ready to reach climate neutrality?

The pursuit of climate neutrality is a pressing global challenge, and cities play a significant role in achieving this goal.

The results of the analysis done for this document reveals that many UPPER sites have recognized the urgency of addressing climate change and have taken steps towards sustainable and low-carbon transport solutions. Strategic documents and policies, such as Sustainable Urban Mobility Plans (SUMPs), Sustainable Energy Action Plans, and Climate-neutral/Climate neutrality action plans, demonstrate the commitment of these cities to address the existing climate challenges.

One of the crucial indicators of UPPER sites' readiness for climate neutrality is the adoption of sustainable mobility projects. The data suggests that cities have implemented various sustainable mobility initiatives, including the promotion of public transport, the development of cycling infrastructure, the deployment of electric vehicles, and the adoption of shared mobility services. These efforts aim to reduce reliance on private cars and transition towards cleaner and more efficient transportation modes.

Furthermore, the presence of specialized departments or entities focusing on sustainable mobility and climate neutrality indicates a dedicated focus on addressing the environmental impact of transport. These departments play a crucial role in fostering relevant expertise and competences, coordinating initiatives, and ensuring the integration of sustainable mobility measures into broader environmental and climate action plans.

However, despite these positive steps, challenges remain, especially for the mobility system. The results highlight several barriers faced by local authorities in developing sustainable mobility and climate neutrality planning documents (addressed previously in this document). To overcome these challenges and ensure readiness for climate neutrality, local authorities need to prioritize knowledge sharing and capacity building. Investing in training programs, fostering partnerships with academic institutions and research organizations, and leveraging international networks could help.

Political support is crucial for driving sustainable mobility initiatives forward. Local authorities must actively engage policymakers, raise awareness about the benefits of sustainable transport, and advocate for supportive policy frameworks and funding mechanisms. Building a strong commitment from stakeholders, including transport companies, economic and business groups, NGOs, and citizens, is essential, especially for developing a collaborative approach towards climate neutrality.

Additionally, addressing organizational fragmentation and establishing clear governance structures can enhance the efficiency and effectiveness of sustainable mobility planning and implementation. Streamlining decision-making processes, coordinating efforts across different departments and levels of government, and promoting information sharing can contribute to a more integrated and cohesive approach.

In conclusion, while UPPER sites have made progress in adopting sustainable mobility measures and integrating climate neutrality approach in current and future projects, challenges still need to be addressed to achieve full readiness for climate neutrality. By addressing knowledge gaps, securing political support, overcoming organizational fragmentation, and engaging diverse stakeholders, local authorities can enhance their capacity to address the climate challenges. With concerted efforts and strategic actions, the sustainable mobility systems in UPPER sites can play a pivotal role in reducing greenhouse gas emissions and creating sustainable and resilient local environments.

4. SUMPs in the UPPER sites

As previously mentioned, and further explained in **Annex A**, all UPPER sites have their own particularities and planning experience and methods. In many of the cities and regions in Europe, the Sustainable Urban Mobility Plan

concept has been deployed and in some of them, because of the change of the national and regional legislation they become mandatory documents for urban mobility planning. In many countries, although not enforced by the law, there is a pressure to create them, as the SUMP became a required condition when applying for funds from central and donor banks. However, there are few countries and/or regions where the transport and mobility planning is included in other major strategies at their level. Moreover, given the urgency of the climate change actions, many sites chose to develop a more comprehensive strategy for climate. Within some of these strategies developed in European cities, there is no barrier between different sectors; actions are thought to achieve expected results based on their impact on the climate, rather than on a sectorial achievement.

Without any doubt, the SUMP is still an important planning exercise, that allows cities to develop a vision for mobility and a plan to achieve it. UPPER sites have all put effort in developing a SUMP, some of them being at the second edition, some of them extending the scope of the SUMP at the regional or metropolitan levels. This approach demonstrates the importance of the SUMP as mobility planning instrument recognised not only at the city level, but also at the national and European levels.

UPPER sites have made significant efforts towards sustainable mobility and climate neutrality planning. However, the development of their SUMP and other related planning documents have met various barriers and challenges in design and implementation. This section will examine the main challenges noticed by the UPPER sites in the process of designing and implementing their Sustainable Urban Mobility Plans, with a particular focus on the central role of the public transport system within these plans.

4.1   The SUMP in UPPER sites – an overview of the current situation

All UPPER sites have a SUMP or an equivalent, such as a master plan for transport or urban development strategy containing transport projects. Some of the sites are in the process to update their current SUMP; some of the cities are expanding the scope of the SUMP from the city level to metropolitan area, such as Rome and Lisbon. All SUMPs are or will be developed either at the local level or at the municipal level or even at the regional level. Moreover, UPPER measures are included, or they will be included in the SUMP objectives or specific projects. In Table 1 it is presented an overview of the SUMP situation in all UPPER sites, while Figure 10 presents how many measures from the total of the UPPER measures are directly linked with SUMP objectives and measures.

Table 1 Overview of the SUMP situation in UPPER sites

UPPER site	SUMP status	Covered area	Funding source
Valencia	2013	City	City budget Regional government
Rome	Adopted: Year 2019 - Approved Year 2022	City	City budget EU funds National government
IdF/VGP	The SUMP is adopted region wide. The current version was covering the 2010-2020 period (a first evaluation took place in 2017); has been evaluated again in 2020 and is now being revised. The next version is near completion and will cover the 2020-2030 period.	Region	Regional government

UPPER site	SUMP status	Covered area	Funding source
Oslo	SUMP is covered by other strategic plans		
Mannheim	SUMP is under Development / will be adopted by end of 2023/beginning of 2024	City	City budget
Lisbon	The current SUMP was published in 2016 (last revision in 2019). New metropolitan and city SUMPs are being launched; expected to be concluded in 2024/25.	City/Metropolitan	EU funds Regional government 18 municipalities of the Lisbon Metropolitan Area
Budapest	2019	City	City budget
Leuven	Year 2003 - new expected in 2023	City	City budget
Thessaloniki	2022	City	City budget
Hannover region	2023	Region	Region budget

Figure 10 Overview of the identified UPPER measures in all sites related with SUMPs objectives or specific projects in all UPPER sites
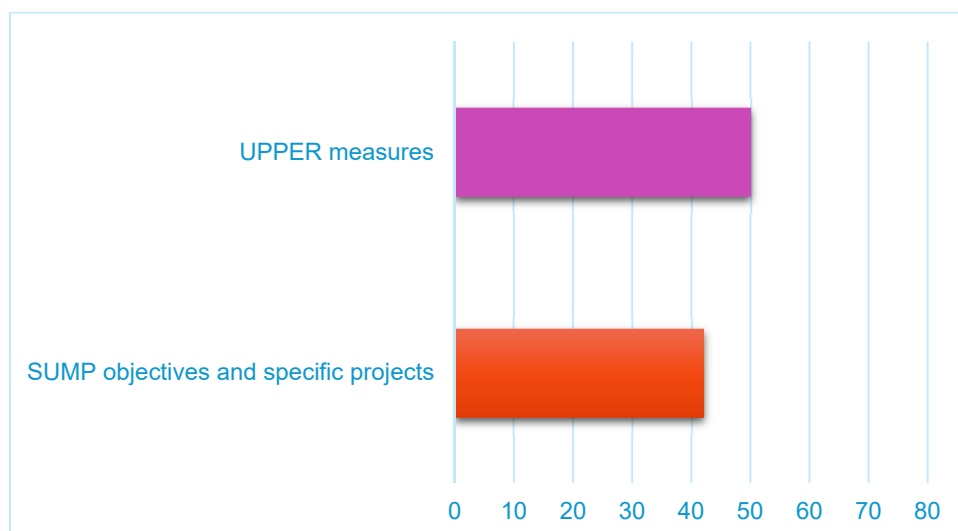
There are few notable particularities regarding the SUMP development and practice in UPPER sites. One of them is represented by the City of Oslo which does not have a SUMP, as defined by the European guidelines. However, the City of Oslo has different plans and strategies, which address the transport and mobility aspects; they all together consist of an equivalent to a SUMP in Oslo. All these plans and strategies are developed at different levels; one prominent example is the "Oslo package". This is a plan for redevelopment, which is made by the city of Oslo together with the neighbouring counties. Another important document at local level, The Municipal Master Plan provides the strategic umbrella for many transport projects. Last, but not least, the Climate Strategy for the

City of Oslo focuses on measures that would contribute to reducing the transport related emissions. The Climate strategy covers all areas for emission reduction, with the aim of reducing climate emission by 95% within 2030. It is important to mention that although the existence of these plans may provide an image of fragmentation, they all are developed in collaboration with major stakeholders at local and regional levels.

Another important particularity is represented by the UPPER site of Versailles Grand Parc (VGP). Administratively, VGP is a conglomeration of communes in the South-Western area of Paris. The administrative layers (the French "mille-feuille" administrative structure) and the relationship between the major local and regional authorities provide a very complex governance structure. VGP represents the interests of 18 communes in any decision taken at the regional level. This complex decision-making system requires that each of its stakeholders correctly articulates their needs and interests to obtain a good quality transport system. The SUMP is elaborated by the regional transport authority, Ile de France Mobilités (IDFM) for the entire region, therefore the collaboration between VGP and IDFM is crucial. The last SUMP covered the period 2010 – 2020. By continuously assessing the plan and its implementation, IDFM creates roadmaps for project implementation on a shorter time-horizon of 2 to 3 years. A new version of the SUMP is under preparation, being expected to be approved in 2024. This new plan will cover the period until 2030.

The process that the UPPER sites undertook to deliver their SUMP follows more or less the same pathway, despite the differences between the sites, their governance structure and traditional planning culture (Figure 11). Moreover, the political support has been perceived as a crucial element in the process of developing the SUMP and later in the process of approval and its subsequent implementation. One of the major characteristics that is an integral part of the process of development of the SUMP is the stakeholder and citizen engagement. All UPPER sites have declared that this activity is an important step in the process, and it requires effort, skills and sometime specific partnerships created to ensure that the engagement process has results, both for the city authority (or regional authority in certain cases) and the end users. Some UPPER sites developed internal structures (departments/offices dealing with public engagement) that support the engagement activities.

Figure 11 Responsibility for producing SUMP
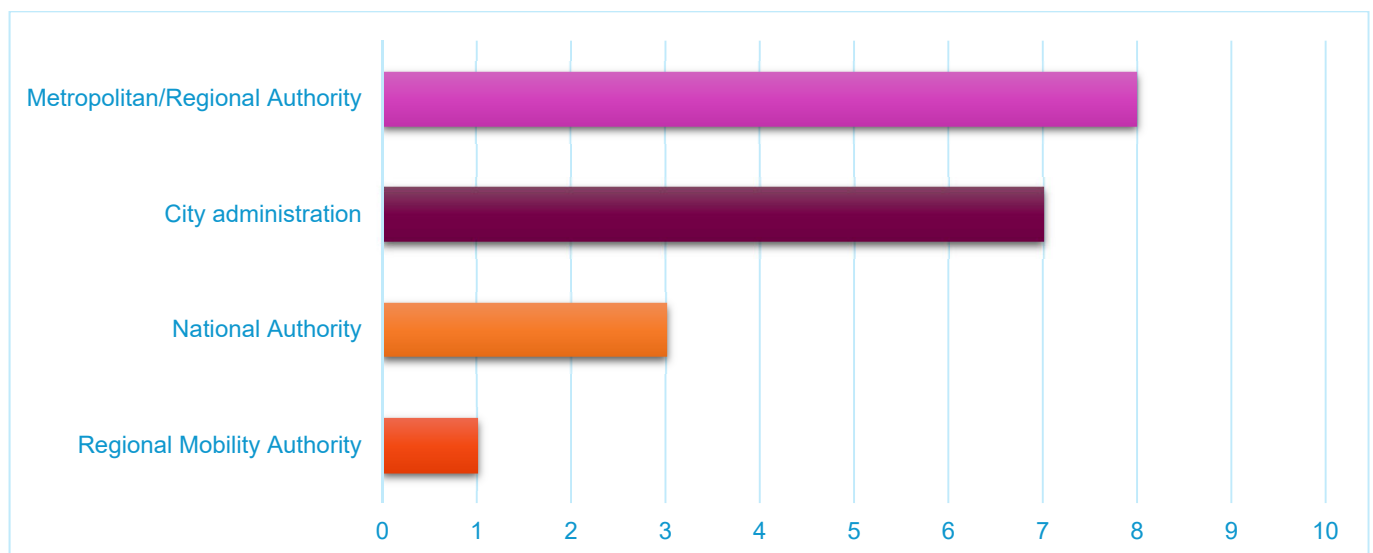
The urban mobility planning usually is done at local or regional level, however that are some situations when the importance of the city - sometime a capital city or a major economic centre in the country - implies that the mobility planning could be done at regional level, or it could even be influenced by national rules and regulations in force. It is worth mentioning that it is encouraging to observe that it is an ascending trend of developing a more comprehensive transport system, integrated, and addressing the needs and expectations of a larger area than traditional administrative area of a city. This is an immediate result of the dialogue between the City Authority and

the neighbouring authorities, associated or not (such as in in the case of Ile de France/Versailles Grand Parc or Lisbon collaborating with the administrations of the surrounding localities). The positive results of such an approach are significant for the city, and for the region.

