# SmartHubs

## Smart Mobility Hubs as Game Changers in Transport

WP6. Governance, policy guidelines and knowledge exchange

T6.2. Guidelines for successful integration of hubs into SUMPs

# Deliverable D6.2

Guidelines for successful integration of mobility hubs into SUMPs

# Executive summary

This deliverable contains guidelines for developing mobility hubs within Sustainable Urban Mobility Plans (SUMPs) based on the findings of the SmartHubs. This deliverable, which belongs to the last work package for the project (WP6) aims to facilitate policy-makers and practitioners in the adoption of the outcomes of the project when implementing mobility hubs in their local context. In this regard, this deliverable relates to all the deliverables of the project which contain findings useful to policy-makers and practitioners, as well as the tools developed to support the development of mobility hubs.

In the first section, the document explores the EU's SUMP framework and related policies in SmartHubs living labs – Brussels, Munich, Rotterdam-The Hague and Vienna – identifying best practices and gaps. The structure of SUMPs is also explained, as well as the outcomes of the project that are relevant to developing mobility hubs within SUMPs. In the second section, the four key phases of a SUMP – preparation and analysis, strategy development, measure planning, and implementation and monitoring – are further developed and details are given on how each deliverable of the SmartHubs project can be used at each step.

The last section contains 10 recommendations which summarise how to best develop mobility hubs within SUMPs. These include forming interdisciplinary teams to ensure a multi-sectoral view, securing political and institutional support, involving stakeholders and citizens comprehensively, assessing regulatory and policy landscapes, defining the geographic and demographic scope of hubs, standardizing and integrating data, focusing on accessibility and equity, creating and appraising scenarios aligned with SUMP objectives, aligning the vision and objectives with broader goals, and implementing a detailed monitoring framework.

# Document change record

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# Table of contents

# List of tables

# 1   Introduction

The aim of this deliverable is to provide guidelines for the development of mobility hubs as part of Sustainable Urban Mobility Plans (SUMP), building upon the tools and results from the SmartHubs project.

The SmartHubs project aims to improve urban mobility with on-street smart mobility hubs offering sustainable transportation options. Through user-driven design and innovative tools, it assesses their potential to enhance inclusive accessibility. Active in four major cities (Brussels, The Hague-Rotterdam, Munich and Vienna, it employs methods such as 'open accessibility assessments' and 'augmented reality' for co-creation. Research focused mainly on, but is not limited to, impacts on vulnerable populations like low-income individuals, digital novices, women, and refugees.

In this deliverable, we firstly explore the general framework of SUMPs in the European Union (EU) and the planning frameworks for mobility hubs in effect in the SmartHubs living labs, in order to present best practices or gaps. It is followed by guidelines on how the results of the SmartHubs project can contribute to the integration of mobility hubs in SUMPs considering the four key stages of SUMP development. Finally, we present recommendations for a seamless integration of mobility hubs in a SUMP.

## 1.1   Mobility hub governance in the European Union

The European Commission influences urban mobility policy through various directives and strategies, despite urban mobility being primarily a local jurisdiction. Key funding mechanisms include the European Regional Development Fund (ERDF)[1], Cohesion Fund[2], Horizon Europe[3], and the Connecting Europe Facility (CEF)[4].

The ERDF is the EU's main investment fund for regional development. It aims to reduce economic and social disparities between regions by supporting innovation, job creation, and sustainable development (European Commission, 2024b). The cohesion fund is complementary to the ERDF and provides additional support for infrastructure projects in less developed EU countries (GNI below 90% of the EU average) (European Commission, 2024a). It focuses on transport and environmental investments. Horizon Europe is a research and innovation program. It funds research and development projects in multiple fields (e.g. transport) and aims to push scientific and technological progress (European Commission, 2024c). Finally, the CEF funds programs focused on the development of strategic infrastructure networks in transport, energy, and digital sectors. It aims to improve connectivity in the European Union and neighbouring regions (European Commission, 2023c).

The European Urban Mobility Framework (or European Urban Mobility Package), is a combination of proposals from the European Commission that aim to modernize the EU's transport system, specifically focusing on urban areas. It underscores the adoption of Sustainable Urban Mobility Plans (SUMPs) and the development of multimodal mobility hubs (European Commission, 2021). Mobility hubs are crucial to enhance the efficiency of and access to urban mobility systems and can be defined as a physical location where different shared transport options are offered at permanent, dedicated and well-visible locations and public or collective transport is available at walking distance (Geurs & Münzel, 2022).

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[1] https://ec.europa.eu/regional_policy/funding/erdf_en
[2] https://ec.europa.eu/regional_policy/funding/cohesion-fund_en
[3] https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en
[4] https://cinea.ec.europa.eu/programmes/connecting-europe-facility_en

A core aspect of the EU's approach is the focus on mobility hubs with a multimodal character. The new TEN-T regulation proposal and the mission on climate neutral and smart cities emphasises the EU's commitment to sustainable urban transport, emphasized by the development of mobility hubs (European Commission, 2023a). This approach aims to create a coherent framework for sustainable urban mobility, with mobility hubs as a central feature, facilitating efficient, integrated, and sustainable options in urban areas.

A more in-depth explanation of the governance of mobility hubs in Europe can be consulted in D2.3[5].

## 1.2 Policy integration of Mobility hub

This section provides a brief summary of the policy frameworks for mobility hubs in four SmartHubs living labs, each in a specific socio-spatial context. The living labs are located in: Brussels (Belgium), The Hague-Rotterdam (The Netherlands), Munich (Germany) and Vienna (Austria). A more in-depth analysis of the governance frameworks for each living lab area can be consulted in SmartHubs D3.2.3[6].

