



Holistic Approach for Providing Spatial & Transport Planning Tools and Evidence to Metropolitan and Regional Authorities to Lead a Sustainable Transition to a New Mobility Era

D1.4 Stakeholder requirements and scenarios for regional spatial and transport planning- Final Version

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
AV	Autonomous Vehicle
D	Deliverable
DC	Distribution Center
ITS	Intelligent Transport System
MaaS	Mobility as a Service
M	Month
MS	Model Suite

- Final

NGO	Non-governmental organization
OEM	Original Equipment Manufacturer
OXS	Oxfordshire
RIAB	Research and Innovation Advisory Board
ROT	Rotterdam
S&T	Scientific and Technical
SUMP	Sustainable Urban Mobility Plan
T	Task
TRIK	Trikala
TSDW	Transport and Spatial Data Warehouse
UAM	Urban Air Mobility
UTM	Unmanned Traffic Management
WP	Work Package

Executive Summary

Since stakeholder engagement enhances communication channels between all parties, increasing the project's support and allowing for the collection of information to keep improvements undergoing, every project that wants to succeed needs to get involved with the major stakeholders taking part in their environment. Therefore, it is crucial for projects to develop activities to involve important actors in order to obtain their thoughts and opinions and to comprehend their demands and pain areas. It's crucial to take into account all of this information in order to create solutions that are most suited to end-user needs.

The present report D1.4, belongs to WP1 and is part of T1.3. The aim of WP1 "HARMONY conceptual framework" is to evaluate the most recent methods, processes, techniques and KPIs in spatial and transport planning, as well as to work and to hand with stakeholders to identify requirements for planning and decision making. Similarly, T1.3 "Specification of Stakeholder Needs" enables communication with important stakeholders such as public authorities, transport and freight operators, mobility companies, etc., through different types of activities in order to properly understand key barriers, opportunities and requirements for the HARMONY project.

A previous version of "Stakeholder Requirements and Scenarios for Regional, Spatial and Transport Planning" was done in D1.2, where a detailed description of the methods used to organize the first cross-metropolitan workshop in Rotterdam serving as a reference tool for the whole HARMONY consortium for future events, as well as to elaborate on stakeholder requirements and scenarios for regional, spatial and transport planning, feeding the analysis on stakeholder requirements. Also, findings from T1.1 and T1.2 were used to prepare questionnaires and presentations to feed discussions.

This report, which is a continuation of D1.2 aims to analyse results of different stakeholder engagement activities, such as cross-metropolitan workshops, interviews conducted with transport planning authorities and modellers, co-creation workshops, demonstrations/pilots, surveys, focus groups and on-line questionnaires/polls that have been set up throughout the project to update the stakeholders' requirements. Hence, D1.4 collects in a single document the feedback collected from all stakeholder engagement activities in order to provide a list of requirements for both HARMONY Model Suite and Transport and Spatial Data Warehouse (TSDW). Also, a distinction between functional and non-functional requirements has been made for each one of the components.

A four-step methodology is used to deploy this task. In the first phase, "Stakeholder's identification and classification", literature review as well as inputs from some internal workshops is used to identify and classify different stakeholders. Also, a registry of stakeholders is constructed where partners provided information about relevance, attitude impact, and resources owned by each stakeholder group as well as the interaction among them. Then, power- interest grid is used to identify the target stakeholders and define the strategy to engage each stakeholder group in the project. This step was crucial for identifying most important stakeholders to be targeted, such as authorities, OMEs and firms related to the transport sector, as well as cities and regions, to conduct activities to know more about opportunities, barriers, and requirements for the HARMONY project.

Interviews with key stakeholders from the six metropolitan areas (Athens, Oxfordshire, Rotterdam, Trikala, Turin, and Upper Silesian-Zaglebie metropolitan area) as well as with modellers were conducted as part of the second phase, "Stakeholder's Needs and Requirements," to better understand the needs and requirements of the end users. WP1, WP9, and WP10 also scheduled a number of stakeholder engagement activities to properly comprehend the needs and demands of the other stakeholders. Section 5 provides a summary of the key findings. With the use of these insights, a complete list of project requirements was created, categorizing them into functional and non-functional requirements for both MS and TSWD. Finally, data regarding user acceptability of HARMONY MS and the dashboard collected through multiple surveys distributed to end users.

1. Introduction

1.1 Aim of the Project

HARMONY's vision is to develop a new generation of harmonised spatial and multimodal transport planning tools which comprehensively model the dynamics of the changing transport sector and spatial organisation, enabling metropolitan area authorities to lead the transition to a low carbon new mobility era in a sustainable manner.

HARMONY envisages providing a new generation of integrated tools, which comprehensively model new forms of mobility for freight and people, and their business dynamics in metropolitan areas. The HARMONY model suite (MS) integrates: 1. Strategic models (land-use, economic growth), 2. Tactical models (people/freight transport activities), and 3. Operational models (multimodal land- and air-network) allowing for multi-scale spatial and transport planning. This approach is necessary, because strategic decisions, affect the tactical and operational and vice versa; for example, the construction of transit hubs or the introduction of Mobility-as-a-Service (MaaS) schemes (strategic decisions) may affect residential/firm location choice or vehicle ownership decisions of households/firms (strategic) and their mode choice decisions for everyday mobility (tactical), which in turn affect transport network traffic flows (operational) requiring the re-design of transport networks (once again strategic). Thus, a feedback loop is required for these three levels of decisions so that authorities can understand if policies are economically viable, while also contribute to meeting COP22 targets, social equality and wellbeing. HARMONY goes beyond simply designing this model suite. Stakeholders are actively engaged in co-creation labs to understand their needs in terms of integration of traditional and new transport modes, as well as regional spatial and transport planning feeding the development of the HARMONY MS' functionalities. New mobility technologies and concepts [such as electric autonomous vehicles (AVs) and drones] are demonstrated and integrated with the traditional transport modes to derive the real-world challenges, social acceptance, and policy requirements. HARMONY uses the results of the MS and the co-creation labs to offer a complete solution including recommendations for a new generation of SUMP (Sustainable Urban Mobility Plans) ready to tackle the challenges of the new mobility era and regional planning. In addition, urban and regional multi-stakeholder partnerships, business models and cases required for attracting investments and for a sustainable transport system are proposed. HARMONY's outputs act as an enabler of the innovation process and its introduction in HARMONY with the needs and requirements of agglomerations.

1.2 Purpose of Document

The objective of WP1 "HARMONY conceptual framework" is to review latest practice in spatial and transport planning, project appraisal techniques and KPIs and works with stakeholders to understand requirements for planning and decision-making. These findings are used to build the conceptual HARMONY MS architecture and the underlying software framework components guiding the development of the S&T WPs. Specifically, WP1:

- a) provide an update on the relevant state-of-the-art in spatial and transport planning approaches;
- b) review transport technologies and services that are currently available or will be available up to 2050;
- c) review the latest developments in project appraisal and the KPIs authorities and industry use to identify the gaps in terms of multimodality, regional planning, new mobility technologies and services;
- d) work with stakeholders to identify their requirements in terms of spatial and transport planning and integration of traditional and new mobility services;
- e) prepare the use-case scenarios that guide the development of the HARMONY MS;
- f) define the conceptual modelling frameworks, the reference architecture and the software framework components of the HARMONY MS that guide the technical developments from WP2 to WP7.

As part of this WP1, T1.3 “Specification of Stakeholder Needs” works with targeted stakeholders (public authorities, transport and freight operators, mobility-related companies, infrastructure, construction/real estate and investment companies, etc.) to identify requirements, barriers and opportunities in terms of regional and transport planning, multimodality and integration of traditional and new mobility services. Data collected from all stakeholder engagement activities is useful to identify stakeholder’s functional and non-functional requirements provided in this deliverable.

Deliverable D1.4 “Stakeholder Requirements and Scenarios for Regional Spatial and Transport Planning” aims to continue gathering insights from stakeholder engagement activities, following D1.2, which detailed the methods used to organize the first cross-metropolitan workshop and the analysis of its results. Also, it reports the stakeholder engagement activities that have been and will be conducted for HARMONY project, highlighting, and analysing main pain points, needs and opinions. It uses insights collected to come up with a list of requirements and assessment of those, through a survey disseminated among key stakeholders.

1.3 Intended Audience

This document is particularly useful to address mobility stakeholders, practitioners and decision makers who need to be aware of advances/challenges/areas of impact etcetera. These directly arise/emerge from stakeholders participating in cross-metropolitan workshops, interviews, and other stakeholder engagement activities. Moreover, it serves as a useful resource for people organizing similar activities in transportation and mobility areas. Internally, it is often used by S&T partners involved in the modelling of HARMONY MS conceptual architecture as they need to better understand the needs and requirements of the stakeholders and adjust the project solutions based on the feedback received from various stakeholder groups.

1.4 Structure of the Document

This document consists of seven main sections. After a brief introduction in Section 1, the methodology for the deliverable is detailed in Section 2, followed by stakeholder identification and classification in Section 3 and a timeline of all HARMONY stakeholder engagement activities from the beginning of the project until the end in Section 4. Consequently, in Section 5 the results of stakeholder engagement activities are described for each type of activity, which will lead to the identification of stakeholder requirements (functional and non-functional) in Section 6. Next, an assessment of requirements is included by analysing the results of surveys for HARMONY MS and the dashboard in Section 7. Some final remarks in Section 8 will conclude the document.

2. Methodology

The relevance of including stakeholders in the creation and assessment of new solutions, policy initiatives, or similar schemes is growing [7]. This is especially true for programs involving software development and research [11]. Integrating stakeholders in the creation of new products has a variety of advantages, including: a better understanding of needs and requirements; developing trust; giving them the chance to learn about the technologies developed in the project and how to use them [8], [10]. Engagement with stakeholders and knowledge of their needs are crucial to the success of the Harmony project and the acceptance of the Harmony MS platform. The process of involving stakeholders was divided into four iterative phases.

In the first phase, the questions “Who are our stakeholders?”, “What are their characteristics?”, and “Who are potential users of the technologies developed in HARMONY?” had to be answered. Stakeholders, thus, had to be identified and classified according to their importance, relevance, resources, and attitude. For this, an internal workshop was organized by ENIDE, and inputs were acquired from partners.

The second phase focused on answering the questions “What are the needs and requirements of main stakeholders, especially final users?”, “What are the scenarios for regional spatial and transport

planning?”. “What are the requirements for each scenario?”, and “What are the users’ expectations from HARMONY MS?”. During the first months of the project, the first cross metropolitan workshop was organized to engage key stakeholders and elicit their spatial and transport planning requirements regarding new forms of mobility and spatial design. A wide range of requirements were collected from areas with different demographic, economic growth and travel needs characteristics. These requirements then fed the design of HARMONY MS and the revision of SUMP. Also, some interviews with key stakeholders from the public and private sector were conducted. Six interviews were conducted with traffic authorities and representatives of the cities collaborating with HARMONY: Athens, Oxfordshire, Rotterdam, Trikala, Turin and Upper Silesian-Zaglebie metropolitan area. This set of interviews provided us with interesting insights regarding SUMP and modelling processes. Moreover, 6 interviews were organized with traffic modellers to better understand their requirements for HARMONY MS. The second cross metropolitan workshop organized in M29 provided us the opportunity to have a direct dialog with some key stakeholders and better understand their needs and requirements in regard to spatial and transport planning.

In the third step, multiple workshops were organized with MobyX as well as ICCS, and UAGEAN to define the functional and non-functional requirements of HARMONY MS and TSDW, taking into consideration the needs of potential clients. Some of the requirements were gathered through polls, questionnaires, and surveys. Also, meetings with potential users and co-creation labs helped to define the requirements. The inventory of requirements is a living document and will be updated throughout the project.

In the fourth phase, for assessing the user acceptance, some questionnaires were designed and circulated among potential users and partners after each demonstration of the HARMONY MS platform as well as the dashboard. Moreover, in collaboration with T9.4 (Exploitation and IPR strategy) a meeting was organized with the Research and Innovation Advisory Board (RIAB) members to validate the business of the HARMONY MS and get further end users/potential clients’ feedback.



Figure 1 Methodology used in HARMONY to identify the stakeholders' needs and requirements

3. Stakeholder Identification and Classification

Stakeholder analysis is critical for identifying public interest and concern, and it is becoming increasingly relevant as the globe gets more interconnected [3]. A stakeholder is any entity (individual or organization) with a legitimate expectation from the system, in other words, the stakeholders are all those who may be influenced or who would be able to influence the system in general [2].

The first crucial stage of a project is the identification of potential stakeholders because, once organized into the target groups according to clearly defined categories, they will participate in the requirements definition process, which is where business and user needs are discovered and recorded. The ability of designers to satisfy the needs and requirements of stakeholders across the whole life cycle is crucial to a project's success. All potential groups must be taken into account when identifying the stakeholders.

3.1 Initial Stakeholder Scan

Because one stakeholder's impact on a project can differ significantly from another, there is a huge potential for involvement. Requirement definition procedures might, for instance, involve system users, customers, etc. This illustrates the significance of beginning a stakeholder analysis categorization procedure in order to manage the requirement definition appropriately. There are a variety of ways for identifying the right actors, including identification based on involvement, interests, or participation [6]. In accordance with the PMBOK's stakeholder analysis methodology [2], we have to consider the following:

- Information gathering and analysis to identify the interests that should be considered for the project;
- Technical and/or managerial expert judgment (derived from any reliable source);
- Meetings to analyse profiles and gain an understanding of the key project stakeholders.

As a result of these activities, we identified 11 groups and 45 subgroups of stakeholders relevant to HARMONY project.

No.	Stakeholder Group	Sub-group/Individual Stakeholder
1	Technology providers	Software providers
		Telecommunication and network providers
		Integration service providers
		Data providers
		UTM providers
2	OEMs	AV manufacturers
		Drone manufacturers
		Technology integrators
3	Research entities	MaaS department
		Emissions department
		Safety department
4	Firms	Mobility related consultancy companies
		Traffic planning consulting companies (e.g., TRT)
		Freelancers
		Civil engineering companies (ALTRAN, ALSTOM, JACOB, SWARCO, SWECO)
		Survey firms
		Traffic simulation/software companies
5	Universities	Traffic planning researchers/Labs
		Transport policy researchers/Labs
		Modelling experts
		Students
		Cooperation oversees
		Valorisation centre

6	Cities and regions	City and regional governments
		Public transport authorities
		Transport Infrastructure authorities (road, rail, UAM)
		Traffic and transport planning experts; civil engineers
		Policy makers
		Police
		City and regional associations
7	Civil Society	NGOs
		Associations of drivers
		Active Travel User (different user groups, e.g., disabled, vulnerable etc.)
		Advocacy groups
		Public transport Passengers (different user groups)
		Citizens
8	Service Providers	Passenger transport providers
		Freight operators
9	Infrastructure	Road operators
		Toll operators
		Rail network
		Tube / Metro / Tram
		Traffic operators (traffic lights)
		Parking providers
10	Unions	Pharmacists
		Taxi drivers
		Logistics / Truck drivers
		Public transport operators
11	Public Health	Hospitals

Table 1 Stakeholder Groups and Sub-groups

A Stakeholder Registry (Figure 2) was used to collect inputs from partners for the identification of relevant stakeholders, as well as evaluating the resources they possess, their attitude, their relevance to project and the interaction between them.

To gather practical requirements for the project, the Stakeholder Registry was developed through the various HARMONY stakeholder management processes including internal workshops.

Stakeholders		Relevance, Attitude & Impact			Resources			
Stakeholder Group	Sub-group/Individual Stakeholder	Relevance: Interest in Problem/Issue	Attitude	Impact	Resources possessed	Resources lacked	Importance of resources	Interactions
General Stakeholder group	Sub-groups within the general stakeholder group or examples	High/Med/Low	Supportive/Opposing/Indifferent	High/Med/Low	Financial/Social/Institutional/Technical	Financial/Social/Institutional/Technical	High/Med/Low	The interactions between different stakeholders

Figure 2 Stakeholder Registry

3.2 Stakeholder Analysis

The Power/Interest Grid, in particular, can be a useful tool to assess how a possible stakeholder would affect the project. It can also help in choosing the best communication strategy for each stakeholder or stakeholder group. The "power/interest matrix" divides project stakeholders into one of four categories (Figure 3) according to their influence and interest in the project.

