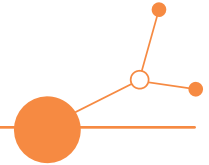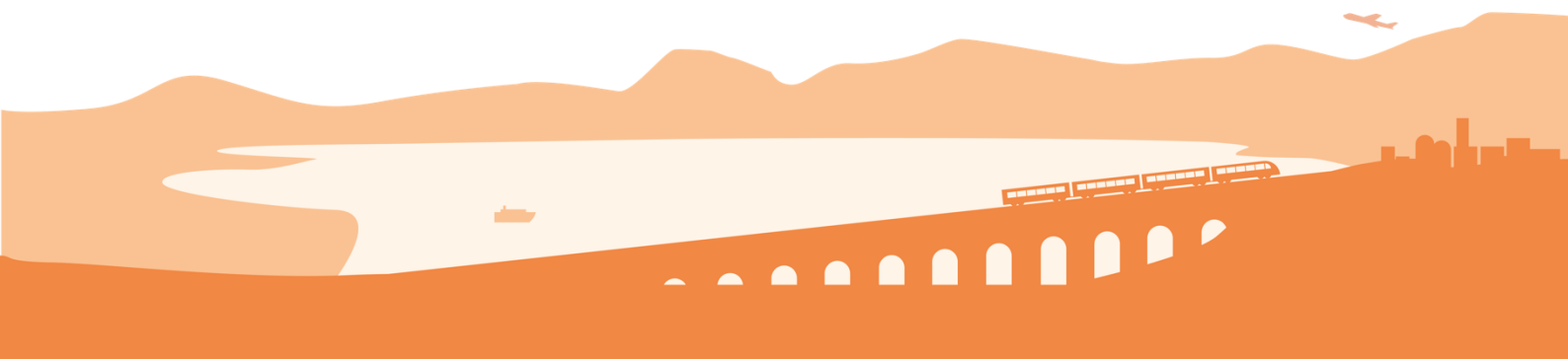# D3.1.1 Methodological background for the design of DRT integrated solutions

Final Version

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Authors and log change of the document

Partner No.	Partner Acronym	Name of the author	Action	Version
2	Redmint	Gabriele Grea	Draft structure and input provision	0
12	RC	Daniel Franco Hassan Hussin	1st version of the document	1
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12	RC	Daniel Franco Hassan Hussin	3rd version of the document	3
2	Redmint	Gabriele Grea	Final review	Proposed final
1	SRM	Chiara Lepori	Edited approved version for official release	Final

Contents

1. Executive summary

The territory of central Europe is characterised by uneven transport connections and mobility opportunities, across and within regions, between urbanized contexts and rural and peripheral areas.

The project's common challenge is to improve accessibility and connectivity in CE peripheral and rural areas through better integration of public transport networks with Demand Responsive Transport (DRT) services, building on joint development and implementation of governance, planning, digital and operational innovations.

DREAM_PACE will develop innovative DRT concepts complementing regional mobility networks.

The project will improve DRT planning and delivery capacities of public authorities and operators.

A new generation of DRT services will become functional and integral part of regional mobility networks, enhancing accessibility for citizens, territorial cohesion and social inclusion. Integration is the key to the DREAM_PACE innovative approach, as DRT services are mostly developed as stand-alone solutions to specific needs, the potential of scalable strategies and solutions is widely underestimated.

Project Partners (thereafter PP) will jointly develop a strategy for DRT in Sustainable Urban Mobility Plans to be adopted at EU level, co-design, test and implement innovative DRT solutions enhancing mobility networks. Strategies and solutions will foster a better integration of DRT and public transport (Bologna, Pavia, Budapest areas), support a higher coordination among existing DT initiatives (Osttirol, Baden-Württemberg) and experiment new integrated approaches for DRT "green fields" (Split-Dalmatia County).

DREAM_PACE will exploit the potential of integrated planning and digital and operational innovations for a common strategy and develop innovative DRT modular solutions. The project implementation builds on transnational cooperation to guarantee an adequate responsiveness and adaptability of project results to specific characteristics of mobility ecosystems across CE rural and peripheral areas.

This deliverable presents the DREAM_PACE methodology for the analysis, the diagnosis of local contexts, stakeholder engagement and co-design of DRT innovative solutions, providing guidance to the project's Living Labs for the planning and delivery of innovative, integrated, and inclusive DRT services.

This document is organized as follows.

Chapter 2 introduces the DREAM_PACE project, which aim to enhance DRT planning in six Living Labs across different pilot areas. It outlines the comprehensive methodology, covering stakeholder engagement, mobility analysis, local strategy development, and solution co-design for sustained impact beyond project completion.

Chapter 3 addresses fundamental concepts for the DREAM_PACE project. It defines Demand Responsive Transport (DRT) and its role in balancing sustainability and efficiency. The chapter outlines Living Labs as open innovation ecosystems, explains Sustainable Urban Mobility Planning (SUMP) for strategic and citizen-involved transport planning, and highlights the RAIM framework as a guide for intelligent mobility solutions in multi-actor engagements and co-design processes.

Chapter 4 tackles the first phase of the methodology, the Living Labs preparation phase, emphasizing its role in shaping successful DRT integration. It outlines activities, including analysing the local context, mapping stakeholders, and building awareness, and engaging stakeholders effectively. The chapter provides practical guidance and tasks, ensuring a comprehensive approach to prepare for tailored DRT solutions in target areas.

Chapter 5 delves into the second phase of the methodology - the State-of-the-Art Recognition phase, which centres on analysing the mobility context, policies, and regulations for informed decision-making. This

chapter places emphasis on comprehending regulations, assessing existing plans, conducting spatial analyses, and orchestrating workshops to align strategies. The overarching objective is to establish a strong foundation for customized DRT solutions that effectively address local challenges and capitalize on opportunities.

Chapter 6 focuses on the scenario development phase. It delves into creating a DRT strategy by aligning a common vision, defining objectives, understanding risks, and developing alternative scenarios through participative discussions. The objectives include agreeing on a widely supported vision, formulating clear objectives, understanding risks and opportunities, and developing alternative scenarios to inform decision-making. The tasks encompass strategy development, definition of alternative scenarios, and scenario evaluation and prioritization, emphasizing the importance of stakeholder engagement and participation in envisioning the future of urban mobility.

Chapter 7 delves into the Co-design of solutions, focusing on the transition from strategic to operational planning for DRT. It underscores the need for collaborative efforts with key stakeholders to prepare for DRT implementation. Objectives include cooperative planning and design, creating an implementation roadmap, and planning for monitoring and evaluation. The chapter provides practical guidance on facilitating co-design activities and workshops. The outcomes are documented in deliverables, presenting co-design processes and DRT solution blueprints for DREAM-PACE's pilots.

Chapter 8 serves as the concluding chapter, summarizing key insights and emphasizing the significance of the guidelines in shaping effective DRT solutions.

In Chapter 9, readers will find a comprehensive list of references providing the sources and background information for the document.

Chapter 10 describes the D3.1.1 Annexes, providing practical guidance aligned with the DREAM_PACE methodology phases for developing DRT-integrated solutions. The Annexes serve as initial templates for partners to craft content within project deliverables.

2. Introduction

The DREAM-PACE project aims to develop innovative DRT concepts complementing regional mobility networks and to improve DRT planning and implementation capabilities of public authorities and operators. To this end, six Living Labs will be established in each pilot area engaged in the project: Bologna, Budapest, Ost Tirol, Dalmatia-Split, Pavia and Baden-Württemberg, for running four different Pilot Actions.

PILOTS	Pilot action 1.1: GOVERNANCE AND PLANNING of INTEGRATED DRT-public transport in a MaaS logic for peripheral and low demand areas	Pilot action 1.2: GOVERNANCE AND PLANNING of a COORDINATED DRT network enhancing accessibility in peripheral and rural regions	Pilot action 2.1: enhancing existing DRT networks responsiveness in rural and peripheral areas through DIGITAL/OPERATIONAL INNOVATIONS	Pilot action 2.2: EXPERIMENTAL DRT SERVICE in a new regulatory framework
COMPONENTS	- Strategic planning approach (tested within SUMPs and Master Plans processes) - Recommendations on data governance and integration, tariff and funding - Business planning tool for flexible management of DRT-PT (tested on running services) - DRT dedicated tendering procedure (demonstrated on field)	- Governance scheme for the coordination of DRT, and set up of coordinator (demonstrated on field) - Strategic planning approach to DRT (strategic guidance for DRT coordination) - Business model for crowdsourcing (tested by engaging potential participants)	-tools for digitalization of existing services - digital integration between DRT and PT - operational hybrid DRT models enhancing flexibility (based on hotspots, integration of different services) - new approaches to inclusiveness (including no or simplified booking through interactive screens)	Applying the tendering procedure from A.1.3, will implement and test the first-of-a-kind DRT experimental service in Croatia, building on the ecently issued regulatory framework at national level
TEST SITES				
Bologna - Appennino	■			■
Pavia - Oltrepò	■		■	■
Split - Dalmatia	■			■
Budapest	■			■
Osttirol		■		
Stuttgart Region		■		

Figure 1: DREAM_PACE Pilot Actions

In order to ensure a harmonised and comprehensive process for the DREAM-PACE Living Labs, this report provides a common engagement and codesign methodology for the structured preparation, planning and implementation of DRT pilots in each Living Lab, including:

(a) stakeholder mapping and engagement, raising awareness among local communities through dedicated communication actions;

(b) analysis of the initial mobility situation and context conditions, as well as the governance, policy and regulatory framework;

(c) development of a local strategy for DRT with a common vision and specific objectives, and definition of alternative scenarios for DRT implementation;

(d) codesign of solutions and joint elaboration of blueprints for the solutions and actions to be tested in the pilots. Labs will accompany and monitor the pilots and remain after the end of the project.

As seen in Figure 2 below, each of these steps relates to an Activity in WP1 and WP2, which will report on the different stages of the process within each Living Lab.

