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SmartHubs

Smart Mobility Hubs as Game Changers in Transport

WP5. Impact assessment of SmartHubs Living Labs
T5.5. Integration of mobility hubs and public transport

Deliverable 5.5
Integration of shared mobility hubs and public transport

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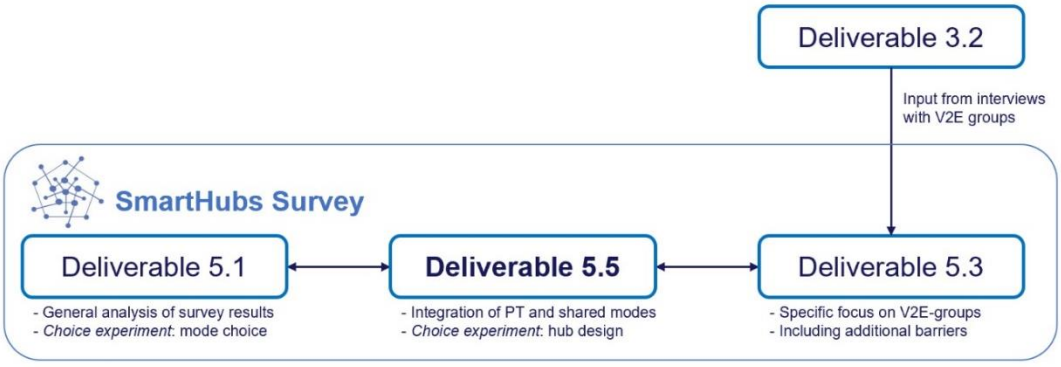
SUMMARY

This deliverable aims to assess the relative importance of different shared mobility hub design elements. A standardised survey was developed and applied among users and residents in different areas, including a stated preference experiment, to examine trade-offs between integration dimensions and the willingness to pay for different attributes of hubs.

The results underscore a disparity between the attributes most valued by respondents and their willingness to pay for them, which holds significance in the planning and functioning of mobility hubs. Although elements such as information and digital integration were indicated as prerequisites for a successful shared mobility hub, respondents are not willing to pay for it, indicating that these would have to be arranged by the government and/or transport operators. Respondents are more willing to pay for shared mobility and public transport within walking distance from one another or for placemaking strategies (such as services or landscaping), which are more evident elements related to the physical integration (and design) of hubs.

Relation to other SmartHubs deliverables

The relationship between the "Integration of Mobility Hubs with Public Transport" (Deliverable 5.5) and other SmartHubs deliverables is visualized in the diagram below. **D5.5** explicitly focuses on a hub's design and the willingness to pay for different hub elements. D5.1 explains the full setup and data-gathering process of the survey, focuses on the full sample, and focuses on mobility patterns, user clusters and mode choice. D5.3 explicitly focuses on the pre-defined (vulnerable to exclusion (V2E) groups and analyses the survey results from the perspective of those groups. D5.3 uses input from D3.2 regarding barriers and needs of V2E groups.



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1. INTRODUCTION

Shared mobility hubs have the potential to become game-changers in urban mobility and accessibility if the modes and services are adapted to the needs of all groups. Shared mobility hubs are defined as “physical locations where different shared transport options are offered at a dedicated, non-temporary and recognisable location, and public transport is available within walking distance” (Geurs et. al., 2024, p.7).

A typology, named the “SmartHubs Integration Ladder” was presented in **SmartHubs Deliverable 2.1** and published in Geurs et. al., (2024), can be used to categorise shared mobility hubs and is based on three integration dimensions: physical, digital and democratic. The presence of mobility-related services (such as shared cars, bicycles and scooters, and digital travel information provision) and other amenities (such as waiting areas, trees, kiosks for coffee, parcel storage and activity centres) are seen as physical dimensions of mobility hubs. The physical dimension describes the effort to integrate mobility and non-mobility services in the public space. In addition, the digital dimension describes the effort of integrating information from different mobility providers into one digital platform (i.e., a Mobility-as-a-Service, MaaS app) for planning, booking, and/or paying public transport and/or shared mobility trips. The democratic dimension

However, it is not clear which hub elements (being them mobility-related or not directly) improve the physical and digital integration at mobility hubs, and for which elements users and non-users of mobility hubs are willing to pay. In addition, it is not yet clear how shared mobility hubs could be better integrated with existing transport networks.