- **High power, highly interested people (Manage Closely):** Stakeholders should be actively involved, and their needs should be prioritized.
- **High power, less interested people (Keep Satisfied):** It should be ensured that the needs of these stakeholders are met because they have influence over the project (financial, permits, etc.). These stakeholders have significant influence over your ability to complete the project on time and within your budget, even though they aren't particularly interested in the outcome of your project. These Stakeholders must be involved and maintained satisfied.
- **Low power, highly interested people (Keep Informed):** These stakeholders can do little damage to your project because of their limited impact capability, but they are nonetheless interested in the development or end outcome of the work your team is doing. Usually, just

letting them know about the initiative and keeping them informed is enough. Their suggestions on the project's specifics can be highly helpful.

- **Low power, less interested people (Monitor):** They shouldn't be ignored, but neither should excessive time be spent communicating to them. Regularly checking on them is frequently adequate; specifically, to make sure that neither their power nor interest levels have altered much. The broader public, for instance, which frequently isn't even necessarily aware of your initiative, is an example of these stakeholders.

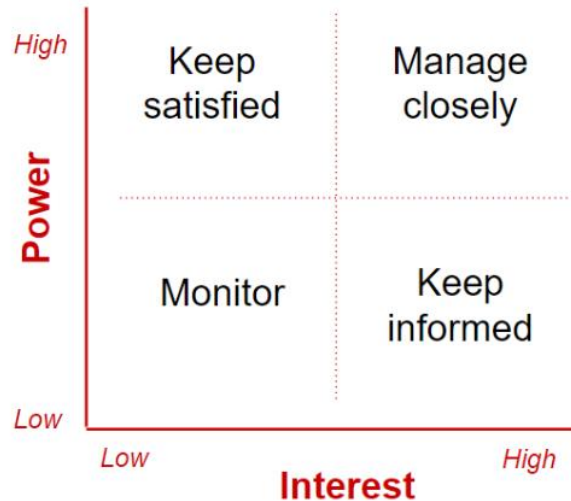


Figure 3 Power Interest Grid

The key benefit of allocating stakeholders in accordance with this grid is that it enables immediate identification of the power source, which facilitates better project decision-making and the identification of the most effective channels of contact with interested parties.

3.3.1 Power-Interest Grid

A power-interest grid classifies various actors according to the power and interests of specific stakeholders [12]. Stakeholders are positioned on this grid according to how interested they are in the subject and how powerful they are (high-low). The resources an actor possesses, and their proportional significance (financial, technological, administrative, and legal in the implementation and viability of the system) are what characterize their power. We also considered the stakeholders'

attitudes, including whether they were in favour, against, ambivalent, or indifferent.

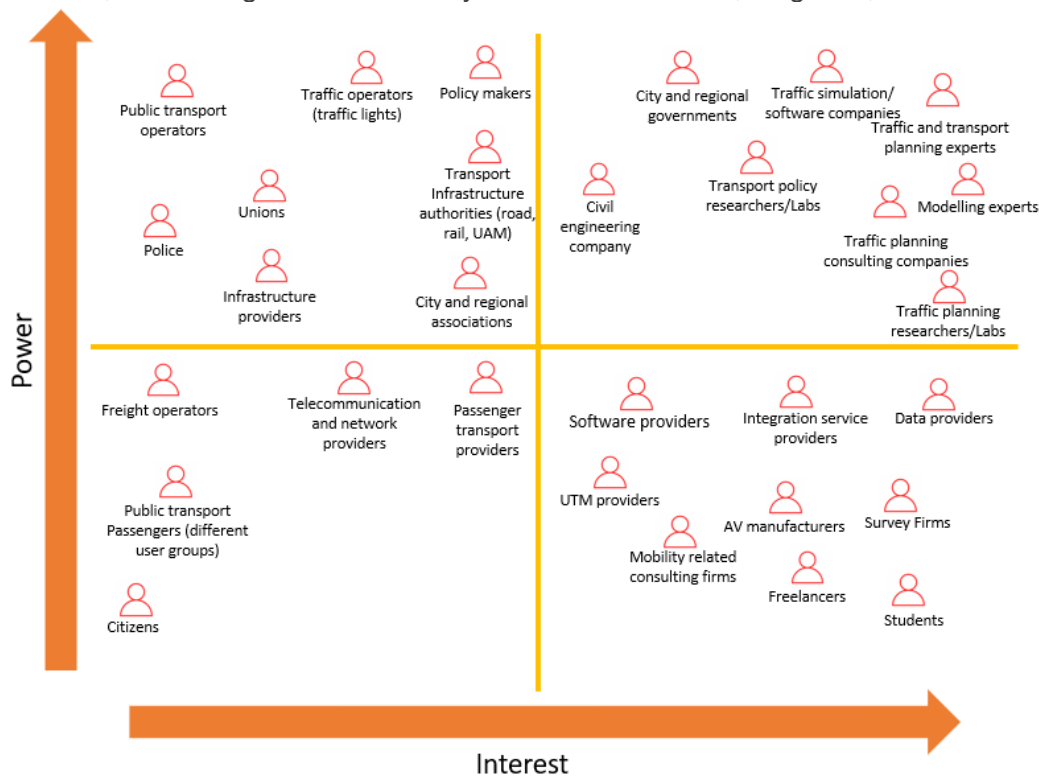


Figure 4 Power Interest Grid for the HARMONY Stakeholder Groups

This analysis was helpful for the inclusion of external stakeholders in WP1, WP9, and WP10, to define the platform requirements and better understand the needs and expectations of various stakeholders. Based on this classification, we have identified the main target group for the project exploitable results, specifically, HARMONY MS including different simulations and models.

According to the power-interest grid, key actors with high power and high interest include potential customers and end users as modelling experts, traffic and transport planning experts, traffic simulation/software companies, traffic planning consulting companies, traffic policy researchers/labs, city and regional governments, as well as civil engineering companies. The ability to develop rules, laws for the implementation of SUMPs, and favourable incentives to alter citizen behaviour is possessed by entities with a high institutional power. As they have significant influence and little vested interest in the project's outcomes, these stakeholders are regarded as ones we need to maintain satisfied. It is strategically important for the technological viability and ongoing improvements to have software providers, integration service providers, data providers, survey companies, students, freelancers, mobility-related businesses, and UTM providers. Some of these groups might convert to potential clients or contributors in the future with more resources and power. Thus, we need to keep them informed about the project results.

As they have little influence and interest in the project's outcomes, citizens, users of public transportation, freight operators, telecommunications and network providers, and providers of passenger transportation are all placed in the "Monitor" group. However, we ought to periodically check in on them to make sure that neither their power nor degree of interest has changed.

It should be highlighted that it is a research project and the technologies developed are still in development and test phases, thus the position of the stakeholder can vary through time.

4. Timeline of Stakeholder Engagement Activities

This section aims to provide a detailed visualization of all stakeholder engagement activities for HARMONY, from the beginning of the project in the last quarter of 2019 (M1) to the termination of it in the first quarter of 2023 (M45).

Stakeholder engagement activities have been and still are a fundamental task for the development of the project; therefore, interactions with key actors were planned and executed in different WPs and through different types of activities, from cross-metropolitan workshops, interviews, surveys, on-line polls/webinars to demonstrations. All these types of activities were part of each metropolitan area's co-creation labs, which are detailed in D9.4; however, this deliverable does not focus on specific activities done in each city; it rather focuses on describing general activities carried out during the lifetime of the project in order to have a holistic view on all the stakeholder engagement moments.

Other activities will be done at the end of the project that will be key for the involvement of potential clients and users, such as trainings courses/workshops. Also, a third cross-metropolitan workshop is planned for M43, as well as the final conference in M45.

In particular, the WPs involved in stakeholder engagement activities were:

WP1	<ul style="list-style-type: none"> • 1st cross-metropolitan workshop • Interviews with HARMONY areas spatial & transport planning authorities • On-line polls + webinar • Interview spatial & transport planning authorities and modellers • 2nd cross-metropolitan workshop
WP9	<ul style="list-style-type: none"> • Interviews with spatial & transport planning authorities and other stakeholders • Demonstrations (drones, delivery robot, electric van) • Passenger focus groups • Passenger + freight survey • Co-creation workshops (to inform, get feedback, discuss survey or modelling results)
WP10	<ul style="list-style-type: none"> • University training workshops (3) • Metropolitan workshop demonstrations (3) • 3rd cross-metropolitan workshop • Final Training course • Final conference

Table 2 Stakeholder engagement activities and related WP

Figure 5 gives details each one of the activities mentioned before, the related WP and the month in which the activity took place/will take place.

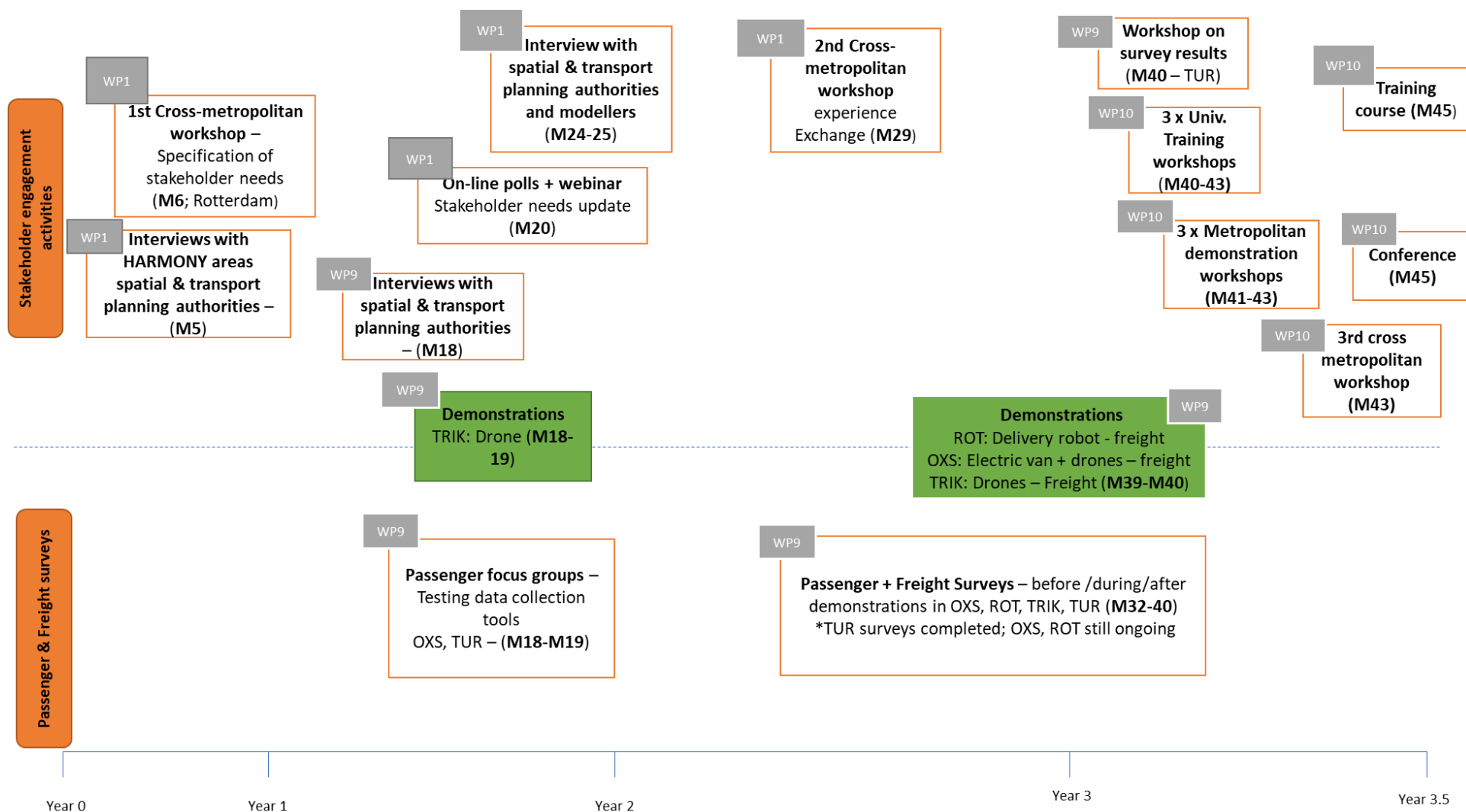


Figure 5 Stakeholder Engagement Activities Timeline

5. Stakeholder's Needs and Requirements

Co-creation and end-user involvement are essential for the process of innovation development. This implies a cooperative process where all stakeholders can influence the solutions. HARMONY conducted co-creation workshops, interviews, demonstrations, and surveys to identify needs, pain points, opinions, and suggestions about the offered solutions.

This section is focused on gathering the results and key findings of the different stakeholder engagement activities organised by HARMONY's partners. To have a better understanding of outputs, we have divided this chapter by type of stakeholder engagement activity and its correspondent results. In the next section, we have analysed these results to come up with several stakeholders' functional and non-functional requirements.

5.1 Results of Cross-Metropolitan Workshops

As explained in D1.2, HARMONY organized a cross-metropolitan workshop in Rotterdam in early November 2019 (M6) to engage key stakeholders and elicit their spatial and transport planning requirements regarding new forms of mobility and spatial design. A cross-metropolitan approach was adopted to collect a wide range of requirements from areas with different demographic, economic growth and travel needs characteristics, including important stakeholders such as public authorities, governmental bodies, municipalities, cross metropolitan, and regional authorities, etc.

The main goal of this activity was to understand barriers and opportunities to implement AVs, UAMs and drones, as well as to discuss different scenarios. Results are useful to align potentially conflicting objectives, identify room for cooperative engagement and, consequently, boost the uptake of HARMONY solutions.

During the workshop, round tables and panel discussions related to AVs and UAMs took place, in which different scenarios were discussed. In particular, the idea was to study the impact of a scenario on the overall transport system, the challenges connected to the implementation of the scenario, potential solutions for the sustainable implementation of the scenario and the performance indicators to evaluate the implementation of the scenario. The different scenarios for AVs and UAM can be found in Annex I.

Related to AVs, the impact on the overall mobility was focused on the idea that AVs contribute to an increased use of car-based mobility services (carsharing service, app-based mobility services and private AVs). Therefore, the introduction of AVs could decrease the use of public transport, since people will prefer the tailored offer of AVs, leading to more congestions, travelled miles and emissions. On the opposite case, the introduction of AVs could increase the use of public transport, especially for passengers with reduced mobility. Also, it could decrease the cost of public transport due to more targeted solutions to specific needs. In terms of economic impact, AVs could mean higher costs due to new infrastructure required and employment issues. Hence, it is clear that specific policies are needed in order for AVs to be successful.

UAM also will impact the overall mobility, specifically, land use, infrastructure needed for their implementation and design of the drone itself depending on the purpose. The main topics discussed were the problem with congestion since it is not clear if drones will indeed solve the congestion issue or if it will only add another layer of congestion (in the air). However, drones applied to freight movement are expected to reduce pollution because they are fuelled by clean energy. Also, freight movement by drone could wider the accessibility of goods in remote areas (i.e., mountainous/maritime areas), as well as to reduce travel time in case of an emergency. However, high maintenance costs and safety/security concerns still hinders users' acceptance and satisfaction.

In general, the main findings related to the introduction of AV- and drone-related mobility services in SUMPs, which is expected to result in multiple impacts on European metropolitan areas. For example, the coexistence of different business models could entail some competition among private and public mobility service providers. These latter are also expected to redirect their public

investments towards the optimization of the existing mobility infrastructure and the creation of new one according to the emerging mobility needs. On the other hand, the whole society will be affected by the implementation of AVs and drones, especially in terms of share of public transport, unemployment, accessibility for more users with reduced capabilities and liveability in European metropolitan areas overall. Quite expectably, many challenges hinder the introduction of new technology in mobility services, primarily related to their implementation costs and the lack of dedicated regulations. Additionally, safety and (cyber)security concerns, as well as uncertainties about legal issues of liability, play a remarkable role in the perception and acceptance of AVs and drones. However, some solutions are also envisaged, such as the cooperation among private and public service providers, the issuing of a thorough regulation and standardisation and the optimization of mobility infrastructure. Also, mobility stakeholders' engagement is deemed necessary to widen the number and reach of research, pilots and co-creation activities such as HARMONY's ones all over Europe.

