D.T.1.1.5 CE SUMP 2.0 TOPIC GUIDE: MAAS IN SUMP

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Contents

Executive Summary

In Central Europe regions, the concept of **Functional Urban Area** (FUA) identifies a broad range of areas where innovation is fundamental to improve connectivity and increase cohesion between central and peripheral, urban and rural territories. A FUA is the dimension where sustainable and multimodal mobility – and therefore **Mobility as a Service ecosystems** - are important in order to reduce the negative impacts of private motorized mobility in terms of congestion and pollution, both in major and in medium and small cities in Central Europe, where the use of cars as main mean of transport is particularly extensive.

The main objective of the guideline annex **CE SUMP 2.0 Topic Guide: MaaS in SUMP** is to provide a contextualization of MaaS planning principles presented in the Sump Practitioner Briefing in Central Europe cities and Functional Urban Areas, and in parallel to enrich the process with a dedicated tool fulfilling the need of a better understanding of the implications of different MaaS governance approaches.

The investigations of the CE specific context and the lessons learned by the project partners designing and implementing innovative MaaS approaches in the interested territories, combined with the analysis of relevant literature and good practices and with the advice by experts in the field of MaaS implementation, brought to the formulation of a set of recommendations dedicated to cities and FUAs in Central Europe engaged in the MaaS planning and development process.

According to the needs and challenges emerged during the diagnosis phase of the Dynaxibility4CE project, the recommendations have been collected and organized according to four main themes relevant for MaaS planning and implementation: a) **local engagement and demand analysis**, b) **data availability, quality, standardization, sharing and management**, c) **incentive measures and schemes supporting MaaS take up**, and d) **integration of traditional and new mobility service providers** in the MaaS ecosystem.

The set of recommendations is complemented by the description of a new **MaaS scenarios self-assessment tool**, aiming at supporting the planning process helping policymakers and mobility planners to evaluate the consequences of measures fostering the implementation of different MaaS models. The tool elaborates different challenging scenarios according to territorial e socioeconomic characteristics of the areas of applications, and to operational and market structure of existing and planned mobility networks.

The customised outcome of the self-assessment process, generated after responding to the questionnaire, represents a preliminary checklist of key points to be discussed among policy makers and stakeholders setting and/or finetuning the strategy for a successful implementation of a MaaS ecosystem.

Introduction

Mobility-as-a-Service (Maas) is a user-centric, intelligent mobility management and distribution system, in which an integrator brings together offerings of multiple mobility service providers, and provides end-users access to them through a digital interface, allowing them to seamlessly plan and pay for mobility (Kamargianni et Al, 2018).

This document focuses on Mobility as a Service as one of the three pillars of the Dynaxibility4CE project together with 'UVAR' and 'Connected and Automated Driving'.

The project develops enhanced knowledge to support CE Public Authorities in defining their approach towards the three abovementioned themes, with the support by expert stakeholders from across the Central European region, through qualitative and quantitative feedback.

The CE SUMP 2.0 Topic Guide: MaaS in SUMP aims at contextualizing the planning approach elaborated in the Mobility as a Service (MaaS) and Sustainable Urban Mobility Planning Practitioner Briefing (ERTICO, 2021) for Central Europe cities and Functional urban Areas.

The first chapter sets the scene of the debate on planning for MaaS, and summarizes the substance of the contribution by the Dynaxibility4CE project.

The second chapter introduces the concept of Functional Urban Areas connected to the MaaS planning process and presents the common challenges and needs for CE cities and FUAs planning for MaaS.

Developed with the contribution of project partners (in particular the cities of Budapest, Graz, Krakow and Koprivnica planning for MaaS initiatives within the framework of the project) and experts, and building on existing knowledge (EU projects, good practices, scientific literature), the core of Dynaxibility4CE contribution on MaaS is represented by the set of recommendations exposed in chapter 3, complemented by the development of a MaaS scenarios self-assessment tool described in chapter 4.

1. Planning, visions and approaches, a short overview

This chapter introduces the Mobility as a Service (MaaS) and Sustainable Urban Mobility Planning Practitioner Briefing (ERTICO, 2021) as reference for the development of the present guidance document for Central Europe cities and FUAs, integrates the vision of main relevant stakeholders at EU level and summarizes the substance of the contribution to the MaaS planning debate by the Dynaxibility4CE project.

1.1. MaaS planning in SUMPs

The Mobility as a Service (MaaS) and Sustainable Urban Mobility Planning Practitioner Briefing (ERTICO, 2021) is a step-by-step guidance for planning MaaS based on the concept of SUMP, as outlined by the European Commission's Urban Mobility Package.

This Practitioner Briefing developed by ERTICO – ITS Europe, also as a host of the MaaS Alliance, in collaboration with several experts and stakeholders of the MaaS environment[1], provides support to mobility planners, policymakers and stakeholders in better understanding MaaS, its challenges and opportunities, and explains the process for planning and implementing MaaS solutions within the SUMP planning approach.

Moreover, the document codifies three operational and governance models as reference for MaaS ecosystems and provides guidance on how to assess the existing preconditions in territories for MaaS implementation.

1.2. The vision of stakeholders

EMTA (European Metropolitan Transport Authorities), **POLIS** (network of European cities and regions cooperating for innovative transport solutions) and **UITP** (Union Internationale des Transports Publics) developed a common vision on MaaS strongly built around the central role of public transport in the future of integrated mobility networks (UITP, EMTA, POLIS, 2021).

This joint approach delivered a set of recommendations for the development of a MaaS approaches where market governance based on public-value principles. The eight recommendations recognize the importance of local authorities and public transport operators in delivering public goals through MaaS, ensuring sustainability, equity and effective governance and a fair participation to the ecosystem and collaborative approaches.

The **MaaS Alliance** is a public-private partnership representing relevant stakeholders in Europe contributing to the development of a common approach to MaaS. Through several contributions to the debate, it provides a comprehensive view of the future of MaaS encompassing technical, regulatory and market elements.