### 1.2.1 Brussels

The Good Move plan by the Brussels Capital-Region (BCR) government emphasizes the significance of mobility hubs for the promotion of sustainable, safe and fair mobility. It aims to collaborate with municipalities, transport operators, and shared mobility providers to foster the growth and management of these hubs. The government's focus is on improving multimodal travel and integrating various transport modes at the hubs. This focus is elaborately explained in the local mobility plan in action C. 11: 'strengthening the shared mobility service'[7]. Currently, the government's goal is to install 20 hubs, without indicating a finalisation date (Borzęcka et al., 2023). However, while expecting positive impacts such as a reduction in car usage, increased multimodality and improved accessibility, the government has yet to develop specific indicators and related targets for monitoring these impacts as part of mobility hubs (Brussel Mobiliteit, 2020). 'De visie voor de ontwikkeling van mobility hubs in het Brussels Hoofdstedelijk Gewest' is a detailed vision on mobility hubs for the BCR. In collaboration with the local government and expert organisations, they developed a vision to effectively implement hubs in Brussels. The document indicates a positive attitude approach towards mobility hub development and will be used to develop policy later on (Borzęcka et al., 2023).

### 1.2.2 Munich

The city of Munich is actively developing the concept of mobility hubs and has installed several of them. The main goal for these hubs is to serve as a location where seamless multimodal mobility is adopted. This concept is part of Munich's overarching strategy to improve urban mobility (City of Munich, 2022).

The city plans to create a network of 100 to 200 mobility hubs by 2026, of which 49 have already been implemented (München unterwegs, 2024). The hubs are positioned across the city to answer to diverse transportation needs and serve as central nodes to provide seamless

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[5] SmartHubs D2.3: Governance arrangements for Smart Mobility Hubs
[6] SmartHubs D2.3: Governance arrangements for Smart Mobility Hubs
[7] https://mobilite-mobiliteit.brussels/sites/default/files/2021-04/goodmove_NL_20210420.pdf

connection between transport modes such as public transport, bike-sharing and car-sharing aimed at promoting multimodal travel. Additionally, it is foreseen that these hubs will play a pivotal role in reducing private car usage, decreasing congestion levels, and improving air quality (City of Munich, 2022).

The city's Mobility Strategy 2035 (Mobilitätsstrategie 2035) outlines the framework to develop a network of interconnected hubs seamlessly integrated with existing transportation infrastructure and services. To achieve this strategic goal, the city employs innovative technologies to improve the functionality and accessibility of mobility hubs.smart mobility platforms will provide real-time information on available transportation options, while digital displays and user-friendly interfaces will guide users through the hub's amenities and services (City of Munich, 2022).

### 1.2.3   The Hague-Rotterdam

In their local mobility plan, The Hague demonstrates a comprehensive approach towards mobility hubs, viewing them as crucial multimodal junctions that connect different transportation modes and provide a network across the city and region. Although they have not been constructed, these hubs will serve, not only as transit points but also as community spaces and economic catalysts. The Hague emphasizes the importance of these hubs for fostering multimodal transport, and reducing car dependency. Specific objectives include enhancing ease of transfer between modes, creating space-efficient solutions, and promoting the shift from vehicle ownership to usage, although no specific targets have been set (Gemeente Den Haag, 2022). However, the city has decided that up to 100 neighbourhood level micro-mobility hubs will be installed in the city starting in 2024. As a result, 2500 shared two-wheelers will be available to the citizens (CROW, 2023).

In contrast, Rotterdam also acknowledges the importance of mobility hubs, as part of their SUMP, but the document provides less detailed information about the social and ecological impact, rather the focus is more on the economic value of hubs (and in particular logistic hubs). Exemplary of their focus on the social impact allocated to mobility hubs is their participation in the European Interreg North Sea project 'ShareDiMobiHub' (Gemeente Rotterdam, n.d.).

For the city of Rotterdam the hubs are considered vital for economic growth and urban development, focusing on improving accessibility and connectivity. The approach includes enhancing regional and super-regional public transport accessibility, differentiating the purpose of each hub, and improving spatial quality for pedestrians and cyclists. However, the plan from Rotterdam appears less detailed compared to The Hague's approach, with fewer specified objectives and activities (Coffeng, 2017; Gemeente Rotterdam, 2020).

### 1.2.4   Vienna

The concept of mobility hubs is quite strongly integrated into the city's mobility plans, serving as an important aspect for sustainable and accessible urban mobility. The Mobility Master Plan 2030 (Mobilitätsmasterplan 2030), the Integrated Urban Mobility Plan (Integrierter Urbaner Mobilitätsplan - IUMP), and the Mobility Hub Concept (Mobilitätshub-Konzept) are three examples that recognize the importance of mobility hubs and describe their role in the future mobility system.

Specifically for Vienna, the urban development plan (STEP 25) sets forth a sustainable mobility vision for the city building on three main goals: multi-modal integration, focus on public transport usage and decreasing private car dependency. In this plan, the WienMobiel mobilityhubs play a crucial role as an instigator for multimodal mobility, with a seamless integration of various transportation modes such as public transport, bike-sharing, car-sharing, and e-scooters.

Mobility hubs are identified as nodes in this (urban) network, providing easy access to transportation options and pushing for a shift away from private car usage (City of Vienna, 2015).