Finally, requirements and needs from stakeholders have been identified, such as measurements to evaluate AVs and UAM implementation (total travelled time, occupancy per modem, congestion, safety, willingness to use, air traffic efficiency, etc.). More information about the indicative AV/drone related KPI that could be estimated in HARMONY MS can be found in Annex II and Annex III.

On the other hand, the second cross metropolitan workshop was held in October 2021 in Aachen, Germany. The workshop was part of the Parallel Session 1 "Parking Management, Planning for E-charging Infrastructure and Innovative Planning Decision Support" in CIVITAS Forum 2021. This was a joint session among Horizon H2020 projects Park4SUMP, Green Charge, and HARMONY. The main goal of the workshop was to exchange the experiences of the six HARMONY metropolitan areas based on the initial results of surveys, co-creation activities, and simulations of different components of the Model Suite. Additionally, the workshop gave urban and regional authorities from the CIVITAS community the possibility to express their needs and challenges related to sustainable spatial and transport planning, multimodality and integration of new mobility services and technologies by participating in the HARMONY drone delivery game.

A 3rd cross metropolitan workshop is planned for the end of the project (M43), being one of the last activities involving stakeholders.

5.2 Results of Interviews

During May and June 2021, different interviews were conducted with potential users in the transport planning sector, specifically, 6 interviews were led by ENIDE with traffic authorities and cities/regions' representatives from the metropolitan areas involved in the project. In addition, other 6 interviews were organized with traffic modellers. This set of interviews provided interesting insights regarding needs and barriers of modelling processes, SUMP's and requirements for the MS. All the insights collected were included in the list of requirements detailed in Section 6.

5.2.1 Interviews with Cities' Traffic Authorities and Representatives

ENIDE conducted interviews with six traffic authorities and representatives of the cities collaborating with HARMONY: Athens, Oxfordshire, Rotterdam, Trikala, Turin and Katowice metropolitan area. This set of interviews provided us interesting insights regarding SUMP's and modelling processes.

We have concluded that each city has different SUMP's and different processes. Some of them would like to have a single organization that oversees the plans for the regions, not by municipality. Most of them are updating their planning so new models are needed. Moreover, the main obstacle is coordination with authorities and governments regarding budgeting and decision making on transport planning. On the other hand, most of the cities depend on consultancy agencies to develop their models. However, there is a need to create their own models to reduce consultancy costs. Also, it is important to train their internal staff so that they do not have to depend on external agencies to run the models once those have been developed.

We have identified important inputs regarding end-user pain points, potential gains of using MS, important tasks and features MS should have, type of payment system and information of their current modelling processes, which are summarized in table 3.

5.2.2 Interviews with Modellers

Modellers represent important stakeholders for HARMONY project; hence, interviews with this group were conducted in order to get meaningful insights about requirements for HARMONY MS.

Regarding models and the functionality of MS, most of the modellers contacted highlighted the importance of the ease of use and integration with different models for MS, since the multimodal functionality it is necessary to show different scenarios. Similarly, flexibility is a key aspect, since according to interviewees MS should be able to integrate with existing models and tools, be adjustable to each use case and locality needs/characteristics, as well as to be able to deal with different transportation modes and use demanding data, fit different data sets from different sources. On the other hand, some interviewees, prefer an open-source platform, rather than a commercialised one. Others are interested in commercialisation and licencing. Also, if the licence is of public domain, the model could be open source, which could be helpful for intellectual development. In general, modellers agree that it is crucial to highlight the value added of the package and to prove what MS can do that other packages cannot.

Moreover, when it comes to local authorities, one of the main barriers they have are budget and time constraints, depends on external funding. Most of the cities want to have an in-house model to reduce consulting costs. Each locality has its own features, such as population and demographic characteristics, therefore models should be different/adapt to each locality.

Finally, modellers stated their opinions on end-users, remarking that the platform should be easy to understand, offer tutorials videos for different scenarios and training, which should be provided by the experts to employees, master and bachelor students, public authorities, and consultancy companies.

City	Important tasks/features	Pains	Gains of using MS	Current transport and spatial model	Revenue model for HARMONY MS
Athens	<ul style="list-style-type: none"> -Main task: report Interested in: <ul style="list-style-type: none"> - macroscopic model - Multitasking - Multilevel - Clear to understand - Clear results - Need incorporation of VISSUM with AIMSUN/LUTI 	<ul style="list-style-type: none"> - Incorporation of stakeholders (e.g. installing bike station) - Lack of metropolitan authority and coordination - Lack of unification of SUMP (vary in each municipality) OASA doesn't have the ultimate decision regarding SUMP 	<ul style="list-style-type: none"> - Quantify environmental impact 	<ul style="list-style-type: none"> - Do not have one -LUTI (WP4) - Mix in-house and onboarding consultants - Process: choosing the measure - Is being updated - Do not include signal timing plans (not needed) - Software package: Vissum 	<ul style="list-style-type: none"> - Subscription fee per year
Oxfordshire	<ul style="list-style-type: none"> - Easy to use and adjust –Local model - Strategic model: measures, different assumptions, business cases, validated - Interested in activity-based models and agent-based model (demographics) - Friendly User Interface - Language: English 	<ul style="list-style-type: none"> - Consultant fees and models difficult to update - DFD approval - Technical barriers (downwards) - Funding (depends on the ministry) - OCC procurement - Gathering data - Commercial: - Uncertainty 	<ul style="list-style-type: none"> - Great scope - Integrated models - Ability to see how different levels are linked (multilevel) (micro and macro) 	<ul style="list-style-type: none"> - Onboard consultancy - The use of the model is in-house - Investing in OMM (Oxford Mobility Model): Country wide strategic model - Consultancy agency for specific interventions (are not satisfied) - Specific departments use specific models - Software package: AIMSUN, PIRAMIX, VISSUM 	<ol style="list-style-type: none"> 1.Freemium model: <ul style="list-style-type: none"> - Extra payment for training or consultancy - One time license, training, and consultancy - Capital payment: buy MS and pay for updates 2.No subscription
Rotterdam	<ul style="list-style-type: none"> - Efficient interface –Meet noise level requirement - Integration of existing model and standardization - Interact with people doing economic measures - Traffic simulation 	Noise level –Traffic	<ul style="list-style-type: none"> - Good freight simulator - Evidence based decision making (visualize the movements of people and vehicle. energy provider, where do we need charging points, how many etc.) - Models can be implemented at a national level 	<ul style="list-style-type: none"> - Onboard consultancy - Environmental models/noise - Traffic simulation - Demographic development - Forecast for stock of houses - LUTI is automated - Software Package: Not specific one (as a good as AIMSUN) 	

Trikala	<ul style="list-style-type: none"> - Clear benefits - Visualization: Dashboard with diagrams/maps on different data collected - Interface: clear conclusions and usage of data - GIS tool (land use and traffic flow) - Freight activity based - Not complex - Lite version is preferred - Training courses are needed 	<ul style="list-style-type: none"> - Financial barriers (the use of the model depends on the funding) 	<ul style="list-style-type: none"> - Evidence based decision making - Different sectors for transport planning - Integrated value for decision making (policy makers) 	<ul style="list-style-type: none"> - In-house models - Traffic modelling by a university - Traffic modelling - Environmental, energy and metrological models 	<ul style="list-style-type: none"> - Subscription (if the agree on the price)
Turin	<ul style="list-style-type: none"> - Important tasks: see process (8 points) - Training - Language: Italian 	<ul style="list-style-type: none"> - Capacity building of the staff: no generational change 	<ul style="list-style-type: none"> - Providing new transport policy on MaaS - Measure on SUMP 	<p>Plan process is defined by law: 1. Definition of the working group; 2. Preparation of the cognitive framework; 3. Start of the participatory process; 4. Definition of objectives; 5. Participatory construction of the plan scenario; 6. Adoption of the plan and strategic environment assessment, 7. Approval of the plan; 8. Monitoring; Models from In-House companies; GTT: City of Torino is the owner</p> <p>Software packages: 5T: Vissum for macro models GTT: Vissum for building the network of PT</p>	
Upper Silesian-Zaglebie	<ul style="list-style-type: none"> - Important tasks: 12 steps from EU guidelines - Analysis and gathering data (from mobile phones, accidents with pedestrians.) - Qualitative analysis for mobility - Real time data to get movement of people from mobile phone - Trainings (free) - Simple - Visual (similar to Google Maps) - Language: English/Polish 	<ul style="list-style-type: none"> - Metropolis lacks authority - Existing transport is not good - Lack of stakeholder's alignment - Lack of modellers - Only have license for Vissum 	<ul style="list-style-type: none"> - Not clear yet 	<ul style="list-style-type: none"> - External consultancy agency - Developing a strategy upon the SUMP (new) - Transport planning model - Strategic model - Model for creating public transport network - Model for metropolitan bus line and railway - Software packages: Vissum 	<ul style="list-style-type: none"> - Annual fee

Table 3 Results Interviews with Cities' Representatives and Traffic Authorities

5.3 Results of Stakeholder Engagement Activities

Different stakeholder engagement activities have been conducted in order to collect insights regarding the HARMONY case. Each one of the metropolitan areas developed co-creation labs, which consisted of a series of events involving different stakeholders, from co-creation workshops, surveys and interviews to demonstrations (for three out of the six areas). For detailed information of the activities performed in each city, see deliverable 9.4.

Co-creation activities and workshops are fundamental in order to bring together insights and feedback from different stakeholders involved in the project. Different cities and municipalities have participated in these activities, such as Athens, Rotterdam, Katowice, Turin and Oxfordshire County Council between M13 until M24, both in person and online.

In general, the main purpose of co-creation activities/workshops was to showcase the capabilities of HARMONY for different scenarios and stakeholders and to understand main pain points, needs and requirements of actors involved. Also, studying possible policies related to new mobility models were another objective of workshops.

Important barriers and challenges were identified such as the level of social acceptance for implementing new mobility models (such as UAMs) and low user competences. On the other hand, for implementing HARMONY solutions into transport planning, financial constraints represent an important challenge for some cities, as well as lack of coordination between institutions, intermodality issues, public resistance, and safety concerns, together with low levels of readiness and accessibility of infrastructure (i.e., low use of ITS).

Therefore, requirements and needs from stakeholders have been identified from the results of the activities, showing that there is a need for promoting inter-modality, better coordination between entities and higher budgets. For model specific requirements, it is clear that 2050 forecasting and activity travel/what if scenarios are essential. Also, stakeholders were interested in having details about algorithms, version controlling models and consistency between models. Furthermore, WebTag compliance status, due diligence and beta testing were other important requirements identified.

Demonstrations and pilots are important for stakeholders engaged in the project to understand the viability and usefulness of HARMONY project. 3 demonstrations have been planned in different cities: Trikala, Oxfordshire, and Rotterdam. At the beginning of the project, the idea was to include AVs, but due to ARRIVAL withdrawal, the vehicles were substituted by a delivery robot in Rotterdam and electric van (in combination with drones) in Oxfordshire.

The drone demonstrations in Trikala have been completed during M28-30. The goal was to launch the demonstration of drone deliveries for medicines and start initial dialogue with local ecosystem on UAM, including citizens, Hellenic civil aviation authority, union of pharmacists, municipality of Trikala and universities. Nevertheless, some barriers among stakeholders participating were identified due to security and regulation concerns. After the activity, the identified stakeholder needs, and requirements were focused on the need for policies, regulation, and security measures regarding the use of drones, as well as noise levels reductions.

Other two demonstrations are planned for M39-M40 due to the fact that ARRIVAL left the consortium and the activities needed to be shifted and an alternative plan needed to be developed. One of them will be conducted in Rotterdam and consists of a delivery robot used for last mile logistics, that aims to answer some learning questions concerning technical, operational, economic, legal and social questions on the closed campus. However, the academic research performed during the pilot is mainly focused on the interaction between the robot and the environment, and not directly on city logistics. Nevertheless, they expect to involve interactions between delivery robots and public roads in the future, but this plan is still uncertain. On the other hand, by the end of 2022, other demonstrations for electric van and drones will be done in Oxfordshire for freight transport. Details on the demonstrations can also be found in deliverable 9.4.

Passenger and freight **surveys** are also important for capturing insights from stakeholders regarding HARMONY case. These surveys have been disseminated before, during and after demonstrations in Oxfordshire, Rotterdam, and Trikala during M32-M40. For instance, in Trikala, a survey related to drone deliveries game was disseminated among polish residents to understand the users' preferences on drone deliveries, highlighting parcel type, safety, drone operator, authorizations, safety of the UAV technology, security, privacy, noise (volume levels), building type, delivery point, delivery cost and delivery time. The survey has been completed but the results are not available yet. In Turin, another survey related to passenger and freight was done but there will be a workshop on the survey results planned for September (M40). On the other hand, in Oxfordshire and Rotterdam, surveys are still to be distributed closer to the demonstration dates.

Other surveys were disseminated via online questionnaires for reaching transport planning authorities in order to understand how Covid-19 affected the transport planning priorities of authorities during the 2020/2021 Covid-19 lockdowns, showing that the priority planning objectives were different in the period during the 2020/2021 lockdowns compared to the period before that. The main reasons for prioritising specific planning objectives were to secure public health, minimise environmental impact, support economic recovery and address social equity. Also, the main requirements identified was the need for having an emergency planning scenario as part of the Sustainable Urban Plan Framework.

Other type of activities involved, **passenger focus groups** for Oxford and Turin, which were done in M18-19 to test data collection tools and **online polls and webinars** to update stakeholder needs in M20 of the project. For instance, a webinar "managing the unexpected: SUMP and new mobility services during COVID 19" involved metropolitan and city authorities, industry professionals, researchers and students with the goal of exploring new mobility stakeholder's requirements (due to COVID 19 pandemic) and to understand transport planning priorities. The main findings were in the short and medium run, the transport planning priorities are: Promote active mobility; Improve public transport systems; Reduce private car usage and single occupancy vehicles; Promote shared mobility, micromobility and MaaS. In the long run, the transport planning priorities are: Promote active mobility; Promote shared mobility, micromobility and MaaS; Improve public transport systems. The driver for this prioritization is primarily the environmental impact, then public health and economic recovery at the same level. However, stakeholders (mainly local authorities) identify financial limitations, public resistance, safety issues, and readiness/accessibility of infrastructure as barriers to achieve their priorities.

Upcoming Events include a 2nd co-creation lab for Athens that will take place in autumn 2022 (M40-42), as well as a third cross-metropolitan workshop that will be held in December 2022 (M43). In the same period, 3 metropolitan demonstrations will be done between M41-43. Moreover, training courses will be also part of the activities involving stakeholders, which will consist of 3 university training courses that are planned for M40-M43 and a final training course in M45 (February 2023). To conclude the project, the final conference will be done in February 2023 (M45).

6. Definition of Requirements for the HARMONY Project

Several workshops were conducted by MobyX, ICCS and UAGEAN to define functional and non-functional requirements for the project. The identification of requirements through cross-metropolitan workshops, interviews, and other stakeholder engagements activities like polls, questionnaires and surveys described in the section 5 serve to fill the list of requirements presented in this section. Requirements for the HARMONY project were identified for both HARMONY Model Suite and TSDW. In the following section, functional and non-functional requirements are described, distinguishing between Model Suite and TSDW requirements. For each requirement has a specific requirement ID, a quality attribute, description, a specification regarding the subsystem it belongs to, the users concerned, the level of difficulty, priority, and importance (1=low, 2=medium, 3= high).

6.1 Functional Requirements

Model Suite

We have identified 40 functional requirements in total for Model Suite, covering quality attributes such as integration, interoperability, usability, customization, productivity, specification, convenience/ease of use, visualization, and payment. In general, the most important functional requirements are related to the integration and running models, visualization of KPIs/outcomes and increase of efficiency for end-users.

Further analysis allows to classify requirements depending on the level of priority/importance and to relate those to the level of difficulty/attainability during the lifetime of the project. We have encountered that there are 20 functional requirements that are considered as “high priority” and “highly important”, from which 11 are categorized as low difficulty, 8 are categorized as medium difficulty and only 1 is considered as highly difficult. This means that from the most important requirements, half of them can easily be obtained within the timeline of project as the level of difficulty is not high and will not need major changes/improvements of the platform. Those requirements are related to customization, integration, performance, usability, specification, and user’s credentials issues.