D.3.1.1	**Methodological background for the design of DRT integrated solutions**			RP1	RP2	RP3	RP4	RP5
A	**Living labs preparation**	D.1.2.1	Living labs preparation: stakeholder mapping, raising awareness and local engagement	■				
		D.2.2.1	Living labs preparation: stakeholder mapping, raising awareness and local engagement	■				
B	**State of the art**	D.1.1.2	State of the art report on governance structures and planning processes for DRT in the pilot areas		■			
		D.2.1.2	State of the art report on digital and operational approaches for DRT in the pilot areas		■			
C	**Scenarios development**	D.1.1.3	Development scenarios for DRT innovative governance and planning approaches		■			
		D.2.1.3	Development scenarios for DRT innovative digital and operational approaches		■			
D	**Co-design of solutions**	D.1.2.2	Living labs meetings documentation on the co-design process for governance / planning in pilot areas			■	■	■
		D.2.2.2	Living labs meetings documentation on the co-design process for digital / operational approaches in pilot areas			■	■	■
		D.1.2.3	Co-designed solutions blueprint of integrated DRT implemented /tested through pilot activities				■	■
		D.1.2.4	Co-designed solutions blueprint of coordinated DRT implemented /tested through pilot activities				■	■
		D.2.2.3	Co-designed solution blueprint improving existing DRT, implemented /tested in pilot activities				■	■
		D.2.2.4	Co-designed solution blueprint implementing new DRT, implemented /tested in pilot activities				■	■

Figure 2: D3.1.1 and its interconnection with other deliverables and Reporting Periods

3. Methodological and conceptual background

3.1. What is DRT?

Demand Responsive Transport (DRT) is a form of public transport that is characterised by its flexibility and efficiency to adapt to user needs by allowing them to book a transport service that is not restricted to following a fixed timetable or route but rather adjusts to the requests from users, designing its route and schedule based on the specific transport demand received. This reservation mechanism constitutes its main differentiator from traditional public transport services. In this way, DRT aims to balance the sustainability and efficiency of collective transport and the personalisation and comfort of individual services, such as taxis [Liftango. Definitive Guide to DRT].

This balance among flexibility, sustainability and shareability, for the different types of transport forms, is described in the diagram below, developed by the Interreg CE project SMACKER. As seen, DRT services achieve a high degree of sustainability and shareability, while compromising on flexibility in comparison to individual services. Still, its capacity to adapt to user demands and cost-effectiveness makes DRT a valuable solution to enhance public transport networks, for instance, by complementing mass transit (e.g., metro, tram, BRT) or providing better coverage in rural and peri-urban areas.

The success of DRT solutions heavily relies on the suitable definition of service and operational parameters, such as fleet size, zone selection, booking mechanisms or integration into the public transport network, to the specific dynamics and mobility needs of the served area.

As it will be presented in this guide, a well-structured, holistic and participative planning process is essential to achieve this goal, following the analysis of current conditions, user and stakeholder needs as well as the policy and regulatory framework, to assess alternative scenarios which guide the identification of a suitable strategy and co-design effective solutions for DRT.
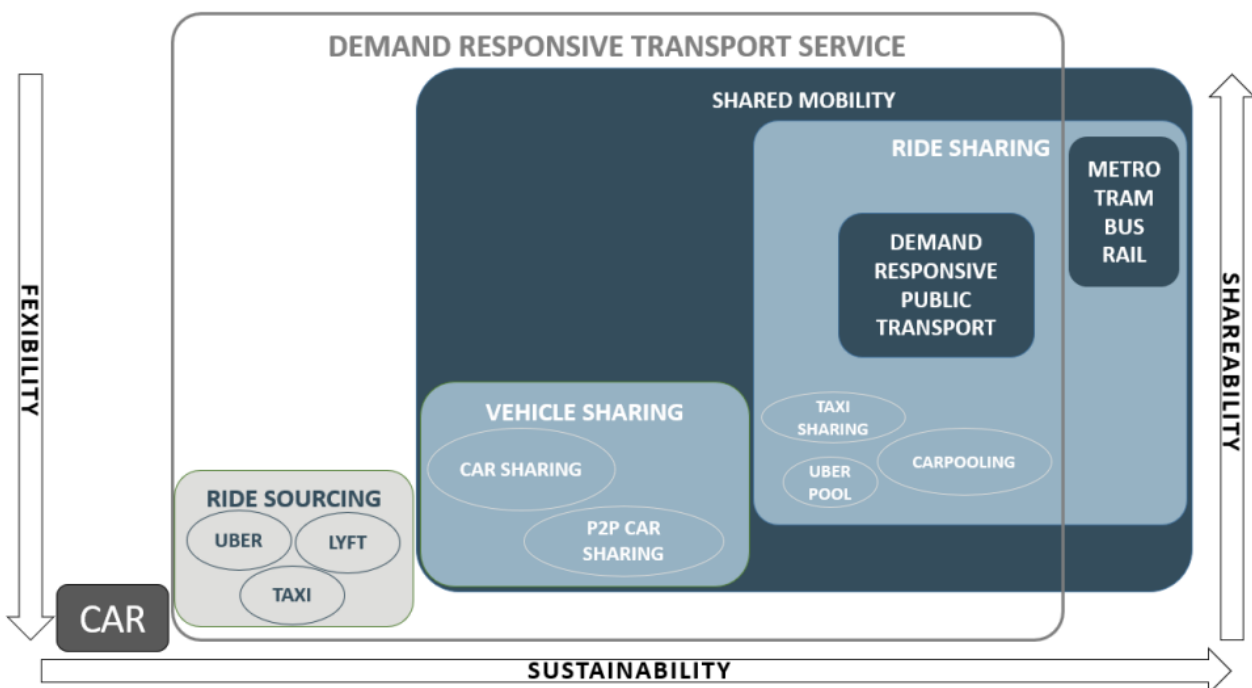

Figure 3: Demand Responsive Transport Service Options [SMACKER, 2022]

3.2. What is a Living Lab?

"Living Labs are open innovation ecosystems in real-life environments using iterative feedback processes throughout a lifecycle approach of an innovation to create sustainable impact. They focus on co-creation, rapid prototyping & testing and scaling-up innovations & businesses, providing (different types of) joint-value to the involved stakeholders" [Guideline for new stakeholder engagement formats in experimental designs/Living Labs, Dynaxibility4CE, 2022].

DREAM-PACE aims to develop inclusive and integrated DRT concepts through the implementation of six Living Labs where pilot projects will guide the participative analysis and planning of innovative DRT solutions. The Living Labs will facilitate collaborative design, implementation and learning from the pilot results, by enabling the establishment of co-design processes and structures in real-life contexts so users and stakeholders can become active participants in the project.

Promoting collaborative engagements among various stakeholders, living labs serve as catalysts for innovation by establishing institutional support and minimizing the risks of innovation failures [Pierson and Lievens, 2005]. They equipped with governance structures that encourage user participation and contributions [Hyysalo & Hakkarainen, 2014]. The ENoLL[1] website boasts a comprehensive list of more than 340 living labs worldwide.

Take the Helsinki Living Labs as an illustration, established in 2007 to foster collaboration between companies and the public sector across various projects. Serving as a platform for activities in Helsinki and neighbouring cities, these Living Labs adhere to a three-phase methodology, resembling a spiral evolution. In the initial phase, referred to as "Grounding" by Amirall, Lee, and Wareham (2012), stakeholders and users are identified and approached to participate in Living Lab activities. The subsequent phase, "Interactive and Iterative Co-Design," involves inviting future users to engage in ideation and co-design workshops for the development of prototypes and concepts. Moving on to the third and final phase, labelled "Appropriation and Implementation," the outcomes from co-design workshops are tested in real-life contexts, and feedback is collected [Amirall, Lee, Wareham, 2012]. Post this phase, an adaptation phase may ensue, potentially involving further ideation and re-design through additional rounds of co-design workshops and prototyping. This iterative process may include multiple co-design loops, where solutions are tested, feedback is gathered, and subsequent iterations of the co-designed solution are implemented.[2]

3.3. Sustainable Urban Mobility Planning (SUMP)

Sustainable Urban Mobility Planning is a strategic and integrated approach to dealing effectively with the complexities of urban transport. With a structured and comprehensive methodology and a set of core principles which can be flexibly applied to different thematic areas, the SUMP process provides a valuable framework for the planning of innovative mobility solutions and new services, such as DRT, ensuring its alignment with local policy goals and mobility strategies while guiding the engagement of complex stakeholder and institutional ecosystems as well as the management of technical and operational requirements.

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[1] European Network of Living Labs, https://unalab.eu/en/project-partners/enoll
[2] https://enoll.org/network/living-labs/?country=finland

Figure 4: Sustainable Urban Mobility Plan Cycle [Rupprecht Consult, 2019]

SUMP advocates fact-based decision-making guided by a long-term vision for sustainable mobility. As key components, this requires a thorough assessment of the current situation and future trends, a widely supported common vision with strategic objectives, and an integrated set of regulatory, promotional, financial, technical and infrastructure measures to deliver the objectives. In contrast to traditional planning approaches, SUMP places particular emphasis on the involvement of citizens and stakeholders, the coordination of policies between sectors and broad cooperation across different layers of government and with private actors.

In this way, the SUMP methodology provides an essential framework for the activities in DREAM-PACE. As shown in Figure 5, the SUMP cycle is aligned with the sequence of tasks in the project and can be effectively adapted to guide the design and planning of DRT solutions.
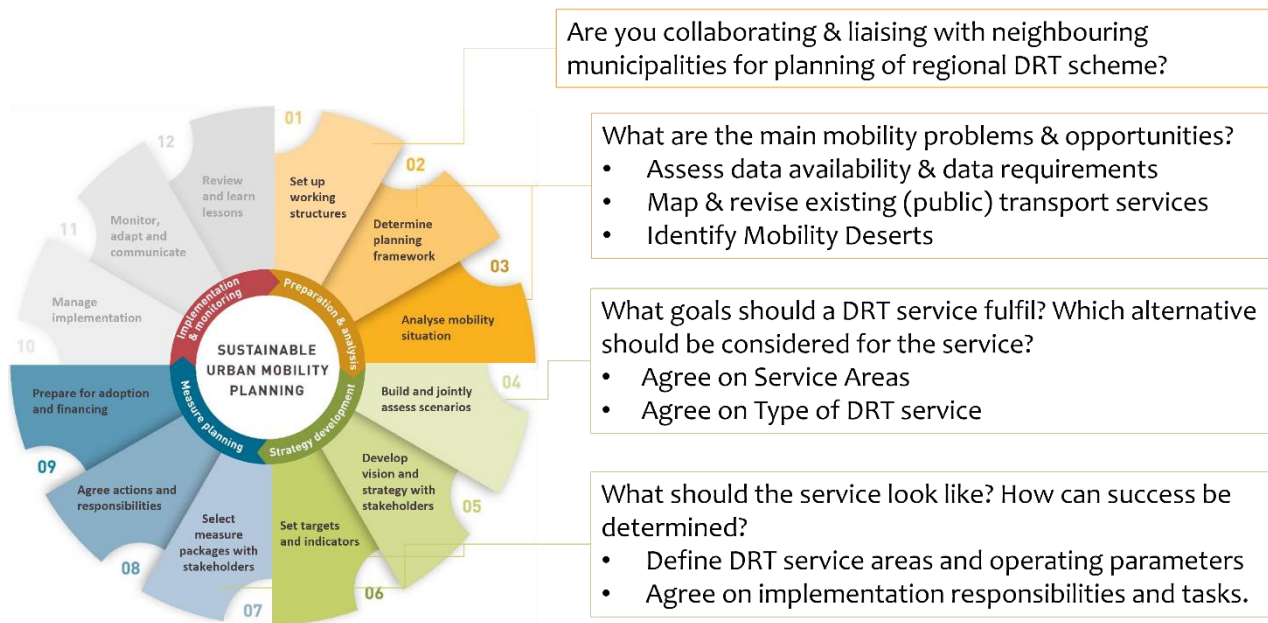
Are you collaborating & liaising with neighbouring municipalities for planning of regional DRT scheme?