One aspect that is important to notice is that usually a SUMP is developed in isolation. Sometimes the SUMP is integrated with a SULP, an urban development strategy, a smart city strategy or even a climate strategy. Even though the current practice[4] encourages the development of the SUMP as a single document that governs the implementation of the sustainable mobility, there are examples of good practice where major strategies at local level are developed in an integrated way. Moreover, the current urgency to action to protect the climate, may determine a new approach to better integrate the mobility in the climate strategy.

The SUMP development has been funded differently in UPPER sites; the funding sources varied. Many of the UPPER sites have funded their SUMP from the city or regional budget, such as the case of Budapest, Leuven, Valencia, Thessaloniki, or Lisbon. However, if we are considering the regional level, Lisbon develops their regional level SUMP partially with EU structural and cohesion funds, partially with the contribution of the municipalities in the Lisbon Metropolitan Area. These are only examples of how UPPER sites are trying to use efficiently the available resources for important projects and initiatives at local level.

However, many UPPER sites representatives declared that there is room for a more efficient use of the available resources, especially considering the implementation of sustainable mobility solutions. Only half of the UPPER sites' representatives declared that the usage of resources is done in an efficient manner, asserting that there is room of improvement of how the available funds are used. Most of the insights provided in this respect refer to the City authority's capacity to correctly prioritise the local projects and align them with the local/regional priorities. Other insights refer to improve the integration of local strategies and plans developed at local and regional levels; sometimes, they are developed in isolation, without considering the needs and priorities of different other sectors and projects. Eliminating possible barriers will facilitate the efficient usage of resources with immediate impact on the integration between different actions at local level.

4.2 Barriers and drivers in developing and implementing SUMP's measures in the UPPER sites

Developing and implementing Sustainable Urban Mobility Plans (SUMPs) in the UPPER sites can be influenced by various barriers and drivers (Figure 12, Figure 13, Figure 14). These factors play a critical role in shaping the success and effectiveness of measures within the SUMPs. This section explores the key barriers and drivers identified in the context of UPPER sites, highlighting the challenges and opportunities faced during the planning and implementation process.

The organizational fragmentation within the city/authority proved to be a significant hurdle. Various departments and agencies involved in urban planning and transportation often operated in silos, lacking coordination and collaboration. This fragmented approach hindered the smooth integration of sustainable mobility measures into the overall urban development framework.

Another key barrier was the lack of political support. Despite the importance of sustainable mobility and climate neutrality, there were instances where the political support to prioritize these issues was insufficient. This lack of support resulted in limited resources, inadequate funding, or a lower level of commitment from decision-makers, impeding the progress of implementing either the SUMP or other related planning documents.

Another barrier faced by UPPER sites is the political sensitivities associated with parking policy. Parking policies can be politically contentious, often requiring careful navigation to strike a balance between stakeholders' interests. Overcoming these sensitivities requires strong political will and commitment, which serve as drivers for pushing forward with sustainable mobility measures. Political decision-making processes can also act as a barrier, especially when there are delays or lack of consensus. However, the presence of a participatory framework that encourages stakeholders' involvement can serve as a driver by fostering collaboration and ownership of the measures.

Financial challenges and the search for funding sources present additional barriers to the successful implementation of SUMP measures. Lack of funds and delays in institutional cooperation and SUMP adoption can hinder progress. However, drivers such as international transport-related commitments and the support of national and regional authorities in providing adequate funding could facilitate the implementation process. It is essential to establish a supporting framework that aids in the monitoring and evaluation of SUMP measures, providing financial support and ensuring the availability of resources.

Figure 12 Perceived barriers for developing sustainable urban mobility planning (multiple choice response, % of the total answers received across the 10 UPPER sites)
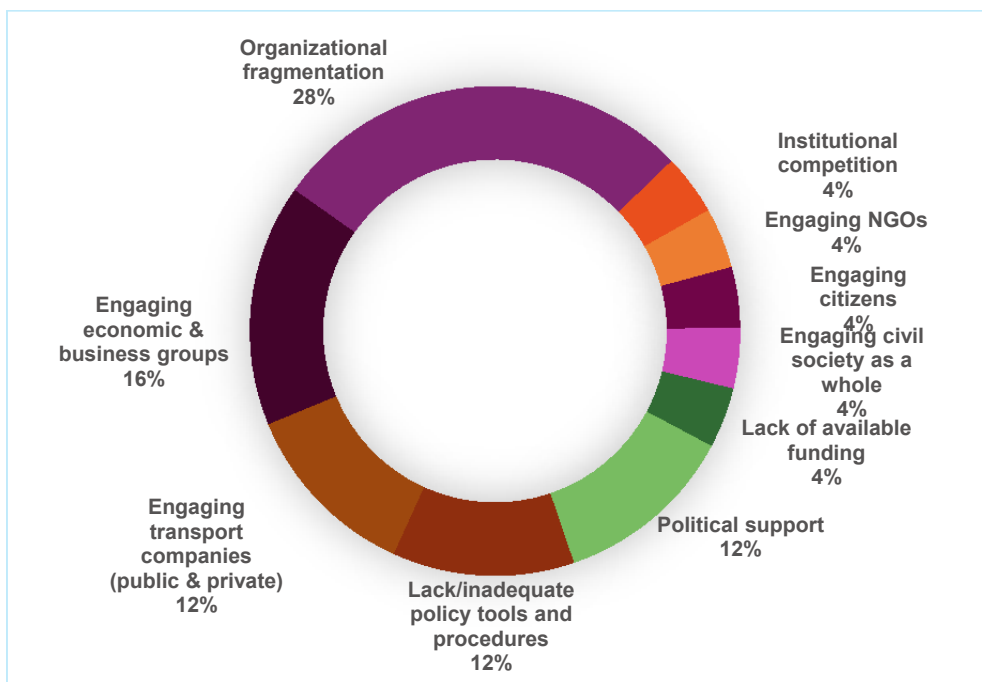
Figure 13 Perceived drivers for implementation of sustainable mobility policies (level of importance 1 low and 5 high, weighted average values based on all UPPER sites that responded to the question)
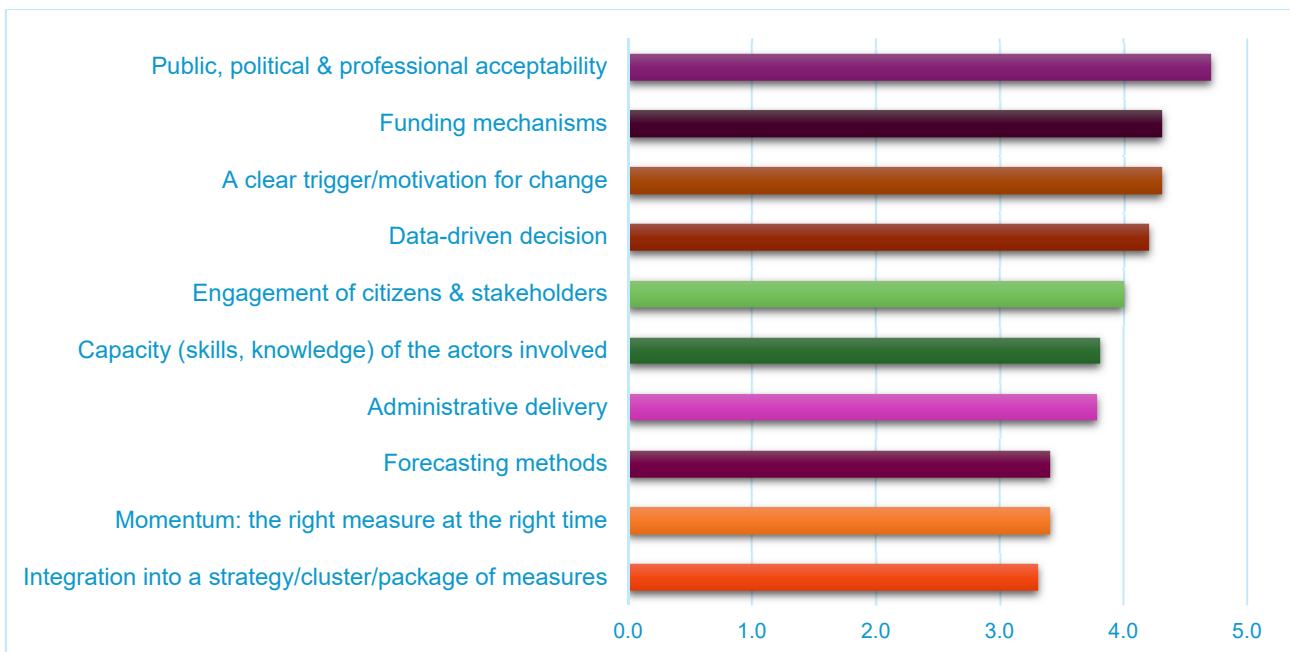
Figure 14 Perceived obstacles for implementation of sustainable mobility policies (level of importance 1 low and 5 high, weighted average values based on all UPPER sites that responded to the question)
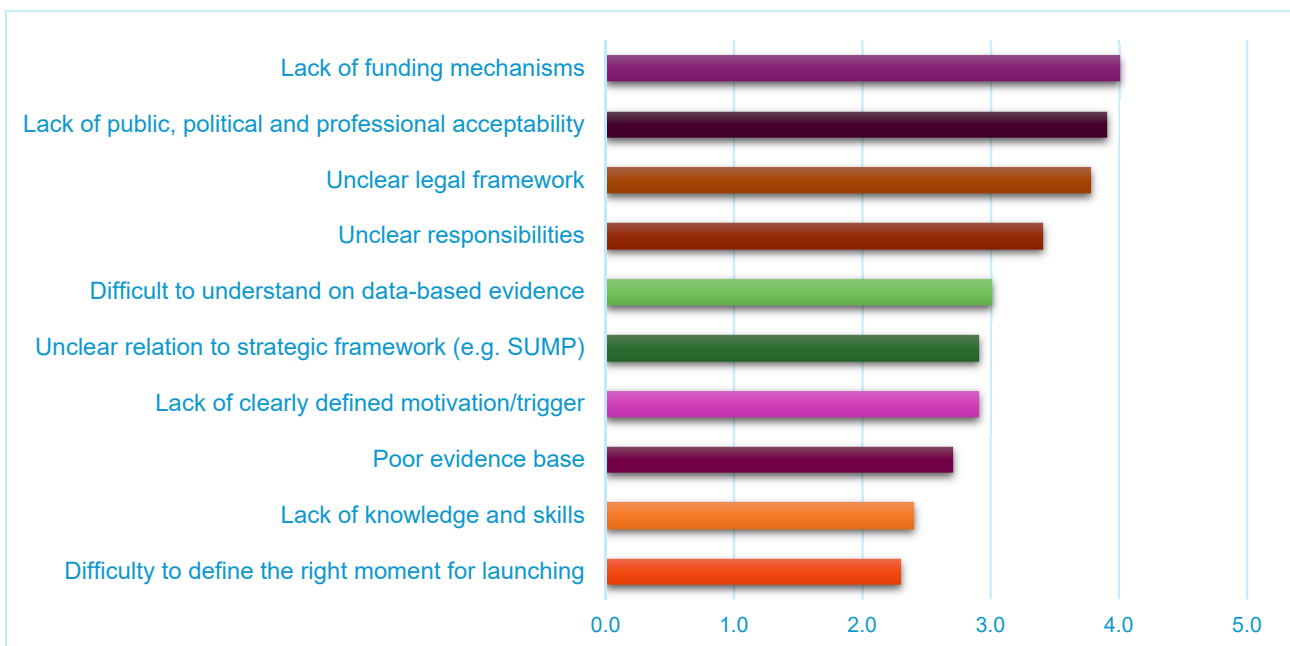
Ownership of the measures and difficulties in cross-sectoral cooperation and leadership might create some barriers to effective implementation. Coordinating and aligning efforts between local and regional authorities is crucial for successful execution, requiring strong coordination. Furthermore, local coordination between planning, transport, infrastructure, and traffic engineering organizations is essential to overcome barriers and drive the implementation

process forward. Establishing new collaboration schemes, such as public-private partnerships and other innovative models, can serve as drivers to mobilize resources and expertise.

Engaging citizens and gaining their involvement is another critical aspect of the SUMP implementation. Slow changes in attitudes and behaviour towards sustainable mobility among politicians and inhabitants can act as a barrier. However, creating proper communication channels between mobility experts and the public to establish support and increase active participation can be a driving force for successful implementation. Additionally, the lack of broad and active public support necessitates efforts to develop a participatory framework that involves citizens in decision-making processes, ensuring their voices are heard and their needs are addressed.