In its White Paper (MaaS Alliance 2017), the organization promotes an approach to MaaS ecosystems based on key principles as openness and inclusiveness, interoperability and roaming, and innovation in business and business models for mobility. In the MaaS Market Playbook (MaaS Alliance 2021) for example, the business potential for all the different actors is investigated further and the principles for the implementation of an open MaaS ecosystem for innovations are defined building on the centrality of users, the role of advanced sharing of data, trust and participation.

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[1] UCL - MaaSLab, University of Aegean, TRT Trasporti e Territorio, UITP, CERTH, EMTA, Polis Network, the City of Antwerp and Forum Virium Helsinki. UCL - MaaSLab, University of Aegean and TRT Trasporti e Territorio contribute as part of the Maas4EU project

1.3. The Dynaxibility4CE contribution to the debate

The main objective of this guideline annex is to provide a contextualization of MaaS planning principles presented in the Sump Practitioner Briefing in Central Europe cities and Functional Urban Areas, and in parallel to enrich the process with a dedicated tool fulfilling the need of a better understanding of the implications of different MaaS governance approaches.

Under these premises, the Dynaxibility4CE project investigated a broad range of EU funded projects from different programs (Horizon, Interreg, EIT, Shift2Rail, etc.) in order to analyze the main relevant contributions to the design and implementation of MaaS initiatives and the different trends and achievements on a EU wide perspective.

Moreover, a selection of academic works has been analyzed to better understand in detail the implications of the development of different MaaS operational, governance and business models, and to extract useful insights enriching the set of recommendations elaborated in this document.

Indeed, the most consistent contribution to the debate, fostering the contextualization of MaaS principles in Central Europe cities and FUAs, has been provided by the partner cities engaged in developing their action plans for the development of MaaS initiatives (Budapest, Graz, Krakow and Koprivnica).

Budapest (HU), with its extensive mobility network and the emergence of new mobility services, focused on technical implementation of MaaS features for public transport and the progressive integration of services such as DRT, sharing, etc. A first relevant challenge to the approach consisted in the lack of electronic ticketing functionalities for public transport, followed by the difficulties of integration with regional and national (railway) systems.

In **Graz (AT)**, where car transport still plays a primary role despite a negative trend in favor of cycling, the perspectives of MaaS integration rely both on digitalization and on the implementation of 25 multimodal mobility stations offering (e-)carsharing, (e-)taxi, car-rental, electric charging infrastructure and bike parking. Here the MaaS implementation process is at an advanced stage, and concentrates now on a multi-level-governance approach for a joint development of a regional MaaS implementation strategy. The main strategic focus is on how translate the effort towards digitalization and integration in a MaaS ecosystem capable to generate an impact on modal split, and how to scale up the concept at FUA level.

In **Krakow (PL)**, mobility across the city borders is strongly car dependent, and the motorization rates are continuously growing. Although new mobility services are growing at urban level, a relevant challenge is the development of infrastructure for sustainable (e.g. bike lanes) and intermodal (park and ride) transport, including nodes and hubs. A second range of technical challenges refers to integration, encompassing tariff, information and digitalization. In addition to this, the governance of the mobility system is poorly coordinated among levels and functions. The main objective of the actions is the implementation of a MaaS concept at city level, to be extended to the FUA.

In **Koprivnica (HR)**, the MaaS approach has been considered as a reference framework for the development of an extended mobility supply at FUA level, focusing on multimodal integration of traditional services.

Last but not least, international experts and stakeholders have been engaged in the debate to validate and integrate the drafted approach to MaaS planning, and to provide insights and recommendations based on successful experiences and detailed knowledge of the MaaS industry trends.

2. Planning MaaS in Central Europe, a Functional Urban Area perspective

2.1. Functional Urban Areas and mobility planning in Central Europe

"A functional urban area consists of a city and its commuting zone. Functional urban areas therefore consist of a densely inhabited city and a less densely populated commuting zone whose labour market is highly integrated with the city'" (OECD, 2012).

This concept, translated in the Central Europe contexts, identifies a broad range of areas where innovation is fundamental to improve connectivity and increase cohesion between central and peripheral, urban and rural territories. At the same time, a FUA is the dimension where sustainable and multimodal mobility is important in order to reduce the negative impacts of private motorized mobility in terms of congestion and pollution, both in major and in medium and small cities in Central Europe, where the use of cars as main mean of transport is particularly extensive.

The idea that sustainable mobility planning needs to consider the FUA perspective is a well-established principle in Central Europe. As the Interreg CE LOW CARB Project Mobility Strategies in FUAs (2020) explains: *"Planning for sustainable mobility in the FUA means to go beyond administrative boundaries, and to consider the integrated area of daily flows of people and goods, rather than a confined municipal area. This entails communicating with a variety of "new" or additional institutional and organizational actors on a common vision, joint objectives, targets, and indicators. As such a procedure challenges the traditional planning approach, it requires to find new ways of cooperation and agreements on, e.g., joint objectives and data-sharing, with actors from other municipalities, regional planning institutions, public transport companies and authorities, or from the private and civic sector."*

And the need for a FUA approach to sustainable mobility is still well represented in the Interreg Central Europe Programme 2021-2027 Specific Objective 3.2 Greening urban mobility in central Europe Territorial needs for central Europe: *"Smart and green solutions have to be introduced in functional urban areas (FUA), taking account of interactions between "urban cores" and their "hinterlands". In central Europe, many FUAs face similar challenges when greening their mobility. They need integrated approaches to address the vast diversity of territorial aspects (from e.g. energy demand, air pollution, congestion and urban logistics to public transport services, mobility behaviour and good governance) and to achieve net zero GHG emissions. In all this, digitalisation and novel technologies show significant potentials to help greening the future of urban mobility."*

2.2. Common challenges and needs for CE cities and FUAs planning for Maas

Within the Dynaxibility4CE Project, partner cities Budapest, Graz, Krakow and Koprivnica organized diagnosis workshops in their FUAs, where key requirements, knowledge gaps and challenges for the MaaS implementation process were identified.