The IUMP provides a more in-depth look at the implementation of Vienna's mobility strategy, specifically focusing on the location and design of mobility hubs. The plan identifies the best-suited locations for hubs across the city, emphasising that they are accessible to a diverse population and answer to all transportation needs. It also stresses the necessary infrastructure and services that should be provided at each hub, such as bike parking, charging stations for electric vehicles, and passenger shelters (City of Vienna, 2015). Currently, 18 hubs have been installed and are an integral part of the city's mobility network. In addition to the physical hubs, a digital platform has been developed that contains a route planner and information on booking options.

For a more in-depth explanation of the mobility hubs and how they were developed, D3.3[8] can be consulted.

## 1.3 Structure of a Sustainable Urban Mobility Plan

The SUMP-concept was developed by the European commission and is proposed as the 'ideal' approach to develop an urban mobility plan aimed at providing sustainable transport in an urban area. Although it provides a very logically structure approach to develop an urban mobility plan, other approaches can be adopted as well. Due to its popularity we have adopted the approach for this deliverable.

The development process of a SUMP is structured into four specific phases, which contain three steps that involve 2 to 4 activities. Phase 1, 'Preparation and Analysis,' sets the groundwork to understand and structure the mobility context. Phase 2, 'Strategy Development,' is more action oriented and progresses through steps that include collaborative scenario building and objective setting. In Phase 3, 'Measure Planning,' and Phase 4, 'Implementation and Monitoring,' the focus shifts to practical measure selection, creating measure packages, action agreement, execution, and the ongoing and repeated assessment of the objectives set in the SUMP (European Commission, 2023b). The structure can be visualised as follows:

**Phase 1: preparation and analysis**

> Step 1: Set up working structures
>
> Step 2: Determine planning framework
>
> Step 3: Analyse mobility situation

**Phase 2: Strategy development**

> Step 4: Build and jointly assess scenarios
>
> Step 5: Develop vision and objectives with stakeholders
>
> Step 6: Set indicators and targets

**Phase 3: Measure planning**

> Step 7: Select measure packages with stakeholders
>
> Step 8: Agree on actions and responsibilities
>
> Step 9: Prepare for adoption and financing

**Phase 4: Implementation and monitoring**

> Step 10: Manage implementation

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[8] D3.3: Digital integration and signage at mobility hubs

Step 11: Monitor, adapt and communicate

Step 12: Review and learn lessons

This structure is adopted and used for the integration of the SmartHubs tools and results into a SUMP. Due to the scale of a SUMP (city/regional level) and a hub being a local phenomenon, there are some activities included in the SUMP that are not applicable to the development of mobility hubs. The omitted activities are listed in table 2.

## 1.4   SmartHubs Tools

As part of the SmartHubs project, four tools were developed that can help to enhance the integration of inclusive and accessible mobility hubs into the SUMP guidelines. These tools are the Co-Design Tool, Accessibility Tool, the Resilience Tool, and the co-Appraisal Tool. Each tool brings insights and different types of assessments to the urban mobility planning process, to make sure that mobility hubs are in line with the diverse needs of the citizens. Integrating these tools can significantly improve the effectiveness of SUMPs in their aim to create more accessible and inclusive mobility hubs and other transport systems.

Table 1: SmartHubs' toolbox for an accessible an inclusive mobility hub

| SmartHubs Tools | Description of tool and functionality |
|---|---|
| Co-design tool[9] | Design Games provide a playful approach to generating design ideas. An actual game, including gaming material and specific rules, is designed to be played with potential users or other relevant stakeholders. The players need to explicitly articulate their perspectives on particular tasks throughout the play, providing designers with new insights and ideas. Design games can be used to develop a shared understanding of complex problems. Usually, design games are realized as haptic games, such as a board game or a card game.The SmartHubs co-design tool comprises a set of gaming materials and a guiding handbook to enable living labs to design tailored Design Games. A ready-to-use Design Game for re-structuring a public area by adding needed elements and discussing them among the players is also part of the co-creation tool. The gameplay of this game is supported by augmented reality layers, where players can explore the designed scene virtually. |
| Accessibility tool[10] | The SmartHubs Accessibility Tool is an easy-to-use web tool that lets users analyze the accessibility of mobility hubs. The tool relies on open data sources to automatically perform an accessibility analysis using different transport modes. It can be easily applied anywhere in the world and requires three main inputs: transportation modes, amenities, and locations. If the user has access to GTFS data, a more detailed public transport analysis can be performed. The tool presents results in the form of a map showing the areas accessible from the given locations and a summary table of the amenities that can be reached from each point. Users also have the opportunity to download the geospatial data and process it further. |
| Co-appraisal tool[11] | The SmartHubs Co-appraisal Tool supports the decision-making processes concerning the implementation of mobility hubs. The tool visualises how relevant is each option of a mobility hub for the stakeholders involved in the process, on the basis of stated criteria as well as their importance. The tool can also show the positive and the negative impacts of the different options. Through the different steps of the tool, participants gain a better understanding of the needs and preferences of other stakeholders. The outcome of the tool supports the opinion-forming process of stakeholders and it can facilitate reaching a consensus between the different stakeholders. |

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[9] https://www.smartmobilityhubs.eu/co-design-tool

[10] https://www.smartmobilityhubs.eu/accessibility-tool

[11] https://www.smartmobilityhubs.eu/appraisal-tool

| Resilience tool[12] | The SmartHubs Resilience Tool (SHRT) is designed to investigate the influence of mobility hubs on urban transport resilience. The tool comprises two main components:Connectivity Component: This software, provided as R code, is capable of generating a public transport (PT) network, integrating it with sharing systems, calculating indicators based on network analysis, and modifying the network to simulate both PT disruptions and additions of mobility hubs near PT stops. It also computes the variation of the indicators following these changes; Accessibility Component: This software, provided as an interactive webpage, can rank areas based on an accessibility indicator, which is computed using a doubly constrained spatial interaction model.<br><br>The combined use of these two components enhances our understanding of urban resilience. Here, urban resilience is defined as the degree of variation in connectivity and accessibility following disruptions to the PT network and/or additions of mobility hubstool is usable after defining the location of a mobility hub but can also be used for evaluating potential sites. |
|---|---|

# 2 SmartHubs' results and tool integration into SUMPs

Integrating SmartHubs tools into SUMPs aligns specific project deliverables with each step of the SUMP framework (Table 2), and aims at improving the accessible and inclusive character of mobility hubs and the digital transportation overall. Further details about the deliverables can be found in the website of the project.