In certain cases, implementation challenges arise from unforeseen events during the construction of new public transport infrastructure, such as archaeological constraints (Rome is a perfect example in this regard). While these challenges may lead to delays, they can be addressed through careful planning and risk management strategies. Furthermore, the creation of business models that align with SUMP solutions and measures can serve as drivers for implementation, providing financial viability and sustainability.

In conclusion, UPPER sites face a range of barriers and drivers in developing and implementing SUMP measures. Overcoming these barriers requires political will, adequate funding, coordination among different levels of governance, cross-sectoral cooperation, citizen engagement, and the establishment of collaborative frameworks. The presence of drivers such as international commitments, financial support, participatory approaches, and shifting attitudes towards sustainable mobility can propel the implementation of measures outlined in the SUMPs. By addressing these barriers and leveraging the drivers, UPPER cities can make significant strides towards achieving sustainable and climate-friendly urban mobility.

UPPER sites have made progress in sustainable mobility and climate neutrality planning, but several barriers have been encountered during the development of the SUMP and related planning documents. Overcoming challenges related to policy tools, organizational fragmentation, political support, stakeholder engagement, and the weaknesses of the public transport system will be essential to achieving sustainable and climate-friendly urban mobility in the region.

4.3 The importance of public transport-related measures in SUMP in UPPER sites

Public transport measures play a crucial role in the SUMPs developed by the UPPER sites. These measures are of paramount importance for achieving sustainable and climate-friendly urban mobility objectives. By prioritizing and investing in public transport, UPPER sites can address various challenges related to congestion, air pollution, carbon emissions, and social equity. This section will explore into the significance of public transport measures in SUMPs, focusing on two key aspects: reducing private vehicle usage and promoting sustainable, accessible, and efficient public transport systems. This approach allows to provide an understanding for the push and pull measures that will be implemented in UPPER.

One of the primary goals of public transport measures in SUMPs is to reduce private vehicle usage. Private vehicles contribute significantly to traffic congestion, emissions, and energy consumption. By shifting the travel patterns of residents and visitors towards public transport, UPPER sites can alleviate congestion on roads and reduce the environmental footprint associated with private vehicles. Public transport measures, such as improving accessibility to public transport stops and stations, enhancing service frequency and reliability, and providing efficient intermodal connections, aim to develop an attractive alternative to individual car use. These measures encourage modal shift, attracting more individuals to choose public transport for their daily commutes and reducing the overall dependency on private vehicles.

Promoting sustainable, accessible, and efficient public transport systems is another crucial aspect for public transport measures in SUMPs. Sustainable public transport helps in achieving climate neutrality targets by reducing greenhouse gas emissions and promoting clean energy solutions. UPPER sites can prioritize the use of low-emission or zero-emission vehicles in their public transport fleets and invest in infrastructure to support electric

or hydrogen-powered buses, trams, and trains. Integrating sustainable mobility solutions, such as bike-sharing schemes, pedestrian-friendly infrastructure, and last-mile connectivity options, further enhances the accessibility and attractiveness of public transport.

Accessibility is a key consideration in public transport measures, ensuring that all segments of society, including people with disabilities, the elderly, and economically disadvantaged individuals, have equal access to transport services. Hence, UPPER develops the MaaR concept (Mobility as a Right) where UPPER sites will focus on improving physical accessibility by providing barrier-free access to public transport infrastructure, use of vehicles with features that accommodate to different mobility needs and implementing real-time information systems to assist passengers with planning their travel. Moreover, efforts to ensure affordability and fair pricing policies, such as fare integration, concessionary schemes, and flexible payment options, make public transport more accessible and socially inclusive.

Efficiency is essential for the success of public transport measures in SUMPs. UPPER sites intend to optimize the performance of their public transport systems by implementing intelligent transport systems, data-driven planning, and demand-responsive services. ITS technologies, such as real-time tracking, smart ticketing, and traffic signal priority, will contribute to enhance the reliability, convenience, and efficiency of public transport operations. Data-driven planning enables evidence-based decision-making, allowing cities to identify demand patterns, optimize routes and schedules, and allocate resources efficiently. Additionally, demand-responsive services, such as flexible routes and on-demand transport options, improve the public transport systems capacity to adapt to the evolving needs of passengers.

Apart from the direct benefits of public transport measures in terms of reducing congestion, improving air quality, and promoting sustainable mobility, there are numerous indirect advantages. Public transport contributes to social cohesion by facilitating social interaction and reducing social segregation, particularly for vulnerable groups. It also supports economic development by providing affordable transport options for workers commuters, improving access to employment centres, and reducing the economic burden associated with private vehicle ownership and operation.

In conclusion, public transport measures play a pivotal role in the SUMPs of UPPER sites. By prioritizing public transport, UPPER sites intend:

- to reduce private vehicle usage,

- to promote sustainable, accessible, and efficient transport systems,

- to address challenges related to congestion, air pollution, and social equity.

Public transport measures contribute to a more sustainable, climate-friendly, and socially inclusive urban mobility landscape. Efforts to enhance accessibility, optimize efficiency, and integrate innovative technologies and services will be instrumental in realizing the vision of sustainable and accessible transportation systems in UPPER sites.

Turning to the weaknesses of the public transport system in UPPER sites, several aspects require attention. Accessibility, particularly the ease of reaching public transport stops/stations by walking, was identified as a weakness by the UPPER sites' representatives. Improving pedestrian access to mobility hubs would enhance the overall convenience and attractiveness of public transport.

Integration, both within the public transport system and with other mobility services, was another perceived weakness by the UPPER sites' representatives. Seamless transfers and multi-modal connectivity are vital for encouraging a shift towards sustainable mobility. Efforts should be made to facilitate smooth and efficient transfers between different modes of transport.

Vehicle comfort and accessibility, including provisions for vulnerable user groups, also need improvement. Ensuring safe and comfortable journeys for all passengers, regardless of their mobility needs, is crucial for promoting inclusive and sustainable transportation.

5.The public transport role in UPPER sites – a SWOT analysis

As explained in the first part of the document, a SWOT analysis has been done within the context of the UPPER project. This approach allowed UPPER sites representatives and their local mobility stakeholders to reflect on the current situation of mobility at their site, including the opportunities, and the potential challenges related to the delivery of an efficient, reliable, and eco-friendly transport service to the wider community.

This analysis specifically focused on the existing and potential role of public transport as an essential component of the mobility system within urban areas and regions. City/Regional authorities, public transport professionals, land-use planners, researchers, etc. joined their efforts to identify the strengths and weaknesses, as well as the opportunities and threats they face in their respective mobility environment. By engaging in this process, site representatives/stakeholders could develop various strategies that can support evidence-based decision making, stakeholder engagement, innovation, and continuous improvement. The MIRO board supporting this activity is presented in Figure 15.

The work on the MIRO board was divided in two major parts:

1. First part, the actual SWOT analysis when UPPER sites representatives have tried to identify the most representative aspects for their city/region

2. The second part of the analysis was dedicated to understanding how they can take advantage of the understanding of the SWOT and how they can define strategies for coping with the existing weaknesses and threats and how to take advantage of the opportunities considering their strengths, mainly to develop a resilience strategy.

Figure 15 SWOT analysis template

UPPER Site
SWOT analysis of the overall mobility offer, focusing on the current and potential PT role
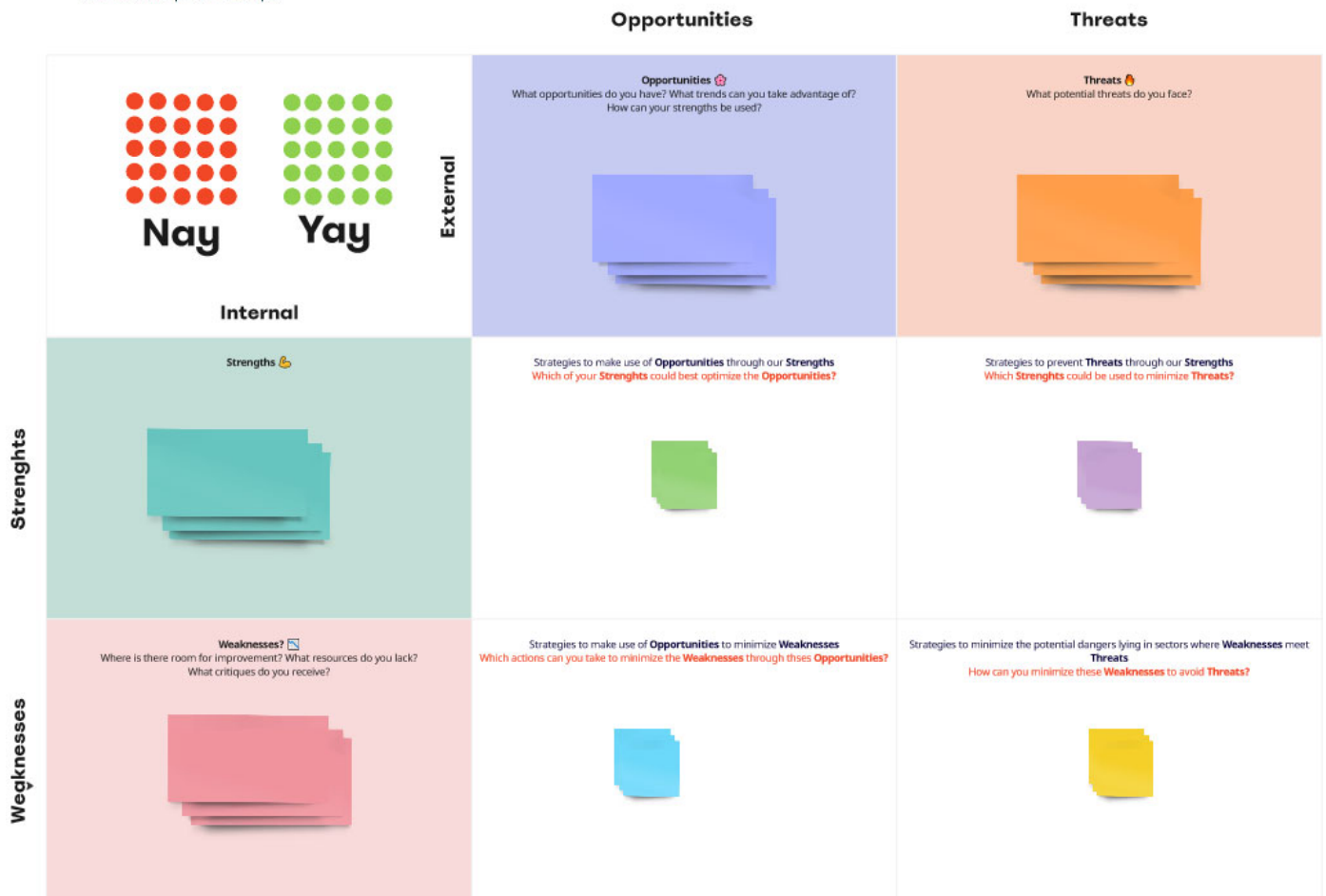
This chapter presents the mainly common findings of the SWOT analysis for the 10 UPPER sites. There are additional elements, but specific to each site.

5.1. UPPER sites - perceived strengths

The main common **strengths** of the current mobility offer in UPPER sites, as a result of the SWOT analysis are presented in Figure 16.

All 10 UPPER sites have a high level of public transport coverage, meaning that most of the urban area and population are served by public transport modes, such as metro, tram, bus, etc. This ensures that inhabitants, tourists, and visitors have a variety of mobility options to choose from and can easily reach their destinations without relying on private cars.

Seven UPPER sites declared their strong engagement with stakeholders, such as politicians, local authorities, transport operators, civil society, private sector, etc as a strength. This collaborative approach contributes to obtaining an innovative public transport system. Moreover, this capacity is vital for facilitating the development of new mobility services that are sustainable, relevant to the public.