What are the main mobility problems & opportunities?
• Assess data availability & data requirements
• Map & revise existing (public) transport services
• Identify Mobility Deserts

What goals should a DRT service fulfil? Which alternative should be considered for the service?
• Agree on Service Areas
• Agree on Type of DRT service

What should the service look like? How can success be determined?
• Define DRT service areas and operating parameters
• Agree on implementation responsibilities and tasks.

Figure 5: Integrating DRT Design in the SUMP Cycle [Rupprecht Consult, 2023]

3.4. Framework for innovative and intelligent mobility: RAIM

RAIM[3], a German framework for Architectures of Intelligent Mobility Services (translated from German), provides a guide for design planning, as well as the functional, technical, and economic implementation of intelligent mobility solutions. The latter are data-based applications in the field of transport and mobility that can be used by users. On a contractual, organisational and technical level, RAIM supports smooth communication between the actors involved.

The RAIM framework aims to be used, for example, to subsequently structure existing services in the transport sector or to enable cooperation between private and public actors in the creation of intelligent mobility services (or enable integrated management), while highlighting the importance of promoting dialogue and consensus between stakeholders in the case of new services (mobility services). It is primarily intended to address mobility service providers, public transport companies, navigation service providers, app operators, regulators, authorities, and urban actors.

Rupprecht Consult, as a partner of the RAIM project (funded by the Federal Highway Research Institute – BASt) and co-author of the RAIM guidelines for implementation, will build on this experience to enrich DRT planning and implementation processes in DREAM-PACE.

For the purposes of the project's multi-actor engagement and co-design processes, the RAIM framework provides a useful model to guide the engagement efforts and to address key topics and questions in a structured manner, as well as handling typical uncertainties and challenges of such cooperative processes, in particular with multiple numbers of actors in a data-based and highly innovative field.

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[3] Rahmenwerk für Architekturen intelligenter Mobilitätsdienste - Framework for intelligent mobility services architectures
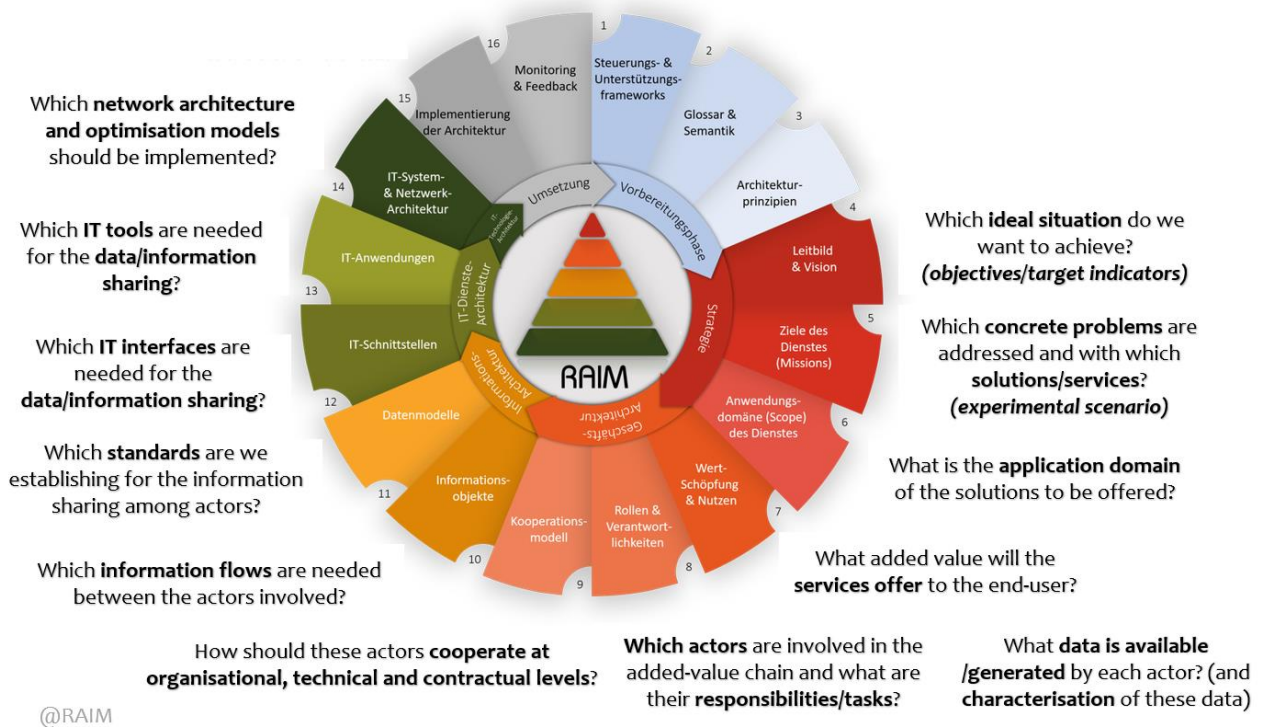
Figure 6. Adaptation of the RAIM process [RAIM Project, 2021]

The RAIM model is divided into sequential modules, guiding through the preparation, planning and implementation of innovative solutions and service architectures. The methodology brings key actors together to achieve reliable compromises and design optimal cooperation models. This is achieved through general building blocks which can be adapted to the specific objectives of each Living Lab and tools to address data-based services (incl. data exchange between actors) in the mobility sector.

4. Living Labs preparation

4.1. Rationale

The Living Labs preparation phase for DRT integration is essential due to its significance in shaping the success of the project. This phase serves as the groundwork for designing effective and context-specific solutions that can transform local transportation systems. Its relevance lies in the need to comprehensively analyse the local organizational and institutional context, identify key stakeholders, and create awareness and engagement within the community.

The Living Labs preparation phase includes various activities:

- Analysis of Local Context: In this activity, the focus is on gaining a deep understanding of the local context in which the DRT integration will take place. This involves examining various factors that impact transportation, such as the regulatory environment, cultural and social dynamics, infrastructure, financial considerations, and technological readiness. The aim is to uncover insights that will inform the design and implementation of DRT solutions that are responsive to the unique characteristics and needs of the target area.

- Identifying and Mapping Stakeholder Ecosystem: Recognizing and comprehensively understanding the stakeholder landscape is a critical aspect of preparing for DRT integration. This activity involves identifying a diverse range of stakeholders, including government entities, private organizations, community groups, and residents, and analysing their roles, interests, and relationships. The goal is to create a clear picture of the stakeholder ecosystem to facilitate effective communication, collaboration, and alignment of interests during the project.

- Stakeholders Engagement and Awareness Building: Local stakeholders hold a pivotal role in the success of the initiative, and efforts are made to secure their commitment and active involvement by aligning their interests and values with the DRT project. This involves creating collaborative working structures to facilitate effective communication and decision-making among stakeholders, fostering a sense of ownership and shared responsibility within the community. Simultaneously, raising public awareness is prioritized, with the creation of informative materials, planning of launch events, development of educational resources, and the use of various communication channels to disseminate information. Engagement with local stakeholders and the establishment of feedback mechanisms ensure a two-way communication flow, promoting community involvement and support for the DRT initiative.

In summary, the Living Lab preparation phase encompasses a comprehensive approach that considers the local context, stakeholders, awareness building, and local engagement. These activities collectively lay the foundation for the successful implementation of Demand-Responsive Transportation solutions tailored to the specific needs of the target area.

4.2. Objectives

The Living Lab preparation phase for DRT integration is pivotal for the project's success. Its rationale involves understanding the local context, engaging stakeholders, building awareness, and fostering local commitment. The following objectives serve as the foundation for effective DRT integration tailored to the community's needs and the previously mentioned rationale:

- Establish a clear understanding of the local context's influence on DRT integration.
- Identify the critical components of stakeholder engagement and awareness building.

- Analyse the regulatory environment to ensure compliance with transportation regulations.

- Assess cultural and social factors to design DRT services that align with community preferences.

- Evaluate infrastructure and geographical factors for operational feasibility.

- Examine the financial landscape to develop sustainable funding models.

- Assess technological readiness to determine the feasibility of digital solutions.

- Identify and categorize diverse stakeholders, including government bodies, private entities, and community organizations.

- Analyse stakeholder relationships and interactions to understand power dynamics and potential conflicts.

- Collaborate with local authorities for official public announcements.

- Establish mechanisms for collecting public feedback through surveys and social media.

- Build collaborative working structures, such as committees and working groups, to facilitate effective communication.

- Define the roles and responsibilities of local stakeholders to avoid confusion.

- Secure commitment and active participation of local actors by involving them in decision-making processes.

4.3. Tasks and practical guidance

This section delves into the core steps that underpin the preparation phase. Each task or step is accompanied by essential guidance text, shedding light on its concept, approach, and key considerations as well as a list of tasks and tools which aid in understanding the complexities of DRT integration.

4.3.1. Analysis of local context

In designing Demand-Responsive Transportation (DRT) integrated solutions, a critical phase involves conducting a thorough analysis of the local organisational and institutional context. This activity aims to develop a comprehensive understanding of existing structures, roles, and dynamics within the transportation ecosystem of the target area. By delving into the details of the local context, planners can identify previous experiences and projects related to transportation systems, as well as create a preliminary mapping of key actors who play significant roles in the implementation of DRT solutions.

Step 1: Understanding Existent Structures and Roles

Before implementing DRT-integrated solutions, it is essential to understand the existing transportation infrastructure and its associated frameworks. This understanding involves delving into the roles and responsibilities of regulatory bodies, government agencies, and private entities responsible for transportation management. Such insights are instrumental in untangling the hierarchical structure and decision-making processes within the transportation ecosystem. During the understanding of existent structures and roles, several considerations come into play as per the following tasks.

Tasks:

- Regulatory Environment: Understanding the regulatory framework governing transportation services is vital for compliance and seamless integration of DRT solutions.

- Cultural and Social Factors: Cultural norms, societal preferences, and demographics significantly impact transportation choices. These factors influence the design of DRT services that are accessible and acceptable to the local population.

- Financial Landscape: Evaluating the financial capabilities of different stakeholders helps in devising sustainable funding models for DRT integration.

- Infrastructure and Geography: The physical layout of the area, including road networks, mobility modes, and geographic constraints, affects the operational feasibility of DRT services. Therefore, an initial analysis of these aspects is essential at this stage.

- Technological Readiness: Assessing the availability of technology infrastructure and the digital literacy of potential users informs decisions on the technological aspects of DRT solutions.

Tool:

- Organizational Mapping: Create visual diagrams or organizational charts to illustrate the hierarchy of transportation agencies, their roles, and relationships.

Step 2: Identifying Previous Experiences/Projects

Reviewing past experiences and projects related to transportation systems, particularly those involving innovative approaches like DRT, can offer invaluable lessons. By studying the successes, challenges, and lessons learned from previous initiatives, planners can draw upon best practices and avoid potential pitfalls. This analysis also aids in understanding the context-specific factors that contributed to the success or failure of previous projects, enabling the design of more effective and tailored DRT solutions.