Integrating the results and tools of the SmartHubs project into the SUMPs is important for a continuous improvement of urban mobility plans. While it is possible to integrate mobility hubs into SUMPs without considering the SmartHub project results, it is important to take into account the advantages of doing so. These advantages include, but are not limited to, promoting inclusive development, enhancing stakeholder involvement, ensuring convenient locations, and strengthening network resilience of mobility hubs.

While some SmartHubs deliverables are multipurposed and applicable to more than one SUMP step, it is notable that SmartHubs does not offer specific results or recommendations for every action part of the SUMP. Similarly, some of the activities of the SUMP are not relevant for developing mobility hubs, or were not considered during the SmartHubs project. These activities are: '1.1 Evaluate capacities and resources, '2.3 Agree on timeline and work plan', 2.4 Consider getting external support, '6.2 Agree measurable targets', '8.2 Identify funding sources and asses financial capabilities', '8.3 Agree on priorities, responsibilities and timeline', '9.1 Develop financial plans and agree cost sharing', '9.2 Finalise and assure quality of 'Sustainable Urban Mobility Plan', '10.1 Coordinate implementation of actions', '12.2 Share results and lessons learned' and '12.3 Consider new challenges and solutions' indicated in yellow in Table 2.

Table 2: Aligning SmartHubs results with SUMP guidelines

| Sustainable Urban Mobility Plan (step by step) | SmartHubs' input |
|---|---|
| **Phase 1: preparation and analysis** ||
| **Step 1: Set up working structures** ||
| 1.1 Evaluate capacities and resources | / |

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[12] https://www.smartmobilityhubs.eu/resilience-tool

| 1.2 Create inter-department core team | D2.3: Governance frameworks for mobility hubs in the SmartHubs living lab areas |
|---|---|
| 1.3 Ensure political and institutional ownership | D2.3: Governance frameworks for mobility hubs in the SmartHubs living lab areas |
| 1.4 Plan stakeholder and citizen involvement | D2.1: A multidimensional mobility hub typology and inventory (SmartHubs integration ladder – democratic integration) <br><br> D6.1: Report on governance impact of mobility hubs in case study |
| **Step 2: Determine planning framework** | |
| 2.1 Assess planning requirements and define geographic scope | D3.1: Guidelines for the integration of mobility hubs into the urban space |
| 2.2 Link with other planning processes | |
| 2.3 Agree on timeline and work plan | / |
| 2.4 Consider getting external support | / |
| **Step 3: Analyse the mobility situation** | |
| 3.1 Identify information sources and cooperate with data owners | D3.3: Digital integration and signage at mobility hubs <br><br> D5.5: Integration of Smart mobility Hubs and public transport <br><br> SmartHubs open data platform: https://www.smartmobilityhubs.eu/odp |
| 3.2 Analyse problems and opportunities (all modes) | D3.2 Report on user needs assessment <br><br> D3.3: digital integration and signage at mobility hubs <br><br> D5.1: Mobility hubs impacts on mobility patterns and behavioural change <br><br> D5.2: Open Accessibility Tool <br><br> D5.3: SmartHubs Equity Assessment <br><br> D5.4: Resilience and vulnerability assessment <br><br> D5.7: Application of the SmartHubs co-appraisal Tool |
| **Phase 2: Strategy development** | |
| **Step 4: Build and jointly assess scenarios** | |
| 4.1 Develop scenarios of potential futures | D3.4 Recommended co-design technologies <br><br> D5.1: Mobility hubs impacts on mobility patterns and behavioural change <br><br> D6.1: Report on governance impact of mobility hubs in case study <br><br> Areas |
| 4.2 Discuss scenarios with citizens and stakeholders | D5.7: Application of the SmartHubs co-appraisal Tool <br><br> D5.2: Open Accessibility Tool |
| **Step 5: Develop vision and objectives with stakeholders** | |
| 5.1 Co-create a common vision with citizens and stakeholders | D2.3: Governance frameworks for mobility hubs in the SmartHubs living lab areas <br><br> D3.4 Recommended co-design technologies <br><br> D3.5: SmartHubs co-appraisal Tool for sustainability and stakeholder management <br><br> D4.2-.5: Living Lab reports |