On the other hand, there are other requirements that are not considered as an urgent priority, in particular, 10 requirements that are categorized as medium priority and 10 that have a low priority. Nevertheless, most of those requirements are important for HARMONY’s stakeholders (between 2-3 level of importance), which highlights the idea that even when these requirements will not be met during the life of the project, once investment is increased, the focus will be to achieve the less prior but still important requirements. Some of the requirements identified under this category are linked to access to the platform, usability, payment, interoperability, extensibility, and flexibility characteristics.

Req. ID	Quality Attribute	Description	Component/sub-system	Users concerned	Difficulty	Priority	Importance
			To which subsystem/s it belongs	Modellers, Planners, Admins	1=Low, 2=Medium, 3=High	1=Low, 2=Medium, 3=High	1=Low, 2=Medium, 3=High
Req_02	Integration	The platform should be able to start and stop the execution of integrated models	backend	Modeller, Planner	1	3	3
Req_03	Integration	The platform should provide to each integrated model the inputs it needs to run	backend	Modeller, Planner	1	3	3
Req_04	Integration	The platform should obtain from each integrated model that completes its execution the outputs it generates and persist them.	backend	Modeller, Planner	1	3	3
Req_05	Integration	The platform should obtain from each integrated model that is under execution the progress of that model.	backend	Modeller, Planner	2	3	3
Req_06	Integration	The platform should be able to process the model outputs and calculate KPIs defined by transport modellers by transforming and combining different outputs	TSDW	Modeller, Planner	2	2	3
Req_07	Integration	The platform should be able to process the model outputs and reading KPIs that are already contained in the outputs	dashboard	Modeller, Planner	1	3	3
Req_08	Interoperability	The platform should allow running a sequence of models (where some of the first model's outputs become inputs for the second model, and so on)	backend	Modeller, Planner	2	3	3
Req_09	Interoperability	The platform should allow running models in parallel to speed up the analysis of a single scenario & to allow different users to run the same component (multi-tenancy)	backend	Modeller, Planner	3	1	2
Req_10	Usability	The planner should be able to select which model series (scenario) to run	frontend	Planner	1	3	3
Req_11	Customization	The planner should be able to customize each model in a selected series (i.e. provide values for each input of the model)	frontend	Planner	1	3	3
Req_12	Customization	The planner should be able to see which model (earlier in a series) generated which input data (later in the series).	frontend	Planner	1	2	2
Req_13	Usability	The planner should be able to run a series of models by clicking a button.	frontend	Planner	1	3	3
Req_14	Usability	The planner should be able to upload data (files to be used as inputs to models)	frontend	Planner	1	3	3
Req_16	Usability	The planner should be able to see and/or download sample files for each file input, to see what is expected from each input file, and also in which form/format (on top of the description of each input).	frontend	Planner	3	1	2

Req_17	Productivity	The planner should be able to select from files that he or she uploaded in the past instead of uploading new files (when customizing a model series)	frontend, TSDW	Planner	3	2	3
Req_18	Usability	The planner should be able to associate each uploaded file to a corresponding model input.	frontend	Planner	1	2	3
Req_20	Convenience/ease of use	The planner should be able to select from files that others in the same user group uploaded in the past instead of uploading new files (when customizing a model series)	frontend	Planner	3	2	2
Req_21	Usability	The planner should be able to specify a default run for a series of models and several alternative runs (by providing different inputs)	frontend	Planner	2	3	3
Req_23 ₁	Productivity	The planner should be able to clone an existing project into a new one and use that as a starting point, instead of starting from selecting a project template	frontend	Planner	2	2	2
Req_24	Performance	The planner should be able to follow the progress of a scenario via a progress indicator.	frontend	Planner	1	3	3
Req_25	Usability	The planner should be able to delete the results of a scenario	frontend	Planner	1	2	2
Req_26	Usability	The planner should be able to delete the specification of scenario - this deletes also the results	frontend	Planner	1	2	2
Req_27	Usability	The planner should be able to delete a project - this deletes also all the scenarios and all their results	frontend	Planner	1	2	2
Req_29	Visualization	The planner should be able to visualize the results of a scenario, i.e. the KPIs, using graphs, diagrams, charts, tables, maps	dashboard	Planner	3	3	3
Req_30	Usability	The planner should be able to see the values of all inputs and outputs of a scenario that was run (and be able to preview and download all files)	dashboard	Planner	2	3	3
Req_33	Visualization	The planner should be able to visually compare the results from different scenarios	dashboard	Planner	2	3	3
Req_34	Usability	The planner should be able to download the data of a KPI in different formats including csv, html, and pdf	dashboard	Planner	2	2	3
Req_35	Specification	The modeller should be able to specify which KPIs should be shown as results for a scenario	dashboard	Modeller	2	3	3
Req_36	Specification	The modeller should be able to specify the default graph for each KPI	dashboard	Modeller	1	3	3
Req_37	Specification	The modeller should be able to specify a component by specifying its model id, and its input and the output parameters	cross-cutting/TSWD	Modeller	2	3	3

¹ Project is a collection of scenarios. This is another way of creating scenarios. Instead of starting from scratch you can clone an existing scenario and bring changes to it.

Req_38	Extensibility	The modeller should be able to onboard one or more components to the platform by providing the component code	cross-cutting/TSWD	Modeller	3	1	2
Req_39	Specification	The modeller should be able to provide a project template that describes the order in which several components (if more than one) should be run and which model outputs are used as model inputs	cross-cutting/TSWD	Modeller	2	3	3
Req_40	Credentials	The admin should be able to create new users and give them credentials	frontend	Admin	1	3	3
Req_41	Access	The admin should be able to create new user groups and associate users to groups	frontend	Admin	1	1	2
Req_42	Access	The admin should be able to delete users and user groups	frontend	Admin	1	1	2
Req_43	Access	The admin should be able to change the ownership of projects across users	frontend	Admin	2	1	2
Req_44	Usability	The admin should be able to do whatever a planner and a modeller is able to do	frontend	Admin	2	1	2
Req_54	Flexibility/customization	The modeller should be able to dynamically select which components to run in a sequence.	cross-cutting/TSWD	Modeller	3	1	1
Req_67	Payment	The user should receive a message confirming that they have paid for the product	cross-cutting	All	2	1	1
Req_68	Payment	The user should receive a message in case of any error in the payment	cross-cutting	All	2	1	1

Table 4 Model Suite Functional Requirements

TSWD

For TSDW, we have found 10 functional requirements, with quality attributes like access control and security, versioning/searching/reproducibility, storage, and interoperability. As the following table show, important requirements cover aspects such as securing and storing data to run simulations, as well as to store data coming out of simulations, to calculating KPIs.

Regarding the level of priority/importance and how difficult it will be to achieve the requirements needed, we have found that 9 functional requirements are considered as both high priority and highly important², from which all of them are considered to be categorized with a medium difficulty, which means that in order to comply with the needed requirements within the lifetime of the project, efforts will be needed, specifically for access control, versioning, searching, reproducibility, data storage and interoperability features. By contrast, only 1 requirement is categorized as “low priority/importance” related to customization of components to run in a sequence, which is considered as highly difficult feature to achieve during the project.

² Only 1 requirement concerned to the platform integration and combination of different outputs to calculate KPIs define by transport modelers, is considered with a medium priority but highly important, with a medium level of difficulty

Req. ID	Quality Attribute	Description	Component/ sub system	Users concerned	Difficulty	Priority	Importance
			To which subsystem/s it belongs	Modellers, Planners, Admins	1=Low, 2=Medium, 3=High	1=Low, 2=Medium, 3=High	1=Low, 2=Medium, 3=High
Req_1	Access control and security	The TSDW should support the configuration of user groups, access rights and roles that encompasses data related to access control and security.		Admin	2	3	3
Req_2	Versioning / Searching	The TSDW should provide a transport simulators registry for maintaining data and metadata related to the available transport simulators and their versions.		Modeller	2	3	3
Req_3	Versioning / Searching / Reproducibility	The TSDW should provide a simulation scenarios registry to store data related to simulation templates and related simulation scenarios that Modellers and Planners can execute.		Modeller	2	3	3
Req_4	Storage	The TSDW should be able to store data required by the simulation to run, including:		Modeller	2	3	3
		o Structured and semi-structured data in the form of CSV, JSON, Excel					
		o Operational data including simulation workflow logs					
		o Binary Large Objects (BLOBS), including shapefiles					
Req_5	Storage	The TSDW should store raw output information coming out of the simulations		Modeller	1	3	3
Req_6	Access	The TSDW should allow interested third parties to access the stored outputs of the HARMONY MS simulators.		Modeller / Planner	2	3	3
Req_7	Interoperability	Rely on open data standards as much as possible and provide standardized data access interfaces.		Modeller	2	3	3
Req_8	Interoperability	Support data access and retrieval for components implemented in varying programming languages and which rely on different technologies (i.e. a software-agnostic model suite)		Modeller	2	3	3
Req_9	Integration	The platform should be able to process the model outputs and calculate KPIs defined by transport modellers by transforming and combining different outputs	TSDW	Modeller, Planner	2	2	3
Req_10	Flexibility/customization	The modeller should be able to dynamically select which components to run in a sequence.	cross-cutting/TSWD	Modeller	3	1	1

Table 5 TSDW Functional Requirements

6.2 Non-functional Requirements

Model Suite

In the case for non-functional requirements, there are 34 requirements for Model Suite. Those cover different attributes like efficiency, integration, extensibility, productivity, performance, etc. In general, Model Suite should be designed to allow users to integrate other models, offer scalable data, be automated, create scenarios, be easy to use and maintain, and allow only the planner to have access to his/her own project.

As mentioned before, further study of the identified requirements, helps to understand if important/priority requirements could easily be reached. From all the non-functional requirements to MS, 10 are considered as high priority and highly important, from which 5 are considered as low difficulty and the other 5 as medium difficulty, which means that the achievement of these requirements is feasible, but some efforts will be needed in order to comply with all of them within the project. These requirements cover features such as the authentication/authorization of the platform; immutability; legal aspects, convenience efficiency and customization of the platform; integration/extensibility; testability of the platform and compliance with security and architectural requirements. Following, medium priority requirements (14) were also identified. Even though are not the top priority, those requirements are also viewed as high/medium-sized important and 6 of them were low difficulty, 7 medium difficulty and only 1 with high level of difficulty.

Contrary, 10 requirements are categorized as less priority due to the level of effort that it would be needed to achieve those, since most of them have a high or medium level of difficulty, which means that stakeholders believe that first, the most attainable and important requirements should be addressed, and for the other requirements that need more technical efforts and investment, time would be needed to achieve those.

Req. ID	Quality Attribute	Description	Component/ sub- system	Users concerned	Difficulty	Priority	Importance
			To which subsystem/s it belongs	Modellers, Planners, Admins	1=Low, 2=Medium, 3=High	1=Low, 2=Medium, 3=High	1=Low, 2=Medium, 3=High
Req_01	Integration, extensibility	The platform should be designed in a way to enable the users to integrate other models easily into the platform	backend	Modeller, Planner	2	3	3
Req_15	Productivity	Data uploading should be scalable in the sense that multiple files can be uploaded easily, e.g., via a drag and drop functionality	frontend	Planner	2	2	3
Req_19 ³	Productivity	The association between the uploaded file and the model input should be automated, if possible, e.g., by relying on the name of the uploaded file to deduce the corresponding input	frontend	Planner	2	1	2
Req_22	Productivity	The planner should be able to create alternative scenarios, given a default scenario, with the least effort, e.g., by reusing files uploaded for the default scenario by default	frontend	Planner	2	2	2
Req_28	Performance	The progress indicator for a scenario run should be updated every 10 seconds at most.	frontend	Planner	1	2	2
Req_31	Customization	The planner should be able to customize the way the results are shown by being able to select which KPIs are shown and in which order in the dashboard	dashboard	Planner	2	3	3
Req_32	Customization	The planner should be able to customize the way each KPI is depicted in the dashboard: which diagram is used and how big the KPI is in the dashboard	dashboard	Planner	2	2	2
Req_45	Immutability	The planner should not be able to edit a scenario once he or she creates it	frontend	Planner	1	3	3
Req_46	Data security	Sensitive data should be encrypted or anonymized	cross-cutting	All	2	2	3
Req_47	Authentication and authorization	The platform should grant access only to authorized users	cross-cutting	All	1	3	3
Req_48 ⁴	Integration	The platform should be programming-language-agnostic: modules should be written in different programming languages	backend	All	2	3	3

³ This requirement exists because of Req_14. By association, we mean a mapping between the file and the input it corresponds to.

⁴ This is an architectural requirement

Req_49 ⁵	Testing	The platform should be easily testable: end-to-end tests with its main functionalities (creating scenarios, running them, and showing the results) should be easy to perform	cross-cutting	All	2	3	2
Req_50	Legal	The planner should only have access to his or her own projects, uploaded files, and scenario results	frontend	Planner	1	3	3
Req_51	Legal	The planner should be able to grant and revoke read access to the results of a scenario he or she run to the public.	frontend	Planner	2	1	2
Req_52	Ease of use	The platform should guide the users in all the different steps of its usage (selecting what scenario to run, uploading data, viewing results)	frontend	Planner, Modeller	3	2	2
Req_53	Scalability	The platform should be able to scale w.r.t. to the active users and scenarios that are run in parallel	backend	Planner, Modeller	3	1	2
Req_55	Flexibility/customization	The modeller should be able to dynamically select which components to run in a sequence in an intuitive way (e.g. designing a workflow)	frontend	Modeller	3	1	1
Req_56	Ease of use	The planner should be guided in the process of selecting a project template by viewing metadata for each template, e.g. name, description, components involved, diagram showing connected components	frontend	Planner	2	1	3
Req_57	Access	The user should get more information about the different buttons that exist in the platform in an intuitive way (e.g. hovering with the mouse opens explanation window - tooltip)	frontend	Planner, Modeller	1	2	3
Req_58	Access	The planner should get more information about each model input (e.g. description of the input), apart from the input name, in an intuitive way (e.g. hovering with the mouse opens explanation window - tooltip)	frontend	Planner	1	2	3
Req_59	convenience/Ease of use	The terminology used in the platform should be comprehensible to all stakeholders (different types of stakeholders, integrators) e.g., via providing a glossary of important terms	manual	All	1	3	3
Req_60	Access	The functionalities of the platform and the way to use it should be documented in a user manual	manual	All	1	1	2
Req_61	Visualization	The UI should be consistent in terms of colours, themes, design of buttons, etc. and visually pleasing	frontend	All	2	2	2

⁵ Dummy runs

Req_62	Visualization	The design of the frontend should be responsive, i.e. adapt to the different screens	frontend	All	1	2	2
Req_63	Documentation	The code of the core modules of the platform should be documented	cross-cutting	All	1	2	2
Req_64	Efficiency	The user interface should respond to user's requests within 3 seconds at most	frontend	All	1	3	3
Req_65	Payment	The platform should provide different payment options to the users	cross-cutting	All	3	1	1
Req_66	Payment Security	The platform should securely connect the user to a third part payment gateway	cross-cutting	All	2	1	1
Req_69	Privacy	Customer confidentiality and privacy must be maintained	cross-cutting	All	2	2	3
Req_70	Human error	The platform should be able to detect when people have provided inaccurate or incomplete information, e.g., when skipping a mandatory input in the specification of a scenario	cross-cutting	All	1	2	2
Req_71	Availability	The platform should have high availability (more than 95%)	cross-cutting	All	2	1	2
Req_72	Reliability	The platform should be reliable, i.e., mean time between critical errors should be more than a month	cross-cutting	All	2	1	2
Req_73	Maintainability	The platform should be easy to maintain, in particular, fixing of faults or errors should not take more than 2 hours	cross-cutting	All	2	2	2
Req_74	Standards	The platform must follow and comply with the security and architectural requirements	cross-cutting	All	2	3	3

Table 6 Model Suite Non-Functional Requirements

TSDW

There are 2 non-functional requirements for TSDW that refer to the scalability and usability of the data warehouse, mentioning the provision of enough storage and scalability to handle large datasets and to provide a user-friendly interface.