Tasks:

- Examine both successful and unsuccessful past projects to identify factors contributing to their outcomes. Consider factors like public acceptance, funding models, and technological implementations.

- Identify recurring themes or lessons learned from previous projects that can inform the design of DRT solutions. These lessons could relate to community engagement, stakeholder communication, or operational strategies.

Tool:

- Case Study Analysis: Gather case studies of past transportation projects, particularly those involving innovative or flexible transportation services. Analyse these cases using frameworks like SWOT analysis to extract insights and lessons.

4.3.2. Identifying and Mapping the Stakeholder Ecosystem

In this process, the objective is to recognize, outline and map the various actors shaping the transportation landscape. These stakeholders encompass a spectrum of entities, including government bodies, transportation agencies, community organizations, private transportation providers, technology collaborators, and local residents.

Step 1: Preliminary Identifying and Analysing the Stakeholder Ecosystem

Each stakeholder fulfils a unique role in the transportation framework and carries differing levels of influence, resources, and interests. Identifying and analysing these stakeholders is instrumental in clarifying power dynamics, fostering partnerships, and ensuring that the envisioned DRT solution effectively caters to the requisites and concerns of all pertinent parties.

Tasks:

▪ Identify the transportation ecosystem stakeholders. This encompasses entities such as governmental authorities, private enterprises, community groups, and potential end-users of the DRT service.

▪ Understand the resources (financial, human, and technological) that each stakeholder brings to the table. Identify potential contributions and constraints.

Figure 7: Identifying and Analysing the Stakeholder Ecosystem [© SUMP Guidelines]

Tools:

▪ Stakeholder Inventory: Create a structured template to systematically document different stakeholders. Include categories such as government, private sector, community organizations, technology partners, and residents.

▪ Surveys and Interviews: Conduct surveys or interviews with key informants, experts, and community members to identify stakeholders across various categories.

Step 2: Stakeholder Mapping

Stakeholder mapping is a fundamental practice within the analysis of the stakeholder ecosystem. It involves mapping the relationships, influence, and interests of various stakeholders. By creating a graphical representation of stakeholder dynamics, planners gain a clearer understanding of power structures and areas of alignment or potential conflict.

Tasks:

▪ Identify the interrelationships and interactions amongst these stakeholders. Understanding the complex web of connections unveils the power structures, mutual interests, and possible conflicts within the stakeholder network.

▪ Utilize stakeholder mapping techniques to visually represent the connections between stakeholders. This can be done through network diagrams or relationship matrices, illustrating the interplay of interests and influence.

By examining the mapping, identify stakeholders with significant influence and those who may have conflicting interests.

Tools:

- Stakeholder Analysis Matrices: Employ matrices to assess the influence, interest, and attitudes of different stakeholders. Tools like Power/Interest Grid or Influence/Impact Matrix aid in categorizing stakeholders based on their significance.

- SWOT Analysis: Apply SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis to understand the internal and external factors influencing stakeholders. This aids in identifying potential allies and areas of concern.
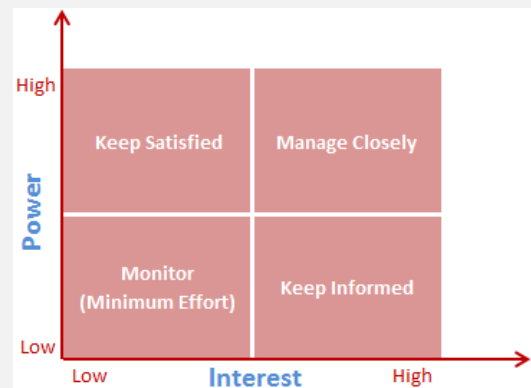

Figure 8: Power / Interest Grid
[© MindTool]

4.3.3. Stakeholders Engagement and Awareness Building

In the realm of developing comprehensive solutions like Demand-Responsive Transportation, the active involvement of local stakeholders holds the key to success. Local engagement embodies the fundamental process of establishing robust working structures while fostering deep commitment and participation from key actors within the community. This multifaceted approach not only facilitates effective communication and decision-making but also nurtures a profound sense of ownership and shared responsibility.

Step 1: Building working structures.

Building working structures involves establishing collaborative mechanisms and frameworks that facilitate effective communication, decision-making, and partnership among local stakeholders. This step ensures commitment and active involvement from key local actors, fostering a sense of ownership and shared responsibility for the DRT solution's development and implementation.

Tasks:

- Form working groups or committees composed of representatives from various stakeholder categories. These groups become platforms for collaboration, discussion, and decision-making.

- Define roles and responsibilities for each stakeholder within the working structures to avoid confusion and duplication of efforts.

- Organize regular meetings to discuss progress, challenges, and decisions related to the DRT solution. Ensure that these meetings are inclusive and provide opportunities for active participation.

Tool:

- RACI Matrix: Use a RACI (Responsible, Accountable, Consulted, Informed) matrix to clarify roles and responsibilities. Assign R, A, C, and I label to different tasks or decisions, indicating who is Responsible, Accountable, Consulted, or Informed. This method ensures role clarity for various aspects of the project.

Step 2: Raising awareness

A well-crafted promotional and educational approach is pivotal to fostering awareness and meaningful engagement within the community for a DRT initiative. This approach aligns closely with the communication plan and serves as a medium for disseminating information, creating enthusiasm, and empowering individuals to actively participate in shaping the DRT solution.

Tasks:

■ Create compelling and informative materials that highlight the benefits and significance of the DRT initiative. These materials will be used across various communication channels to capture the public's attention.

■ Plan and execute launch events or roadshows to introduce the DRT initiative to the public. These events provide opportunities for interactive learning, engagement, and firsthand experience with the initiative.

■ Develop educational resources such as workshops, webinars, and simulations to enhance the public's understanding of the DRT system, its functionalities, and its impact on local transportation.

Figure 9: Raising awareness
[© SUMP Guidelines]

■ Utilize various communication channels such as social media platforms, local newspapers, radio broadcasts, and community bulletin boards to disseminate promotional and educational content.

■ Collaborate with local authorities to ensure official public announcements that lend credibility to the initiative and its commitment to community enhancement.

■ Establish mechanisms for collecting feedback from the public through surveys, social media, and other channels. Address concerns and queries to maintain a two-way communication flow.

Step 3: Achieving Commitment and Engagement of Local Actors

This step focuses on securing the commitment and active participation of local stakeholders. By aligning their interests and values with the DRT initiative, this step ensures their continued involvement and dedication to its success. Clear communication of the initiative's vision, involvement in decision-making processes, and provision of training opportunities empower local actors to contribute effectively.

Tasks:

■ Clearly communicate the vision, objectives, and potential benefits of the DRT solution to local actors. Help them understand how their involvement contributes to positive change.

■ Involve local actors in decision-making processes related to the DRT solution. Their input and insights enrich the solution's design and lead to more practical outcomes.

■ Provide training, resources, and skill development opportunities to empower local actors to actively participate and contribute effectively.

Tools:

■ Communication Platforms: Utilize communication tools such as newsletters, social media, and dedicated project websites to regularly share updates, progress, and success stories. Keep local actors informed and engaged in the project's developments.

- Town Hall Meetings and Workshops: Organize in-person or virtual town hall meetings and workshops where local actors can openly discuss the DRT initiative. These platforms foster transparent communication, address concerns, and provide opportunities for input.

- Surveys and Feedback Mechanisms: Design surveys to gather feedback and insights from local actors. These allow to collect opinions on specific aspects of the DRT solution and adjust strategies accordingly.

- Focus Groups: Conduct focus group discussions with representatives from local communities. These sessions enable deeper conversations, uncovering concerns, and gathering qualitative insights that can inform decision-making.

4.4. Alignment with deliverables and reporting periods

The results of this phase are presented in D1.2.1 and D2.2.1, for the governance & planning and the digital/operational innovation aspects of the project's pilots, respectively.

D.3.1.1	Methodological background for the design of DRT integrated solutions			RP1	RP2	RP3	RP4	RP5
A	Living labs preparation	D.1.2.1	Living labs preparation: stakeholder mapping, raising awareness and local engagement					
		D.2.2.1	Living labs preparation: stakeholder mapping, raising awareness and local engagement					

5. State-of-the-art recognition

5.1. Rationale

This phase serves as a critical cornerstone in the design of Demand-Responsive Transportation (DRT) integrated solutions, laying a robust foundation for well-informed decision-making and detailed strategic planning. Within this phase, a multitude of key components are thoroughly examined, with each component serving a unique purpose, driven by its distinct rationale, thereby contributing to a holistic and informed approach.

The State-of-the-art recognition phase analyses the initial mobility situation and context conditions, as well as the governance, policy and regulatory framework. It includes various activities:

- Planning, Policy, and Legal Framework: In this aspect, the analysis of existing plans and strategies is essential for understanding the historical context of transportation policies and their implications for DRT integration. Likewise, comprehending the existing regulatory framework helps ensure that DRT solutions align with prevailing laws and regulations while identifying gaps allows for necessary adjustments and alignment. Additionally, the assessment of planning and policy-making practices ensures that DRT integration adheres to best practices and evolving policy trends. Lastly, the cross-sectorial and multi-level analysis acknowledges the complex nature of transportation systems, requiring consideration of collaboration across various governmental bodies at local, regional, and national levels;

- Diagnosis of Mobility Context, Challenges, and Opportunities: This component is centred on gaining a comprehensive understanding of the current mobility landscape. This process involves analysing the characteristics of the transport network to collect insights about the available modes and data sources. Spatial analysis plays a pivotal role in this diagnostic approach, visually highlighting geographical gaps and deficiencies in transportation services. This visualization helps identify where DRT (Demand-Responsive Transport) can enhance accessibility and connectivity, while also aiding in the identification of key areas or locations for innovative mobility solutions. This, in turn, ensures efficient resource allocation to maximize impact. Simultaneously, identifying barriers and challenges in the existing public transit system remains essential for addressing deficiencies and enhancing the overall transportation experience.

- Diagnosis Workshop: The diagnosis workshop serves as a critical juncture for validation and collaboration. It validates the findings from the state-of-the-art assessment process, ensuring alignment with the actual context and needs on the ground. Moreover, it provides a platform for stakeholders to discuss policy, regulatory, and planning issues, fostering collaboration and consensus on priorities. Ultimately, the workshop enables in-depth analysis of the mobility context and synthesizes the findings from the diagnosis phase, allowing stakeholders to collectively draw conclusions and set strategic directions for DRT integration.

In essence, the "State-of-the-art" phase serves as a comprehensive diagnostic exercise, illuminating the intricate web of factors that influence DRT integration. It provides the necessary insights and knowledge to inform subsequent phases, ensuring that DRT solutions are well-informed, compliant, and responsive to local challenges and opportunities.