| | D6.1: Report on governance impact of mobility hubs in case study areas |
|---|---|
| 5.2 Agree on objectives addressing key problems and all modes | D2.1: A multidimensional mobility hub typology and inventory |
| | D2.2: Synthesis of KPIs to evaluate mobility hubs |
| | D3.2: Report on user needs assessment |
| | D6.1: Report on governance impact of mobility hubs in case study areas |
| **Step 6: Set indicators and targets** | |
| 6.1 Identify indicators for all objectives | D2.2: Synthesis of KPIs to evaluate mobility hubs |
| 6.2 Agree measurable targets | / |
| **Phase 3: Measure planning** | |
| **Step 7: Select measure packages with stakeholders** | |
| 7.1 Create and assess long list of measures with stakeholders | D2.1: A multidimensional mobility hub typology and inventory |
| | D2.2: Synthesis of KPIs to evaluate mobility hubs |
| | D6.1: Report on governance impact of mobility hubs in case study areas |
| 7.2 Define integrated measure packages | D3.5: SmartHubs co-appraisal Tool for sustainability and stakeholder assessment |
| 7.3 Plan measure monitoring and evaluation | D2.1: A multidimensional mobility hub typology and inventory |
| | D2.2: Synthesis of KPIs to evaluate mobility hubs |
| | D3.5: SmartHubs co-appraisal Tool for sustainability and stakeholder management |
| | D5.2: Open Accessibility Tool |
| | D5.4: Resilience and vulnerability assessment |
| **Step 8: Agree on actions and responsibilities** | |
| 8.1 Describe all actions | D2.3: Governance frameworks for mobility hubs in the SmartHubs living lab areas |
| 8.2 Identify funding sources and assess financial capabilities | / |
| 8.3 Agree on priorities, responsibilities and timeline | / |
| **Step 9: Prepare for adoption and financing** | |
| 9.1 Develop financial plans and agree cost sharing | / |
| 9.2 Finalise and assure quality of 'Sustainable Urban Mobility Plan' | / |
| **Phase 4: Implementation and monitoring** | |
| **Step 10: Manage implementation** | |
| 10.1 Coordinate implementation of actions | D2.3: Governance frameworks for mobility hubs in the SmartHubs living lab areas |
| 10.2 Produce goods and services | D3.3: Digital integration and signage at mobility hubs |
| **Step 11: Monitor, adapt and communicate** | |

| 11.1 Monitor progress and adapt | D2.2: Synthesis of KPIs to evaluate mobility hubs |
| | D3.4 Recommended co-design technologies |
| | D3.5: SmartHubs co-appraisal Tool for sustainability and stakeholder assessment |
| | D5.2: Open Accessibility Tool |
| | D5.4 Resilience and vulnerability assessment |
| 11.2 Inform and engage citizens and stakeholders | / |
| **Step 12: Review and learn lessons** | |
| 12.1 Analyse successes and failures | / |
| 12.2 Share results and lessons learned | / |
| 12.3 Consider new challenges and solutions | / |

## 2.1 Phase 1: Preparation and analysis

The initial phase of a SUMP starts with a commitment to improve mobility and enhance sustainability, aiming for broader goals such as enhanced quality of life and environmental well-being. The first phase focuses on the preparatory works necessary to implement a SUMP. Most often the initial motivation for a SUMP stems from legal obligations or local/regional political decisions. Finding political support may require presenting the expected benefits of a SUMP such as improved accessibility, safety, and environmental quality. Explaining the potential negative impacts of inaction and the best examples from other cities can help to gain support. Subdividing long-term goals into short-term, visible changes can help to convince local stakeholders.

In this section, we explain how the results of the SmartHubs project, consisting of both tools and deliverables, fit into the different steps and activities proposed in the SUMP guidelines. The main goal is to provide a comprehensive approach on the integration of smart mobility hubs in the development of a SUMP.

### Step 1: Set up working structures

The first step of the SUMP is aimed at organising and setting up working structures that will be adopted throughout the full SUMP creation. For this step, input from the SmartHubs project can be consulted in three deliverables and could prove valuable for activities 1.2, 1.3 and 1.4.

For **activity 1.2**: 'Create inter-department core team' and **activity 1.3**: Ensure political and institutional ownership', SmartHubs D2.3: describes the multilevel approach to governance, explaining the different levels at which governance frameworks operate. For these activities, specifically, the overview of European mobility policies and mobility hubs could be useful.

For **activity 1.4**: 'Plan stakeholder and citizen involvement'. D2.1: contains several topics that could help to identify different stakeholder groups and help determine their level of involvement in the project. The 'SmartHubs integration ladder' can be used as a valid starting point for the setup of citizen and stakeholder involvement. It provides a detailed overview of the physical, digital and democratic levels of integration linked to a smart mobility hub. For a more in-depth look at the democratic integration of mobility hubs D6.1: 'Report on governance impact of mobility hubs in case study' where different participatory processes, across multiple living labs are studied and compared.

### Step 2: Determine the planning framework

The integration of mobility hubs in **activity 2.1**: 'Assess planning requirements and define geographical scope' builds on two deliverables: D2.3 and D3.1.

The first aim of step 2 is the identification and assessment of legal regulations, policy documents, and higher strategies that could influence the development or introduction of hubs as part of a SUMP. SmartHubs D2.3 presents an overview of the academic literature concerning the governance of mobility hubs, as well as insights provided by local stakeholders through 29 semi-standardised interviews. Furthermore, it provides an introduction to the current organisational frameworks and overarching strategies that impact the development of mobility hubs.

A second aim is to select the geographic scope of the SUMP. Therefore, the results of D3.1 could provide useful information. In D3.1, a methodology for ranking different locations of hubs was developed. The methodology integrates relevant factors such as amenities, infrastructure, population density, and land use. These factors have a pivotal role in the functioning of a hub or even the SUMP as a whole.

Furthermore, it is important that the development of hubs would ideally be part of the roll-out of the SUMP.