Concerning **key requirements**, the following were identified:

a) A multi-level-governance process should be detailed. Mobility as a Service is an interdisciplinary topic and does affect several stakeholders from different institutions. Cooperation and integration are essential parts of a MaaS-strategy. Rolled-out from the city to the region, the number of actors involved are even higher.

b) A solid technical basis should be integrated the content of the existing topic guide and support the scenario development process, in order to provide guidance for the step-by-step integration of mobility services and providers into the mobility ecosystem, with special attention to shared and flexible options, market and non-market-oriented services, regional and local, etc.

Common challenges have been classified in technical, governance, data, social, economic.

Technical challenges: different transport subsystems in the same area are managed by different organisations and therefore different systems. Efficient solutions must focus on the following elements: planning a combined offer of mobility services; coordination of timetables; common ticketing and tariff integration (public and private transport services and mobile applications); enhancement of passenger information; increasing the quality of service in transport; identification of suitable/efficient systems/approaches (e.g. build an own customised open-source-based platform or use an existing system and service – advantages, costs, long term perspective and requirements).

Governance challenges: as mentioned, the development of effective MaaS approaches requires strong coordination on different governance level. The need for identification and coordination of responsibilities at different levels affects: technical infrastructure, traffic organisation; transportation systems on local/regional/national level; public and private transport services; service contracts; regulation for private operators / micro mobility; regulation for integrating transportation systems at each level of their functioning.

Data challenges: missing knowledge on data and data formats / open data and its importance on public level; availability and exchange of data and data formats / open data; regulation for data availability and management.

Social challenges: behavioural change; inclusion of vulnerable groups.

Economic challenges: financial impact of COVID19 on public transport systems, which in many cases slowed down the investment process in measures and activities as the MaaS related ones; investments in technical infrastructure and equipment; costs for supporting the activities related to the participative approach (co-design, living labs, etc.); forms and principles of mutual financial settlements between different transport organizers in the current legal and formal conditions; tariff structure / mobility packages; competition among different providers, identification of common leverages to foster sustainable travel behaviour.

The challenges collected and processed represent the basic framework for the development of recommendations on the implementation of MaaS in Central Europe cities and FUAs. The recommendations are presented in the next chapter and organized in four thematic areas (local engagement and demand analysis; data availability, quality, standardization, sharing and management; incentive measures and schemes supporting MaaS take up; integration of traditional and new mobility service providers in the MaaS ecosystem).

3. Planning and implementing MaaS in Central Europe

The investigations of the CE specific context and the lessons learned by the project partners designing and implementing innovative MaaS approaches in the interested territories, combined with the analysis of relevant literature and good practices and with the advice by experts in the field of MaaS implementation, brought to the formulation of a set of recommendation dedicated to cities and FUAs in Central Europe engaged in the MaaS planning and development process.

According to the needs and challenges emerged during the diagnosis phase of the Dynaxibility4CE project, the recommendations have been collected and organized according to four main themes relevant for MaaS planning and implementation: a) local engagement and demand analysis, b) data availability, quality, standardization, sharing and management, c) incentive measures and schemes supporting MaaS take up, and d) integration of traditional and new mobility service providers in the MaaS ecosystem.

3.1. Local engagement and demand analysis

How to reach car users, a day-by-day engagement. The ultimate goal of MaaS initiatives is to provide a competitive alternative to private motorized mobility and reduce the use of cars in cities and FUAs. This requires an in-depth knowledge of the main drivers of private mobility, user needs and behaviours, and continuous engagement of potential users. Dedicated resources are needed to manage the development and promotion of user-centred solutions and competitive alternatives.

Work at micro-level. Policies don't change behaviours as much as services do. Therefore, focus on solutions for neighbourhoods, relevant local needs that today can only be fulfilled through the use of a car.

Design infrastructure for MaaS. MaaS services build on integration, digital and organizational but also physical. Successful experiences of cities and FUAs, developing a variety of infrastructural nodes enabling the seamless connection among services, show how this is often a pre-requirement to digital integration and a key success factor for full integration. Mobility hubs, not only in traditional nodes such as stations and public parking but also at neighbourhood level integrating public transport and shared services including micro mobility (e.g. the example of Graz FUA's "tim" multimodal mobility stations), have been developed and promoted in different local contexts also through EU funded projects.

Make people choose. Often, identifying the correct mix of services fulfilling user needs is a real riddle for mobility planners. In other cases, services planned on a top-down logic or delivered on a pure market basis can generate barriers and discontent among non-users. Organizing test days, experimental living labs for innovations and in some cases co-design processes to develop a mobility offer much closer to user needs is a robust strategy to promote integrated mobility, making people choose and reaching good levels of acceptance and scaling up potential.

Find allies. Multipliers and facilitators can play an important role in supporting the take-up and continuous evolution of MaaS initiatives. A good example is the engagement of mobility mangers from main companies and traffic generators. Mobility providers also play a crucial role, and developing trust in the integration process is fundamental. Mutual benefits must be highlighted, and rules of engagement transparent.

3.2. Data availability, quality, standardization, sharing and management

Create incentive for data sharing. The sharing of data among operators and public administration must build on fairness and non-discrimination principles. However, data sharing shall be fostered by creating and highlighting benefits for the participation to the ecosystem. These include non-monetary incentives such as labelling, possibility of joining sustainable mobility communication activities and innovative projects, providing technical support to integration, etc. This is often a critical issue in the MaaS building process, especially when the digital expertise and knowledge of planners and regulators is limited.

Transparent algorithms, open Application Programming Interfaces (APIs). The role of public administrations consists not only in fostering the participation of operators to the ecosystems by sharing data, but also to make sure that their use is oriented to achieve societal goals. Algorithms must be transparent and oriented to foster sustainable choices. At the same time, APIs should be open to allow the participation in the ecosystem to different actors, including the ones with lower negotiation power but high sustainability and inclusiveness potential.