1.1. Research Objective

The goal of Deliverable 5.5 is to assess the relative importance of different shared mobility hub design elements. A large-scale survey (N=2515) was conducted among citizens of four living lab areas of the SmartHubs project: Metropolitan region Rotterdam-The Hague, in the Netherlands (MRDH), Eastern Austria (Austria), Brussels (Belgium), and Munich (Germany). Based on the responses of a stated preference experiment, we derived respondents’ willingness-to-pay (WTP) from a discrete choice model including different mobility hub elements and compared WTP across different respondent profiles. This will allow the derivation of equitable policy recommendations for the planning and designing of future mobility hubs.

1.2. Structure of the deliverable

The remainder of the report is structured as follows: Section 2 presents the theoretical framework while Section 3 the methodology, including the data collection strategy and description of the SmartHubs Survey. Results of the revealed and stated preference data are presented in Section 4, while Section 5 presents the conclusions.

2. THEORETICAL FRAMEWORK

This section starts with defining some concepts that are used throughout this study and the SmartHubs project and ends with a brief section on related literature.

2.1. Definition of concepts

A (shared) mobility hub is “a physical location where different shared transport options are offered at a dedicated, non-temporary and recognisable location, and public transport is available within walking distance” (Geurs et al., 2024, p. 7). This definition focuses on the mobility and transfer components of the hub itself, but a hub could offer multiple other mobility-related and non-mobility-related elements (CoMoUK, 2019). Besides the physical integration of multiple modes and services, hubs also incorporate digital and democratic integration dimensions (see Geurs et al., 2024).

The shared transport modes offered at these mobility hubs can be defined as shared modes or **shared mobility**. These modes, generally, are used within a city's network and the vehicles are accessible by the public for a variety of trip purposes. Within this study, shared mobility includes shared bikes or e-bikes (a), shared e-scooters (b), shared cars (c), shared e-moped (d) and shared cargo bike/ e-bike (e) (Figure 1).

(a) Shared bike/e-bike (b) Shared e-scooter (c) Shared car (d) Shared e-moped (e) Shared cargo bike/e-bike

Figure 1 Visualisation of shared mobility

A **mobility hub user** is defined in this study as a person who has used a mode of transport at a mobility hub in the last year, in their home country/residence area.

Mobility services are directly related to travelling, such as a bus stop, an information kiosk, a ticketing office, etc.

Non-mobility services can be found on a mobility hub and are not directly connected to travelling, such as cafes, restaurants, benches, trees, parcel lockers, etc.

Digital mobility skills are a measure of the capacity of a person to plan, book and pay using a mobility-as-a-service (MaaS) application. It is derived from Horjus et. al. (2022).

Mobility impairment is attributed to a person who has difficulties walking more than 10 minutes and cannot cycle or use a moped.

Vulnerable-to-exclusion (V2E) groups are defined as individuals with structural transport difficulties, i.e., people who encounter additional barriers when using transport services. Vulnerable users may belong to certain or multiple vulnerable-to-exclusion groups (**V2E-group**), potentially classified based on socio-demographical, economic, geographical, health-related or cultural factors (Martinez et al., 2022).

2.2.Related literature

Shared modes are expanding rapidly in many cities around the world and, yet little is known about their impact on travel behaviour. Shared mobility hubs are locations where shared modes can be parked, avoiding cluttering the streets and sidewalks. However, a hub takes up valuable space, therefore, smart combinations need to be made with, for example, public transport networks or bicycle parking. Research has shown that transport network changes, such as spatial expansions, price reductions and infrastructure development could change traveller's behaviour. Shared mobility hubs could, consequently, lead to mode substitution and/or integration with public transport (Luo et. al. 2023).