As it can be seen from the table, both requirements are important and to be given priority; however, some technical developments and improvements would be needed to achieve those, since they are categorized as a medium size difficulty.

Req. ID	Quality Attribute	Description	Users concerned	Difficulty	Priority	Importance
			Modellers, Planners, Admins	1=Low, 2=Medium 3=High	1=Low, 2=Medium 3=High	1=Low, 2=Medium 3=High
Req_9	Scalability	Provide adequate capacity and storage as well as be scalable to support large and increasing volumes of data.	Admin / Modeller	2	3	3
Req_10	Usability	The TSDW should provide a user interface to support the management of the data	Admin / Modeller	2	3	3

Table 7 TSDW Non-Functional Requirements

General Comment

In general, most of the requirements identified that are considered high priority are currently being achieved during the project, as the level of difficulty is not high, meaning that with the current features and capabilities of both TSDW and MS, those requirements will be covered. On the other hand, those requirements that are not priority, are those that have been identified as more difficult to obtain since they would need higher investment, time, and improvements of both components; nevertheless, this does not mean that would not be achieved in the future, by contrast, once the project ends, the needed efforts to comply with those requirements will be addressed so that all stakeholder's requirements will be tackled.

Moreover, the list of requirements is under constant review and new requirements will be added as the project goes on.

7. Assessment of Requirements

After identifying requirements for the HARMONY project, a survey to assess requirements was carried out with different stakeholders in order to get insights and opinions about HARMONY MS and HARMONY Dashboard. The survey was disseminated among potential users and Research and Innovation Advisory Board members. The objective of this activity was to get a sense of the user-acceptance for both elements, since getting to know what main stakeholders think of the platform is key for the life of the project. A sub-section for detailing survey results for each feature follows next.

7.1 Survey Results: HARMONY MS

Concerning HARMONY MS platform, a total of 15 participants responded to the user-acceptance questionnaire, in which respondents were asked how they would rate the platform from 1 to 5, resulting in an average response of **3.6**, meaning that MS is not completely satisfying the needs of potential users, and must be improved.

Moreover, respondents revealed that the most important features for MS are the analysis and definition of scenarios, KPIs visualization and the ease of use/flexibility of the application. Other important features identified were regarding to modelling. For stakeholders involved in this activity, the robustness in modelling framework is important, as well as to get descriptions of the models, simulations, production of statistics and results per transport vehicle. In general, the platform should be user-friendly and provide clear outcomes so that users understand the added value of MS for the planning process. Similarly, respondents highlighted the most interesting functionalities of MS, from which the interface design, presentation of results and scenarios comparison were the most liked characteristics of the platform.

On the other hand, stakeholders also provided their opinion on different characteristics of HARMONY MS, indicating the level of agreement from “Strongly Agree” to “Strongly Disagree”. With respect to **usefulness** of the platform, 46.7% of all respondents agree that using MS will increase efficiency, while 13% and 20% more or less agree and are undecided, respectively. Also, with respect to time saving, 46.7% believes that the platform will help to save time. Moreover, 46.7% also think that MS will provide them with more insights, access to different models and simulations. When it comes to work performance, 26% agrees MS will improve their productivity.

Regarding the **ease of use** of the platform, between 13% and 26.7% of respondents strongly agree and agrees that the platform is user friendly. Similarly, 40% believes it is a clear and understandable interface. However, concerning **the level of the platform usage** by users, 46.7% are still undecided on whether they will often use MS and 40% do not know if they will use the platform after the project. Furthermore, 40% more or less agree that it is not clear when can they use MS. Still, respondents also revealed that if they had access to MS, they would intend to use it (46.7% agrees).

To obtain **difficulties** to use the platform was another important part of the survey. When it comes to efforts to properly use MS, 26.7% more or less agrees that it will not require a lot of efforts, while 13.3% are undecided and another 13.3% thinks it will require some efforts from part of the end user (more or less disagree). Regarding the complexity of the platform, 33% more or less agrees that MS is complex but also, 33% more or less disagrees with this statement. Moreover, respondents agree that in order to properly use the platform and to tackle difficulties, training and help from a technical person will be beneficial. Moreover, there are still some concepts that were not clear for respondents. For instance, stakeholders highlighted their concern about the interoperability between the different transport programs and their linkage to the MS and how to upload files.

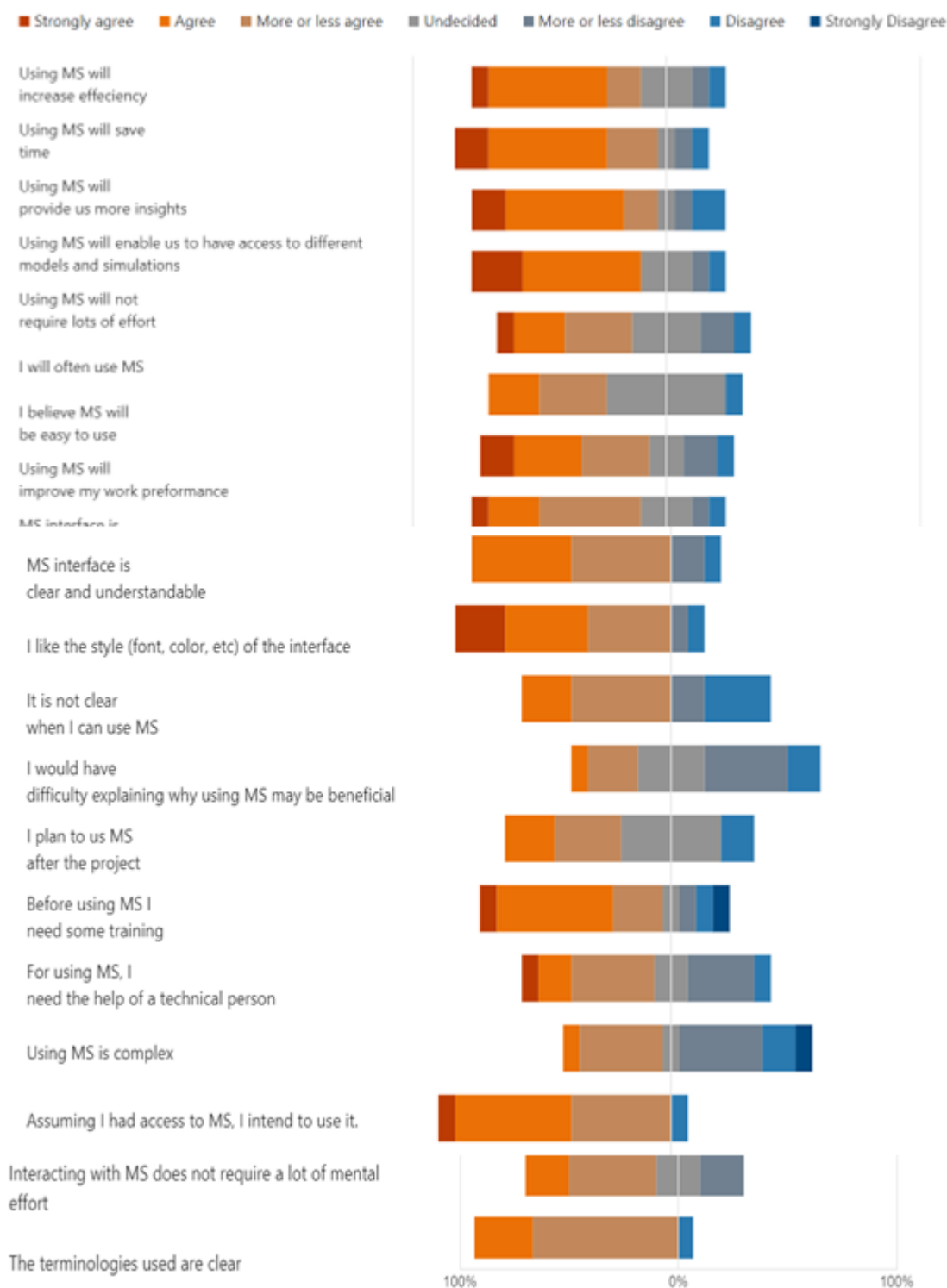


Figure 6 Survey Results for HARMONY MS

Finally, some recommendations by stakeholders involved could be gathered from the survey. For instance, respondents suggested to make the platform simple and clear without losing the technical level. Also, some stated that a clearer difference between project and scenarios could be beneficial, as well as offering the possibility of comparing different model runs. Moreover, training courses and tutorials for using the platform were among the most suggested steps to be done in the future in order to improve the MS platform and its usage.

7.2 Survey Results: Dashboard

Similarly, the survey aimed to collect information about the user-acceptance of the dashboard. 11 respondents rated the dashboard from 1 to 5, from which the average rate was a **3.45** score. Same as before, the dashboard is not fully filling the needs of respondents and could be further improved. Likewise, stakeholders shared their opinion on different aspects of the dashboard, indicating if they strongly agree, agree, disagree, strongly disagree or were neutral about specific characteristics of the component.

Regarding **ease of use**, 61.5% agrees that the dashboard is clear and understandable. Also, 84.6% agrees that is easy to customize. Moreover, 38% understand how the dashboard functions, 30.8% finds it easy to use and 38.5% agrees that the dashboard is intuitive. In general, the dashboard is perceived as user-friendly. However, 30.8% do not think that is clear which inputs are need and how to get the outputs, but in contrast, the same percentage agrees with the statement, therefore different opinions can be found around this topic.

On the other hand, respondents also rated the dashboard taking into account if it will **improve their jobs**. For instance, around 70% agrees that the dashboard saves time and helps them being more efficient in their tasks, by interpreting results easier. However, same as for the HARMONY MS, training and manuals are seen as positive features to be added.

In general, the dashboard is considered as an important component of the MS and it is perceived as secure and useful.

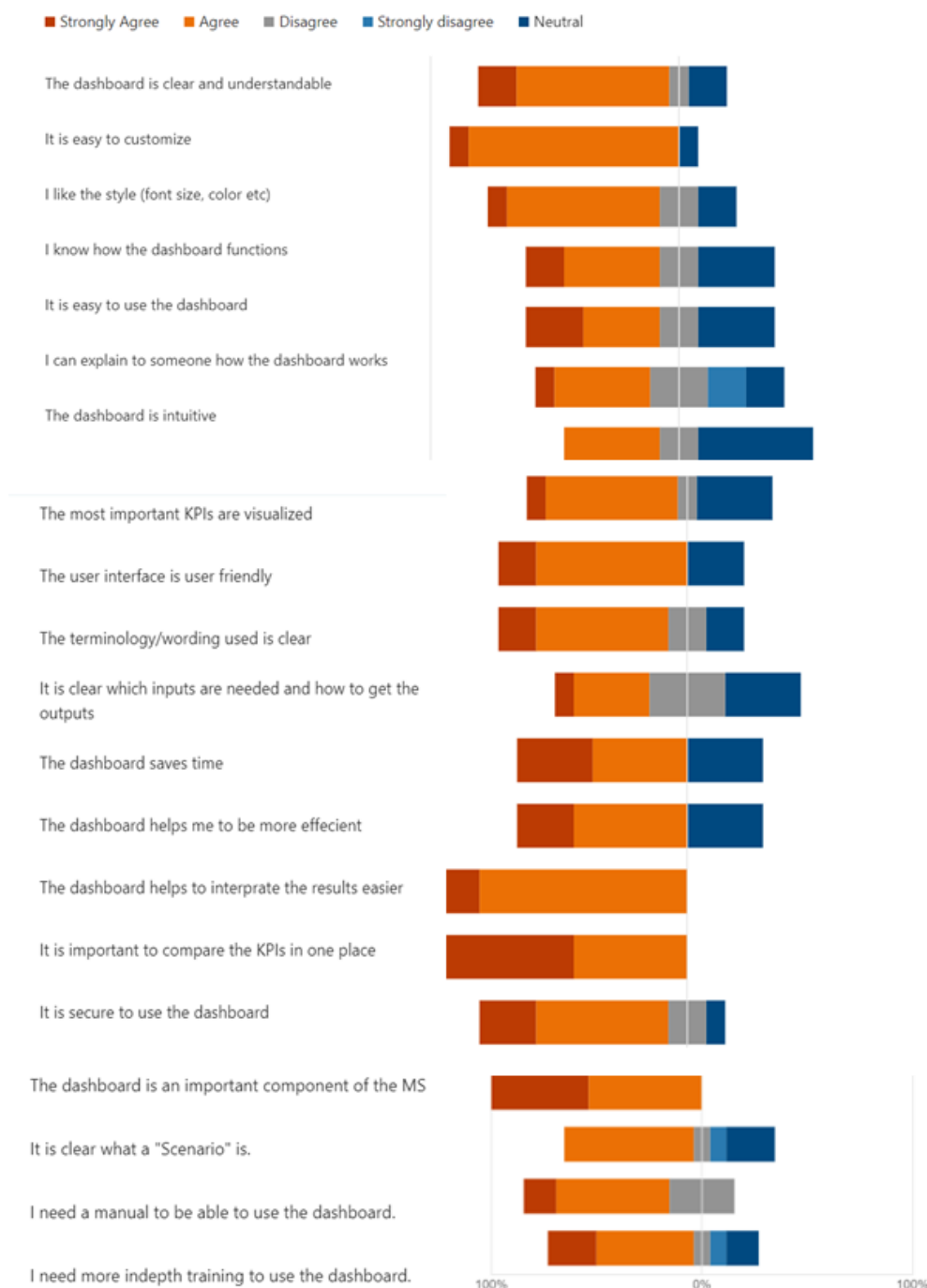


Figure 7 Survey Results for Dashboard

Nevertheless, the dashboard has some complications identified by stakeholders, such as the initial set up and the fact that a different ID is needed every time to access it, defining scenarios and coupling them to actual model runs, and customization.

In addition, stakeholders stated their interests on new features for dashboard, like the possibility of creating maps and pivot tables from output files, more types of visualization and being able to fully customize the dashboard by the user according to his/her needs.

8. Conclusions

Stakeholder engagement activities, such as the ones detailed in this deliverable, are of primary importance to ensure a good understanding of the opinions, pain points and needs of all parties involved, so that requirements for HARMONY MS and other solutions can be identified.

Initiating with the explanation of the methodology implemented, these deliverable details the meticulous procedure to involve stakeholders in the project through a four phases process: 1. Stakeholder's identification and classification, 2. Stakeholder's needs and requirements, 3. Definition of functional and non-functional requirements, 4. Assessment and evaluation.

In phase 1, an internal workshop was conducted to identify and classify stakeholders according to their importance, relevance, resources, and attitude. In section 3, the initial stakeholder scan provided a list of 11 groups and 45 subgroups relevant to HARMONY project. Nevertheless, further analysis helped to focus on those stakeholders, which are considered to have high power (in terms of resources) and high interest in the project, together with those which have high impact on the sector. In particular, the focus has been put on transport planning authorities, cities, and regions, as well as OMEs and firms. These actors should be actively involved, and their needs should be prioritized; However, other relevant stakeholders and their requirements (high power, less interest, etc.) will be further taken into consideration by MOBY for the development of the platform.

Phase 2 aimed to identify needs, barriers, expectations, and requirements through the different activities performed for engaging key stakeholders. Section 5 provides interesting insights for the project by analysing results of different activities. Starting with a revision of D1.2 and main results of the first and second cross-metropolitan workshop, in which scenarios and its impact on the transport system were discussed, in particular for AVs and UAM, highlighting the effect on new mobility services on the whole society in terms of share of public transport, unemployment, accessibility for more users with reduced capabilities and liveability, as well as the barriers to adapt new technologies like high costs and security/liability issues. Moreover, interviews with potential users such as traffic authorities, cities/region's representatives and modellers were conducted, from which important requirements for MS and modelling were identified, together with interesting insights related to SUMPs, such as the need for in-house models to reduce costs, friendly and efficient interface, integration of existing model and standardization, simulations, and better coordination between authorities and governments regarding budgeting and decision making on transport planning. Also, results of other stakeholder engagement activities, such as co-creation workshops, demonstrations/pilots, surveys, focus groups and online polls/webinars developed in different metropolitan areas are detailed in section 5.3. On the other hand, upcoming events were also included, since will be deterministic for the termination of the project, since it will involve potential users that might be interested in the platform once the project ends, such as training courses and the final conference. As it has been mentioned before, the idea was to gather all activities in a generalized matter, in order to have a holistic view on activities involving key actors. Requirements identified in this section fed the development of phase 3.