Figure 16 The five most common strengths of the 10 UPPER sites
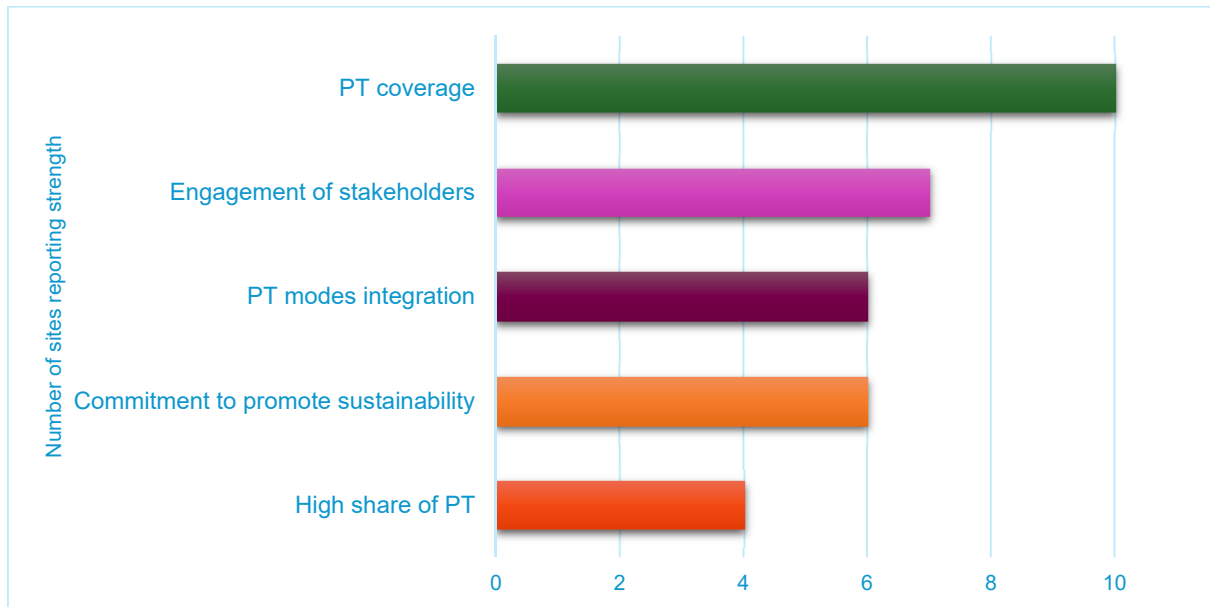
Several UPPER sites have achieved a high level of integration in their mobility systems. The integration refers to the infrastructure (e.g. stations, stops, lanes, etc.) to facilitate the intermodal transfer and accessibility of users, and also to the ticketing and payment systems, allowing users to pay for different modes with a single card or making use of various apps. This implies a coordinated planning and operation of different modes of transport, such as public transport, bike-sharing, car-sharing, etc.

More than half of UPPER sites highlighted a strong commitment in promoting sustainability through their public transport and mobility policies and practices. This indicates that they have set up ambitious goals and targets to mitigate greenhouse gas emissions, enhance air quality, promote social inclusion, and encourage economic development. In addition, various measures and incentives have been implemented to promote the usage of public transport and other environmentally friendly modes of transport, including cycling and walking, and to integrate social and economic aspects in the decision-making process.

Among the common strengths observed in UPPER sites is the significant public transport share. This suggests that the public transport system is highly used in UPPER sites, mainly based on their reliability, affordability, and overall efficiency.

Beside these common strengths, it is worth mentioning other several strengths that support the position of public transport:

- the capacity to adapt the public transport service to meet demand,

- the potential to integrate advanced innovative IT solutions within their mobility service structures,

- the availability and the use of various sources of funding,

- the international decarbonization commitments.

In a nutshell, in the 10 UPPER sites there are lots of strengths that could jointly contribute to the improvement, promotion, and development of public transport and sustainable mobility services.

5.2. UPPER sites - perceived weaknesses

The analysis has revealed the existence of five prevalent **weaknesses** that have a direct effect on the performance and quality of public transport and mobility services in UPPER cities/region (Figure 17).

Figure 17 The five most common weaknesses identified during the SWOT analysis in UPPER sites
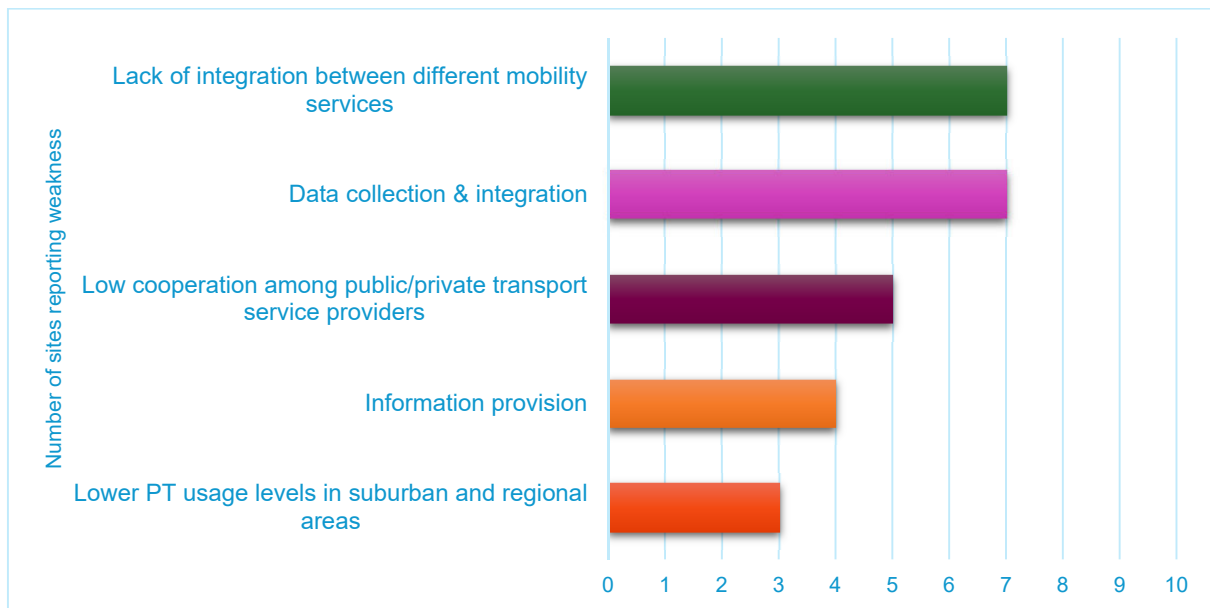
One of the most common perceived weakness is related to the integration among different mobility services and the associated supporting infrastructure. As an example, several UPPER sites do not have a good level of connectivity among various modes of transport, such as urban public transport and regional or intercity rail systems, or between public transport and alternative mobility options, such as bike-sharing services, taxi, car-sharing, etc. Consequently, there are inefficiencies, longer transfer times, and a diminished level of seamlessness for passengers, thereby fostering a preference towards private car usage.

Most UPPER sites do not have a comprehensive and accurate data infrastructure that efficiently acquires and integrates information related to various mobility services, mobility patterns, travel demand, and user preferences, etc. This is related to the lack of integration of data generated from diverse sources and platforms, managed by multiple providers. The process of collecting and integrating data is of paramount importance in the strategic development, ongoing evaluation, performance assessment, and improvement of public transport and mobility services. The lack of reliable and comprehensive data presents difficulties when identifying the requirements and forecasts, strengthening the use of resources, evaluating the success and impact of services, and developing innovative approaches.

Thirdly, there is an inadequate level of cooperation and collaboration between public and private transport service providers. This situation leads to a fragmented and competitive market for mobility, in which various stakeholders prioritize their individual interests instead of collaborating to provide an efficient and integrated mobility service for users. For instance, certain private operators are reluctant to share their data with public authorities or other mobility operators, or sometimes they are not compliant with existing rules or regulations.

One additional limitation refers to the insufficient information offered to citizens who want to use public transport and mobility services. Several UPPER sites do not have user-friendly and easily accessible information platform that provides schedules, routes, and real-time updates associated with different modes of transport. Additionally, the available information might be insufficient or difficult to access. This shows a challenge for users in terms of effectively planning their trips, evaluating different alternatives, and making well-informed decisions. Additionally, this reduces the level of trust and overall satisfaction with the mobility system.

A fifth perceived weakness is that suburban and rural areas use public transport less frequently than urban areas. That phenomenon can be linked to a multitude of factors, including but not limited to a higher level of car ownership, lower population density, longer distances, lack of awareness regarding available public transport alternatives, lower frequency, and coverage of services. This effect leads to a vicious cycle, wherein diminished demand results in lower supply, thereby discouraging the use of public transport.

Besides these weaknesses, there are others mentioned by the UPPER sites. These include the administration rigidity, which slows down the development and integration of innovative and sustainable transport systems. Additionally, there is a lack of secured funding mechanisms and administrative skills, or the failure of public transport systems to adequately address the vulnerable users 'needs, weakening inclusivity and effectiveness.

To improve the reliability, efficiency, and long-term sustainability of transport systems in the UPPER sites, it is important to address these identified weaknesses.

5.3. UPPER sites - perceived opportunities

The SWOT analysis conducted in UPPER sites has revealed the main shared opportunities related to public transport and mobility services (Figure 18).

Figure 18 The five most common opportunities identified during the SWOT analysis in UPPER sites
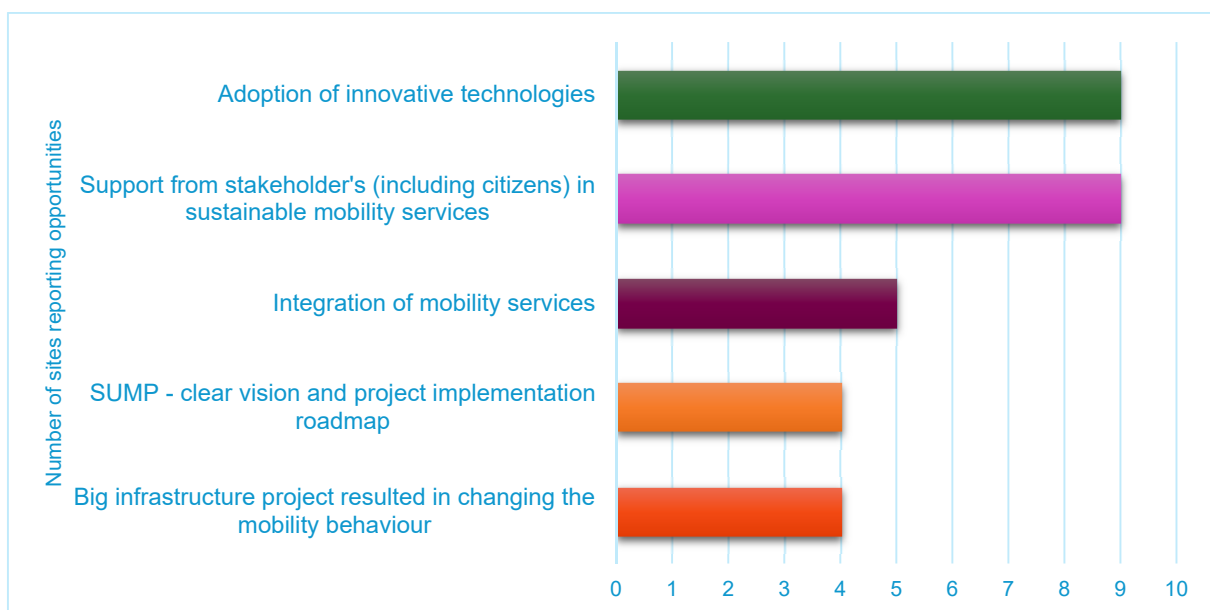
The adoption of innovative technologies was highly considered as an opportunity by many of the UPPER sites. This indicates a significant preference and the capacity for embracing new technologies that have the potential to improve the efficiency, safety, accessibility, and environmental sustainability of public transport and mobility services. Several examples of innovative technologies that were either considered or already implemented by sites include smart ticketing systems, real-time information systems, bike and car-sharing schemes, and MaaS.

The level of support from stakeholders (including citizens) in sustainable mobility services was highly mentioned by most of the sites. This indicates a significant degree of interest and active involvement from different entities and groups in encouraging and enforcing sustainable mobility solutions. Several factors played a role in facilitating this opportunity. These factors include:

- the availability of participatory methods and processes,

- the implementation of awareness and education campaigns,

- the engagement of local media and

- the positive acceptance of previous pilot projects.

Moreover, stakeholders play a crucial role in providing valuable inputs, feedback, resources, and support throughout the various stages of designing, testing, promoting, and evaluating innovative solutions aimed at improving public transport and mobility services.

The integration of mobility services is seen as a logical opportunity, following the adoption of new technologies. This will allow the coordination and integration of different modes of transport and mobility services into a single and user-centric framework capable of fulfilling different needs and preferences of users. The integration of mobility services encompasses various aspects, including physical integration, operational integration, tariff integration, and information integration.

The implementation of a large-scale infrastructure project is seen as an opportunity to produce an important shift in the mobility behaviour by creating a window for introducing or promoting new or alternative modes of transport and mobility services. Several significant infrastructure projects mentioned by the cities included airport, metro and tram lines, etc. These projects are expected to produce favourable outcomes in terms of mitigating congestion, pollution, travel time, and accidents.

The opportunity to have a clear vision and project implementation roadmap through SUMP was mentioned by several cities. There are multiple advantages associated with the implementation of a SUMP. These include the provision of a strategic framework and guidance for mobility policies and initiatives, the promotion of coherence and consistency across various plans and projects, the facilitation of effective communication and collaboration among stakeholders, the securing of funding and resources, and the monitoring and evaluation of progress and outcomes.