Standardize the way you create and integrate data. Data must be standardized since their creation according to the needs and approach of the ecosystem being developed. A good example is the Transport Operator to MaaS Provider – Application Programming Interface (TOMP-API) approach, developed in The Netherlands across 40 MaaS projects to improve interoperability among operators and cities.

Ask only for data you need, protect the user privacy. Data represent an important asset for digital and traditional mobility providers. MaaS regulatory framework must ensure that they are not used for different purposes without user agreement, but especially data to be shared must be functional to the implementation of MaaS features and to achieve societal objectives.

3.3. Incentive measures and schemes (monetary and non-monetary) supporting MaaS take up

Be creative! Non-monetary incentives can be even more attractive for example if focused to create the conditions for smooth integration of services in the ecosystem, or providing visibility to mobility services connected to their sustainability potential.

Monetary. Incentives must be focused on innovations and their contribution to the MaaS ecosystem. Public calls for development of innovative features, lump sums to be invested to fulfill interoperability requirements, etc.

Focus on operators, offer support. Incentives must enable the participation of operators to the ecosystem. In many cases, regulatory, legal and business barriers discourage mobility providers from participation as much as the underestimation of generated benefits. Incentives consisting in guidance and support to overcome the abovementioned barriers, also through the assistance by qualified public personnel, have proven to be effective.

Focus on user experience, **"If you'll have to think, you'll get in the car"**. The best incentive for users to join MaaS is the competitiveness towards private alternatives. User friendliness and seamless approach are requirements to make the user experience smooth and are important to attract users in experimenting new forms of mobility. The competitiveness in terms of time, comfort and affordability is the driver that keeps customers in the ecosystem in the long run.

3.4. How to involve traditional and new mobility service providers in the MaaS ecosystem

Manage spatial planning to make MaaS work. Urban regeneration and development projects represent a great opportunity to create the condition for integration of new forms of mobility in MaaS. In other contexts, spatial planning in built environments can create advantages for sustainable mobility options over private motorised mobility. Moreover, successful experiences for MaaS in those neighbourhoods have the potential to be replicated and scaled up within the related FUA.

Demand Responsive Transport (DRT) supporting public transport offer. MaaS initiatives aim at adding flexibility to existing transit network through integration in many ways. Lately, DRT services –directly managed by PT operators or developed by private or public-private initiatives (e.g. solutions promoted by companies, private operators, citizen groups etc.) – have proven to be effective in enhancing connectivity in peripheral and low-demand areas as well as in off peak time. DRT platforms can be natively designed for

MaaS implementation or adapted to it, therefore their addition is usually easier and potentially generating strong impacts in terms of flexibility and capillarity.

Variety. A plurality of new mobility services facilitate the customization of mobility solutions and packages within the MaaS ecosystem. Policymakers must foster the development of innovations (especially through collaboration among mobility providers) and create a solid framework for the integration (including data sharing protocols and rules).

MaaS is about the ecosystem. Societal goals are fundamental principles inspiring the creation of the rules for the ecosystem, but they can only be pursued by successful sustainable services (and not by the policies alone). Public administrations must design their ecosystem in order to promote the interoperability of sustainable services, and create the conditions to attract innovative services with high sustainability (environmental, social and economic) potential.

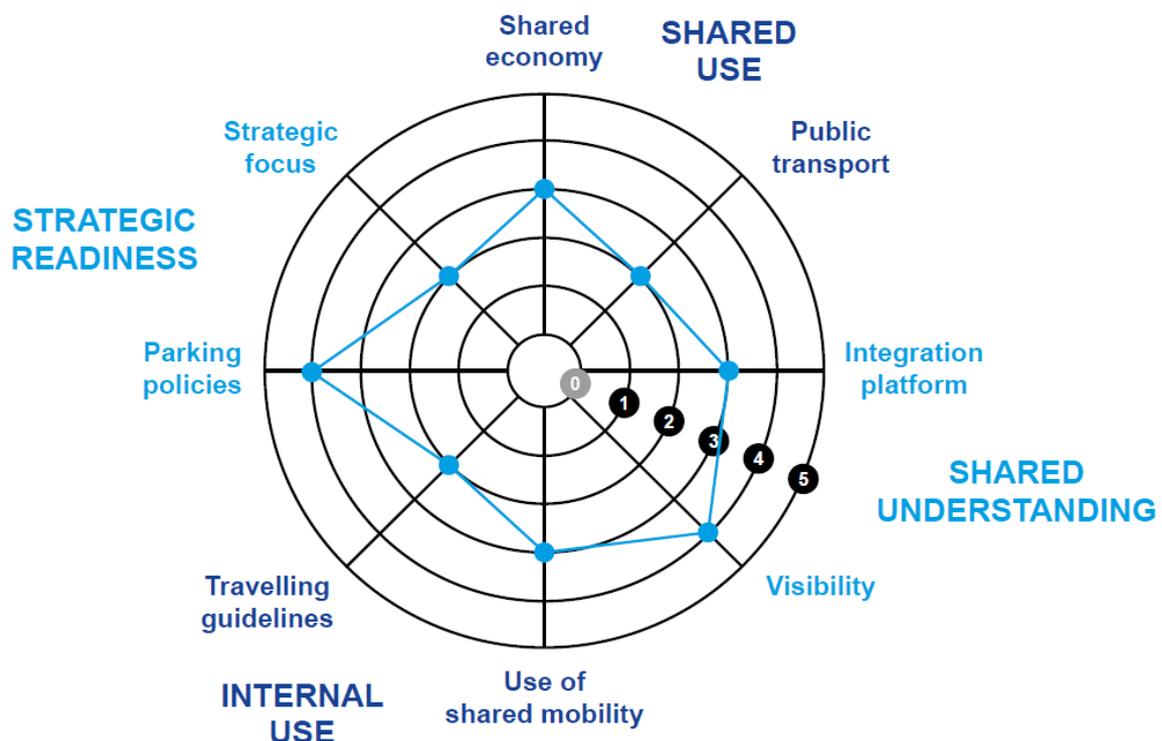# 4. A self assessement tool for MaaS scenarios

4.1. The forerunners of MaaS assessment: readiness and maturity

Among the several approaches developed to assess and accompany the development of MaaS planning, business ecosystems and models, we have chosen two examples investigating the aspects of readiness and maturity as reference and inspiration for the development of a new self-assessment tool responding to the needs of CE cities and FUAs emerged during the diagnosis activities within the Dynaxibility4CE project.