5.2. Objectives

This phase is dedicated to a comprehensive assessment of the current landscape, which includes examining planning, policy, legal aspects, the mobility context, spatial dynamics, and fostering stakeholder collaboration. Its primary goal is to establish a robust foundation for making well-informed decisions and developing strategic plans. In pursuit of this objective, the phase aims to address the following aspects:

- Understand the current regulatory framework, its conditions, and gaps that need addressing.

- Evaluate existing plans and strategies, identifying their implications for DRT integration.

- Assess planning and policy-making practices to align DRT integration with best practices.

- Conduct cross-sectorial and multi-level analyses to acknowledge the broader governance context.

- Examine the characteristics of the transport network, including modes, data sources, and governance structures.

- Identify barriers, challenges and opportunities within the current public transit system for targeted improvements.

- Conduct a spatial analysis to visualize geographical and time-based transport gaps.

- Identify key areas and locations where innovative mobility solutions can have a significant impact.

- Validate the findings through a diagnosis workshop, ensuring alignment with on-the-ground realities and fostering stakeholder collaboration.

5.3. Tasks and practical guidance

5.3.1. Planning, Policy and Legal Framework

In the context of "Planning, Policy, and Legal Framework," an in-depth analysis of existing plans and strategies is crucial for gaining insight into the context of transportation policies and their implications for seamless DRT integration. This phase also ensures a thorough examination of the current regulatory framework to ensure DRT solutions align with prevailing laws and regulations while identifying gaps that may necessitate adjustments or alignment efforts. Additionally, assessing planning and policy-making practices is vital to ensure that DRT integration adheres to best practices and stays in line with evolving policy trends.

Figure 10: Planning, Policy, and Legal Framework [© SUMP Türkiye 2022]

Step 1: Analysis of Existing Plans and Strategies

Before proceeding with DRT integration, it is necessary to delve into the historical records of transportation plans and strategies. This analysis helps uncover past approaches to mobility and provides critical context for the development of DRT solutions. Key tasks within this step include the following:

- Conduct a comprehensive review of historical transportation plans and strategies, focusing on objectives, priorities, and past decision-making.

- Identify any previous initiatives related to flexible transportation services or innovative transit solutions, drawing insights from both successful and unsuccessful projects.

- Analyse the implications of historical policies and strategies on the current transportation landscape and potential implications for DRT integration.

Tools:

- Policy Analysis Frameworks: Structured methodologies to assess existing transportation policies and strategies systematically. They evaluate objectives, impacts, and effectiveness.

- Historical Documentation and Records: Archives, reports, and documents providing a historical perspective on transportation plans and policies, offering insights into past initiatives.

- SWOT Analysis: A strategic planning tool identifying internal and external factors impacting projects. It highlights strengths, weaknesses, opportunities, and threats in relation to DRT integration.

Step 2: Analysing the Regulatory Framework

Understanding and navigating the regulatory environment is vital for the successful implementation of DRT solutions. Tasks in this step involve:

- Identifying the relevant regulatory bodies, government agencies, and authorities responsible for transportation oversight and decision-making.

- Gaining an understanding of the roles and responsibilities of these entities, as well as their respective levels of decision-making power.

- Assessing the current regulatory framework governing transportation services, including relevant laws, regulations, and standards.

- Identifying any gaps or conflicts within the regulatory framework that may need to be addressed to facilitate DRT integration.

Figure 11: Analysing the Regulatory Framework [© Rebekah Thorne 2023]

Tools:

- Regulatory Gap Assessment: Systematic identification of gaps within the regulatory framework, revealing areas needing legal adjustments for DRT alignment.

- Regulatory Compliance Analysis: Evaluation of DRT's adherence to existing transportation regulations, ensuring legal compliance within the regulatory framework.

- Legal Experts' Consultation: Seeking advice from legal professionals specialized in transportation and regulatory law to navigate complex legal issues.

Step 3: Assessment of Planning and Policy-Making Practices

To ensure that DRT integration aligns with best practices and evolving policy trends, it is essential to assess planning and policy-making practices. This step involves:

- Evaluating the methodologies and processes employed in transportation planning and policy development.
- Identifying areas where DRT can complement or enhance existing transportation strategies and policies.
- Examining how public engagement and stakeholder consultation have historically factored into decision-making processes.

Tools:

- Policy Analysis Frameworks: Structured methodologies used to assess and evaluate existing policies and strategies systematically. They evaluate objectives, impacts, and effectiveness.
- Stakeholder Consultation Reports: Documents capturing input and feedback from stakeholders, including government agencies and community groups, providing insights into their perspectives on transportation policies and DRT integration.
- Best Practice Benchmarking: This involves comparing current practices with industry or international best practices to identify areas for improvement and innovation in DRT integration.

Step 4: Cross-Sectorial and Multi-Level Analysis

Transportation systems are inherently complex and often involve collaboration across various governmental bodies at local, regional, and national levels. Therefore, it is crucial to conduct a cross-sectorial and multi-level analysis, considering:

- The interplay and relationships between different levels of government responsible for transportation planning and management.
- Collaborative opportunities and potential conflicts that may arise in multi-level governance structures.
- Strategies for fostering cooperation and alignment of policies and practices across sectors and levels of government to facilitate DRT integration.

Tools:

- Multi-Level Governance Frameworks: These frameworks help in understanding and managing governance structures and collaborations across different levels of government, ensuring effective coordination and alignment in DRT integration.
- Cross-Sectorial Collaboration Assessment: This tool assesses the degree of collaboration and cooperation between different sectors (e.g., transportation, environment, urban planning) to identify opportunities for integrated policy approaches.

Throughout these steps, these tools and methodologies can be employed to extract valuable insights and ensure that DRT integration aligns effectively with the planning, policy, and legal framework of the target area.

5.3.2. Diagnosis of Mobility Context, Challenges, and Opportunities

This activity is pivotal within the Demand-Responsive Transportation (DRT) integration planning process for gaining comprehensive insights into the current mobility landscape. This phase is instrumental in shaping effective DRT solutions tailored to the community's unique needs and challenges. The methodology for this component involves a structured approach comprising several steps and tasks.

Step 1: Analysing the Transport Network

Figure 12: Analysing the Transport Network [© Rupprecht Consult, Guidelines for Developing and Implementing a Sustainable Urban Mobility Plan, Second Edition, 2019]

In the initial step, a thorough analysis of the existing transport network is conducted. This includes an examination of various transportation modes, their coverage, frequency, and reliability. The goal is to understand the strengths and weaknesses of the current transportation options available to the community. This analysis informs decisions on how DRT can complement or enhance the existing modes.

Tasks:

- Conduct a comprehensive inventory of the transportation modes operating in the area.
- Evaluate the coverage and service frequency of each mode.
- Assess the reliability and quality of the existing transportation services.

Tool:

- Mode Analysis Matrix: Create a matrix to systematically document the characteristics and performance of different transportation modes.

Step 2: Spatial Analysis

Spatial analysis is a crucial component of Demand-Responsive Transportation (DRT) integration planning, offering insights into the geographic aspects of the current mobility landscape. To implement this analysis, the following tasks can be undertaken:

- Geospatial Data Collection: Collect comprehensive geospatial data related to transportation infrastructure, including bus stops, train stations, road networks, and areas with higher population density. Ensure data accuracy and completeness for meaningful analysis.

- Service Coverage Mapping: Create detailed maps that visually represent the current coverage of public transportation services. Pinpoint the location of transportation stops, routes, and service areas for different modes of transportation (e.g., buses, trains). Distinguish between various modes of transportation for clear visualization.

- Accessibility Analysis: Calculate travel times and distances from various points within the community to key transportation hubs or essential destinations. Identify areas with limited access to existing transportation services based on travel time and distance analysis.

- Time Gap Assessment: Analyse data related to service schedules and passenger wait times for public transportation. Identify areas and time periods where passengers experience prolonged wait times or gaps in service frequency.

- Geographical Gap Identification: Overlay the service coverage maps with additional data, such as population density and employment centres, to identify geographical gaps where residents or employees face challenges accessing transportation options. Consider demographic distributions and employment centres to pinpoint areas in need of improved transportation solutions.

Tools:

- Geographic Information Systems (GIS) software, such as ArcGIS and QGIS

- Analysing public transportation service schedules and wait times with specialized software such as GTFS (General Transit Feed Specification) data analysis tools and custom-built scripts.
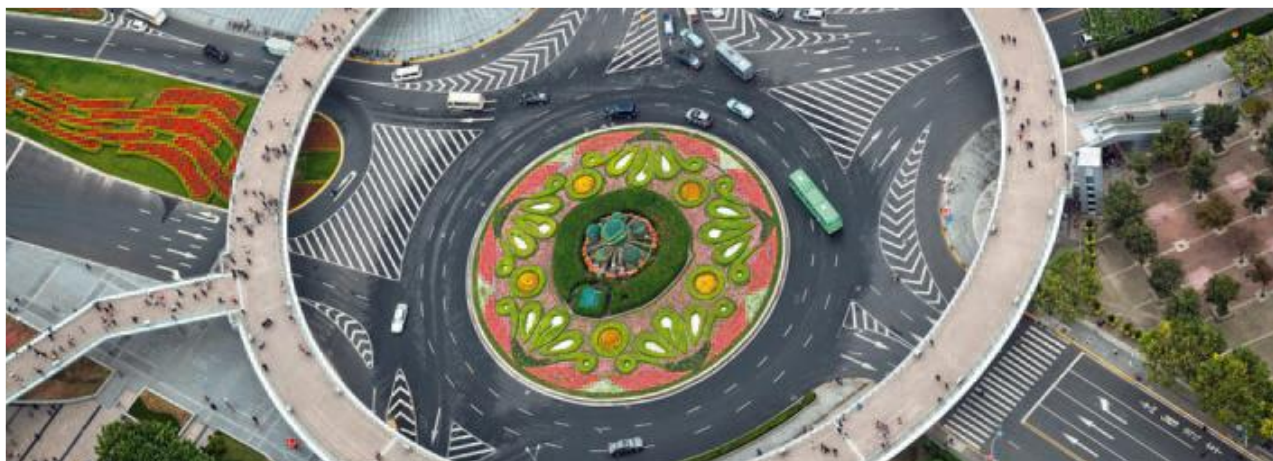

Figure 13: Spatial Analysis [Rupprecht Consult, Guidelines for Developing and Implementing a Sustainable Urban Mobility Plan, Second Edition, 2019]

Step 3: Identifying Barriers and Challenges

Understanding the challenges and barriers within the current public transit system is crucial for addressing deficiencies and improving the overall transportation experience. In this step, a focused analysis is carried out to pinpoint the specific obstacles that passengers face in accessing and utilizing transportation services.

Tasks:

- Conduct surveys or interviews with passengers to gather feedback on their transportation experiences.
- Identify common challenges reported by passengers, such as long wait times, limited coverage, or accessibility issues.
- Analyse data on service disruptions or breakdowns to identify recurring issues.