Several studies have estimated discrete choice models based on survey responses from a stated preference experiment. These experiments are useful to analyse trade-off behaviour between multiple attributes that affect the choices of respondents. In the context of mode choice analysis, Choudhury et.al., (2018) developed a stated preference survey to investigate the acceptability of three smart mobility options (including car sharing) alongside existing options and their traditional variants like congestion pricing and improved public transport systems.

Reck et. al. (2022) developed a stated choice experiment to estimate a mode choice model between shared and personal micro-mobility modes (e-bikes, e-scooters) and more established transport modes (public transport, car, bike, walking), and derived environmental impacts for Zurich based on distance-based substitution rates between these modes. Their findings suggest that trip distance, precipitation and access distance are fundamental to micro-mobility mode choice. Luo et.al. (2023), on the other hand, estimated a discrete choice model based on a stated preference survey distributed to identify the key factors that could shift trips from cars to shared mobility services, and the drivers that encourage the integration between

shared mobility and public transit as a multimodal system. They found that travel cost, in-vehicle time, and out-of-vehicle time, and traveller's social values and perceptions of shared mobility are crucial attributes that affect an individual's choice of shared mobility and multimodal systems.

In a study in China, Liu et al. (2022) designed a choice experiment to estimate the integration between bus and bike-sharing as feeder options to a rail system and found that bicycle infrastructure was the key element encouraging the use of bicycles. Yan et al. (2019), on the other hand, developed a choice experiment to investigate the integration of ride-railing and bus with conventional modes (walking, bicycle, car and bus) and found that waiting time for ride-hailing was the main deterrent for multimodal usage.

As shown in this brief literature review, many studies have focused on the integration of shared mobility and public transport systems in terms of their usage within a multimodal system. To the best of our knowledge, no study has yet focused on shared modes within a shared mobility hub, the relative importance of different shared mobility hub design elements, and their integration with public transport.

3. METHODOLOGY

This section will present the setup of the SmartHubs survey (3.1), the description of the study area and the dissemination strategy employed in each living lab (3.2), a description of the sample in terms of respondent's profiles, mobility patterns and familiarity with mobility hubs (3.3). The stated preference experiment of mobility hub design is presented in section (3.4), followed by the description of the discrete choice modelling approach that was used (3.5). We also apply a purchasing power correction factor to account for the different living lab contexts (section 3.6).

3.1.SmartHubs survey setup

A full description of the methodology of the survey, the data cleaning, data gathering process and sample representativeness can be found in **SmartHubs Deliverable 5.1**. The SmartHubs survey questions can be found in **Annex 8.2**.

The goal of the SmartHubs survey was to get a (quantitative) understanding of the current and potential use of mobility hubs, and the importance of physical and digital integration elements in hub design strategies. The full SmartHubs Survey can be found in Appendix 1, and Figure 2 below shows the structure of the survey.

Starting with a language selection, the survey was available in 4 languages: English, French, German (differences between Germany and Austria were considered) and Dutch (differences between The Netherlands and Belgium were considered). In the introduction (1) the goal of the survey and a definition of mobility hubs (and an image) were shown to respondents, as the information on the expected completion time and contact details of the responsible researchers. Within Section (2) 11 questions on socio-demographics including residence area, personal and household characteristics, and 3 questions on digital mobility skills were included. Section (3) contained 17 questions on mobility characteristics, and Section (4) focused specifically on mobility hubs with 16 questions including hub use and awareness, and (future) needs and preferences. The next part of the survey consisted of two choice experiments: (5) on hub design, focused on the integration of shared mobility hubs with public transport, which is the focus of the present deliverable, whereas (6) focuses on mode choice behaviour (discussed in detail in Deliverable 5.1). Section (7) has 5 questions regarding participation and democratic integration, ensuring that the three dimensions of the SmartHubs integration ladder (physical, digital and democratic) (Geurs et.al., 2024) were included in the survey.