The CIVITAS ECCENTRIC MaaS Readiness Level Indicators tool is based on eight critical elements describing the context where MaaS could be established. The self-assessment based on the tool results in a diagram providing local authorities with a clear view on which areas the readiness level is satisfactory and on which areas there is still work to be done.

The critical elements considered and evaluated are the strategic focus, the parking policy, the travelling guidelines for staff and politicians, the use of shared mobility within the local administration, the availability and market penetration of shared and combined travel options, the public transport sales strategy, the integration platform, and the visibility of multimodal and shared mobility options.

Figure 1 - The MaaS Readiness Level Indicators, example of the city of Stockholm
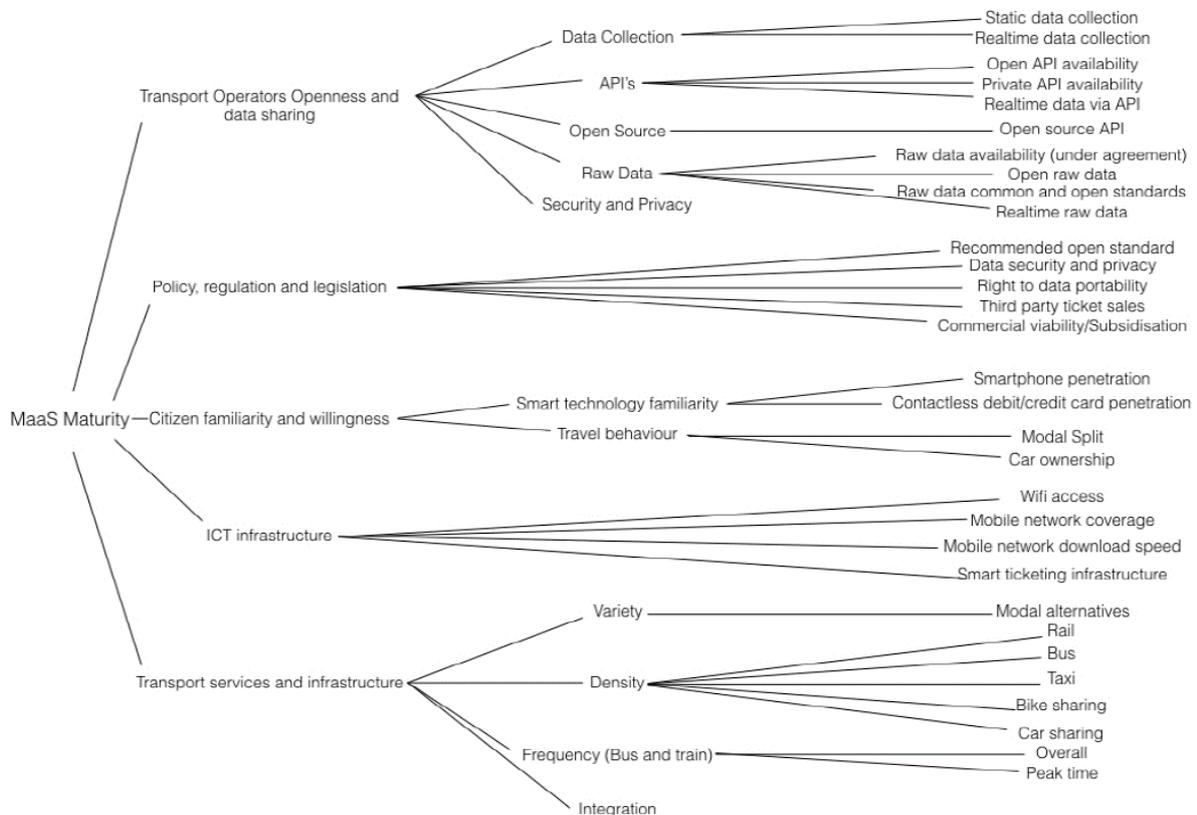

Source: CIVITAS ECCENTRIC

The MaaS Maturity Index developed by UCL MaaSLab is based on five core dimensions through which a city's potential to introduce MaaS can be assessed: transport operators' openness and data sharing, policy regulation and legislation, citizens familiarity and willingness, transport services and infrastructure, ICT infrastructure. The five dimensions are then defined further in a set of sub-dimensions, as result of an in-depth literature analysis and with the engagement of experts.