Tools:

- Passenger Feedback Surveys: Design surveys to collect feedback on passenger experiences and challenges;
- Incident Data Analysis: Examine historical incident data to identify recurring issues affecting service reliability.

Step 4: Analysis of Local Challenges and Opportunities

This step involves a structured SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis to assess the local mobility context comprehensively. The SWOT analysis highlights the internal and external factors that can impact DRT planning and implementation. It offers a strategic framework for decision-making, emphasizing areas of focus and potential advantages.

Tasks:

- Identify the strengths and advantages of the current mobility ecosystem.
- Recognize the weaknesses and deficiencies within the existing transportation network.
- Explore opportunities for improvement and innovation in mobility services.
- Assess potential threats or challenges that could hinder the success of DRT integration.

Tool:

- SWOT Analysis Matrix: Utilize a matrix to categorize and visualize the identified strengths, weaknesses, opportunities, and threats.

By following this methodology, planners can gain a comprehensive understanding of the mobility context, challenges, and opportunities within the target area. This knowledge serves as a foundation for designing effective DRT solutions that address specific community needs and enhance overall transportation accessibility and efficiency.

5.3.3. Diagnosis Workshop

The diagnosis workshop serves as a critical stage for validation and collaboration. It validates the findings from the state-of-the-art assessment process, ensuring alignment with the actual context and needs on the ground. Moreover, it provides a platform for stakeholders to discuss policy, regulatory, and planning issues, fostering collaboration and agreement on priorities. Ultimately, the workshop enables in-depth analysis of the mobility context and synthesizes the findings from the diagnosis phase, allowing stakeholders to collectively draw conclusions and set strategic directions for DRT systems.

Step 1: Workshop Preparation

The foundation for a successful workshop lay in defining clear objectives, identifying key participants, securing a suitable venue, crafting an agenda, and preparing presentation materials summarizing the mobility context findings.

Tasks:

- Define the objectives and goals of the diagnosis workshop, outlining what stakeholders should achieve during the event.

- Identify key stakeholders and invite them to participate in the workshop.

- Secure a suitable venue and necessary equipment for presentations, discussions, and data sharing.

- Develop an agenda that outlines the workshop's schedule, including breaks and discussion sessions.

- Prepare presentation materials and data reports that summarize the findings from the mobility context diagnosis phase.

Figure 14: Diagnosis Workshop [© Katy Huaylla, 2023]

Tools:

- Workshop Agenda Template: A structured document outlining the event's schedule and objectives;

- Communication and Invitation Tools: Email, phone calls, or online platforms to invite stakeholders.

Step 2: Participants Engagement

Effective engagement is vital. The aim is to reach out to diverse stakeholders such as government agencies, community representatives, and transportation providers, provide background information, and encourage stakeholders to share their insights on mobility challenges and opportunities.

Tasks:

- Reach out to relevant government agencies, community representatives, transportation providers, and other stakeholders to ensure their participation.

- Provide stakeholders with necessary background information and the findings of the mobility context diagnosis to facilitate informed discussions during the workshop.

- Encourage stakeholders to share their perspectives, experiences, and insights related to mobility challenges and opportunities.

Tools:

- Stakeholder Engagement Plan: A document outlining the strategy for engaging with stakeholders.

- Reports summarizing the diagnosis findings.

*Figure 15: Participants Engagement [© Rupprecht Consult, Guidelines for Developing
and Implementing a Sustainable Urban Mobility Plan, Second Edition, 2019]*

Step 3: Workshop Facilitation

Facilitators guide the workshop, ensuring productive discussions. Presentation materials aid discussions, and skilled facilitation helps participants engage with data and insights effectively.

Tasks:

- Facilitate the workshop sessions, ensuring that discussions are productive, focused, and aligned with the workshop's objectives.
- Encourage open and constructive dialogue among participants, enabling them to share their insights and concerns.
- Use the presentation materials to guide discussions and present key findings from the diagnosis phase.

Tools:

- Trained facilitators or workshop leaders.
- Reports, charts, and maps to illustrate findings.

Step 4: Data Validation and Analysis

This step focuses on validating and refining data presented during the workshop. Stakeholder feedback is analysed to enhance diagnosis quality and identify priority areas and challenges.

Tasks:

- Engage workshop participants in validating the data and findings presented during the workshop.

- Analyse the feedback, comments, and insights shared by stakeholders to refine and enhance the diagnosis results.

- Summarize the validated data and use it to identify priority areas and challenges within the mobility context.

Tools:

- Feedback Collection Tools: Surveys, feedback forms, or online platforms for gathering stakeholder input;

- Data Analysis Software: Tools for analysing and synthesizing feedback.

Step 5: Setting Strategic Directions

In the final step, participants collectively draw conclusions, set strategic directions, and document agreements. This forms the foundation for subsequent planning and implementation phases, ensuring alignment among stakeholders.

Tasks:

- Facilitate discussions to collectively draw conclusions on the key challenges and opportunities identified during the workshop.

- Encourage stakeholders to collaborate in setting strategic directions and priorities for DRT integration.

- Document the agreed-upon strategic directions and priorities to serve as a foundation for the next phases of planning and implementation.

Tools:

- Collaboration Tools: Whiteboards, group discussion platforms, or online collaboration software.

- Documentation Tools: Note-taking software or templates for recording workshop outcomes.

The diagnosis workshop plays a pivotal role in bringing together diverse stakeholders, validating findings, and collectively shaping the strategic direction for Demand-Responsive Transportation (DRT) integration. Through open dialogue and collaboration, stakeholders can align their efforts to address mobility challenges and opportunities effectively, setting the stage for successful planning and implementation in the subsequent phases.

5.4. Alignment with deliverables and reporting periods

The results of this phase are presented in D1.1.2 and D2.1.2, for the governance & planning and the digital/operational innovation aspects of the project's pilots, respectively.

D.3.1.1	Methodological background for the design of DRT integrated solutions			RP1	RP2	RP3	RP4	RP5
B	State of the art	D.1.1.2	State of the art report on governance structures and planning processes for DRT in the pilot areas					
		D.2.1.2	State of the art report on digital and operational approaches for DRT in the pilot areas					

6. Scenarios development

6.1. Rationale

Following the analysis of the mobility situation and relevant policy, planning and regulatory frameworks, the results and conclusions of the diagnosis will guide the development of a DRT strategy.

This strategy consists of a clear vision for DRT implementation in the region, with specific objectives, targets and indicators to monitor its achievement. A vision refers to "a qualitative description of the desired mobility future for the city, which is then specified by concrete objectives that indicate the type of change aimed for" [SUMP Guidelines].

If a vision is not yet defined, visioning exercises with stakeholders and citizens will support the development of a shared understanding of desirable futures, based on the results of the mobility analysis. Decision makers should also get actively involved at this stage since a key strategic direction for the next years is defined.

To find a roadmap for the achievement of this vision, a set of alternative scenarios for the DRT solution should be identified, considering the various possibilities of service combination and operational design, its target users, technical implementation and integration with the transport network. A participative discussion with local actors enables the identification of suitable scenarios, considering different needs and perspectives, as well as their appraisal and selection.

6.2. Objectives

This phase aims to:

- Agree on a widely supported common vision for DRT solutions, aligned with long-term goals for mobility development in the city and serving as a pilar for the decision-making and assessment throughout the planning and service design process.

- Formulate clear objectives and strategic priorities that specify the directions for improvement, defining concrete targets to monitor success.

- Understand the risks and opportunities related to current trends and possible changes in circumstances.

- Develop alternative scenarios that inform about the likely impacts of different DRT solutions.

6.3. Tasks and practical guidance

6.3.1. Strategy development

The definition of a common vision and strategic objectives are cornerstones of every planning process [SUMP Guidelines]. The two provide the basis for all subsequent steps, providing an agreed-upon basis for the solution design process, decision-making and resolution of trade-offs.

The vision should be prepared taking into consideration all policy perspectives it seeks to address, especially those of existing general city visions or strategic plans, urban and spatial planning, economic development, environment, social inclusion, gender equity, health, and safety.

To provide strategic guidance, a vision needs to be specified by concrete objectives that indicate the type of change that is desired. This goal-oriented approach contrasts with a planning approach that focuses on the delivery of schemes and infrastructure without reference to higher-level objectives.

Vision and objectives can only be such guiding elements if they are widely accepted among stakeholders and citizens; therefore, it is crucial to co-create them and establish common ownership. This can be achieved by a vision-building workshop/event, which should be part of the overall engagement strategy of the planning process.

In the case of DREAM-PACE, the strategy development should come shortly after the diagnosis workshop, in a subsequent event where also the scenario building and appraisal process should take place (see next sections).

Box 1: Future Search Workshop [Rupprecht Consult - Forschung & Beratung GmbH (editor). 2019]

Future search workshop

There are many formats to involve stakeholders and citizens in the visioning process. One of them is a Future Search Workshop or workshop series. This involves three stages of discussion, where a diverse group of local stakeholders follow a sequential analysis and consensus-reaching process to define a joint vision and roadmap for implementation.

A Future Search Workshop is typically built around three themes:

1. Diagnosis: Take a look back in time to analyse how the current mobility situation has developed. Then look to the future by exploring structural trends that are likely to influence mobility patterns in the future. In DREAM-PACE, this step refers to the diagnosis workshop (see section 5.3.3);

2. The desired future: Define the ideal future situation and share these amongst the other participants. Common ground is sought and principles of actions to reach the desired future are outlined. Any differences and disagreements are also collected.

3. Action plan: In the final step of the process, the focus is put on the formulation of concrete projects and actions, based on the visions developed in the previous phase. In DREAM-PACE, this step is addressed through the solution co-design process (see section 7).

Understanding the potential benefits of the DRT solution can be a valuable basis and reference for the identification of strategic objectives. The SMACKER project identified these general benefits of DRT as follows.

Box 2: Benefits of Demand Responsive Transport [SMACKER, 2022]

Benefits of Demand Responsive Transport

- **Replace a fixed route:** Because a DRT service operates only when needed and on an optimised route, it can cover fewer kilometres overall than a fixed-route service, which reduces fuel consumption. Also, the size of the vehicles can be adjusted to the expected number of passengers, reducing CO_2 emissions per passenger and per kilometre travelled. More trips can be made when a DRT service is aimed at unlocking suppressed travel demand to improve social inclusion and rural mobility.

- **Substitute car journeys:** A DRT service can replace multiple, single-occupancy car journeys. For example, in a commuting area where there is insufficient demand for a fixed bus service, or to serve those who work in shifts or work flexibly. Switching from a private petrol or diesel car to a DRT vehicle would improve emission reduction.

- **Encourage active travel:** There is an opportunity to better link bus and DRT services with cycling and walking to make it easier to travel without a car and by different modes of transport. This can be facilitated by taking bicycles on board or on external racks, or by providing secure bicycle parking facilities at bus stops or frequent destinations.

6.3.2. Definition of alternative scenarios

Based on the analysis of problems and opportunities, different scenarios should be developed and discussed with citizens and stakeholders. These scenarios help improve the understanding of what urban mobility in the city could look like in the future.