These opportunities have the potential to be used in order to improve the efficiency, quality, attractiveness, sustainability, and user satisfaction related to public transport and other sustainable mobility services. Nevertheless, the above-mentioned opportunities require careful planning, efficient management, and successful implementation to overcome possible obstacles and threats. Therefore, it is necessary to adopt a holistic and coherent strategy towards public transport and other mobility services that considers every aspect of urban mobility in an equitable manner.

5.4. UPPER sites - perceived threats

There are several **threats** that are common to UPPER sites that might hinder the attractiveness, efficiency, and sustainability of the public transport and sustainable mobility services, as resulted from the SWOT analysis (Figure 19).

Figure 19 The five most common threats identified during the SWOT analysis in UPPER sites
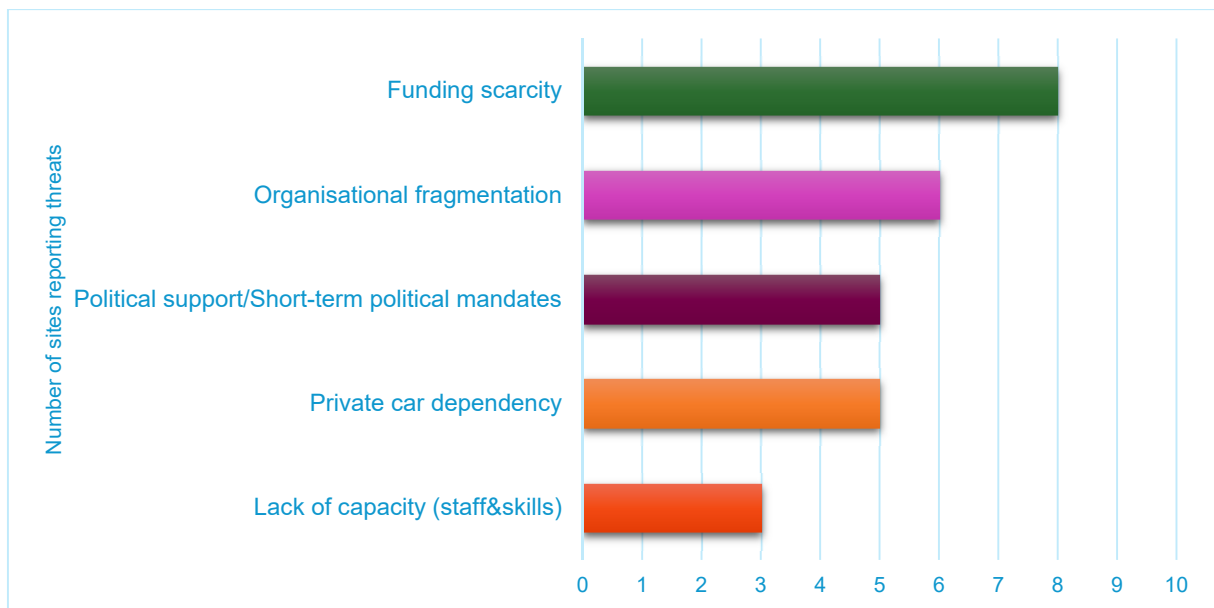
The main declared threat by UPPER sites is scarcity of funds. Public transport and sustainable mobility services more globally frequently experience a shortage of financial resources, thereby preventing their capacity to adequately maintain their infrastructure, operations, and overall performance. Funding scarcity can result from a variety of factors, including but not limited to:

- reduced fare revenues,

- higher operational expenses,

- a reduction in budget allocations,

- inadequate funding mechanisms in place.

The shortage of funds can result in a negative impact on the reliability, safety, accessibility, and attractiveness of public transport as well as mobility services.

Another threat faced by certain UPPER sites is the fragmentation within the management of public transport and mobility services. This fragmentation arises from the existence of multiple actors with different objectives, responsibilities, and interests. Organisational fragmentation could be a result of a range of factors, including heritage, institutional complexity, political interference, or inadequate coordination. The possible consequence of this situation could be a gap in the coordination, integration, and cooperation among the various modes of transport, operators, and stakeholders involved. The existence of organisational fragmentation can lead to inefficiencies, conflicts, and gaps in the planning, regulation, and delivery of services.

The prevalence of private car dependency represents a significant threat to a few UPPER sites. This suggests that public transport meets significant competition from private cars, which continues to be the preferred form of transport in many urban areas. Private car dependency may exist because of numerous factors, including cultural preferences, convenience, affordability, limited awareness, acceptance, and satisfaction with public transport, as well as a lack of alternatives. Too much reliance on private cars might result in negative effects for urban/metropolitan areas, including increased congestion, pollution, weakened public health, and reduced liveability. Moreover, it might hinder projects aimed at promoting and improving the use of public transport.

One additional threat that impacts 5 out of 10 UPPER sites is political support and the impact of the short-term political mandates. This indicates that the political will and vision of decision-makers who are in the position to influence the development and implementation of public transport and mobility services are essential. The potential consequences of this situation may have an impact on the stability, continuity, and legitimacy of policies, strategies,

and projects related to the transportation sector. Furthermore, it is important to consider that the existence of short-term political mandates has the potential to hinder the long-term vision and strategic planning of public transport and mobility services, as well as their alignment with the higher objectives of urban development.

Certain cities experience a shortage in qualified and skilled personnel across various levels in public transport. The potential consequences of this could include a negative impact on the overall quality, safety, and innovation of the services, as well as a reduced ability to swiftly adapt to changing demands and requirements of the users. Furthermore, the limited capacity could impact the capacity to effectively adopt and implement best practices, standards, and regulations within the transport sector. Lacking capacity to effectively tackle emerging challenges can result in service disruptions and decreased levels of customer satisfaction.

These threats represent significant challenges that cities need to address to ensure the sustainability, efficiency, and success of their public transport and mobility services. Proper planning, investment, and cooperation among stakeholders are essential to overcome these threats and create a more reliable and user-friendly public transport system.

The results of the second part of the SWOT analysis are specific to each UPPER sites and are included in **Annex A**.

6.UPPER measures to improve public transport

The UPPER project aims to revolutionize the mobility ecosystem across its 10 demo sites by placing Public Transport at its core. This strategic approach will not only align with each site's local ambitions but also contribute to achieving the broader UPPER project goals. The project's success will be achieved through the implementation of about 80 innovative, user-centric, and mission-oriented measures, working on the 5 innovation axes that influence user's choice in transportation:

- **Mindset and culture:** Perception of accessibility, User satisfaction, Concept of Freedom, Maslow applied to PT, the status of PT, PT as a carrier of culture, image, "coolness".

- **Urban Mobility Planning:** Ability to structure space at regional, local and hyperlocal levels, PT as the focal point for urban development and economic activity, the combination of infrastructures and services.

- **Mobility services ecosystem:** Intermodality, MDMS, digital ecosystem, eMobility system, the first mover in automation.

- **Road network management:** Priority management (traffic lights), access regulation, low emission zones regulation and monitoring, parking space management.

- **Democratic governance:** Multi-stakeholder and multi-level governance, PT as a driver for inclusion, societal return on investment of long-term capital and revenue spending.

While the UPPER measures may have an impact on multiple innovation axes, they have been systematically categorized based on their primary area of influence (Figure 20). This classification ensures a clear understanding of each measure's main focus and enables us to address the most critical aspects of innovation for effective implementation and evaluation.

Figure 20 Classification of the "push and pull" UPPER measures
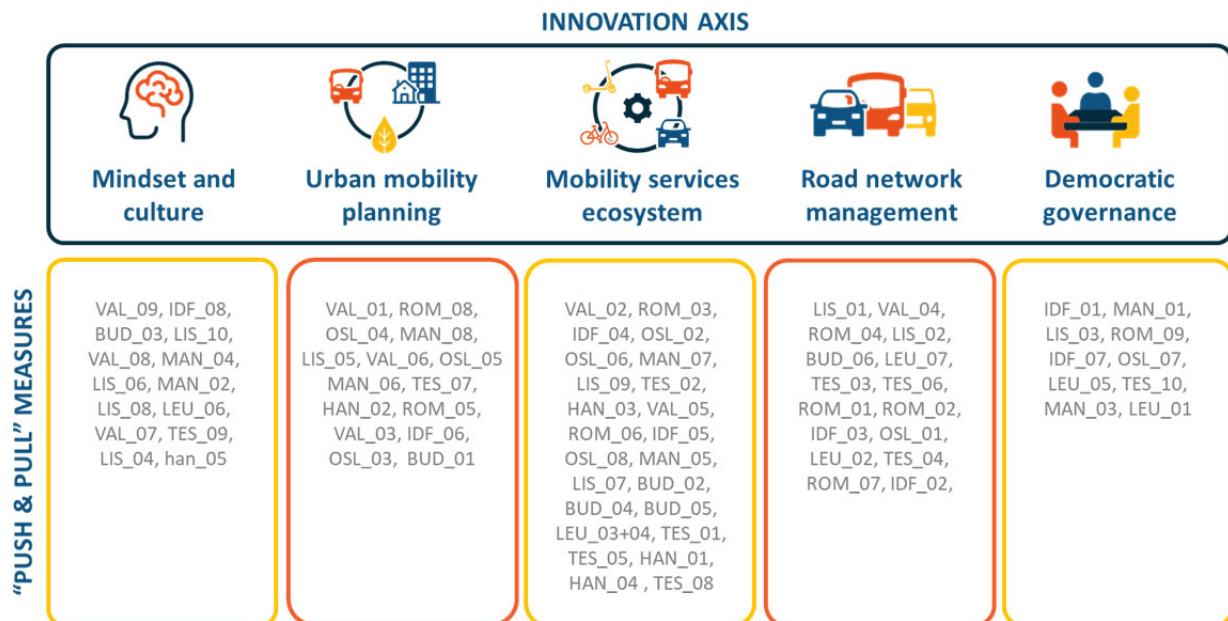
Each site, according to its current situation, needs and strategies, and also in line with its respective SUMP, has defined its own set of measures. This chapter provides an overview of the measures that will be implemented and demonstrated by each demo site. The comprehensive description of each measure, with regard to each of Living Labs and Twinning Sites, could be found in **Annex A**.

6.1 Living Labs

6.1.1 VALENCIA

VAL_01: 'Redistribution of urban space with a focus on Mobility as a Right'

This measure aims to redistribute the urban space in one of the main corridors of Valencia (Blasco Ibáñez Avenue), currently mostly used by cars, by improving on the one hand, the layout and capacity of the bus lanes, including a segregated space for the PT, as well as improving pedestrian and cyclist mobility, and on the other hand, increasing road safety in a space of great influx. This measure will deliver the construction project of a new distribution of the urban space in the surroundings of Blasco Ibáñez Avenue based on human-centred design, offering Mobility as a Right (MaaR) solutions.

VAL_02: 'Creation of a network of multimodal hubs'

This measure aims to establish two multimodal hubs in Blasco Ibáñez avenue, integrating various transportation modes to encourage modal shift. An evaluation of the corridor's mobility offer, and a citizen survey will gather preferences, needs, and barriers to modal shift. Based on collected information, the mobility offer in the hubs will be enhanced, including the introduction of new services like bike sharing and improved connections between modes. Real-time information about the mobility offer will be provided through multimodal panels.

VAL_03: 'To optimise public transport offer based on advanced technology'

This measure utilizes geospatial analysis of passenger and traveller flows to determine the optimal transport offer for specific city situations. With support from U-NEED, public transport passenger flows and underlying trends in mobility will be evaluated. Inefficiencies in the current transport offer will be identified, and potential solutions such

as increasing bus line frequency or adding/moving bus stops will be proposed. U-SIM.plan will simulate corrective actions, and the most suitable ones will be implemented.

VAL_04: 'To reduce travel times through the implementation of dedicated bus lanes'

This measure will assess, plan, and test a dedicated bus lane (BRT) connecting the Maritime District with the city centre via Blasco Ibañez Avenue. The analysis of mobility needs in the area will inform adjustments to the PT offer, such as increased bus frequency. Traffic light priority for public transport fleets will ensure efficient BRT lane performance. Findings from this first dedicated lane assessment will guide the identification and planning of BRT lanes in other districts of the city.

VAL_05: 'New Multimodal Digital Mobility Services (MDMS) with a focus on accessibility and inclusion'

Valencia is working on a new MaaS solution (called "Ciudades Conectadas") in coordination with 5 other cities in Spain. This will be the first integrated MaaS application for Valencia. So far, the main technical features of the application have already been defined. This measure will focus on the definition and integration of new accessibility related features into the MaaS, with the aim of properly integrating the MaaS concept. The new features will focus on physical accessibility for people with mobility impairments, universal accessibility for people with intellectual impairments and gender perspectives to meet the needs of all.