Definition of functional and non-functional requirements are detailed in section 6. A detailed list of requirements for both MS and TSDW was developed through multiple workshops with MobyX, ICCS and UAGEAN considering the needs identified in the previous phase, as well as requirements identified through polls, questionnaires, and surveys. The focus has been made on those requirements that are considered high priority and highly important, which in general are also categorized as with a low to medium difficulty, meaning that with the current capabilities of the platform, those needs and requirements will be covered, such as customization, integration, efficient performance, usability, specification and user's credentials issues, access control, authentication/authorization of the platform, versioning, searching, reproducibility, data storage and interoperability features. It is clear that there is a general need for solutions to be easy to use, clear and user-friendly. Moreover, the definition of scenarios, flexibility, and visualization of KPIs were largely highlighted. Additionally, interoperability and integration of models are key so that users can be able to run different models and use different programs. Also, there is a need for solutions to be secure and controlled, so that users feel comfortable using the platform. For instance, only the

planner should have access to his/her own projects. As it has been illustrated in this deliverable, stakeholders need that the offered solutions to improve their jobs by helping them to efficiently do their tasks and save time. On the other hand, there are other requirements that are not priority in the current stage of the project, but that does not mean that are not categorized as important. Therefore, as the project evolves, and more investment is available, these requirements will be tackled. It is important to highlight that the inventory of requirements is a document that will be continuously reviewed and updated in order to include rising needs for spatial and transport planning.

Phase 4 aims to assess the user acceptance for HARMONY MS and the dashboard through questionnaires that were disseminated among potential users and Research and Innovation Advisory Board members. In section 7, results of the surveys for both components are provided, from which it can be highlighted that the rating on the platform is not the most satisfactory result: on average 3.5 (from 1 to 5), meaning that the general feeling is that the platform could be further improved to meet needs and expectations. Following, stakeholders find solutions to be useful and interesting; however, more training and courses are needed in order to properly use the platforms, as well as new features and improvements.

In conclusion, HARMONY MS has a high potential based on the feedback received from stakeholders; nevertheless, the feedback gathered from all the activities and assessment of user acceptance should be taken into consideration to further improve the platform. Consequently, the level of user acceptance will increase, which will be evident via the increase of the platform rating. In general, it must be clear which is the added value that the platform, so that users engage in the use of the platform once the project ends. Other solutions of the project are also highly beneficial to booster the adoption of SUMP by metropolitan areas.

References

- [1] CIVITAS (2019), “Harmony cross-metropolitan workshop”, last retrieved online 21/11/2019, <https://civitas.eu/event/harmony-cross-metropolitan-workshop>
- [2] Guide to the Project Management Body of Knowledge (PMBOK® Guide)—Sixth Edition
- [3] Bryson, J.M. (2004). What to do when stakeholders matter: stakeholder identification and analysis techniques. *Public Management review* 6(1), 21-53.
- [4] Filippova, R., and Nicolas, B. (2020). *A Handbook on Sustainable Urban Mobility and Spatial Planning: Promoting Active Mobility*. No. ECE/TRANS/298.
- [5] Freeman R. E. (1984). *Strategic Management: A Stakeholder Approach*. Boston: Pitman.
- [6] Hermans, L.M. & Cunningham, S.W. 2018. *Actor and Strategy models. Practical applications and step-wise approaches*. John Wiley & Sons, Inc.
- [7] Baur, H., Watts, J., Engels, J., (2002). The importance of stakeholder involvement in the implementation of the Global Plan of Action
- [8] Taysom S., (2020). 7 Benefits of Stakeholder Engagement [WWW Document]. <https://keyahconsulting.com/7-benefits-stakeholder-engagement/>
- [9] ELTIS. (2019). “Harmony cross-metropolitan workshop”, last retrieved online 21/11/2019, <https://www.eltis.org/participate/events/cross-metropolitan-workshop-frame-harmony-h2020-project-rotterdam-7-november-2019>
- [10] Wedgwood J. (2019). The importance of stakeholder engagement [WWW Document]. <https://thehappinessindex.com/employee-engagement/importance-stakeholder-engagement/>
- [11] Skyes S. (2017). The Importance of Stakeholder Engagement with developers and testers [WWW Document]. <https://www.cpsgroupuk.com/blog/the-importance-of-stakeholder-engagement-with-developers-and-testers>
- [12] Hermans, L.M. & Cunningham, S.W. (2018). *Actor and Strategy models. Practical applications and step-wise approaches*. John Wiley & Sons, Inc.
- [13] HARMONY. (2019). D1.1 *Review of new forms of mobility, freight distribution and their business models; gaps identification in KPIs and SUMP*s
- [14] HARMONY, (2019). D10.2 *Communication kit*
- [15] HARMONY, (2022). D9.3 HARMONY areas engagement activities – Second version

Annexes

Annex I: Scenarios for AVs and UAM

Topic	Scenario	Description
AVs for passenger transport	Privately owned AVs	Households replace their private conventionally fuelled vehicles with AVs; assumption of different penetration rates.
	Door-to-door autonomous e-hailing service	App-based mobility services where the fleet is fully composed by AVs.
	Fixed on-demand responsive autonomous shuttle service	Automated passenger minibuses offering transit rides between variable locations with varying schedules or fixed stations with varying schedules.
	Carsharing services with AVs	Station-based or free-floating AVs which can be hired in the same notion as with carsharing/car-clubs.
	Bus fleets replacement with AVs	Replacement of conventionally fuelled bus fleets with fully electric AVs.
	First- and last-mile to mass transit with AVs	Automated passenger shuttles/vans/minibuses offering door-to-station and station-to-door rides.
	Integrated multimodal/intermodal services - MaaS	MaaS providers offering all or combination of the above services via a single app where riders plan and access all services seamlessly.
AVs for freight transport	Dedicated autonomous urban distribution services	Use of autonomous vans in restricted car-free areas.
	Delivery bots	Delivery bots for specific deliveries in local small-scale areas.
	Autonomous trucks and truck platooning	Use of platooning and automated trucks in specific transport corridors (i.e. connection between cities).
	Autonomous trucks	Autonomous trucks services connecting terminals with DCs.
Drones for passenger transport	On-demand point to point urban coverage	On-demand point-to-point non-stop air taxi service from one destination to another. Fluctuating medium to high demand between the destination
	Scheduled airport shuttles	Scheduled operations with fixed flight plans and pre-booked flights, flights schedules are adjusted to arrival and departure times of airport. Landing sites are close to gates and terminals.

	Intercity flights	Interregional flights connecting cities that are too close to be connected by regional flights.
Drones for freight transport	Express delivery services	Drone delivery service for dedicated high value deliveries inside urban areas.
	Port delivery services	Drone delivery service to ships in the Port of Rotterdam.
	Express delivery in remote areas	Drone delivery services connecting cities with rural areas .

Annex II: Indicative AV- related KPI that could be estimated in HARMONY MS

	Land-use & transport infrastructure	Environment	Regional economy	Inclusive communities
D1.1	Change in inter/intraregional transport infrastructure capacity	Noise levels (e.g. people exposed to high noise levels)	Change in population density	Transport affordability/poverty
	Mode sharing infrastructure/public space	Carbon intensity (CO ₂ , NO _x emissions)	% change in number of VAT registered business	Transit accessibility
	Increase of risk mitigation measures (resilience)	VMT per mode	Investments attracted in EUR	Measures of wellbeing
Workshop	Total travelled time	Occupancy per mode	GDP per region	Willingness to use AVs
	mode choice - intermodal trips		Entrepreneurial diversity	Willingness to share AVs
	Delays			Safety
	Congestion location		Employment rates	
	Coverage of service			Technology accessibility
	Communication network capacity			

Annex III: Indicative drone related KPI that could be estimated in HARMONY MS

	Land-use & infrastructure	Environment	Regional economy	Inclusive communities
D1.1	Change in inter/intraregional transport infrastructure capacity	Noise levels (e.g. people exposed to high noise levels)	Change in population density	Transport affordability/poverty
	Mode sharing infrastructure/public space	Carbon intensity (CO ₂ , NO _x emissions)	% change in number of VAT registered business	Transit accessibility
	Increase of risk mitigation measures (resilience)	VMT per mode	Investments attracted in EUR	Measures of wellbeing
Workshop	Measures of air traffic efficiency	Energy consumption	Employment rates	
	Measure of drone services demand			Technology accessibility
	Congestions			Safety
	Technical KPIs from UAV (energy consumption, operating time, etc)			

Annex IV: Stakeholder Engagement Questionnaire

Harmony First Cross Metropolitan Workshop

Organization Name: ENIDE

Stakeholder Activity Number		#1
Type	<input type="checkbox"/> Interview	<input checked="" type="checkbox"/> Co-creation Workshop
	<input checked="" type="checkbox"/> Focus group	<input type="checkbox"/> Survey
	<input checked="" type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input type="checkbox"/> Other	If other, please specify.
Date	07/11/2019	

Number of participants	44 attendees, 52 registrations
Stakeholders engaged	metropolitan and city authorities, industry professionals, academics/researchers, students, etc.
About	<p>Who: ENIDE, GROT, S&T partners</p> <ul style="list-style-type: none"> What: The workshop was structured around two main sessions on automated vehicles and drones respectively. Both provided enriching platforms for knowledge exchange and discussions, such as presentations, round tables and panel discussions. A poster session run throughout the day showcasing the HARMONY pilots in the six metropolitan areas participating in the project. When: 07/11/2019 Where: Rotterdam, the Netherlands Involved WPs: WP1, WP9, WP10
Purpose	<ul style="list-style-type: none"> The first cross-metropolitan workshop engaged key stakeholders and elicited their spatial and transport planning requirements regarding new forms of mobility and spatial design from different areas with specific demographic, economic growth and travel needs characteristics. More specifically: AVs and UAM scenarios impacts on transport systems Challenges to AVs and UAM scenarios implementation Opportunities for AVs and UAM scenarios implementation (e.g. policies, infrastructure, expertise, etc.) Identification of KPIs to evaluate AVs and UAM scenarios implementation These requirements will then feed the design of HARMONY MS and the revision of SUMP.
Findings	<ul style="list-style-type: none"> AVs impact on transport systems: AVs might decrease the share of multimodality and Public Transport. This could lead to increased congestions, travelled miles and emissions. On the other hand, the introduction of AVs as part of the public transport system could increase its attractiveness, especially for passengers with reduced mobility. AVs could entail increased expenses (technology, infrastructure, etc.) and unemployment. Challenges to AV implementation: operating costs, unequal access, insufficient regulations, competing business models, transition period with different SAE levels, energy supply, privacy, cybersecurity and safety issues Opportunities for AV implementation: infrastructure optimisation, regulations, public engagement, PPP UAM impact on transport systems: land use, infrastructure, drone design, congestions, emergency services, communications with remote areas Challenges to UAM implementation: privacy, cybersecurity and safety issues, insufficient infrastructure, insufficient regulations, lack of a clear authority in charge

	<ul style="list-style-type: none"> • Opportunities for UAM implementation: regulations • providing a reliable framework for responsibility and liability issues, as well as a selection of safe corridors for drone movement, technical aspects of drone manufacturing, creation of an air authority, public engagement and co-creation
Identified stakeholder needs and requirements	<ul style="list-style-type: none"> • KPIs to evaluate Avs implementation (integrating those in D1.1): Total travelled time, Occupancy per mode, GDP per region, Willingness to use, AVs mode choice - intermodal trips, Entrepreneurial diversity, Willingness to share AVs, Delays, Safety, Congestion location, Employment rates, Coverage of service, Technology accessibility, Communication network capacity • KPIs to evaluate UAM implementation (integrating those in D1.1): Measures of air traffic efficiency, Energy consumption, Employment rates, Measure of drone services demand, Technology accessibility, congestions, safety, Technical KPIs from UAV (energy consumption, operating time, etc)

Harmony Second Cross Metropolitan Workshop

Organization Name: ENIDE

Stakeholder Activity Number		#2
Type	<input type="checkbox"/> Interview	<input type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input type="checkbox"/> Survey
	<input type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input checked="" type="checkbox"/> Other	presentation
Date	20/10/2021	
Number of participants	30 face to face in Aachen, Germany + 20 online	
Stakeholders engaged	metropolitan and city authorities, industry professionals, academics/researchers, students, etc.	
About	<ul style="list-style-type: none"> • Who: UCL, ENIDE • What: The workshop was part of the Parallel Session 1 "Parking management, planning for e-charging infrastructure and innovative planning decision support" in CIVITAS Forum 2021. This was a joint session among Horizon H2020 projects Park4SUMP, Green Charge, and HARMONY. • When: 20/10/2021, 14:00 – 15:30 CET • Where: Hybrid in Aachen, Germany • Involved WPs: WP1, WP2 WP9, WP10 	

Purpose	The main goal of the workshop was to exchange the experiences of the six HARMONY metropolitan areas based on the initial results of surveys, co-creation activities, and simulations of different components of the Model Suite. Additionally, the workshop gave urban and regional authorities from the CIVITAS community the possibility to express their needs and challenges related to sustainable spatial and transport planning, multimodality and integration of new mobility services and technologies by participating in the HARMONY drone delivery game.
Findings	N/A
Identified stakeholder needs and requirements	N/A

Harmony Workshop: Managing the unexpected: SUMP and new mobility services during COVID-19 (webinar+ break-out session)

Organization Name: ENIDE

Stakeholder Activity Number		#3
Type	<input type="checkbox"/> Interview	<input type="checkbox"/> Co-creation Workshop
	<input checked="" type="checkbox"/> Focus group	<input checked="" type="checkbox"/> Survey
	<input checked="" type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input type="checkbox"/> Other	If other, please specify.
Date	14/12/2020	
Number of participants	117 attendees, 200 registrations	
Stakeholders engaged	metropolitan and city authorities, industry professionals, academics/researchers, students, other H2020 project, etc.	
About	<ul style="list-style-type: none"> Who: ENIDE, S&T partners, LEAD (other H2020 project) What: The webinar was structured around two main sessions on Sustainable Urban Mobility Planning (SUMP) and new transport modelling, business models and mobility services respectively. Several HARMONY partners presented the initial project outcomes, as well as the results of the HARMONY survey on the COVID-19 impact on transport planning priorities. Discussion was encouraged by a mix of platforms, such as presentations, polls and interactive workshops with a limited number of participants. When: 14/12/2020 Where: online Involved WPs: WP1, WP9, WP10 	

Purpose	<ul style="list-style-type: none"> The main goal of the webinar was to present the project initial findings and to explore whether new mobility stakeholders' requirements have arisen, especially due to the ongoing COVID-19 pandemic. As a result of the workshop, we expected: Transport planning priorities in the short and medium term Transport planning priorities in the long term Drivers for prioritization (economic recovery, social inclusion, environmental goals, social equity).
Findings	<ul style="list-style-type: none"> In the short and medium run, the transport planning priorities are: Promote active mobility; Improve public transport systems; Reduce private car usage and single occupancy vehicles; Promote shared mobility, micromobility and MaaS. In the long run, the transport planning priorities are: Promote active mobility; Promote shared mobility, micromobility and MaaS; Improve public transport systems. The driver for this prioritization is primarily the environmental impact, then public health and economic recovery at the same level.
Identified stakeholder needs and requirements	Stakeholders (mainly local authorities) identify financial limitations, public resistance, safety issues, and readiness/accessibility of infrastructure as barriers to achieve their priorities. They look at technology as a key to better transport planning process.