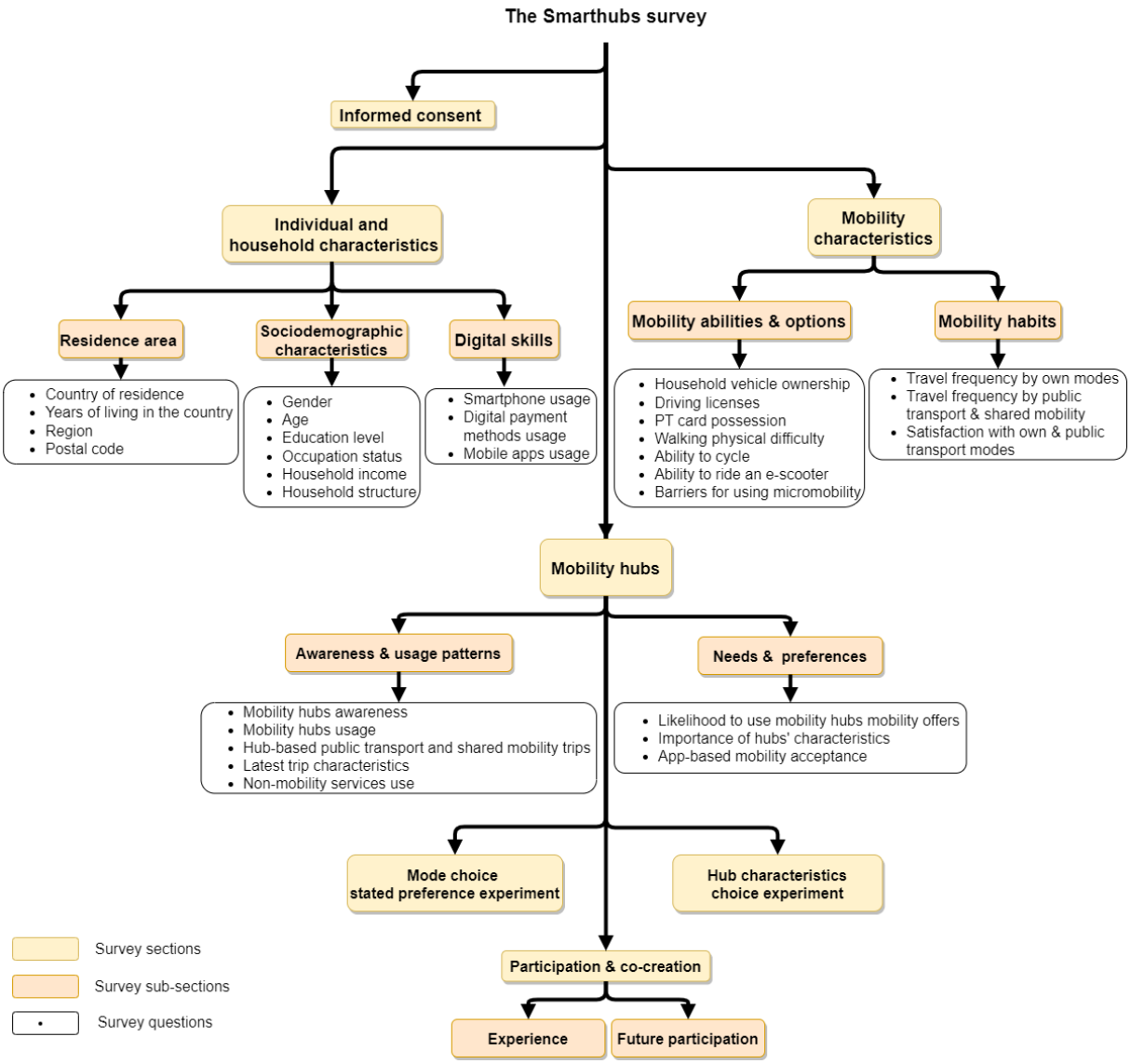

Figure 2: Structure of the SmartHubs survey

3.2.Study area and survey dissemination

The study area consists of four living labs within the SmartHubs project: Metropolitan region Rotterdam-The Hague (MRDH), Brussels, Eastern Austria and Munich. From December 2022 to March 2023, a total of 2515 responses have been collected (number of respondents after data cleaning). Different recruitment methods were used to reach respondents. Panel companies were hired to select a representative sample of respondents corresponding to the focus of each of the living labs (77% of the sample). Additionally, the link to the online survey was posted on social media (LinkedIn) and shared by mobility providers through their mailing list (16%). Because we assumed that respondents with lower digital mobility skills could face difficulties when filling in an online survey, (6%) of the responses were assisted, i.e., collected face-to-face in community centres, libraries, and other gathering places.

3.3. Respondent's profiles, mobility patterns and familiarity with mobility hubs

The respondents' characteristics will be described using univariate and bivariate statistical analysis. Specifically, Section 4 will describe the respondent's socio-demographic and economic characteristics in each living lab location, their mobility patterns and familiarity and their intention to use shared mobility at mobility hubs.

3.4. Stated preference experiment: Hub design

The goal of this experiment was to understand trade-off behaviour between physical and digital attributes of mobility hubs, and the willingness to pay for a "smarter" mobility hub. The choice of attributes and levels was based on a multidimensional typology for mobility hubs, named the SmartHubs Integration Ladder The integration ladder enables the comparison of different hubs with different services, understanding potential effects, and aiding the integration of societal goals into mobility hub developments. The higher up the physical, digital, and democratic ladders, the "smarter" the mobility hub becomes (Geurs et al., 2024).

The ladder is based on three integration dimensions: physical, digital, and democratic. However, the democratic dimension was left out of the experiment because it is related to the planning process that ideally, should occur before the design and implementation of the mobility hub. In addition, it was not realistic to analyse the effects of higher levels of participation with a willingness to pay assessment.