VAL_06: 'To improve the Public Transport offer in peri urban areas'

This measure aims to enhance public transport accessibility in peri-urban areas of Valencia that are currently underserved. It proposes the implementation of an automated Demand Responsive Transport (DRT) system to cater to the needs of vulnerable users and residents in these neighbourhoods. The DRT system will be expanded to serve a broader range of users and operate more efficiently with automation. This measure aims to promote social inclusion by ensuring equitable access to essential services and opportunities for all Valencia residents, regardless of their location.

VAL_07: 'To provide the citizens with clear and accessible information before and during the trip'

This measure will develop a real-time information service for public transport, providing updates on factors that impact performance and travel time (traffic, road works, events, accidents, etc.). A platform will be created to deliver this information to transport operators, enabling them to manage the service and take corrective actions when necessary (route adjustments, frequency changes, etc.). Additionally, real-time performance information will be provided to public transport users through screens, apps, and other channels to enhance transparency and build trust in the service.

VAL_08: 'To design and develop an innovative, inclusive and convenient stop for buses'

This measure aims to develop and test a smart and inclusive bus stop design that enhances user satisfaction and improves public perception of public transport. The design process will involve co-creation with citizens to ensure it meets their needs in terms of accessibility, attractiveness, safety, and inclusiveness. The new bus stop will incorporate services and features to ensure accessibility for all users. The potential inclusion of AI-enabled cameras to identify vulnerable users or detect large crowds will be evaluated for proactive measures by bus drivers.

VAL_09: 'Improving the air quality and the feeling of safety (after Covid) in buses'

This measure aims to enhance perceived safety in public buses by installing air-purifying technology in conjunction with the vehicle's HVAC system. The air quality level will be monitored and displayed to users in a user-friendly manner, with a focus on vulnerable users. The clear presentation of this information will emphasize the improved

air quality and increased safety. The purifying system will prioritize energy efficiency, sustainability, and ease of replication in public transportation.

6.1.2 ROME

ROM_01: 'To reduce private vehicles by implementing a "pollution charge" scheme in the core part of Rome Zone 2'

Within the project timeframe, the implementation of electronic access gates will be completed, adding 53 missing points to reach a total of 74 access points. A "pollution charge" policy will be introduced in the VAM zone to restrict vehicle access based on emissions. The pilot will define the policy, compare it to similar European measures, facilitate participatory discussions, and conduct daily evaluations. Communication packages will be developed to ensure ongoing adaptation and promote a modal shift towards public transport.

ROM_02: 'Implementation of a LEZ in Rome Zone 3'

The measure combines policies and ITS to implement restrictions according to a Roadmap indicated by the City Administration. The measure will take advantage of a total of 154 electronic access gates. The capacity to verify the accessing vehicles membership to a specific Euro classification – divided by category (car, motorcycle, PT, taxi, etc.) will permit the control of the LEZ decided by the Administration and to verify the modal shift towards PT.

ROM_03: 'New mobility services in multimodal interchange nodes'

Rome aims to enhance sustainable mobility through various measures outlined in the SUMP. This specific measure focuses on improving intermodality by encouraging users to shift from private transport to LPT and from road to rail for suburban and local public transport services. This will be achieved through coordinated PT schedules, integrated information systems, unified fares and ticketing systems, and innovative services at transportation nodes.

ROM_04: 'Designing the new high frequency and high-capacity PT infrastructure'

This measure aligns with the SUMP objectives and with the investment expected in PT infrastructures of over €9 billion within a 10-year period to extend and modernize the metro (38.5 km and 27 new stations) and tramway lines (58 km). This measure will support the implementation of these new infrastructures and assess scenarios prior to their opening. Communication regarding the new PT services will also be provided during the construction phase.

ROM_05: 'New LEV and ZEV bus fleet – network adaptation'

To meet the SUMP goals, Rome plans to invest in the renewal of the PT surface fleet with Low Emission Vehicles (LEV) and Zero Emission Vehicles (ZEV) buses by 2030. ATAC, the main PT operator, has identified the need for 1057 new buses between 2023 and 2026. This measure involves integrating LEV and ZEV buses into the PT surface fleet, which requires re-designing low-emission lines and carefully planning routes, bus depots, and lines to ensure efficient operation across a large area.

ROM_06: 'Innovative features into the MDMS system according to the mobility patterns and needs of users' groups'

Roma Capitale will implement the first phase of the MaaS System on a new infrastructure technology, integrating key services and information on public transport. The project aims to provide a user-friendly interface for multimodal travel, allowing users to choose and purchase mobility services. Rules and policies will be established to ensure a regulated environment, and interconnections with the national platform will expand the range of transport options. The goal is to offer accessible and convenient mobility services for both residents and tourists in Rome.

ROM_07: 'Use of advanced technology to increase the efficiency and reliability of PT'

The upgraded Traffic Management Centre (TMC) in Rome oversees and manages various aspects of mobility services and traffic control. The TMC utilizes advanced technology to monitor, regulate, and provide real-time information on traffic conditions, as well as forecast future traffic patterns using AI and machine learning. The enhanced TMC aims to unify and leverage data from different actors and ITS systems in the metropolitan area, offering comprehensive management, regulation, forecasting, and infomobility services to users.

ROM_08: 'Designing the urban space to promote active travel modes, PT and environmental 30 Km/h zones'

The Local Authority plans to introduce 100 km of new cycle lanes and local 30 km/h zones, impacting motorized traffic congestion and promoting active mobility and multimodality. Mobility hubs will be established at PT interchange nodes for bike parking and shared vehicle use. Stakeholders will analyse and plan these road system changes to prevent congestion and ensure road safety. Initial projects include street reorganization, pedestrianization, and bus stop improvements, with similar measures to be implemented in different boroughs as recommended by the SUMP.

ROM_09: 'Incentive packages to support multimodality'

This measure aims to encourage sustainable travel behaviour and establish local public transport as the preferred mode of transportation. This is achieved by engaging local mobility managers in institutions, companies, and schools to promote sustainable mobility practices within their organizations. The activities include promoting multi-modality and integrating public transport in the travel journey, encouraging car-pooling through ride-sharing platforms, promoting cycling as a mode of transportation to work or school, and utilizing welfare legislation to provide incentives such as reduced fares for public transport subscriptions.

6.1.3 ILE DE FRANCE

IDF_01: 'Participative governance framework for the update of the regional SUMP'

Institut Paris Region aims to establish a direct connection between Versailles Grand Parc (VGP) and regional authorities to integrate VGP's measures into the new SUMP. They will facilitate meetings between relevant actors through workshops and work seminars. Institut Paris Region will act as a bridge, fostering collaboration between VGP and regional instances to ensure VGP's projects align with regional goals.

IDF_02: 'Setting-up of a dynamic Digital Twin of the territory'

The work will consist in restricting this simulator to the scale of the territory and setting up modules allowing to calibrate the model in a dynamic way with the help of the available data. This digital twin will allow to obtain a more complete observation of mobility on the territory with the PT interactions with the other mobilities, to follow the impact of the implementation of the actions and also to provide estimates of the non-measured information (carbon footprint and local emissions, ...).

IDF_03: 'Impact evaluation and future design of low emission zones and restricted traffic zones'

Scenarios evaluation is crucial to understand the impact of low-emission zones (ZFE) on vehicle fleet and modal shift in Versailles Grand Parc. Simulating scenarios helps policymakers make informed decisions on financial aid and assess the implications of implementing vehicle restrictions. This measure utilizes a digital twin and data analysis to observe the impact of low emission zones and study the implementation of future policies. Attention will be given to enhancing public transport accessibility to the low-emission zones through simulations and analysis.

IDF_04: 'Added-value services in multimodal nodes to integrate active modes with PT'

This measure aims to increase the visibility of new micro-mobility services and promote active modes like walking and biking. Bike and e-scooter rental stations will be strategically placed in areas such as train stations, main bus lines, and residential districts. These services will be integrated into the MaaS application developed by Instant System, providing users with a comprehensive understanding of the mobility options available and increasing

visibility and usage of the service. Personalized suggestions based on the user's pollution impact will incentivize their use.

IDF_05: 'Promote the use of the PT service by visitors in large events'

This measure aims at promoting multimodal trips (combining PT with demand responsive transport) during the Olympic Games. The main objective of this measure is to help cities involved in the Olympic games to regulate the traffic and ease the transfer of participants from/to events locations. To that aim, the major outcome will be the integration of DRT in the MaaS app and the elaboration of a PT recommendation system a recommender system in the media promoting the event.

IDF_06: 'Advanced technology to optimize the PT offer in line with users' needs'

This measure involves developing an "Observatory of Mobility" tool that utilizes artificial intelligence and big data analysis. It will integrate various data sources, such as video-protection networks, air quality stations, traffic data, public transport data, and cycling infrastructure, enabling cross-analysis. This tool will provide valuable insights into current mobility patterns and identify actionable possibilities tailored to local realities. A dashboard will be created to inform and support cities in city planning and mobility, focusing on themes like mobility, air quality, and traffic conditions, by correlating observations from different data sources.

IDF_07: 'To incentivize the use of Public Transport for commuters'

This measure aims to facilitate the use of mobility credits as a payment method for public transport and micro-mobility services. Private companies in Versailles Grand Parc can provide their employees with mobility credits to pay for sustainable mobility modes. This encourages the use of these modes and promotes a healthier lifestyle. Mobility challenges will be implemented to incentivize users to travel in a more sustainable manner. A dedicated B2B application will be provided to identified private companies for the allocation of mobility credits.

IDF_08: 'Improve public perception of PT'

This measure aims to bridge the gap between perceived and actual quality of public transport (PT) service. To evaluate communication and educational efforts from 2023 to 2026, qualitative surveys will be conducted to assess the perception of PT quality. Surveys include a quality-of-service survey (punctuality, regularity, cleanliness, passenger information…) and a modal split survey (baseline in 2023/2024 and a comparative questionnaire in 2026 in both cases), and the use of serious games. The goal is to understand user expectations, enhance PT perception, and improve overall quality of service.

6.1.4 OSLO

OSL_01: 'Evaluate the development of zero-emission zones in the city to determine how to increase modal split in favour of active modes of transport'

- This measure is not feasible anymore. Here below the reasons behind are presented. Oslo will evaluate other alternatives to replace the measure or reallocate resources to the other ones. -

The City of Oslo has no zero-emission zone at this point. The assessment made by the Norwegian Public Road administration last autumn concluded that the Norwegian law for road traffic does not allow for restrictions required for zero emission zones. Final decision is to wait with implementation of the zero-emission zone until new law is established.

Establishing a new road law is a demanding and lengthy process, consisting of many parts. Thus, given that the law is changed within projects timeline, the City of Oslo will allow a two-years period for citizens to transform to the new restrictions. That is why it's not realistic to have z zero emission zone in place before 2025. As a result, an evaluation of zero emission zone as part of the UPPER project will not be makable. Thus, no zone will be implemented during the UPPER timeline.

OSL_02: 'Consistent visual identity for PT and mobility hubs'

The aim of this measure is to expand Ruter's visual identity to also include mobility hubs and belonging (new) services such as bike lockers, car sharing, etc. In doing so, we will increase the visibility and uniformity of mobility services and build on Ruter's ambitions to provide mobility rather than public transportation only.

OSL_03: 'Improve use and accessibility of public transport in conjunction with alternative mobility to reduce private car ownership'

This measure aims to test and improve the mobility offer beyond traditional activities by utilizing an improved bus route or a new bus route under improvement. It will assess the impact of implemented measures and analyze how existing regulations and frameworks interact with each other, creating challenges and opportunities. The goal is to establish a framework for enhancing bus routes and integrating different mobility services, considering both system and street-level perspectives.

OSL_04: 'Reduce dependency on car ownership'

This measure aims to create cooperation models between Ruter, landowners and mobility service operators. It involves developing an administrative backend system and scalable combined mobility offers for residents. Through different business, pricing and service models, the use of public transportation and shared modes will be incentivized. The goal is to make combined mobility agreements easily accessible to housing associations and residents, offering discounted PT tickets and various shared modes. Landowners have economic incentives to cooperate, while mobility service operators benefit from exposure to Ruter's customer base.

OSL_05: 'Adapt segmented demand responsive transport (DRT) solutions to a broader group'

This measure focuses on integrating an existing age-friendly service with a projected new Demand-Responsive Transit (DRT) service no limited to a particular age group, aiming to reduce costs and create synergies. Key issues to address include designing an "open to all" service that considers the needs of the elderly while supporting them in transitioning to a fully digital service. Collaboration with the ULTIMO project is planned to prepare and assist the elderly in utilizing future autonomous DRT vehicles.