Athens first co-creation lab

Organization Name: OASA (Athens Public Transport Organization)

Stakeholder Activity Number		#4
Type	<input type="checkbox"/> Interview	<input checked="" type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input type="checkbox"/> Survey
	<input type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input type="checkbox"/> Other	
Date	June 2020	
Number of participants	One or two questionnaires were sent to each stakeholder, with the aim to reach out to 41 stakeholders. Feedback was received from 15 of them (37% response rate). This response rate does not apply to all the scenarios examined. More specifically, the number of questionnaires received is analyzed as follows: (a) public transport electrification: 4, (b) autonomous vehicles: 7, (c) demand responsive transit: 19, (d) micro-mobility: 5, (e) introduction (common part in all questionnaires): 14.	
Stakeholders engaged	The stakeholders were identified with respect to their role and expected contribution in the lab's outcome. These included municipalities, ministries, transport operators, infrastructure providers etc.	
About	With respect to the co-creation lab, OASA, taking into account the adverse circumstances surrounding the covid-19 pandemic and	

	<p>bearing in mind the best interest of all the involved parties, decided that it would be best for the lab to take place in a virtual form. As such, questionnaires were sent by e-mail to the stakeholders in order for them to fill them out. The questionnaires were formulated on the basis of four scenarios (case studies) that it would be for the benefit of the Athens metropolitan area to be examined. These included the following:</p> <ul style="list-style-type: none"> • Electrification of public transport (Battery Electric Buses (BEBs)) • Operation of autonomous vehicles (AVs) • Operation of demand responsive transit (DRT) • Application of micro-mobility schemes <p>The questionnaires were formulated in both the Greek and the English language.</p>
Purpose	<p>The aim of the co-creation lab was to help identify stakeholder needs and potential barriers as well as their preferences and possible recommendations over transportation-related subjects. Their responses could be of assistance in terms of more effective mid- and long-term transportation planning and the future testing of scenarios over the greater Athens metropolitan area through the use of the HARMONY MS platform.</p>
Findings	<p>Key findings of the questionnaires may be summarized as follows:</p> <ul style="list-style-type: none"> • Most of the stakeholders admit facing transportation-related challenges. These are mainly focused on difficulties regarding inter-modality issues and the reduced use of ITS. • As expected, these challenges have, among others, a clear impact on the quality of life, as well as on various economic and business aspects. • The main reason that these challenges haven't been resolved yet appears to be the lack of coordination between the entities. This is followed by restrictions on the available budget and the different objectives that the involved entities aspire to fulfil. • Most stakeholders have, however, already collaborated with other entities in the past in the context of a mobility scheme and deem their experience as successful. • All the examined scenarios (BEBs, DRT, AVs, micro-mobility) appear to be well-accepted by the general public. They are also deemed to promote the city's contemporary image. • The provision of financial incentives is argued to be important for the transition to the new mobility era. • Different advantages and disadvantages may be identified when considering the application of each of the individual scenarios. <p>The most important issues include:</p> <ul style="list-style-type: none"> • BEBs: bus line range limitations, cost of the infrastructure • DRT: flexibility of the booking policy and the service in general • AVs: safety and security concerns • Micro-mobility: inefficiencies of the regulatory framework, users' compliance to the traffic regulation laws • DRT is also viewed as a means to promote social equity, due to its ability to provide better services to special groups (e.g. the elderly, mobility-challenged people etc). • Application of each of the scenarios may have an impact on other modes of transport (e.g. taxis, private cars).

Identified stakeholder needs and requirements	<p>The key questionnaire findings drive the extraction of conclusions on the main identified stakeholder needs, concerns and requirements. These include the following:</p> <ul style="list-style-type: none"> • Promotion of inter-modality and the use of ITS. • Better coordination between the involved entities. • Increase of the available budget for interventions, provision of financial incentives for the transition to the new mobility era. • Consideration of the impact of interventions on the other modes of transport, on the quality of life and on wider economic and various business aspects. • Examination of specific concerns for each individual case study (e.g. bus line range limitations for BEBs, safety and security concerns for AVs, regulatory framework for micro-mobility schemes).
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Harmony Survey: the COVID19 Impact on Transport Planning Priorities

Organization name: UCL

Stakeholder Activity Number		#5
Type	<input checked="" type="checkbox"/> Interview	<input type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input checked="" type="checkbox"/> Survey
	<input type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input type="checkbox"/> Other	If other, please specify.
Date	November to December 2021	
Number of participants	19 public authorities	
Stakeholders engaged	All the 19 participants were from public or transport authorities	
About	It was an online questionnaire, followed by an on-line personal interview	
Purpose	<p>Whilst there is considerable research on how Covid-19 impacted travel demand, and the transport supply side, little attention has been paid on how Covid-19 affected the transport planning priorities of authorities during the 2020/2021 Covid-19 lockdowns.</p> <p>The objectives of this activity were to explore:</p> <ol style="list-style-type: none"> 1. How did transport planning priorities change during the 2020/2021 Covid-19 lockdowns⁶? 2. What actions were taken to implement the prioritised objectives and what were the reasons behind them? 	

⁶ We specifically explore the whole 2020 year and the winter/spring 2021, when most of the European countries were in lockdowns and vaccines were not available. For saving space, we refer to this period in the manuscript as 2020/2021 Covid-19 lockdowns.

	3. What barriers did the authorities face and how can the planning phases of the SUMP framework be strengthened to support emergency planning and a more resilient planning environment?
Findings	The results showed that the priority planning objectives were different in the period during the 2020/2021 lockdowns compared to the period before that. The main reasons for prioritising specific planning objectives were to secure public health, minimise environmental impact, support economic recovery and address social equity. The changes in the priority of planning objectives were also diverse between smaller and larger urban areas. Most of the actions adopted to accommodate the prioritised planning objectives were already defined before Covid-19, indicating that the lockdowns have acted as an accelerator of specific existing planning objectives.
Identified stakeholder needs and requirements	Given the challenges the authorities faced during the 2020/2021 lockdowns, as well as the identified gaps in emergency scenario planning, it is recommended emergency planning scenarios to be incorporated in some steps of the Sustainable Urban Plan framework (SUMP; or in the strategies).



Co-creation workshop: Flying taxis? Drones as a component of modern urban mobility

Organization Name: GZM (Katowice)

Stakeholder Activity Number		#6
Type	<input type="checkbox"/> Interview	<input checked="" type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input checked="" type="checkbox"/> Survey
	<input type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input type="checkbox"/> Other	If other, please specify.
Date	15.12.2020	
Number of participants	29	
Stakeholders engaged	Stakeholders from NGOs in the field of mobility, representatives of national and local governments, crisis management services, the R&D and academia, financing institutions, representatives of the drone industry	
About	<p>The HARMONY project has delivered the first workshop of the GZM in Poland with its partners GZM and UCL. The workshop was titled “<i>Flying taxis? Drones as a component of modern urban mobility</i> workshop”. It was conducted on-line in Poland (Metropolis GZM).</p> <p>Stakeholders were given a list of use cases from where they could choose, the use cases included the following:</p> <ul style="list-style-type: none"> - monitoring of events/gatherings, - monitoring of recreational areas, e.g. parks / rivers / lakes, - drone missions as support for rescue missions, - low-emission monitoring of households, - transport of documents between municipal offices, - delivery of a small load, e.g. pizza / books, - transport of medicines / medical samples. <p>The top 3 issues, ie drone missions as support for rescue missions, transport of medicines / medical samples, transport of documents between municipal offices and passenger transport - as the main topic of the workshop - were selected for further discussion.</p> <p>The co creation lab activities included a presentation from UCL on Urban Air Mobility and a presentation from GZM on its upcoming SUMP. The stakeholders were divided into groups and discussed threats and opportunities for each case study, followed by a summary and discussion.</p>	

Purpose	<p>The objectives of the workshop were (to):</p> <ul style="list-style-type: none"> - Bring together stakeholders in the Urban Air Mobility sector to update them on the region's efforts to promote the safety implementation of drones. - Capture stakeholders ideas regarding drones in use cases. Understand who are the involved actors, what are the preconditions and the implementation flow. Identify additional requirements outside the functional requirements the system is expected to perform.
Findings	<p>The top 3 issues, ie drone missions as support for rescue missions, transport of medicines / medical samples, transport of documents between municipal offices and passenger transport - as the main topic of the workshop - were selected for further discussion.</p> <p>Transport of medicines / medical samples</p> <ul style="list-style-type: none"> - to individual recipients, transport of materials for testing (e.g. samples of organic material from primary health care centers to laboratories). <p>In the case of the transport of medicines, the aspects of profitability of such a service, as well as its accessibility to the final recipient, were taken into account in particular. An interesting example was the transport of medicines to non-urbanized areas - far from urban areas. Despite the geographic accessibility advantages of using drones to transport medicines, there is concern about actual availability. In the case of deliveries to elderly residents (highly probable scenario), there is a risk of competence to use the tool.</p>

OPPORTUNITIES:

- Transport of medicines - especially to inaccessible places / (where the population density is low, areas outside the city center, rural areas, e.g. mountainous)
- Possibility of securing the 'last mile' of the sample - that is, the access to the laboratory after collection.
- Reduction of costs and expenses for transport to the laboratory. (You don't need a car and a driver - which also helps to reduce congestion).
- Transport between hospitals (samples, transplant materials, medical records)
- Widespread use of services that will increase public acceptance (incentives)

THREATS:

- High requirements for the standard of transporting organic material. (Description of the package, set of data on the package, cargo drone, conditions such as temperature, humidity etc.).
- Lack of regulations and procedures (necessity to understand procedures by e.g. hospitals)
- Interference in space (into privacy - drones flying in close space).
- Insufficient user competences - e.g. the elderly when receiving medicines from a drone.

Transport of passengers

- human transport considered in various aspects - in particular as flying taxis and air ambulances

The discussion was conducted through transporting patients, to transporting people (generally). As part of the discussion on the geographical aspect of human transport, it was decided that the transport of patients between hospitals may have the greatest chance of implementation. Such technological development was indicated as natural in relation to the currently used patient transport by helicopters. An interesting example discussed during the workshop was the use of drones to transport individuals to hard-to-reach places, e.g. employees to oil rigs, where drones can compete with both helicopters (costs, availability) and boats (costs, service time, availability).

OPPORTUNITIES

- Transport of people between hospitals – rescue from hard-to-reach places (e.g. mountain, water).
- Solving urban problems: congestion, low emissions. Closure of cities to traditional vehicles.
- Turning towards new technologies (drones).
- The use of taxis as an exclusive transport, expensive to implement – possible in very crowded cities.
- Complementing the sustainable mobility system.
- Transporting people to hard-to-reach places, such as oil rigs.

THREATS:

- Restrictions such as for helicopters.
- Concerns about public acceptance of a breach of privacy.
- Concerns of development unprofitability of drone technology for 0.5% of people (high costs).
- Transport by bicycle or scooter is cheaper and more accessible.
- Airspace congestion.
- Noise hazard.
- Risks resulting from the weather, it will not always be possible to use a drone.
- Replacing existing means of transport with non-existent ones, lack of conviction and real benefits from it.
- Threats related to nature protection (birds, animals).

In the second group the opportunities and threats to support drones as part of life-saving missions, as well as analysis for the document transport service were provided.

Support for rescue missions

- support for saving lives, e.g. in water rescue, and other places difficult to access.

An interesting effect of these works is the conclusion that by analyzing the use of UAVs to support saving lives missions, it was possible to identify more opportunities than threats.

OPPORTUNITIES:

- Can do more and better than humans - more effective.
- You can attach a sensor that interests us - we can get the data we are interested in faster (e.g. thermal imaging camera).
- We can find someone / something that interests us faster.
- In congested cities (transport on the ground) a good chance with the speed of movement.
- React quickly upon receipt of information.
- Not only in cities - mountains? Sea? access to difficult places: sand, water, congestion.
- Drone monitoring: accident, event reconstruction.
- Delivery of a defibrillator or other devices that can help quickly (e.g. monitoring of life parameters).

THREATS:

- Autonomous flight software
- Spatial side - chaos: overload in the city – air congestion / visual pollution / threat to citizens (bystanders exposed to danger during rescue operations).
- Noise - pollution
- Strongly depends on social acceptance
- Security - each mission needs different equipment - high technical requirements
- Weather threat - the chance that the drone cannot be used (in the event of disasters / threats due to weather, problematic)

Transport of documents

- between municipal offices e.g. transportation between offices in zero-emission locations / without car access.

On the other hand, the issue of transporting documents turned out to be a borderline case, indicating all the most important aspects determining the use of drones, including: costs, usability for recipients, technological challenges, as well as aspects of social acceptance, which itself does not directly affect the course of the service, but is such an important factor in building a positive image of drones in cities that it was also decided to be highlighted.

The main challenge of the service in question was its definition. It was found that, in line with the principle that *the best form of mobility is the lack of it*, documentation between municipal offices should be transferred primarily electronically. Hence the specialty of the described service for the transmission of documents from zero-emission zones, where the alternative to traditional transport is significantly limited, assuming at the same time that this service will be economically effective.

	<p>An interesting discussion was held on the frequency and form of service provision. It was indicated that the provision of the service had a greater chance of being implemented during office hours than at night (impact on the level of social acceptance and timeliness of cases).</p> <div> <div> OPPORTUNITIES: <ul style="list-style-type: none"> Accelerate the secure document transportation process - deliver on time. Autonomization - the courier aspect is eliminated. Without human intervention (e.g. related to a pandemic). Cheap - financial opportunity Possibility of building drone social acceptance among citizens. </div> <div> THREATS: <ul style="list-style-type: none"> Limited need of such a transport in 21st century, where documents should be proceeded mainly in electronic form. Qualifications and entitlements to operate drones for municipal office workers The device itself - access for participants - a small market today. Highly dependent on individual decision makers. Threat to privacy Drone accident (fall on something) </div> </div>
Identified stakeholder needs and requirements	<ul style="list-style-type: none"> The ratio of opportunities vs. threats of the use of drones depends on the importance of the missions for which the drones are used. The service positively and directly influencing human health and life received greater recognition for the implementation potential. <p>The pros are especially outweighed when drones are used to save lives. In this case, the financial aspects (profitability) take a back seat, and the level of social acceptance increases.</p> <ul style="list-style-type: none"> Contrary to indicated above, in case of document transport, the success of the implementation was clearly dependent on the specialization of the service (no other alternative) and economic efficiency - both financial and non-financial (including time saving, lack of availability of alternative means). Additional value was also indicated - building a positive image of the use of drones in cities. Among the topics of transport of documents, people and medical transport often discussed were the social costs of drone interference in the space (airspace congestion), as well as the fear of restricting privacy. <p>The proposal to introduce drones to cities is sometimes also confronted with a low level of awareness in the field of drone functionality and the opinion of local authorities that there are much more urgent problems in the field of urban mobility.</p>

	Conclusions. drones will not solve all the problems of passenger transport in the short term, but they have good opportunities for development as a means of occasional transport. In case of medicines transport – transport of life-saving medicines (where delivery time is crucial.) is the most likely to be implemented.
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Survey: Drone deliveries game

Organization Name: GZM (Katowice)

Stakeholder Activity Number		#7
Type	<input type="checkbox"/> Interview	<input type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input checked="" type="checkbox"/> Survey
	<input type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input type="checkbox"/> Other	If other, please specify.
Date	23.12.2021 - ongoing	
Number of participants	estimated number of study participants: 1000	
Stakeholders engaged	As part of the study, the participation of Polish residents is expected, taking into account representation in terms of age, sex and place of residence	
About	<p>Drone Deliveries Game survey explores the users' preferences on drone deliveries. The use cases presented in the survey came out through the HARMONY co-creation activities, especially in WP9, GZM Task 9.7.</p> <p>The survey is available in English, Polish, Greek, Spanish and Chinese.</p> <p>The game presents several scenarios where drones deliver goods. Drones may deliver goods within cities, to rural areas or villages. They may or may not be certified. They may deliver food, mail, organs/blood, or they may simply be used for surveillance. Drones may be noisy or quiet. They may deliver goods to respondent or to his/her neighbors.</p> <p>The participant of the study is to consider all the aspects contained in two pictures presented in parallel, for which he/she has to decide each time which one is more acceptable for him/her.</p> <p>The survey is carried out in Poland in the on-line formula. A professional public opinion research agency has been involved in the implementation of the task.</p>	
Purpose	Drone Deliveries Game survey has been launched to explore the users' preferences on drone deliveries.	
Findings	The results of the survey are to present the preferences for drones operations based on specified criteria in the field of: parcel type, safety - drone operator authorizations, Safety of the UAV technology, security, e.g. privacy, noise (volume levels), building type, delivery point, delivery cost and delivery time.	
Identified stakeholder needs and requirements	The survey is ongoing, all data on the achievement of results will be completed after the end of the task. The expected completion of the Drone Deliveries Game survey is March 14, 2022	

Turin co-creation lab

Organization Name: NEXT Generation Mobility (Clickutility)

Completed by: AUCM (Urban Lab Association) + CDT (Municipality of Turin)

Stakeholder Activity Number		# 8
Type	<input type="checkbox"/> Interview	<input type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input type="checkbox"/> Survey
	<input checked="" type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input type="checkbox"/> Other	If other, please specify.
Date	May 18 th , 2021	
Number of participants	2.000 about	
Stakeholders engaged	Cities	
About	Harmony MS presentation and Turin Case pitch	
Purpose	Communicate and promote Harmony EU project and its innovation framework in traffic models.	
Findings	Thanks to high number of participants, we achieved a good promotion for Harmony project	
Identified stakeholder needs and requirements	Cities, some cities could be interested to understand better Harmony capacity and to replicate model in their areas.	