An unlabelled[1] stated choice experiment was developed, with two alternatives of mobility hubs and an opt-out alternative, which indicates neither of the two mobility hubs was preferred by the respondent. Table 1 presents the attributes and their levels; Figure 3 illustrates the introduction page of the experiment and Figure 4 shows an example of a choice task. Five attributes were considered, being three on the physical component (as this is the most obvious component from a hub design point of view), one digital component and one cost component:

1. ***Walking distance*** between the public transport sport and shared modes,
2. ***Information*** (the presence of), such as signage for different modes and/or a digital board,
3. ***Placemaking*** strategies, which focused on different services (e.g., café, package locker, information kiosk) or landscaping elements (e.g., trees, benches, art).
4. ***Digital integration***, which relates to the level of integration between the mobile applications of different mobility providers.
5. ***Monthly cost additional to municipal taxes*** was added to the experiment to allow for the derivation of willingness to pay.

The levels in the experiment are based on the Integration Ladder levels (Geurs et al., 2024), but using a simplified version, to make the task less complex for the respondents. In stated choice experiments, respondents must trade off each alternative in terms of its attribute levels and choose the one that better represents their preferences. The total number of possible combinations, i.e., the full factorial design generated by 2 alternatives, 5 attributes and 3 levels each would be 486 (2 x 3^5 = 486). However, only a fraction, e.g., a reduced version of the full factorial design was presented to respondents, allowing for a more efficient use of resources as it reduces the sample size. The final orthogonal fraction of this full factorial design consisting of 36 choice sets was constructed, and each respondent answered 6 randomly assigned choice tasks (Table 1).

[1] In an unlabelled choice experiment, non-specific alternatives are assigned in the choice set, such as "alternative A," or "alternative B," The labelled form involves assigning labels expressing information regarding the alternative, for example, car, bus, and train.