OSL_06: 'More inclusive micromobility'

This measure focuses on testing an inclusive shared micromobility scheme to provide more user groups with greater freedom of movement. By integrating various forms of micromobility into the existing mobility offer, space on public transport can be freed for other user groups, such as wheelchair users. The aim is to increase the adoption of e-scooters and e-bikes for first and last-mile travel and involve members from different interest groups and geographical areas. Pilot schemes will be designed based on identified adoption barriers.

OSL_07: 'Pilot V2X to prioritize public transport'

This measure aims to enhance traffic safety by implementing in certain corridors a V2X smart speed bump system (Actibump). This solution provides benefits for pedestrians, bicycles, traffic planning, and public transport. It offers continuous vehicle counting, classification, weighing, and environmental measurements. The V2X system can communicate with other roadside equipment and its data is monitored and presented through a software platform. The V2X Actibump system, along with the software, collects and stores data, enables remote monitoring, and presents real-time and historical data to assess its impact on driver behaviour and collect additional vehicle classification information.

OSL_08: 'Digital visualization of services which induce sustainable modes of transport'

By integrating a wider span of services in Ruter's digital user interface, we aim towards accelerating the adoption of green modalities. We will use our positions as PTA and policymakers to cooperate with private operators and present their services as a supplement rather than a competitor to conventional public transport. To accelerate and improve the effect of integrating new services, we also want to explore the possibility of allocating space at public transportation hubs to enable people to use these services.

6.1.5 MANNHEIM

MAN_01: 'Establish participative governance and dialogue formats to address the citizens with a focus on the (special) needs of user groups'

RNV aims to better understand the mobility needs of different target groups and use-cases. This measure proposes different formats of data collection, such as surveys, dialogue formats, and on-site service counters. Based on insights, they plan to develop a modular information package for specific needs. The goal is to create a mobility advisory service that supports the modal shift by easing transition from cars to sustainable transport modes. Specific use-cases, like event mobility or commuter needs, will be identified to provide tailored information and services.

MAN_02: 'Campaigning for sustainable forms of transport, such as PT, walking and cycling. Establishing a PT culture with PT as a green, safe, inclusive, and social space'

The communication campaign focuses on three main areas: promoting public transportation as a sustainable and inclusive service for climate change, improving connectivity in suburban areas and positively influencing community perceptions of public transportation. The campaign aims to strengthen the local public transportation culture and address the changing needs of customers, particularly older age groups. Targeted marketing measures will highlight the advantages of public transport for specific user groups and promote them as part of mobility management.

MAN_03: 'Data-driven platform for supporting PT planning and operations based on the concept of Mobility as a Right'

RNV aims to utilize available data more effectively and improve data quality, processing and storage, emphasizing the importance of accurate data and the recognition of mobility as a basic right. Improvements include data governance, integration of relevant data sources into their cloud environment and developing solutions for various use-cases. Statistical models will be used initially, followed by more advanced machine learning approaches. Additionally, gender-specific gaps in data collection will be addressed during the analysis.

MAN_04: 'An attractive, accessible, secure, comfortable, multifunctional and clean PT stop'

The aim of this measure is to draft, discuss and pilot additional components/ elements at PT stops to improve the overall attractivity and functionality. This includes, on one hand, the introduction of additional digital services at the stops and, on the other hand, the climate-change adaptation of PT stops and infrastructure (such as greening and shading to reduce heat in summer and unsealing paved areas to manage heavy rainfall).

MAN_05: 'Modernize and increase the attractiveness of digital sales channels'

To enhance features, functions and interoperability, RNV will upgrade and extend existing sales, billing and settlement systems. The D-Ticket, based on the VDV-KA standard, will be implemented with chip cards and smartphone applications. Secure keys and certificates will prevent fraud. This upgrade enables full interoperability of all D-Tickets sold by RNV and ensures a digital and secure ticket inspection process. The measure aims to transition more customer groups to a future-proof, interoperable and fully digital ticketing system.

MAN_06: 'Defining concepts and test instruments to improve mobility in peri-urban areas for different user groups'

This measure aims at the development of concepts and the testing of instruments to improve mobility in those peri-urban areas for various user groups. The overall objective is to improve the availability and quality of mobility services in peri-urban areas through improved PT services and an additional focus of connecting PT services with additional mobility options.

MAN_07: 'Create a network of mobility hubs in cooperation with the regional transport association, open for multi mobility providers'

RNV plans to incorporate shared mobility options into the planning, construction and operation of PT hubs. The concept will consider existing micro-mobility services like e-scooters, bike sharing and car sharing. The goal is to facilitate seamless transitions between PT, car sharing, bike sharing, e-scooters, walking and cycling by physically integrating them and improving accessibility. Stakeholders will collaborate to define responsibilities aligned with the shared mobility framework. The measure aims to develop and implement the concept, gradually forming a network of connected mobility hubs.

MAN_08: 'Redesign urban space and test alternatives of using it for social purposes'

This measure focuses on reorganizing parking spaces in urban areas to optimize public space utilization. By reducing the number of parking spaces available, the aim is to create opportunities for alternative uses, such as neighbourhood garages, parklets, and mobility hubs. Additionally, efforts will be made to raise awareness about alternative mobility options, like public transport, and involve citizens in the decision-making process to increase acceptance. Pilot projects and evaluations will be conducted to test and refine these new approaches to parking and public space management.

6.2 Twinning sites

6.2.1 LISBON

LIS_01: 'Restrict car access in the city'

This measure proposes traffic restrictions around schools and other facilities to promote safer and more active modes of transportation. Blocking the school perimeter for non-resident cars creates a safe environment for students, frees sidewalks from illegal parking, and encourages biking or public transportation. The UPPER tools can help analyse and compare flow changes before and after the restrictions, helping decision-makers anticipate challenges. The annual 'Hands Up' Survey will monitor modal changes in schools where the measure is implemented. Trialling this measure alongside Amarelo and Navegante Escola card measures will further support modal change adoption.

LIS_02: 'Promote, extend services and prioritise PT'

This measure will analyse the PT network using advanced tools and big data analytics to identify factors affecting commercial speed. Audits will be conducted on bus stops, road structure, bus services, and intersections to find areas for improvement. Recommendations will be created based on this information to implement PT prioritization measures at bottlenecks, reducing delays and increasing commercial speeds. Furthermore, cameras will be installed on CARRIS buses to automatically detect non-compliant vehicles in bus lanes, enabling law enforcement actions.

LIS_03: 'To improve the mobility planning'

Lisbon and TML are launching public tenders for the development of the 3rd generation of the metropolitan and municipal SUMP. These SUMPs will directly align with the UPPER measures, as they are being developed around the same time frame (expected completion by the end of 2023 for Lisbon and 2024 for TML). Additionally, studies will be conducted to complement the defined measures in the SUMPs. This includes the development of a Municipal Road Safety Plan in Lisbon, adjustments to the PT offer by TML, and network reviews by CARRIS.

LIS_04: 'To improve PT offer, adapted to school students'

This measure aims to increase student bus transportation through two initiatives. The 'Amarelo' pilot project provides free on-board PT monitors on selected routes, ensuring children's safe arrival at school. Parents enrol their children online, specifying the school, bus stop, and preferred schedule. Monitors register the child's entry, and upon reaching the school stop, guide them (excluding older students). This collaboration with CARRIS, the transport operator, and parish councils (the monitors) enhances safety. The measure also expands the 'Navegante

Escola' PT Ticket Card to kindergartens and high schools, promoting PT use. Parents request the personalized PT card, which covers all metropolitan area PT and free monthly tickets for resident students.

LIS_05: 'To enhance multimodal interconnection with the peri-urban municipalities'

This measure aims to enhance the city's cycle path network, improving security, connectivity, comfort, and coherence. The expansion of the shared bicycle network is expected to attract more users. Firstly, it involves reviewing cycling infrastructure plans to integrate with neighbouring municipalities, identifying issues, and prioritizing interventions for network improvements. Secondly, it entails developing a plan to expand the bike sharing system to the city's outskirts or major interfaces connecting with neighbouring municipalities, increasing accessibility and coverage.

LIS_06: 'To improve comfort, convenience and safety of PT interfaces'

This measure aims to carry out a characterization and diagnostic of the conditions of key metropolitan PT interfaces and stations. The focus will be on universal accessibility, identifying obstacles for people with mobility issues, as well as improving comfort, convenience, safety, and security. Based on this analysis, improvement measures will be identified and categorized. Discussions with stakeholders will determine how these measures can be implemented to enhance the overall situation.

LIS_07: 'To create a new Multimodal Digital Mobility Services (MDMS)'

This measure will define the desired MDMS/MaaS platforms for the Lisbon metropolitan area, focusing on user-friendly trip planning, ticket purchasing, and potentially vehicle and platform access validation. It includes an analysis of existing platforms to ensure quality and transparency for transport users. A study will identify improvements for local MDMS/MaaS platforms and define necessary features. Finally, the measure involves designing and implementing these features in the MDMS/MaaS platforms.

LIS_08: 'To implement campaigns and partnership initiatives'

This measure will create a comprehensive marketing campaign to promote the advantages of public transportation (PT). It aims to emphasize the seamless integration of different modes and the extensive coverage of existing services, targeting non-PT and car users. A study will also be conducted to identify strategies for attracting car users and improving PT services. Based on twinning activities, new features will be designed to rebrand the bus service, enhancing its appeal, and enhancing user perception of comfort and safety.

LIS_09: 'To improve the integration of PT and active travel modes'

The UPPER local partners will strategically discuss and promote the integration of PT and active modes at the local level, focusing on improving cycle parking infrastructure at interfaces and integrating PT with public bike sharing services at the ticketing level. The implementation of cycling infrastructure on PT interfaces will follow SmartHub methodologies, involving defining a hierarchy of interfaces, creating bike parking and monitoring their use. TML and the City of Lisbon will collaborate on integrating the GIRA public bike sharing system into the Lisbon PT ticketing system 'navegante'.

LIS_10: 'To improve the quality and efficiency of the bus service'

This measure aims to enhance the quality and efficiency of bus services in Lisbon by addressing perceived quality, effective communication, and system improvement. It focuses on improving the management of perceived quality, coordinating analysis among different operators, bridging the gap between customer and non-user opinions, and attracting new users through better communication and experimentation. Data sharing with stakeholders will be explored to identify measures for overall improvement. The measure emphasizes three key areas: understanding perceived quality, utilizing large-scale events for service experimentation, and enhancing attractiveness through service quality and speed.

6.2.2 BUDAPEST

BUD_01: 'To improve the efficiency and convenience of PT service'

The BKK operates the Unified Transport Model of Budapest, which is a macroscopic model for the city and its surroundings. The Model contains public transport services as well, but it is capable only for headway-based assignment. In this pilot the BKK will investigate the possible development solution of the model, which can strengthen the reliability of the model in the aspect of operational public transport planning.

BUD_02: 'To create new mobility packages of Multimodal Digital Mobility Services'

This measure aims to create a brand and gather data for future Multimodal Mobility Packages in the BudapestGO app. Customers will be able to select discounted services, tickets, and travel products. BKK will collaborate with private transport service providers to test various discount offers, combining public transport fares with sustainable transport options. This measure also strengthens the collaboration between BKK and private providers, and a branding campaign will be launched to promote sustainable mobility services and engage a wider audience.

BUD_03: 'Understanding on a deeper level the connection between the service level and passenger satisfaction'

This measure will qualitatively assess and understand the mobility patterns of non-public transport (PT) users to identify opportunities for targeted interventions. Surveys and data analysis will be conducted to understand mobility flows and address complaints about PT service. New dialog formats will be established with PT and non-PT users to better address their needs. The aim is to encourage non-PT users to consider PT options in the future through service improvements and campaigns.

BUD_04: 'To improve the route planner to increase user satisfaction'

This measure will focus on the further development of the BudapestGO travel planner application by complementing the existing application with new beneficial functions that meet the needs of users. This will include the integration of shared private mobility providers into the travel planner system, making the opportunity for users to plan a journey by using these particular devices as well. In addition, it will also be possible to plan a journey to the location of a dedicated private vehicle owned by a carsharing provider.

BUD_05: 'New services to increase accessibility and convenience of PT'

This measure aims to introduce a predictive travel planning option within the BudapestGO journey planner application. The new feature developed will provide a solution to the problem in a similar way to the Waze application, being that able to manage a significant source of customer feedback. The aim is to be able to minimize the communication of incorrect estimates and to increase the reliability of the data provided by the BudapestGO application.

BUD_06: 'To improve the existing PT prioritizing tools in Budapest'

The measure will focus on the possible introduction of further interventions in brand new locations with the aim to prioritize public transport services (establishment of dedicated bus lanes, new traffic light programmes and other similar transport measures). The process will feature the complex examination of the particular locations, including the traffic and travel patterns, infrastructural specifications, journey times and possible intervention options.