Turin Urban Lab

Organization Name: Urban Lab on Air (inside NEXT Generation Mobility)

Completed by: AUCM (Urban Lab Association) + CDT (Municipality of Turin)

Stakeholder Activity Number		# 9
Type	<input checked="" type="checkbox"/> Interview	<input type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input type="checkbox"/> Survey
	<input type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input type="checkbox"/> Other	If other, please specify.
Date	May 20 th , 2021	
Number of participants	100 about real time connection and 50 views	
Stakeholders engaged	Transport Authority	
About	Harmony Turin's Case	
Purpose	Communicate and promote Harmony EU project and its innovation framework in traffic models.	

Findings	https://www.youtube.com/watch?v=q-rsJkO86dQ&list=PLSfJ8Xv_flpbc7sNQQtQVuWhfBPlzbCu1J&ab_channel=UrbanLabTorino
Identified stakeholder needs and requirements	Transport Authority, debated about Harmony Turin's case and future of Turin mobility

Turin interviews

Stakeholder Activity Number		#10
Type	<input checked="" type="checkbox"/> Interview	<input type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input type="checkbox"/> Survey
	<input type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input type="checkbox"/> Other	If other, please specify.
Date	November 2020	
Number of participants	6 interviews with core stakeholders	
Stakeholders engaged	stakeholders (academic, industry, policy maker) <ul style="list-style-type: none"> • Marco Diana (Associate Professor, Polytechnic of Turin) • Chiara Ferroni (R&D Manager Torino, Wireless Foundation) • Valentina Astori (Managing Director, Arriva Italia) • Paola Bragantini (Transport association) • Rosa Gilardi (Municipality of Turin) • Fabrizio Ghisio (Cooperative association) • Matteo Antoniola (Manager, 5T) 	
About	Online interviews https://www.youtube.com/channel/UCyUaxhMLvbq13wzGcxpzHug/videos	
Purpose	Explore topics for Turin use cases and priorities of Turin mobility	
Findings	Debate about MaaS and transportation goal for Turin and metropolitan area.	
Identified stakeholder needs and requirements	Transport Authority, debated about Harmony Turin's case and future of Turin mobility	

Turin co-creation workshop

Stakeholder Activity Number		#11
Type	<input type="checkbox"/> Interview	<input checked="" type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input type="checkbox"/> Survey
	<input type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input type="checkbox"/> Other	If other, please specify.
Date	17 th December 2020	
Number of participants	20+	
Stakeholders engaged	Knowledge institutions, policy makers, transport experts	
About	Online workshop of about 2 hours, with interactive participation on selected topics (mentimeter).	
Purpose	Description of HARMONY MS and Turin case study, explore topics for use cases	
Findings	Better shared or new knowledge; New or better policy for the modelling suite	
Identified stakeholder needs and requirements	Stakeholders debated about Harmony Turin's case and future priorities of Turin mobility	

Demonstration: e-Trikkala

Organization Name: e-Trikala

Stakeholder Activity Number		#12
Type	<input type="checkbox"/> Interview	<input type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input type="checkbox"/> Survey
	<input type="checkbox"/> Workshop	<input checked="" type="checkbox"/> Demonstration
	<input type="checkbox"/> Other	If other, please specify.
Date	21/9/2021	
Number of participants	Approx. 50	

Stakeholders engaged	Citizens, Mayor of Trikala, Hellenic Civil Aviation Authority, UCL, MobyX, University of Aegean, Union of Pharmacists in Trikala, Pharmacists (individuals), e-Trikala, Municipality of Trikala
About	The activity took place in the venue of GISEMI HUB.
Purpose	Launch the demonstration and start an initial dialogue with the local ecosystem on UAM
Findings	Participatory process in UAM, expectation in data collection as a future step Dissemination was launched through a first video: https://www.youtube.com/watch?v=ppvyjp6uFm8
Identified stakeholder needs and requirements	Municipality: policy making needs Civil Aviation Authority: security needs Pharmacists: UAM to be tested for a continuous operation

Demonstration 2: e-Trikala

Stakeholder Activity Number		#13
Type	<input type="checkbox"/> Interview	<input type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input type="checkbox"/> Survey
	<input type="checkbox"/> Workshop	<input checked="" type="checkbox"/> Demonstration
	<input type="checkbox"/> Other	If other, please specify.
Date	17/12/2021	
Number of participants	Approx. 50	
Stakeholders engaged	Citizens, Mayor of Trikala, Union of Pharmacists in Trikala, Pharmacists (individuals), e-Trikala, Municipality of Trikala, Ministry of Digital Governance	
About	The activity took place in the venue of GISEMI HUB.	
Purpose	Launch the demonstration and continue the initial dialogue with the local ecosystem on UAM	
Findings	Participatory process in UAM, expectation in data collection as a future step	
Identified stakeholder needs and requirements	Municipality: policy making needs Civil Aviation Authority: security needs Pharmacists: UAM to be tested for a continuous operation	

Workshop

Organization name: OCC

Stakeholder Activity Number		# 14
Type	<input type="checkbox"/> Interview	<input type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input type="checkbox"/> Survey
	<input checked="" type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input type="checkbox"/> Other	If other, please specify.
Date	19 th October, 2020	
Number of participants	15	
Stakeholders engaged	Local transport planners, policy makers at Oxfordshire County Council	
About	This was a workshop with local planners to explain the HARMONY modelling suite and its capabilities. It was a 2-hour online meeting conducted on Teams.	
Purpose	The primary purpose of this workshop was to explain the capabilities of the HARMONY MS and understand how it can work together with existing internal models. It was to help identify gaps in models being built within the County Council that could potentially be filled by HARMONY.	
Findings	Key Findings: <ul style="list-style-type: none"> ● 2050 forecasting is very important ● WebTAG compliance status ● Active Travel what-if scenarios are essential ● Can the planners get details of the algorithms used, especially on carbon emissions? ● Version controlling of models, network is needed ● Due diligence of model has to be internal 	
Identified stakeholder needs and requirements	1. Beta testing <ul style="list-style-type: none"> ■ What is the process? ■ Will planners get to use it before developers use it for real-life cases? 2. Version controlling 3. Due diligence 4. Details of algorithms 5. Focus on Active Travel	

Workshop

Organization name: OCC

Stakeholder Activity Number		# 15
Type	<input type="checkbox"/> Interview	<input type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input type="checkbox"/> Survey
	<input checked="" type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input type="checkbox"/> Other	If other, please specify.
Date	24th February, 2021	

Number of participants	10
Stakeholders engaged	Transport planners, HARMONY modellers
About	It was an overview meeting for the Strategic Model by UCL CASA. It was a 2-hour online meeting conducted on Teams.
Purpose	Internal planners at OCC were interested in understanding more about the LUTI model being developed by UCL CASA. This workshop was to give a detailed demonstration of the model and provide clarity to the planners on potential use cases.
Findings	History of LUTI model <ul style="list-style-type: none"> ● Technology challenges in scaling up the model ● Discussion on Interfaces ● Dis-aggregation ● Consistency between models
Identified stakeholder needs and requirements	<ol style="list-style-type: none"> 1. Levels of dis-aggregation <ul style="list-style-type: none"> ● avg: 7000 persons/msoa ● there is another experimental variation (LOUISA) looking at LSOA level ● sparse matrices (not all OD pairs will have value) 2. Usage of Oxfordshire data <ul style="list-style-type: none"> ● will 2040 plans being used? 3. Where will testing happen? <ul style="list-style-type: none"> ● land area, constraints, green belt, housing, transportation proposals 4. Connection with Local Transport & Connectivity Plan (LTCP) <ul style="list-style-type: none"> ● identify differences between models

Avs+Drones-PAX survey

Organization name: OCC

Stakeholder Activity Number		# 16
Type	<input type="checkbox"/> Interview	<input type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input type="checkbox"/> Survey
	<input type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input checked="" type="checkbox"/> Other	Meetings
Date	(multiple meetings) 2019 to present	
Number of participants	8-10	
Stakeholders engaged	Local authorities, drone operators, AV companies, modellers, on-site staff, business park manager	
About	Stakeholder meetings with Milton Park (business park) regarding conducting of drone and autonomous vehicle trials at their location. Initial meetings were done in person on site, but later they were moved to online.	
Purpose	These activities had multiple purposes: <ol style="list-style-type: none"> 1. Assessing pilot location to identify routes, landing spots and paths for drones and AVs 2. Identifying use cases for CAV and UAV trials 	

	3. Engage with business park stakeholders to understand best approaches
Findings	<ul style="list-style-type: none"> ● Governance of roads ● Control over buildings and land within the business park ● Potential time periods for the demonstrations ● Freight and Medical use cases ● Regulations with respect to drones ● Regulations with respect to autonomous vehicles ● Assessment of noise levels with surrounding neighbourhoods
Identified stakeholder needs and requirements	<ol style="list-style-type: none"> 1. Precise timelines of demonstrations to plan working hours and days within the business park 2. Details of landing spots (parking areas / building roof tops) 3. Details of flight paths (line of sight points) 4. Details of routes for van 5. Storage of equipment for pre-demo and demo activities 6. Insurance-related regulations within the business park

Workshop

Organization name: GROT

Stakeholder Activity Number		#17
Type	<input type="checkbox"/> Interview	<input checked="" type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input type="checkbox"/> Survey
	<input type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input type="checkbox"/> Other	If other, please specify.
Date	Wednesday March 3 rd , 2021	
Number of participants	20	
Stakeholders engaged	Traffic modellers, LSPs-TSPs, grid operator, charging service providers, transport authority, financial service provider	
About	On-line meeting, organized by the municipality. Participants invited from the partners of covenant ZECL Rotterdam.	
Purpose	<ol style="list-style-type: none"> 1. To inform stakeholders on the city's draft policy for charging infrastructure, specifically the heavy duty charging for logistics 2. To get feedback from the stakeholders 3. Demonstrating how the city uses the simulation tool for policy development. 4. To call upon the stakeholders to set up/participate in initiatives to gain experience with (joint) use and exploitation of heavy duty charging facilities 	
Findings	<ol style="list-style-type: none"> 1. Stakeholders have been informed by the presentation of the draft policy document 2. Feedback received and processed in final version (established Q4-2021), English version available 	

	<p>3. Presentation of a heatmap (computed with the HARMONY-TFS), indicating transport energy demand at depots, destinations and <i>en route</i>.</p> <p>4. Stakeholders have not taken initiatives yet.</p>
Identified stakeholder needs and requirements	<p>Investment decisions such as where to locate depots for ZE deliveries in the city depend on the availability of sufficient electric energy.</p> <p>Spatial planning of energy grid development is heavily interwoven with the implementation of ZE freight transport policy.</p>

Other

Organization name: GROT

Stakeholder Activity Number		#18
Type	<input type="checkbox"/> Interview	<input type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input type="checkbox"/> Survey
	<input type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input checked="" type="checkbox"/> Other	Development of (domestic) waste transport module for TFS
Date	Q2-2021 until Q2 2022	
Number of participants	5	
Stakeholders engaged	Municipal Waste Collection Department, Commercial Waste Service Providers, Technical University Delft, Mobility <u>Department</u>	
About	(preparations for) Adding a waste transport module to the freight simulator.	
Purpose	<p>In view of the anticipated growth in space and transport capacity resulting from the city's policy on circularity (Zero Waste by 2040), it was considered relevant to take first a step of integrating this component of city logistics in the simulation tool. Legally, domestic waste collection is a public responsibility, while private parties provide waste collection services for the rest of the city.</p> <p>Please explain the main purpose of developing the activity, which inputs you were trying to obtain from stakeholders and expectations.</p>	
Findings	<p>An MSc student has modelled the process of domestic waste collection (planning and operation), supervised by staff from the municipal department. KPI's have been developed, and methods have been implemented to optimize the performance of the system. Getting feedback from the people carrying out the planning and the collection has greatly improved the quality of the result. A sound basis has been created to integrate the submodel in the TFS. We hope to carry out a similar process with the commercial waste collectors.</p>	
Identified stakeholder needs and requirements	<p>Refuse trucks have a bad image, and waste collection is a controversial subjects, about which the municipality frequently gets complaints. A realistic simulation tool describing the process (preferably combining domestic and commercial waste collection) will</p>	

	support a good stakeholder dialogue about service level, minimizing externalities and reserving space.
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Other

Organization name: GROT

Stakeholder Activity Number		#19
Type	<input type="checkbox"/> Interview	<input type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input type="checkbox"/> Survey
	<input type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input checked="" type="checkbox"/> Other	Cooperation with knowledge partner Hogeschool Rotterdam in development and application of simulators
Date	Started Q2 – 2020 and still ongoing	
Number of participants	4	
Stakeholders engaged	Knowledge partner Hogeschool Rotterdam, (educational institute, Rotterdam Academy of Applied Science), Technical University Delft, City of Rotterdam (Mobility Department), Shipper AS Watson, TSP J.C. Cornelissen, Significance	
About	Action to promote the application of the TFS and OFS.	
Purpose	Starting at a Thematic Table session, Hogeschool Rotterdam suggested that the TFS might be applied in a contract research project which HR carried out for AS Watson and Cornelissen. This suggestion has led to an initiative to jointly investigate if (parts of) the HARMONY MS might serve in the research and education programme at the Hogeschool Rotterdam.	
Findings	Tentative analyses have been carried out in the research project (results are confidential). A meeting is being planned to discuss the potential cooperation in development and application of the simulators.	
Identified stakeholder needs and requirements	There is potential for logistic stakeholders to have contract research carried by Hogeschool Rotterdam out using simulation tools. The municipality seeks local partners for setting up a structure for maintenance and development of the HARMONY legacy. For the lectorate on sustainable city logistics, the availability of simulators to develop use cases for public and private parties may be an asset.	

Interview

Organization name: GROT

Stakeholder Activity Number		#20
Type	<input checked="" type="checkbox"/> Interview	<input type="checkbox"/> Co-creation Workshop
	<input type="checkbox"/> Focus group	<input type="checkbox"/> Survey
	<input type="checkbox"/> Workshop	<input type="checkbox"/> Demonstration
	<input checked="" type="checkbox"/> Other	Mobilizing and analysing the Ecostars database
Date	2021-2022	
Number of participants	More than 120	
Stakeholders engaged	Companies in various logistic segments, model developers, municipality	
About	The have been approached (at their request) to support them in making the transition to efficient and emission free city logistics (as the city is introducing a ZECL zone in 2025). In this consultation process, they answer a number of questions on their fleet and its operation. Many of these appeared relevant for the description of the behaviour of various agents in the TFS.	
Purpose	Calibration and validation of the simulator input describing the behaviour of the logistical agents.	
Findings	The municipality primarily focused on using the consultations to stimulate the individual companies. Due to our involvement in HARMONY , we realized that the reports contained much more relevant information. We therefore extracted the relevant information from the available reports (the number of which is still growing), and made it available to TUD for analysis and processing.	
Identified stakeholder needs and requirements	In the process, the city has realised that apart from the change in behaviour (e.g. investing in an electric van) of individual participants in the Ecostars programme, the population statistics is an additional project result of value for both model development and policy evaluation. As participating companies automatically become members of the Logistiek010 community, they also provide a potential target group for future questionnaires or other types of data collection.	



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