Table 1: Attributes and levels in the choice experiment linked with the Integration Ladder

Attributes	Attribute levels	Integration ladder levels (Geurs et al., 2024)
1. Physical Integration: Walking distance 	Level 1: public transport stop only (shared modes are all scattered and not within walking distance)	Level 0: No physical integration. One shared transport mode, not at walking distance to public transport, with no integration between the modes. No universal design criteria are considered.
	Level 2: shared modes are placed together, but not within walking distance from public transport stop	
	Level 3: public transport stop and shared modes at walking distance	Level 1: Acceptable walking distance to shared and public transport. At least two shared transport modes within acceptable walking distance to public transport and at least one service (e.g., shop, parcel locker, kiosk) within acceptable walking distance. Minimum legal inclusive design requirements are considered.
2. Physical Integration: Information 	Level 1: no signage, no digital display	Level 0
	Level 2: signage for all modes	Level 2: Wayfinding and universal design. At least two shared transport modes within acceptable walking distance to public transport with wayfinding and information on using the service and at least one service (e.g., parcel locker, kiosk) within acceptable walking distance. Universal design principles are considered, creating an accessible environment with relevant elements such as ramps, escalators, and elevators.
	Level 3: digital display and signage for all modes	Level 3: Visibility, attractive hub design and branding. At least two shared transport modes visible from a public transport stop and at least one service (e.g., shop, parcel locker, kiosk), information about the service and potential conflicts, attractive design of the mobility hub and branding, including sheltered waiting areas. Universal design principles are considered.
3. Physical Integration: Placemaking  (Landscaping)  (Services)	Level 1: no landscaping, no services	Level 0
	Level 2: landscaping (green, benches, art)	Level 3: Visibility, attractive hub design and branding. At least two shared transport modes visible from a public transport stop and at least one service (e.g., shop, parcel locker, kiosk), information about the service and potential conflicts, attractive design of the mobility hub and branding, including sheltered waiting areas. Universal design principles are considered.
	Level 3: services (cafe, package locker, information kiosk)	
4. Digital integration 	Level 1: no integration between the modes	Level 0: No digital integration of shared and public transport mode options. There are separate services and platforms for each mode. No universal design criteria are considered.
	Level 2: modes are integrated for trip planning	Level 1: Integration of information. Multimodal travel planners can be used to plan mobility offerings at hubs. Minimum inclusive design requirements are considered such as simple and intuitive app design.
	Level 3: modes are fully integrated for trip planning, booking and payment	Level 2: Integration of booking and payment and universal design. Easy access to services for end-users – such as a mobility marketplace or a one-stop shop where the user can find, book, and pay with the same app. Universal design principles are considered, including simple and intuitive app design and low-tech or analogue booking alternatives.
5. Additional costs on monthly municipal taxes	Level 1: no increase	Not present in the Integration Ladder
	Level 2: 5 Euro	
	Level 3: 10 Euro	

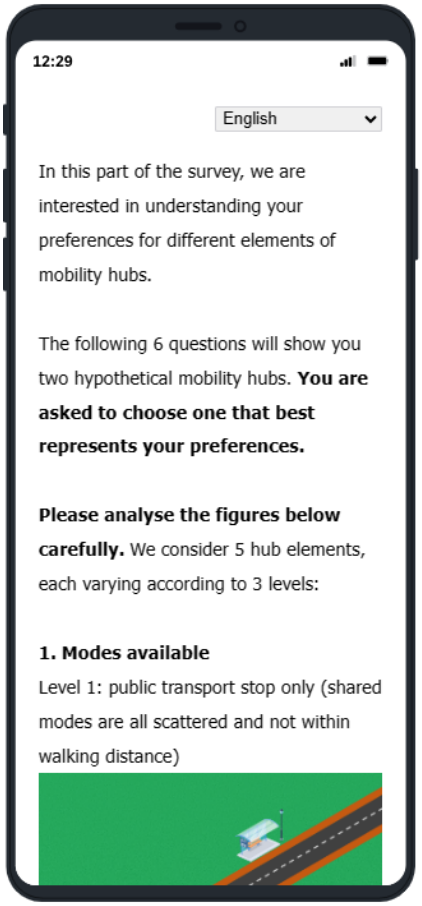

Figure 3: Introduction to the experimental task

Figure 4: Example of a choice task

3.5.Discrete choice modelling

In this section, the discrete choice model used to estimate the willingness-to-pay (WTP) for different mobility hub design elements will be introduced. It is a mixed multinomial logit model, where not only coefficients are estimated, but also standard deviations to account for panel effects (i.e., the same respondent answered 6 choice tasks). This allows for heterogeneity in the estimated parameters in addition to the heterogeneity observed in the explanatory variables, by replacing point estimates of the parameters with some assumed distribution for the estimated parameters (Ben-Akiva and Lerman, 1985).