6.2.3 LEUVEN

LEU_01: 'To exploit the existing mobility data to enhance the evolution of public transport policies'

Research will be conducted in Leuven to study the current use of public transport, focusing on peripheral parking lots and mobility hubs. The aim is to gather data on social patterns, obstacles, and opportunities, identify target groups and develop strategies to enhance public transport usage. Existing datasets and surveys will be used, while new qualitative data will be collected through surveys and a participatory approach. The project also involves improving data management, reporting, visualization and conducting in-depth analyses and simulations.

LEU_02: 'To study the needs of parking and public transport in different areas of the city'

This measure aims to analyse the current use of P&Rs and hubs in conjunction with PT. The goal is to identify social patterns, obstacles and opportunities in these locations. Simulation tools will be used to study the impact of increased P&Rs usage on modal shift. This analysis forms the foundation for the parking policy plan to be adopted in the current SUMP. The study may lead to the implementation of new small-scale parking lots and improvements to the existing offerings.

LEU_03_04: 'To increase visibility and ease of use of public transport by offering improved information on public transport, parking and shared mobility options'

The measure involves revamping public transport, parking, and shared mobility information, including timetables, costs, disruptions and availability. The focus is on identifying necessary information for users and efficient ways of delivering it. Citizen engagement, including serious games and crowdsourcing, will shape the answer. A framework for accessibility and mobility information will be created, streamlining relevant data across platforms. Existing channels will be evaluated and redesigned and non-conventional platforms like social media will be considered for reaching difficult-to-reach target groups.

LEU_05: 'Mobility for all by optimizing the use of financial incentives to increase the share of PT'

This measure aims to leverage technological advancements like integrated ticketing systems and MaaS applications to test smarter and more accessible incentives for targeted social groups. By reevaluating and refining financial incentives for public transport and P&Rs, the uptake of public transport among specific groups will be increased. Current financial incentives will be analysed for their impact and effectiveness. A policy plan on financial incentives will be developed, and at least one integrated, provider-neutral financial incentive will be implemented and evaluated within the project.

LEU_06: 'To launch communication campaigns and digital tools to increase the uptake of PT'

This measure focuses on increasing PT and P&Rs utilization through targeted communication and nudging campaigns. Strategies for behavioural change will be identified and evaluated through participatory processes. Social media campaigns, influencer marketing and traditional marketing methods will be employed to enhance the public perception of public transport. The measure also aims to implement strategies to improve the perception of city centre routes, specifically for the one going through one of the main shopping streets (Bondgenotenlaan).

LEU_07: 'Increase the quality of the PT services through traffic management and dedicated lanes for PT'

The city of Leuven, the regional public transport operator and the regional authorities are currently working on redesigning the public bus system as to create high quality public transport in several dimensions. Within this context, Leuven aims to redesign the different transport axes throughout the city in order to facilitate the creation of separate bus lanes and prioritise traffic signals for the main PT axes. This measure will contribute to the planning, monitoring and evaluation of this redesign process.

6.2.4 THESSALONIKI

TES_01: 'Optimum transfers on P&R areas based on real-time data'

This measure aims to develop a real-time digital service integrated into an existing MaaS app, facilitating intramodality for travellers with long commuting distances. The selection of suitable P&R areas, based on SUMP proposals and stakeholder consultations, will be followed by the implementation of the digital service in at least one chosen area. The digital service will provide real-time information on parking availability, arrival times of PT modes, and the availability of shared mobility options. Data on parking availability, PT schedules, and shared modes will be utilized to develop the service.

TES_02: 'Simulation and analysis of PT needs for LEZ demand fulfilment'

Thessaloniki aims to implement a Low Emission Zone (LEZ) in the Rotonda area and optimize public transport (PT) services accordingly. Through a methodology considering the zone's size, PT stops, and land use, the measure seeks to define optimal PT services and digital transport management for the LEZ. Data collection, surveys, and GIS modelling will assess traveller satisfaction, origin-destination patterns, and PT accessibility. The proposed planning scheme will ensure majority access to the LEZ, with PT frequency, stops, and modes optimized through simulation analysis.

TES_03: 'To improve transit services through dynamic multimodal management of PT corridor'

This measure aims to enhance the management of public transport and pedestrian movements along Egnatia street. Various scenarios will be explored to identify strategies that improve the level of service for public buses, such as implementing protected bus lanes, optimizing route frequencies, and prioritizing buses at traffic signals. The assessment will also focus on pedestrian experience, analysing sidewalk capacities and proposing measures to improve pedestrian flow, especially around metro stations. The outcomes will inform the redesign of Egnatia street, ensuring efficient and user-friendly transportation for both public transport users and pedestrians.

TES_04: 'To influence modal shift through congestion sensitive parking pricing'

The outcome of this measure will be a report proposing dynamic parking pricing policies. Participatory processes and user surveys will be conducted to gather input and estimate private car modal share and willingness to pay. Scenarios will be defined based on these outcomes, considering stakeholder involvement and user preferences. The estimated modal shares will be used in Thessaloniki's traffic model to assess the impacts of modal shift on the city's transportation network and environment. The report will provide quantified recommendations based on demand and simulation modelling.

TES_05: 'To enhance the information provided through adapted services for different groups of passengers'

This measure will develop an improved multimodal planner accessible through the web and integrated within a MaaS app. It will guide travellers in combining PT and shared mobility modes, suggesting optimal combinations and routes. The planner will be enhanced with PT data (GTFS-RT) to include public buses and metro, expanding its coverage. Additionally, the utility function will be personalized based on user data gathered from the app, taking into account their actual mode preferences.

TES_07: 'Increase the accessibility to PT in low demanded areas of the city'

This measure expands an existing DRT service to improve PT accessibility in a low-demand area. Historical data from successful pilot programs in Thessaloniki will inform the development of the new service. An updated survey will gather travel characteristics to optimize scheduling, routing, frequency, and service options. The proposed demand-response system will operate without fixed stations, allowing travellers to book trips in advance and make payments through a dedicated platform/application developed by project partners.

TES_08: 'To create new incentive-based services in the MDMS system to increase the use of PT'

This measure aims to improve accessibility in Thessaloniki by developing a tool for evidence-based decision-making and personalized mobility packages. It involves identifying areas where first/last mile trips can be enhanced through shared mobility. Traffic zones with high potential for shared modes will be identified, optimal locations for shared mobility hubs will be proposed, and the cost of multimodal trips will be compared to existing modes. The neutral platform will enable stakeholders to assess the competitiveness of shared mobility and make informed decisions for enhancing transportation options.

TES_09: 'To raise environmental awareness and trigger behavioural change towards PT'

This measure aims to support the transition to an electrified PT system in Thessaloniki. The plan for electrifying bus lines will involve conducting electric vehicle simulations to determine the feasibility of electrifying specific bus lines and identifying suitable charging options. The aim is to define where e-buses should operate, how they should be

charged and the strategies for effective communication to raise awareness about the advantages of e- buses for the city's public transport.

TES_10: 'Incentivize the use of PT in combination with active modes'

This measure aims to incentivize the use of PT and active modes by allowing passengers to exchange their tickets for vouchers redeemable at local shops. It builds upon measure 8, which identified mobility packages for optimal incentives. Vouchers will supplement the mobility packages. A stated preference survey will estimate the willingness to use PT for financial incentives. An algorithm will be developed to determine incentive details such as timing, type, and redemption methods. The provider of the incentives will also be identified.

6.2.5 HANNOVER REGION

HAN_01: 'Digital tariff piloting'

This measure aims to simplify public transport access in the Hannover Region through a new check-in/be-out system and digital fare billing. Passengers simply need to board the chosen transport and log in to the app, with the system automatically recognizing their exit and calculating the distance from start to destination. This eliminates the complexity of fare zones and ticket options, making access easier for occasional customers and simplifying the overall public transport experience.

HAN_02: 'Sustainable Transport Chains – on-demand service Sprinti'

Under the national funding for the "Model Region for Public Transport" (2022-2024), the Sprinti service will be extended to the entire tariff zone C in the Region Hannover. As part of this measure, we aim to create a "lessons learned" brochure based on the Sprinti expansion. By collecting and evaluating project experiences, the brochure will provide a blueprint for other cities, particularly those in UPPER, to implement their own on-demand systems.

HAN_03: 'Added-value services in multimodal nodes to integrate PT with active modes'

We aim to improve the passenger experience and promote multimodal transportation at stations by implementing Bike+Ride facilities. This includes secure bicycle parking, on-site bike sharing services, and bicycle repair options. As part of the project, a bicycle tower will be established, funded through other sources. Its usage and the opening of another Bike+Ride station will be evaluated within the UPPER program. The objective is to create a comprehensive report on enhancing user satisfaction and convenience at Bike+Ride stations.

HAN_04: 'Mobility dashboard solution'

This measure aims to enhance traffic flow and improve access to public transport through an expanded mobility dashboard solution. Building upon the existing mobility dashboard in Hannover Region, we will add new features. This project will improve the dashboard by providing real-time traffic information, options for switching to public transport, and sensor-based availability updates for P+R parking spaces, making it easier for users to plan their journeys and utilize public transport effectively.

HAN_05: 'Exploring monitoring options of the cities performance towards achieving the goals of the SUMP'

The upcoming adoption of Hannover Region's new mobility development plan prompts the need to monitor SUMP goals effectively. This measure involves exploring the utilization of the U-SUMP tool, providing suggestions from a city authority and planning perspective, implementing the tool, and potentially enhancing it for internal use. These actions will ensure effective tracking and assessment of the plan's objectives and progress.

7. CONCLUSIONS

The UPPER sites demonstrate a strong commitment to develop and implement policies and measures that promote sustainable mobility and climate neutrality, aligned with the objectives of the European Green Deal. Moreover, several UPPER sites have effectively incorporated sustainable mobility into their strategies to achieve climate neutrality. This emphasizes an understanding of the important role of mobility in achieving climate objectives.

The results of this analysis indicate that the Sustainable Urban Mobility Plans (SUMP) concept is experiencing a transformation, shifting from a focus exclusively on cities to a more inclusive and interconnected approach in the surrounding regions. It additionally highlights the recognition that challenges, and opportunities related to mobility are not limited to administrative borders, but instead require an integrated and rational approach which includes different geographic dimensions.

The engagement of diverse stakeholders in the planning and the implementation stages of sustainable mobility projects is an essential aspect of sustainable mobility planning. The research identified that the UPPER sites have established diverse forms of collaboration with various stakeholders, including private companies, research and academic institutions, NGOs, and civil society groups, among others. These partnerships have allowed the sites to gain access to valuable information, resources, and feedback, as well as increase the legitimacy and acceptability of their mobility plans and actions.

A further important aspect is related to the efficient use of various funding sources in order to facilitate the development and the implementation of sustainable mobility strategies and actions. The UPPER sites, in general, efficiently combine diverse funding sources from the local, national, and European levels to develop and implement sustainable mobility measures. The analysis also indicated the challenges and barriers encountered by the UPPER sites in terms of accessing and managing funding sources. These challenges include complex procedures, limited capacity, and a lack of coordination.

Additionally, it was found that the UPPER sites are committed to improving the attractiveness and efficiency of public transport systems by enhancing the quality, accessibility, reliability, affordability, and safety. Moreover, UPPER sites foster to integrating public transport with other sustainable mobility options, such as walking, cycling, car-sharing, e-mobility, etc., to create a seamless and user-friendly mobility experience and lower the dependency of car use.

Technological advancements show significant potential to improve progress in the development of integrated sustainable mobility services. The UPPER sites realize the potential of emerging technologies and aim investigating their usefulness in developing innovative mobility solutions, such as mobility as a service, on-demand transport, V2X communication, etc.

Finally, the study revealed a strong connection between SUMP measures and the measures implemented in the UPPER project. Furthermore, the results of the UPPER project are expected to update and influence future SUMPs, indicating knowledge sharing and collaboration between projects.

The study provides an overview of the present situation in UPPER sites, emphasizing the importance of collaboration, innovation, and the integration of sustainability principles across different boundaries. The above findings can provide valuable insights for policymakers and planners who aim to improve sustainable mobility practices in their respective cities and regions.

As this document lays the foundation for future work in UPPER project, it is important to mention that all UPPER sites have a well-established structure that allows them to manage and develop the local sustainable mobility system. However, only those sites with a more dynamic structure could cope with threats and could easily adapt to new advancements, either in technology, processes, or even new practices. This dynamism of different local authorities to adapt is rooted in a long-term experience in working together with local stakeholders and in listening to their end-users. The communication between different structures, either at the same institution levels (different functional departments) or the collaboration with private entities and research centres could also contribute to this observed dynamism.

All UPPER sites declared that their vision for sustainable mobility is people-centred; this means that although they acknowledge the importance of the technology advancements, their vision is to put them to good use. In this respect, they need to listen, understand, communicate, and better involve everybody in the decisions to improve the sustainable mobility systems.

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Annexes

ANNEX A: Current situation in UPPER Living Labs and Twinning Sites and All UPPER Measure description

ANNEX B: Measure description template