Figure 2 – UCL MaaSLab MaaS Maturity Index nested structure

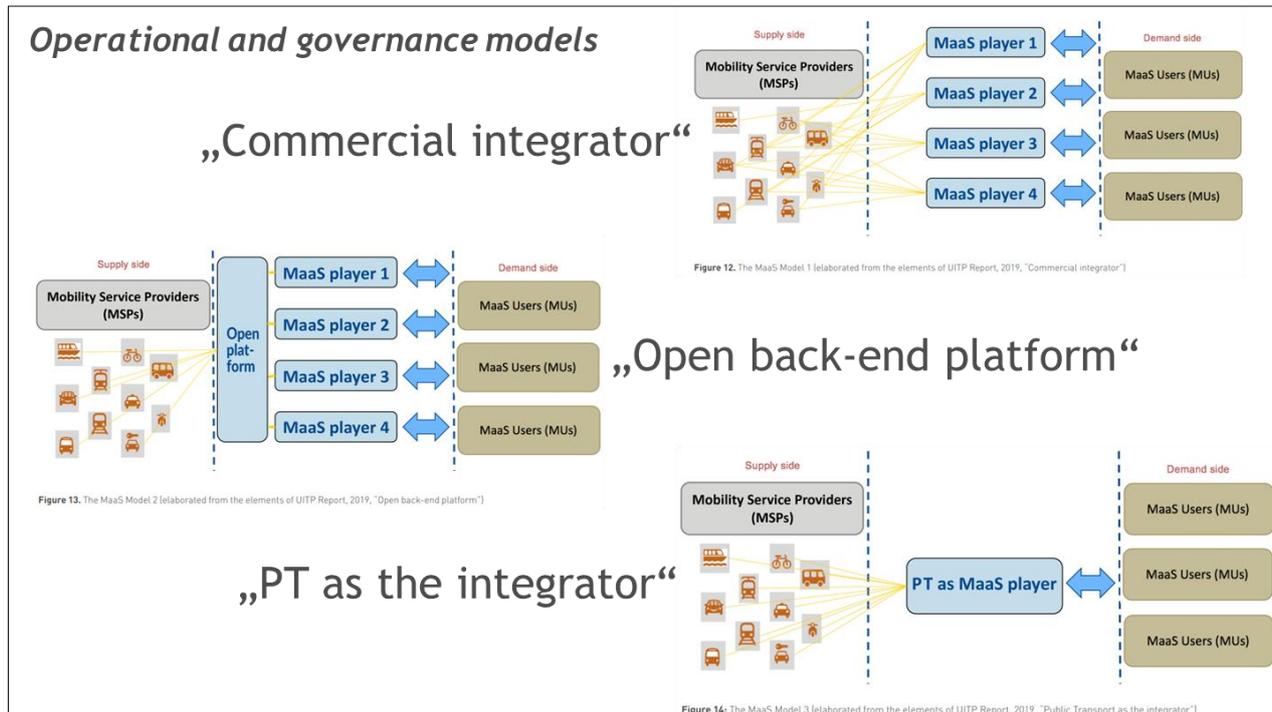*Source: UCL-MaaSLab: MaaS Maturity Index*

With different degree of complexity, both described approaches aim at assessing the conditions for the development of MaaS initiatives and potentially for the development of digital mobility ecosystems, but do not provide any insight on the alternative market frameworks and models that may result from the implementation, on their virtues and shortcomings.

4.2. Why a new tool?

While existing tools deal with the assessment of pre requirements (readiness and maturity) for the implementation of a MaaS initiative (or the definition of an enabling regulatory framework), basic guidance is provided in order to assess the potential implications of adopting different approaches towards MaaS, and enabling different market operational and governance models.

Figure 3 - MaaS operational and governance models

Source: Dynaxibility4CE on ERTICO – ITS Europe (editor) (2021)

The new MaaS scenarios self-assessment tool aims at supporting the planning process helping policymakers and mobility planners to evaluate the consequences of measures fostering the implementation of different MaaS models, designing for them different challenging scenarios according to territorial e socioeconomic characteristics of the areas of applications, and to operational and market structure of existing and planned mobility networks.

The focus is on the perspective of Local Authorities and on their market vision concerning mobility networks and services as well as on their integration.

MaaS is here conceptually considered as a "new service" part of the mobility network, and the tool will identify potential, risks and benefits of different enabling approaches (through regulatory, operational, incentive, fostering, market measures, etc.) according to the local conditions.

The MaaS scenarios self-assessment tool complements the existing scheme represented by the MaaS readiness and maturity assessment approaches, integrating the strategic dimension into the existing structure.
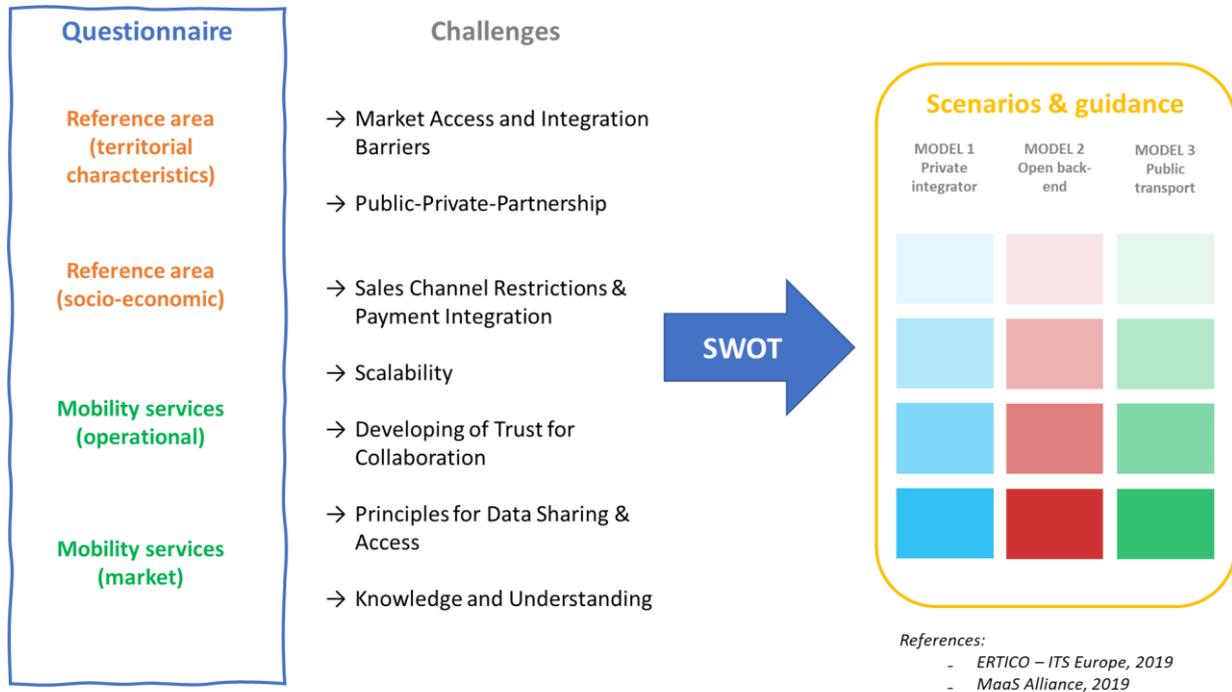
4.3. How does it work?