### Step 3: Analyse the mobility situation

**Activity 3.1**: 'Identify information sources and cooperate with data owners', aims at collecting as much valuable data as possible, while also maintaining a high degree of quality and accessibility of that data. Mobility hubs require a lot of data exchange between multiple stakeholders. In D3.3, the SmartHubs project emphasises the need for standardized data as a key element for digital integration in mobility systems, such as mobility hubs and MaaS. However, the project also acknowledges the challenging road to standardisation, necessitating significant investment, to standardize and integrate their data into MaaS platforms. A second useful source is D5.5:**,** which contains a stated choice survey about potential trade-offs between integration dimensions and the willingness to pay for different attributes of the hub.

In addition, the SmartHubs project created an Open Data Platform (ODP)[13]. On this platform, decision-makers can view, edit and compare mobility hub examples, based on the different levels of integration (SmartHubs ladder of integration) they have. The comparability of mobility hubs is provided by the scores attributed to the hubs. These scores are based on the SmartHubs ladder of integration, consisting of digital, physical and democratic integration.

For **activity 3.2**: 'Analyse problems and opportunities (all modes)', attention is paid to the problems and opportunities present in any operational or planned transport mode. Input from the SmartHubs project is useful for the accessibility, equity and safety of potential and vulnerable users. Firstly, SmartHubs D3.2 provides insights into the needs of mobility hub users. Secondly, D5.3 provides detailed information about vulnerable-to-exclusion citizens and non-users of mobility hubs. In this deliverable, we address the barriers to smart mobility that vulnerable users experience, while also providing recommendations for mitigation. Additionally, D5.1can be consulted as a source of relevant information on the problems and opportunities of mobility hubs that are already in operation.

## 2.2 Phase 2: Strategy development

In the second phase of a SUMP, the strategic goals are defined in collaboration with citizens and other stakeholders. Overall, this phase aims to determine the potential of different options and possibilities for both mobility measures (e.g. cycling lanes) and policies (e.g. mobility hubs)

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[13] www.smartmobilityhubs.eu/odp

To do so, several key factors are defined and scenarios are developed with stakeholders to help navigate the different options and associated uncertainties. Consequently, these scenarios will be used as the basis for identifying practical objectives. It is important to keep in mind that all scenarios and objectives need to be in line with broad policy goals to ensure a widely supported vision for the SUMP.

### Step 4: Build and jointly assess scenarios

The goal of **activity 4.1** is to develop alternative scenarios based on the risks and opportunities linked to trends and disruptions that provide a factual basis for the development of accessible and sustainable transport options. Therefore activity 4.1 benefits from using the co-design tool developed as part of D3.4 (Table 1). Multiple mobility hubs can be envisioned, as well as evaluated if the necessary data is available. D5.7 is a source for good examples, as it presents results of the appraisal of several different scenarios for hubs. This appraisal exercise allows for a clear overview of stakeholders' priorities and the preferences of different scenarios. To determine the aim of the different hub scenarios, more precisely the needs that they should serve, D5.1 provides insights. Firstly, the deliverable explains current travel behaviour and changes in behaviour affiliated to a mobility hub. Secondly, the deliverable focuses on the possible expected impacts of the mobility hubs included in the project. Finally, D6.1 can be consulted for a better understanding of the societal impacts linked to citizen participation during the development of mobility hubs. The deliverable evaluates the development of mobility hubs based on the level of democratic integration. Additionally, it provides insights to conduct a participatory process and how to manage potential barriers during the process.

Once multiple scenarios have been co-designed in activity 4.1, different alternatives can be compared and evaluated as part of **activity 4.2**. Similarly to Step 3, the SmartHubs tools (accessibility and co-appraisal tool) are applicable for evaluating the scenarios on the premise that enough relevant information is available and usable. The SmartHubs co-appraisal tool for sustainability and stakeholder assessment can be helpful here as it facilitates the appraisal of different mobility hub designs by involving key stakeholders such as local residents, local or regional governments, public transport operators, and shared mobility operators. The tool supports the multi-stakeholder decision-making process and ensures the selection of a widely supported option.

### Step 5: Develop vision and objectives with stakeholders

Step five aims to achieve a common vision of the objectives, addressing the key problems for all modes and includes two activities, activity 5.1: 'Co-create common vision with citizens and stakeholders' and activity 5.2: 'Agree on objectives addressing key problems and all modes'. It builds on several earlier activities, including the stakeholders selected as part of activity 1.4, the mobility analysis of step 3 and the scenarios created as part of step 4.

For **activity 5.1**, a separate, integrated vision for mobility hubs including prototype designs can be co-created using the SmartHubs co-design tools. D5.1. For the governance aspects associated with this activity, D2.3 presents the ideal components linked to the development of policy frameworks. The ideal components presented for each living lab describe social interaction, stakeholder involvement, public debate etc., that take place while envisioning a future mobility system and deciding on the objectives.

For **activity 5.2**, which defines the specific (mobility) objectives of the SUMP, of which mobility hub development can be an integral part. Particularly, D3.5: provides an approach to collect and weigh the diverse criteria (namely the objectives) of stakeholders considering the development of mobility hubs. Additionally, the user needs, described in D3.2, can also provide relevant input for identifying and describing objectives for the mobility hubs. Similarly, the results of the large-scale survey presented in D5.1provide useful insights.

Finally, D2.1, the SmartHubs integration ladder, can be consulted again to determine the level of democratic integration that is adopted in the decision-making process of activity 5.2. If a more in-

depth approach to democratic integration is required, D6.1 could be useful as it examines different forms of participation in terms of their performance on the ladder. For the decision process, D3.5 presents an approach to select the most supported vision among the stakeholders. For a better understanding, it can prove beneficial to consult deliverables D4.2 to D4.5, which contain a practical step-by-step planning of a living lab location, as well as a clear description of the co-creation initiatives that took place during the full development phase of mobility hubs.