Scenarios and visions are strongly related, and the sequence of developing them can vary in different contexts or even run in parallel. In DREAM-PACE, the identification and appraisal of alternative scenarios refers to the specific service models, operational parameters, scope and other context conditions of DRT solutions in each pilot region. As such, an analysis of possible futures representing fundamentally different priorities as the basis for the vision-building exercise is not applicable. Rather, the developed vision and strategic objectives will serve as a basis for the evaluation of the alternative scenarios considered, allowing the identification of key factors to achieve that envisioned future.

A series of scenarios should be developed, describing alternative operational and service models and policy priorities and their impacts on a strategic level. At least three scenarios should be developed. A business-as-usual scenario should describe the development forecasted if the current policy direction is continued and only measures that have already been planned are implemented.

Building scenarios should consider the interdependencies between developments in different sectors and the effects of DRT solutions in each sector (e.g., transport, land use, environment, economy, etc).

Local stakeholders should be involved in the scenario building. This enhances their ownership and acceptance of the planning process and resulting solution.

Box 3: Types of different operational DRT services [DREAM_PACE D2.1.1]

Types of different operational DRT services

DRT services offer exceptional flexibility in routes, stops, and schedules, catering to users' mobility needs, particularly in areas with low demand and during off-peak times, such as weekends, holidays, nights, and off-peak hours.

DRT services are classified into two scheduling structures: fixed schedule and flexible schedule. Additionally, the four main operational concepts of DRT services include:

- **Route Deviation with Fixed Stops:**

    In this mode of DRT, vehicles operate on a predetermined route with fixed initial and final terminals and designated stops. The distinguishing feature is the flexibility to deviate from the fixed route, stopping at any location or requested spot along the route, and accommodating on-demand transportation requests.
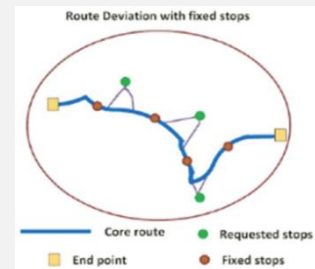

- **Point Deviation with Fixed Stops:**

    Zone-based DRT operates within specific geographical areas, featuring predefined intermediate stops without necessarily having initial and final terminals. These stops guide the structured path of the DRT vehicle, ensuring efficiency while responding to passenger requests.
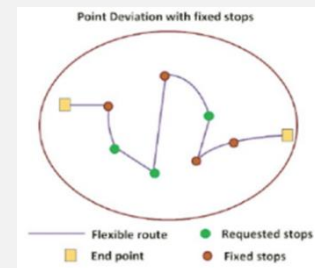

- **Destination Demand-Responsive Transport:**

    This model is designed to transport passengers to specific Points of Interest (POI), such as shopping centres, hospitals, airports, or other significant locations. The primary goal is to efficiently meet passenger transportation needs from various locations to the specific POI they have requested.
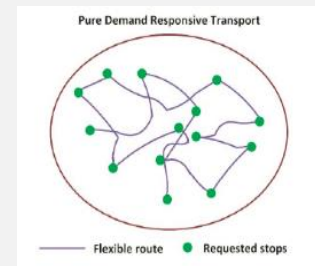
- **Pure Demand-Responsive Transport:**

    This model operates dynamically, responding to real-time passenger requests. Unlike traditional fixed-route systems, this mode offers fully flexible routes and variable schedules, adjusting daily to accommodate the varying demands of passengers.
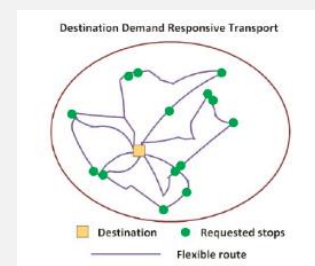
6.3.3. Scenario evaluation and prioritisation

The identified scenarios should then be discussed, and their impacts evaluated, in a participative event with local actors, so the most suitable scenario (or scenario combination) can be identified considering all key perspectives. This also helps to create awareness of the interdependencies and trade-offs between different policies and sectors, the complexity of the strategic decisions to be taken, and the risks faced.

The aim is to discuss and work towards a common understanding of which scenarios or elements of scenarios are desirable. Involving citizens and stakeholders already at this stage will help create broad ownership and acceptance of the objectives and measures that will later be selected.

To this end, the scenarios should be presented to key stakeholders, explaining their expected impacts and priorities. Then, a discussion should be simulated on strategic policy alternatives and their impacts. Group work and other interactive formats can help to create a constructive and engaging atmosphere at the meeting.

Box 4: Scenario evaluation based on user stories [Rupprecht Consult, 2022]
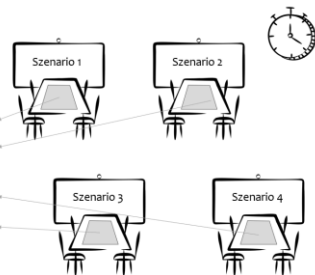
Scenario evaluation based on user stories

A good way of encouraging in-depth discussion of the impacts and related trade-offs of each scenario is to create user stories. User stories set a concrete example for each scenario, describing the user experience, explaining the perceived advantages and disadvantages, and encouraging participants to consider the user's perspective and needs. This allows for a more user-centric analysis and, in consequence, a more inclusive and suitable service design.

In a workshop setting, participants should be divided into breakout groups (one per scenario). Each scenario is described, including a clear definition of the problem addressed and the solution proposed by the scenario, as well as the user story for this case. The breakout groups then should discuss, based on guiding questions to assess the strengths and weaknesses of the scenario. After a given time (e.g., 20 minutes) the groups rotate (in a World Café-type setting) until all groups have discussed each scenario.

Box 5: Digital Advancements Enhancing DRT Services [DREAM_PACE D2.1.1]

Digital Advancements Enhancing DRT Services

In DRT services, the technological landscape varies from systems without any digital elements to partially digitalized ones and fully digitalized setups. Absent digital elements, vehicles adhere to fixed schedules and depart only when passengers are present at the initial stop. In contrast, a fully digitalized on-demand transport system relies on four pivotal architectural components. This section delves into the key architectural components essential for the operation of on-demand transportation technology systems, which can be identified as follows:

- The DRT Travel Dispatch Centre (TDC): This centre is a pivotal component of the demand-responsive transport system, orchestrating real-time travel information for users and drivers, managing order processes, optimizing routes, and monitoring service performance. Through data statistics and analysis, the TDC enhances the DRT service by identifying trends, improving operational efficiency, and continually refining the user experience.

- DRT vehicle device: Suitable vehicle Selecting for a DRT service is crucial for success, with factors like passenger capacity and operational needs playing a vital role. On-demand transport vehicles, such as cars, minibuses, and vans, equipped with onboard computers and position-determination systems, enable efficient communication between drivers and the Travel Dispatch Centre (TDC), enhancing service quality and optimizing routes for a seamless user experience in the DRT ecosystem.

- Costumer interfaces: In DRT systems, users are afforded a range of convenient options for requesting transportation, ensuring accessibility and user-friendliness. Through mobile apps, phone calls, web pages, and SMS, users can seamlessly input their travel details, track vehicle locations, and receive real-time information. The service's flexibility allows users to request transportation well in advance or as close as 30 minutes before travel, promoting user-centric trip planning. Notably, the use of mobile apps and web-based booking systems enables route optimization through sophisticated algorithms, ensuring efficiency and inclusivity, especially for passengers with reduced mobility. This comprehensive approach enhances the overall mobility experience for DRT service users.

- Digital frameworks: In modern transportation, digital frameworks play a pivotal role in enhancing communication, marketing, and passenger information dissemination. These frameworks include communication tools like mobile and radio communication, IoT for data exchange, marketing strategies such as digital advertising and CRM, and passenger information systems like real-time updates, navigation, and digital ticketing. User feedback collection is vital in assessing service quality and making data-driven improvements to meet community demands effectively in Demand-Responsive Transport (DRT).

These digital models are transforming the way DRT services are delivered, making them more flexible, responsive, and user centric. Digitalization plays a vital role in improving the accessibility and sustainability of DRT options.

6.4. Alignment with deliverables and reporting periods

The results of this phase are presented in D1.1.3 and D2.1.3, for the governance & planning and the digital/operational innovation aspects of the project's pilots, respectively.

D.3.1.1	Methodological background for the design of DRT integrated solutions			RP1	RP2	RP3	RP4	RP5
C	Scenarios development	D.1.1.3	Development scenarios for DRT innovative governance and planning approaches		■			
		D.2.1.3	Development scenarios for DRT innovative digital and operational approaches		■			

7. Co-design of solutions

7.1. Rationale

In this phase, the planning process moves from the strategic to the operational level. This phase focuses on measures to achieve the agreed scenario, objectives and targets. Following the selection of the preferred scenario (or combination of scenarios), it is the time to prepare for the implementation of the DRT solution, defining the specific service parameters, digital and operational design, as well as the organisational and governance structures to guide collaboration in the deployment of the service.

DRT services entail the coordination of diverse actors, such as local authorities at different sectors and levels, service operators, technology providers, and, of course, users. In this way, building efficient and well-coordinated multi-actor cooperation structures is essential for the success of the implementation and later operation. To this end, the solutions must be co-designed together with all key stakeholders.

This chapter looks at a general level, how to manage co-design activities as part of the respective Living Labs, to co-create successful mobility solutions. Participation of project initiators and identified key stakeholders is essential. At the core of this phase is to co-design specific solutions, most suitable for the local needs. These solutions might be products, services, experiences, events or some other outputs. Within a co-design process, we have different phases which are broken down into smaller steps.

The co-design activity can be seen as a continuous activity with a starting point, a middle and an end, however, the end can also become a "new starting", as it is set within a new context, building on previous learnings. This cyclical approach was developed into a "co-design loop" building a conceptual framework [Fuad-Luke, 2009], further explained within the co-design manual of the Finnish city Lahti, which incorporated co-design as part of their city planning strategy [Fuad-Luke et al. 2015]. The "co-design loop" comprises three loops or phases with activities, namely the project context (1), the identified problems (2) and potential solutions (3).

In general, the process can be started with the 'context loop' where in a co-design workshop, invited key stakeholders define the project context, before moving into the 'problem loop' where they collaboratively identify challenges from various perspectives. This is followed by defining a shared design brief for exploring possible solutions. In the so-called 'solution loop', the co-design process is about envisioning and prototyping possible solutions for the prior identified project challenges. These solutions might not be perfect in the first run, thus the "co-design loop" as a process, can be repeated several times, offering a "new starting", with a different context [Fuad-Luke et al. 2015].

7.2. Objectives

The objectives of this phase are to:

- Plan and design DRT solutions in a cooperative and participative manner, involving all key stakeholders.
- Create a roadmap for the implementation of the DRT solutions, defining the actions to be taken and assessing their effectiveness and feasibility.
- Plan monitoring and evaluation of the DRT solution implementation.