The tool is developed through the following four components:

- **Questionnaire**: 4 themes (territorial characteristics, socio-economic, operational aspects, mobility market), 18 questions to define the characteristics of the context.
- **Challenges** (MaaS Alliance, Main challenges associated with MaaS): 7 challenges defining the framework for the analysis.
- **SWOT analysis** (Strengths, Weaknesses, Opportunities, and Threats): per each operational and governance model (1. Private integrator, 2. Open back-end platform, 3. Public transport as integrator) challenges will be assessed according to the results of the questionnaire. The SWOT analysis will be performed through the interaction with experts (interviews and/or workshop).

— **Scenarios and guidance**: selected results of the SWOT analysis are summarized into customized considerations and recommendations for the application of each of the operational and governance models.

Figure 4 - The MaaS scenarios self-assessment tool

Source: Dynaxibility4CE

The tool is being promoted as instrument supporting local authorities in decision making related to the design process of MaaS ecosystems, fostering the adoption of market approaches suitable for the related context and able to achieve the policy objectives behind MaaS implementation.

4.4. Outcomes and application of the tool

The questionnaire can be found at the following address:
https://ec.europa.eu/eusurvey/runner/Dynaxibility4CE_MaaS-Self-Assessment-Tool

The customised outcome of the self-assessment process, generated after responding to the questionnaire, represents a preliminary checklist of key points to be discussed among policy makers and stakeholders setting and/or finetuning the strategy for a successful implementation of a MaaS ecosystem.

The tool has been tested and fine tuned thanks to the participation of Dynaxibility4CE partner cities Budapest, Graz, Krakow and Koprivnica, and of other cities and transport operators in the EU.

The following two figures show an excerpt of the results generated during a tool test (limited to "strengths" identified by the SWOT analysis and to one of the three scenarios elaborated), to give an example of the type of output created in line with the general recommendations elaborated in the previous chapter.

Figure 5 – Excerpt from self assessment tool output – Strengths (from SWOT analysis)

MaaS Profile	*City*	
Date:	*31/05/2022*	

	STRENGTHS
Territorial and institutional Structure	Strong focus on daily commuting as a core
	Multimodality develops in different directions (radial, horizontal)
	Center is a favourable environment for zero emissions transport and new mobility services
	Strong control on new mobility services by the policy level
	Fairly suitable environment for a MaaS optimizing transport networks at local level
Socio-economic background	Broad new market for mobility alternatives
Mobility operational context	Demand well identified
Mobility market	Good response to mobility needs in different areas/ for different target groups
	Integration efforts can be reasonably limited
	Backbone services ready for MaaS

Source: Dynaxibility4CE

Figure 6 – Excerpt from self assessment tool output – Challenges and recommendations according to model 2 "Open back-end platform"

Model 2 - "Open back-end platform"	
	Challenges and recommendations
Socio-economic background	Create incentives for the development of integrated solutions on the supply side (e.g. through grants, awards, etc.), and to their adoption through the promotion of solutions such as special tariffs, mobility packages, etc.
	Foster the participation of digitalized services to the development and population of the open-back end platform, by setting standards and incentives for collaboration
	Consider electronic payment and ticketing/billing as requirement for services
	Ensure common rules and standards fulfil data protection regulations, monitor public and private operators, label platforms joining the ecosystem
	Develop a dedicated campaign and targeted actions on data protection in mobility
	Foster the integration of public transport and new mobility services (in particular flexible options e.g. DRT) with the objective of making the service more capillar
	Promote inclusiveness through subscriptions, discounts, integration of new services in mobility packages
Mobility operational context	Co-create new plans and business models integrating new mobility services for peripheral areas, support the intermodal integration among services (e.g. by awarding services that are bundled together, promoting public transport oriented mobility packages, etc.)
	Support the development of flexible services (e.g. DRT) in peripheral areas
	Promote fair competition among Maas platforms

Source: Dynaxibility4CE

5. Conclusions

The work provides a contextualization of MaaS planning principles presented in the Sump Practitioner Briefing in Central Europe cities and Functional Urban Areas, building on inputs provided by the partner cities engaged in developing their action plans for the development of MaaS initiatives (Budapest, Graz, Krakow and Koprivnica).

Common challenges have been classified in technical, governance, data, social, economic. The challenges collected and processed represent the basic framework for the development of recommendations on the implementation of MaaS in Central Europe cities and FUAs.

The combination of the analysis of EU funded projects and good practices, scientific literature and interactions with experts and stakeholders provided the in-depth knowledge then translated in recommendations for CE cities and FUAs.

According to the needs and challenges emerged during the diagnosis phase of the Dynaxibility4CE project, the recommendations dedicated to cities and FUAs in Central Europe engaged in the MaaS planning and development process have been collected and organized according to four main themes relevant for MaaS planning and implementation: a) local engagement and demand analysis, b) data availability, quality, standardization, sharing and management, c) incentive measures and schemes supporting MaaS take up, and d) integration of traditional and new mobility service providers in the MaaS ecosystem.

The results of the described process are summarized in a set of recommendations fitting with the current average level of maturity of MaaS planning experiences in CE and in EU in general. However, it is worth to highlight that a static interpretation of the MaaS principles is limited, as the concept is rapidly evolving thanks not only to the technological enablers but especially to governance and policy priorities and approaches, social and behavioural dynamics affecting mobility demand and business and operational trends on the supply side.

The proposed recommendations must therefore be interpreted as suggestions for the set up of new initiatives according to shared principles based on sustainability and inclusiveness, and practical advice in order to make the designing solutions effective and impactful on the mobility ecosystem.

At the same time, the output generated by the scenarios self-assessment tool represents a preliminary checklist of key points to be discussed among policy makers and stakeholders setting and/or finetuning the strategy for a successful implementation of a MaaS ecosystem.