The output of this step depends on the approach, either a vision is developed for the SUMP (which includes the mobility hubs) or a more in-depth, detailed vision is created for the mobility hubs..

### Step 6: Identify indicators for all objectives

For step 6, the aim of **activity 6.1** is to create a set of indicators that allow for monitoring the objectives defined in step 5. The KPIs should include easily measurable and understandable indicators. One reason for this is the continuous evaluation of said KPIs, which would be less feasible if the KPI's are complex or hard to measure (e.g. only through several proxy's). An example of a difficult to measure KPI would be the amount of $CO_2$ that is not emitted due to the installation of a mobility hub in a particular neighbourhood. This would be difficult due to severe interference by other factors (e.g. weather, industry, etc.). Secondly, targets for the indicators are selected in **activity 6.2**.

D2.2 provides a starting point to include indicators in the SUMP that are relevant specifically for mobility hubs. The deliverable contains a list of 53 essential and 57 non-essential indicators to measure the performance of a mobility hub (similarly to 'core' and 'other' indicators in SUMP).

Each of the SmartHubs KPIs were scored on 'feasibility' and 'usability', respectively indicating 'ease to find and collect the data' and 'the ease of use of the collected data'. Also, the indicators are subdivided into multiple categories such as mobility, services, accessibility, and various forms of integration, increasing their ease of integration into a SUMP.

The method for selecting indicators is similar for both the SmartHubs project and the SUMP guidelines. However, in the SUMP there is an additional subdivision of targets, defining them as strategic indicators (e.g. reduction of 30% greenhouse gases in 10 years) or core transport activities (e.g. increase of biking modal share by 25% by 2030). Although mobility hub KPIs were developed in detail, no specific targets were defined since these are specific to the city where the hubs are developed.

For clarity, the same structure of step 5 can be adopted, either indicators are developed for the SUMP in general that cover key aspects of hub development, or specific subsets of KPIs are defined for evaluating mobility hubs.

## 2.3 Phase 3: Measure planning

From phase three the focus of the SUMP should change towards the operational implementation, during which three key questions are answered: (1) What concrete actions will be taken as part of the SUMP? (2) What resources are available for said actions and who will be responsible for the actions and the allocation of funding? (3) Finally, the responsible parties need to decide if they are ready to proceed with the operational side of the project. Firstly, this decision will be affected by the political and public support that was gained. Secondly, financial aspects are taken into consideration before finally adopting the plan.

### Step 7: Select measure packages with stakeholders

**Activity 7.1**: 'Create and assess long list of measures with stakeholders' aims at defining measures to contribute to the vision, objectives and targets. Doing so will require stakeholder input for which D2.1 can be consulted again, as well as the KPIs as explained in D2.2. The measures range from land use and infrastructure to pricing measures and will contribute significantly to the policy objectives that were identified in step 5. A third useful source of

information is D6.1. D6.1 shows how citizen participation enhances the democratic integration and thus inclusive character of mobility hubs. It also evaluates the level of democratic integration and potential impacts on development linked to said participation.

**Activity 7.2**: 'Define integrated measure packages', aims to merge the measures from activity 7.1 into one or multiple measure packages, keeping in mind all transport modes. Similarly to step 5 and 6, two main approaches are possible: either the packages are developed for the SUMP in general, or specific subsets of measures are created solely for mobility hubs. These packages should build on the specific hub-related objectives defined in step 5 and indicators identified in step 6.

When the initial 'draft' measure packages are created, as is suggested in the SUMP guidelines, an appraisal exercise can be conducted. To build a package of measures, the SmartHubs co-appraisal tool can be used for selecting the measures that have the highest degree of support among the stakeholders. For mobility hubs these should include topics such as inclusivity, accessibility, availability of information, geographical feasibility, cost-efficiency etc. The appraisal exercise can be repeated for each topic until a final shortlist of packages has been identified.

Finally, **activity 7.3**: 'Plan measure monitoring evaluation', builds on activity 6.1 and aims to define a set of measure indicators for monitoring and evaluating all main measures decided upon in activity 7.2.

The indicators developed as part of this activity are agreed upon in more detail (especially for cost estimation). An example: an objective linked to mobility hubs (Step 5) could be to enhance a sustainable modal shift, the indicator (Step 6) would then be the number of people using public transport, and a more detailed measure indicator (step 7) would then be the number of people using public transport instead of their private vehicle for commuting since the mobility hub was installed.

Although already applied earlier, the KPI's specifically developed for mobility hubs in D2.2 can be included for monitoring the mobility hubs. A resilience and accessibility assessment can be performed using the SmartHubs open accessibility and resilience tools.

### Step 8: Agree actions and responsibilities

Step 8 aims at describing the specific actions that will take place and the institutions and organisations responsible for these actions. Actions can be considered as a more concrete interpretation of the measures that were defined in activities 7.1 and 7.2. During this process, one important element is the division of roles and responsibilities, which is discussed in SUMP **activity 8.3**.

The division of roles and responsibilities can be a difficult process and could require some negotiations. This process is relevant as it formalises the responsibilities and resource contribution of each partner. Applied to the development of mobility hubs, SmartHubs D2.3, presents a set of challenges and mitigations experienced by public authorities. Contrary to SUMP step 1, these are oriented at lower-level decision making processes (e.g. at the local level).