The choice between mobility hubs 1 and 2 in choice set t = 1, …, T, for individual n = 1, …, N was modelled using the following random utility maximization specification, where *wd* (walking distance), *in* (information), *pm* (placemaking), *di* (digital integration), *co* (cost) and *i* represents the levels of the different attributes (i = 1, 2 or 3):

$$U_{1nt} = \alpha^*_{1nt} + \beta_{wdi} wd_{1i} + \beta_{ini} in_{1i} + \beta_{pmi} pm_{1i} + \beta_{dii} di_{1i} + \beta_{coi} co_{1i} + \varepsilon_{1nt}$$

$$U_{2nt} = \alpha^*_{2nt} + \beta_{wdi} wd_{2i} + \beta_{ini} in_{2i} + \beta_{pmi} pm_{2i} + \beta_{dii} di_{2i} + \beta_{coi} co_{2i} + \varepsilon_{2nt}$$

The superscript (*) represents the attributes that were considered as random parameters, to account for n individuals making different choices given i alternatives. A random parameter means that not only coefficients were estimated, but also the standard deviations, which allows for the estimation of distributions. Maximum likelihood with one hundred Halton draws was used to estimate the parameters of the model, using the software Biogeme (Bierlaire, 2023). Willingness-to-pay (WTP) was calculated by simply taking the ratio of each coefficient over the cost variable (Greene and Ortúzar, 2002).

3.6.Purchasing power correction

To allow a fair comparison between the different living lab locations, a correction factor accounting for the purchasing power standard (PPS) related to transport[2] (Figure 5) was applied to the cost attribute. Table 2 shows that PPS in Brussels is the lowest, therefore, it was used as a reference. This means that when the cost attribute was €10 in Brussels, it was considered as €9.69 in Munich (1.077/1.044), €9.35 (1.116/1.004) in Eastern Austria and €8.95 (1.167/1.044) in the MRDH region.

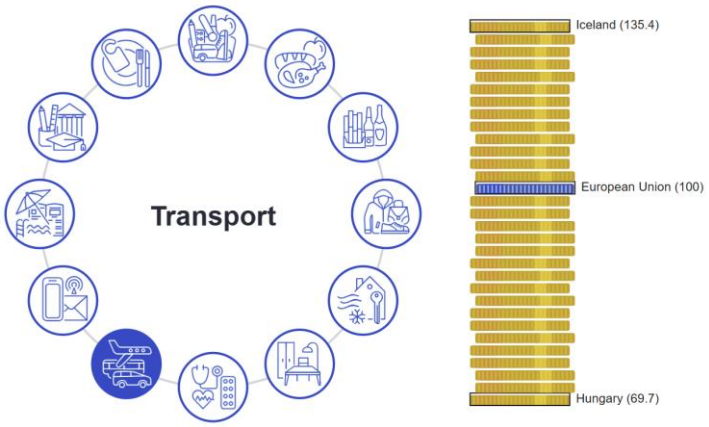

Figure 5: Purchasing power parities, Transport. Source: (Eurostat, 2022)

Table 2: Correction factor applied to the living labs, based on Eurostat (2022)

Living Lab	PPS (Transport)	Correction factor
Eastern Austria	1.116	0.9354
Brussels	1.044	1
Munich	1.077	0.9693
MRDH	1.167	0.8946

4. RESULTS

Sections 4.1 to 4.3 will present a brief descriptive analysis of the response data of the SmartHubs Survey. A more extensive analysis is presented in Deliverable 5.1. The focus of the present deliverable is on the analysis of the results of the discrete choice model estimation based on the stated choice experiment for hub design, shown in Section 4.4.