Annex - The Dynaxibility4CE MaaS scenarios self-assessment tool questionnaire

MaaS Profile	*City*	
Date:	*31/05/2022*	

1	**Territorial and institutional characteristics**		
1.1	*Type of area*	**How would you define your reference area?** a. Region b. Functional Urban Area (FUA) c. Urban area d. Sub-urban area e. Rural/low-density area	
1.2	*Shape*	**What are the characteristics of the settlements and of the main infrastructure networks?** a. polycentric/hive shaped b. radial converging towards a main urban area c. compact combining radial axes towards the center and between peripheral areas	
1.3	*Presence of access restrictions*	**What kind of vehicle access restriction scheme is enforced on the territory?** a. none b. city inner center c. broader low emission area corresponding to a relevant part of the urban territory d. multiple small areas in different zones	
1.4	*Regulation on new services*	**How are new services (sharing, ride hailing, others) planned and regulated?** a. subject to authorisation and quality standard, no limit to the number of operators b. authorization/licence provided to a defined number of operators c. no regulation	
1.5	*National/regional/local regulatory level*	**Concerning mobility policies, what is the level of coordination/harmonization among different governance levels and territories?** a. comprehensive coordination among governance levels (multi-level governance) and between tools (e.g. SUMP, Air quality plans, urban planning, etc.) b. good sectoral coordination (transport and mobility) c. sectoral coordination with harmonization gaps among levels (e.g. lack of regulation at national/regional level when needed for some services) d. poor coordination	

2	Reference area (socio-economic)		
2.1	*Car ownership and use*	**How would you define the car role in the reference area?** a. dominant (high property rates, dominant in commuting flows and largely used for family duties and leisure) b. strongly diffused (high property rates, mainly relevant in commuting flows) c. necessary for targeted activities (high to medium property rates, mainly used for family duties and leisure) d. secondary (low property rates, shared)	
2.2	*Relevance of combined mobility*	**How would you evaluate the combined/multimodal mobility on the territory?** a. good intermodal infrastructure (e.g. park and ride, intermodal stations, mobility hubs) and high usage of combined mobility b. good intermodal infrastructure and limited usage of combined mobility c. limited intermodal infrastructure (covering few areas and/or modes) and combined services d. poor intermodal infrastructure and combined services	
2.3	*Openness towards communication technology, immaterial ticketing and payments*	**How is the attitude of citizens towards digitalization of services?** a. general good adoption of digital services also in mobility (mobility apps, digital ticketing, etc.) b. positive attitude towards ICT services in other sectors (e.g. public services, digital payments, etc.) c. strong gap between more and less digitally advanced social groups (e.g. young and elderly, etc.) d. ICT services limited to early adopters	
2.4	*Level of concern related to data protection*	**How is the general attitude of citizens towards data protection?** a. good knowledge on the topic and attention to data management policies b. good knowledge and concerns mainly on private entities managing data (e.g. private mobility operators) c. limited knowledge and very strong concern toward public and private entities d. limited knowledge and low concern	
2.5	*Perceived quality of public transport*	**How public transport is perceived by citizens?** a. reliable, convenient, capillar, competitive with private mobility in fulfilling most of mobility needs b. reliable, convenient, preferrable for specific mobility needs (e.g. commuting towards city centre) c. only partially reliable, economically convenient d. in general not reliable and used only when there is no alternative	

3	Mobility (operational)		
3.1	*Demand main flows (urban/inter etc.)*	**How would you describe the main mobility flows in the reference area?** a. strongly polarized in space (periphery towards center) and time (relevance of peak hours) b. distributed over a number of poles or multi-directional, polarized in time c. polarized in space, distributed in time d. mainly multi-directional and more distributed in time	
3.2	*Supply relevance of public transport*	**How does the public transport network look like in your territory?** a. focusing on high demand routes, poor presence of feeding services b. very concentrated in densely populate areas, limited in others c. capillar at local level, calibrated according to population density d. widely diffused, ensuring high accessibility also in peripheral areas	
3.3	*Supply other modes*	**How are new mobility services (shared and flexible mobility, e.g. car/bikesharing, micromobility, DRT shuttles, taxi/ridehailing etc.) diffused in your territory?** a. mainly in densely populated and central areas b. mainly in peripheral areas where the public transport network is less developed c. in densely populated and peripheral areas, as alternative to public transport d. in densely populated and peripheral areas, as complement to public transport e. non existing	

4	Mobility services (market)		
4.1	*Number of operators in PT*	**What is the situation of public transport operators in your area?** a. One operator for all relevant local services b. One operator for local public transport and one for railway c. Operators differentiated per mode/area/distance (e.g. bus, tram and train; urban, extra urban and regional, etc.) d. Several operators covering different modes/areas but also in competition in some cases	
4.2	*Number of new mobility services providers (shared and flexible services)*	**How many new mobility services providers are in the market?** a. no new mobility services b. 1 to 3 c. more than 3, but different services (e.g. car sharing, bike sharing, micromobility) d. more than 3, some in direct competition	
4.3	*Service integration between regional and local*	**How would you describe the level of integration (timetable and tariff) among regional and local public transport services?** a. no integration b. partial integration (timetable, no or only partial tariff) c. partial integration (tariff, only partial timetable) d. full integration	
4.4	*Existing integrated services traditional and new*	**Are new mobility services integrated with the public transport network?** a. no/not relevant b. few new services are integrated with public transport and can be easily used jointly c. several new services are integrated with public transport and can be easily used jointly d. several new services are integrated with public transport, also through multimodal mobility hubs at public transport stops	
4.5	*Attitude of players towards data sharing*	**Are mobility players sharing data with the public administration and/or among each others?** a. no operator is sharing data b. operators are sharing data with the public administration, mainly for monitoring purposes c. operators are sharing basic data (e.g. timetables, parking, vehicle availability, etc.) for information purposes d. public transport operators and new mobility providers are sharing advanced data (for trip planning and further integration)	

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