## 2.4 Phase 4: Implementation and monitoring

In the fourth and final phase of SUMP-planning, measures decided on as part of the SUMP are implemented, monitored, evaluated, and communicated to the public. Pivotal for the success of the project is a continued two-way communication with citizens, local stakeholders, public authorities etc. to ensure continued support. Apart from monitoring the current implementations, it is equally critical to consider success and failures, concerning specific measures as well as the overall SUMP, and even more important to communicate them clearly.

### Step 9: Prepare for adoption and financing

Step 9 aims to develop definite, concrete financial plans for all action part of the SUMP. It builds on **activity 9.1** 'Define financial plans and agree cost-sharing' and **activity 9.2** 'Finalise and assure quality of 'Sustainable Urban Mobility Plan' document'. This section is not as it goes beyond the scope of the SmartHubs project and associated results. Despite the extensive nature of the SmartHubs project, it did not specifically address the financial requirements of smart mobility hub development.

### Step 10: Manage implementation

The objective of step 10 is to ensure the correct implementation of all measures and the procurement of goods and services to do so.

There input for **activity 10.1** can be consulted in D2.3: 'governance frameworks for mobility hubs in SmartHubs living lab areas, where primarily the living labs in Vienna and Munich can serve as best practices. The provide relevant information on the actual implementation of mobility hubs in the cities, as well as the role they perform in the regional transport system.

For **activity 10.2**: 'Procure goods and services', SmartHubs D3.3 provides guidelines on the physical integration of mobility hubs in the urban environment. It details all necessary and optional goods/services required when building a mobility hub and shows best practices regarding wayfinding and (digital) kiosks from across Europe.

### Step 11: Monitor, adapt and communicate

Monitoring the progress of mobility hubs integrated into the SUMP requires the application of the SmartHubs accessibility and resilience tools. Each of these gives a detailed description of the hub and can be used to adapt the hubs.

If monitoring of the hubs results in the conclusion that the hub does not answer user needs or lacks accessibility and resilience, several steps can be undertaken. First of all, a full re-development of the hub design using the SmartHubs co-design tool is possible. Less extreme options include the re-evaluation of the target indicators decided in activity 6.1:' Identify indicators for all objectives' and activity 7.3: 'Plan measure monitoring evaluation'. If specific measure indicators do not meet their targets, it can prove useful to re-assess the indicator and change it if necessary (e.g. if the number of vulnerable users suddenly decreases despite the efforts made, it could be that changes in information availability negatively affect vulnerable-to-exclusion citizens). If the measure indicators do not visualise changes as expected, a re-selection of the objectives and their indicators is possible using D2.2.

The relevant citizens and stakeholders that are initially included in the SUMP development (from step 1) should be kept informed about the monitoring of the hub, as well as the potential changes that are planned. Ideally, if a high degree of democratic integration is adopted, they should be involved in any re-development phase.

### Step 12: Review and learn lessons

The final step when developing a SUMP consists of three activities: **activity 12.1** 'Analyse success and failures', **activity 12.2** 'Share results and lessons learned' and **activity 12.3** 'Consider new challenges and solutions'.

## 3 Recommendations

Based on the detailed analysis of how mobility hub planning, design, evaluation and monitoring can be developed as part of the SUMP, the following recommendations have been defined.

1. **Create interdisciplinary teams**: Utilize SmartHubs D2.3's insights on governance frameworks to form inter-departmental teams (Activity 1.2) that include various

stakeholders, ensuring a multi-sectoral view on mobility hub planning, involving experts from the fields of urban planning, participation and infrastructure development.

2. **Political and institutional support**: Consult the multilevel governance approach explained in SmartHubs D2.3 to ensure political and institutional ownership (Activity 1.3), which is pivotal for the successful integration of mobility hubs into SUMPs.

3. **Involvement of stakeholders and citizens**: Use the strategies from D2.1 & D6.1 to plan comprehensive stakeholder and citizen involvement (Activity 1.4), using the SmartHubs integration ladder for effective and structured engagement throughout the different steps of the SUMP.

4. **Regulatory and policy assessment**: Learn from SmartHubs D2.3 and D3.1 to understand the legal, policy, and strategic landscape that influences mobility hub development, focusing on aligning the hub development with existing frameworks (Activity 2.1).

5. **Geographic and demographic scope**: Use the methodology from D3.1 to define the geographic scope of mobility hubs, considering factors like travel behaviour, population density, and accessibility of key activities, which can have a significant effect on functionality of mobility hubs.

6. **Standardize and integrate data**: Consult the recommendations from D3.3 on standardizing data as a key element for digital integration of mobility services at mobility hubs, emphasizing the need for a unified approach among various transport operators.

7. **Focus on accessibility and equity**: Use the insights provided in D3.2 and D5.3 to address accessibility, equity, and safety, particularly for vulnerable user groups in mobility hubs.

8. **Scenario creation and appraisal exercises**: Utilize the SmartHubs co-design tool in D3.4 and co-appraisal tool in D3.5 for developing and assessing various mobility hub scenarios. Make sure they align with stakeholder interests and the overall SUMP objectives.

9. **Vision and objective alignment**: Ensure that the objectives of the strategy for mobility hubs is aligned with broader SUMP goals, using D2.2 for detailed KPI synthesis and ensuring the level of detail is appropriate (Step 5). Revisit the SmartHubs ladder of integration from D2.1 for democratic decision-making processes.

10. **Implement a detailed monitoring framework**: Build a monitoring and evaluation framework for the mobility hubs, drawing on the resilience and accessibility tools developed by the SmartHubs project. Regularly update stakeholders on progress and changes, ensuring ongoing involvement and feedback.

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Appendices