7.3. Tasks and practical guidance

7.3.1. Facilitating co-design activities at the pilot level

At the beginning of each co-design workshop, experts/ facilitators should provide the participants with input and information about the project and its context. In addition, the benefits of participating in the workshop and its hypothetical project outcome should be illustrated, to increase extrinsic and intrinsic motivational factors. For example, the case of InnoLab a German Living Lab project, which developed over 3 years of sustainable mobility solutions for the elderly [Meurer et al. 2017], showed that saving resources was seen as important, however did not result in the motivation to change the individual mobility behaviour. Moreover, it's highly important to allow enough time for questions during the co-design workshops, as not all values or visualizations are tangible and intuitive for users [Meurer et al. 2017]. For instance, when using abstract data, ensure that supporting visualisations and materials help participants understand and interpret the given information for a better evaluation of the context.

The key to successful co-design facilitation is group dynamics, which build on the interaction between participants and a skilled facilitator. An experienced facilitator, who can lead group discussions, also ensures that every voice is heard, and gives participants time to reflect upon tasks and methods used. To achieve a spontaneous and flexible atmosphere, tasks and questions should be formulated openly. Within co-design workshops, participants are asked to leave their comfort zone, take new perspectives, and deal with opposite opinions, which requires the willingness of the participants to deal with the unforeseen. Therefore, an increased degree of flexibility and spontaneity from the accompanying research team is required [Kirchberger et al., 2017].

7.3.2. How to run a co-design workshop?

The following section will briefly describe how to host a co-design session, which could also be split into two sessions. The aim is to develop together (involving a great variety of different stakeholders and users) a shared idea for a possible solution or prototype, which can be tested and iterated throughout the Living Lab.

The successful facilitation of a co-design workshop starts with the facilitator, who should ensure the creation of a dialogue and empathy between the participating stakeholders. This can be enabled e.g. with specific tools such as "Blind drawing", "Collage" or a shared "Word circle" to enable a shared language and understanding of participants' focus and relation towards the project. In the next step, the group will define the context of the project together. A first scoping should be of course done already by the hosting organization; however, this context should be re-defined and refined with real stakeholders, tapping into the "wisdom of the crowd". Specific co-design tools for this could be "Affinity Clustering", "Design Capitalia", "World Café Brainstorming", and "Mapping Needs and Expectations". The tools should generally enable a broadening and understanding of the project context including resources and relevant actors. This is followed by an exercise, where all participants will define the main problem, or problem space together, which will be building on the prior work of the facilitating project team. However, with a diverse group of participants, the problem space can be looked at from different perspectives, enabling a re-framing in relation to other local challenges and barriers. Once, the main challenges are identified at this stage, it is possible to start co-designing solutions together. These solutions should of course address the major problems identified and be set within the defined context. The main outcome of this step is to create concepts and prototypes together, which are supported by the participants.

It is important to develop ideas, while not restricting participants' imagination. The ideas with greater potential will be developed further, while participants should be encouraged to create 2D, 3D or other experiential responses. Sketching, brainstorming, or building models with Lego, playing with dough or even

acting out stories and scenarios can be great methods to explore proposed solutions. These tools and exercises should help the facilitating project team to co-decide with the participants the most promising solutions, which can be taken forward and tested in real-life settings as part of the Living Lab.

7.3.3. Example: SHAREPLACE approach to co-design (Interreg Central Europe 2014-2019)

Within the framework of the SHAREPLACE project, co-design activities started with a series of 2-4 workshops in the spring of 2018. An important aspect of co-designing shared solutions is to document the process and input holistically as it illustrates the collective intelligence and can be reconsidered when evaluating the prototypes.

In SHAREPLACE, each pilot was following roughly a similar timeline, however, acting out the different activities such as Living Lab meetings and co-design workshops in their own rhythm, and with their respective groups of stakeholders. Though, a general approach could be identified, comprising several project phases, which are interlinked, and potentially repeated, similar to the "co-design loop" explained above. In the following, an open outline for the SHAREPLACE approach to co-design will be explained and illustrated in the figure below.

Phase 1 refers to the start of the project, where the project team defined stakeholders, and context and did a first identification of the problems, and challenges of the pilot area. This phase was followed by the facilitation of 2-3 co-design workshops to identify a shared context and define the main problems with the stakeholders, referred to as Phase 2. One more round of workshops was hosted. With the facilitation and analysis of these workshops, partners basically run through the aforementioned Co-Design Loop at least one time. This should allow each pilot area to have a first idea about their possible solutions, key actors, stakeholders and essential resources needed for prototyping and implementation (Phase 3). After successfully hosting these first three co-design workshops, the Living Lab will be established building on a rich participation and engagement of different stakeholders. The next steps towards managing and implementing the co-designed solution can be taken, including a re-evaluation of the context and the problems after a first round of testing in the real context. This re-evaluation can include another co-design workshop or other forms of gathering feedback, to adjust/ re-design the solution or prototype and re-launch it with the modifications applied (Phase 4).
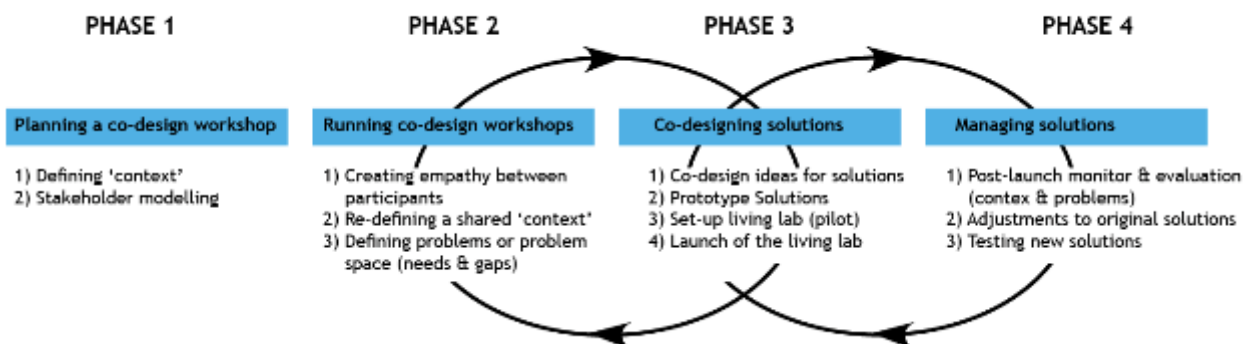

Figure 16:Interrelated Co-Design Approach [SHAREPLACE, 2018]

7.4. Alignment with deliverables and reporting periods

The results of this final phase are presented in various deliverables: D1.2.2 and D2.2.2, provide the documentation of the co-design processes, while D1.2.3, D1.2.4, D2.2.3 and D2.2.4 present the resulting blueprints for the DRT solutions, for the different scopes of DREAM-PACE's pilots.

D.3.1.1	Methodological background for the design of DRT integrated solutions			RP1	RP2	RP3	RP4	RP5
D	Co-design of solutions	D.1.2.2	Living labs meetings documentation on the co-design process for governance / planning in pilot areas		■			
		D.2.2.2	Living labs meetings documentation on the co-design process for digital / operational approaches in pilot areas		■			
		D.1.2.3	Co-designed solutions blueprint of integrated DRT implemented /tested through pilot activities			■		
		D.1.2.4	Co-designed solutions blueprint of coordinated DRT implemented /tested through pilot activities			■		
		D.2.2.3	Co-designed solution blueprint improving existing DRT, implemented /tested in pilot activities			■		
		D.2.2.4	Co-designed solution blueprint implementing new DRT, implemented /tested in pilot activities			■		

8. Conclusions

In the dynamic landscape of Central Europe's transport challenges, DREAM_PACE emerges as a transformative initiative poised to reshape accessibility and connectivity, particularly in peripheral and rural areas. The project's commitment to integrating Demand Responsive Transport (DRT) services within regional mobility networks reflects a strategic vision for fostering inclusivity, territorial cohesion, and social well-being.

This chapter serves as the conclusion of the comprehensive methodology, providing a holistic overview of the DREAM-PACE methodology for developing integrated DRT solutions. It underscores the pivotal role of strategic planning, stakeholder engagement, and co-design processes in shaping the success of DRT integration. Reflecting on the key insights from the previous chapters, it becomes evident that scalability, adaptability, and integration are not mere buzzwords but essential principles driving the project forward.

The guidelines presented in this document offer a roadmap for stakeholders, policymakers, and practitioners to navigate the intricacies of DRT integration successfully. From the Living Labs preparation phase, where the groundwork is laid through in-depth local context analysis and stakeholder mapping, to the State-of-the-Art recognition phase, which provides a comprehensive understanding of the current mobility landscape, each step contributes to a well-informed and strategic approach.

The methodology progresses with the discussion of alternative scenarios and the development of a shared vision for DRT solutions. This visionary aspect is crucial, as it aligns the project with long-term goals, ensures stakeholder buy-in, and sets the stage for the subsequent co-design of solutions. The importance of multi-actor cooperation structures, participatory workshops, and iterative co-design loops becomes apparent when transitioning from strategy to implementation.

As the guidelines emphasize, the success of DRT solutions hinges on collaboration, adaptability, and a deep understanding of local contexts. With this conclusion, Living Labs are invited to not only comprehend the methodology presented but to actively engage with it, applying these principles to their unique settings. By doing so, the DREAM_PACE partners collectively contribute to the realization of innovative DRT solutions that transcend boundaries and empower communities across Central Europe.

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10. Annexes

Annexes to D3.1.1 provide guidance on how to practically develop the foreseen steps for the design of DRT integrated solutions. Each Annex is distinctly aligned with a phase of the DREAM_PACE methodology and it is also associated with specific project deliverables.

It is important to note that these Annexes encompass templates intended as initial guides. They don't represent finalized deliverables but serve as blank guidance tools. DREAM_PACE Living Labs are encouraged to utilize these templates in the different phases of their development.

The Annexes are developed and provided with the logical framework described below and are available as separate documents.

Annex I - Guidance on stakeholder mapping[4]

and

Annex II - Guidance on raising awareness and stakeholder engagement[4]

    Phase A. Living labs preparation finalized, Stakeholder mapping exercise (D1.2.1; D2.2.1)

Annex III - Guidance on State-of-the-Art[5]

    Phase B. State-of-the-Art reports (D1.1.1; D2.1.1; D1.1.2; D2.1.2)

    Phase C. Development of Scenarios: Workshop 1 – Diagnosis

Annex IV - Guidance on development scenarios[5]

    Phase C. Development of Scenarios: Workshop 2 – Scenario development

    Phase C. Development of Scenarios (D1.1.3; D2.1.3)

    Phase D. Co-design of solutions: Workshops 3 and 4 – Co-design

    Phase D. Co-design of solutions: (D1.2.2; D2.2.2; D1.2.3; D1.2.4, D2.2.3; D2.2.4)

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[4] D3.1.1 Annexes I and II are available on the DREAM_PACE G-Drive internal to the project and can be provided to external parties upon request

[5] Annexes under development