4.1. Socio-demographic characteristics

Table 3 shows the characteristics of the full sample and the sample corresponding to the 4 different living lab locations. Females are slightly overrepresented in the full sample and the MRDH and Eastern Austria samples. In terms of age, the Dutch sample has the highest share of older persons, whereas the German sample has the highest share of youngsters. These discrepancies are mainly due to the different living lab recruitment strategies. The Munich sample, for instance, has the highest share of respondents with high digital mobility

[2] "…purchasing power parities (PPPs) are currency conversion rates that are applied in order to convert economic indicators from national currency to an artificial common currency, called the Purchasing Power Standard (PPS), which equalizes the purchasing power of different national currencies and enables meaningful volume comparisons between countries" (Eurostat, 2022).

skills, since a large proportion of respondents are students, whereas Brussels' sample has the highest share of low digital mobility skills. However, the full sample shows that almost half of the respondents can plan a trip using a mobile phone, but a smaller share (37%) is classified as highly digitally mobility skilled. Regarding hub familiarity and use, 58% of respondents indicated having seen a hub before, whereas 60% indicated never using a hub before.

Table 3: Sample characteristics

Variable	Category	Full Sample (N= 2515)	MRDH (N=805)	Brussels (N=589)	Munich (N=542)	Eastern Austria (N=579)
Gender	Female	51%	55%	47%	48%	52%
	Male	49%	45%	53%	51%	48%
Age	Age below 25	17%	11%	14%	34%	12%
	25 - 45	43%	40%	45%	44%	42%
	45 - 65	27%	26%	29%	18%	36%
	Age above 65	13%	23%	12%	5%	9%
Income	Low	22%	15%	23%	32%	19%
	Medium	50%	53%	53%	38%	56%
	High	14%	15%	13%	15%	11%
	I prefer not to say	14%	17%	12%	15%	14%
Digital mobility skills	Level 0 – no phone	5%	4%	8%	3%	3%
	Level 1 – no planning	11%	9%	19%	7%	7%
	Level 2 – planning	48%	54%	45%	35%	53%
	Level 3 – plan, book, pay	37%	32%	28%	54%	36%
Seen a hub (in their living/ activity area)	Yes	58%	36%	71%	75%	57%
	No	24%	42%	15%	11%	24%
	I am not sure	18%	22%	15%	14%	19%
Used a transport mode in a hub in their living/activity area	Yes	28%	15%	40%	42%	18%
	No	60%	72%	45%	47%	73%
	I am not sure	12%	13%	15%	11%	9%

4.2. Frequency of transport mode use

Figure 6 shows the frequency of use of different transport modes (including shared modes) of the full sample and that of each living lab location. A very small proportion of respondents are regular users of shared mobility, but results vary across the countries. For instance, shared moped is more popular than shared bikes in the Netherlands, probably because bicycle ownership is very high, and a shared moped has the advantage of decreasing travel times. The Brussels sample has the highest percentage of frequent users of shared modes while Eastern Austria has the lowest. Shared scooter is not allowed in the Netherlands.

Figure 6: Frequency of transport mode use3

[3] Shared scooter is not available in the Netherlands; Public transport includes bus, tram and metro.

4.3. Importance of shared mobility hub elements

The importance of various physical and digital hub elements has been investigated. Regarding physical and digital integration, the following elements have been included, the visualizations of which can be seen in Figure 7.

a. Different options for shared mobility
b. Various services, refer to the presence of non-mobility related services at the hub, such as a parcel point or coffee corner.
c. Attractive landscaping, related to the importance of placemaking and design of the hub, such as benches, trees, lighting, or art.
d. Information provision, both signage and a digital information screen. This element is important for physical and digital integration.
e. A mobile app for planning, booking, and paying for a ride with any mode of transport, i.e., the availability of a mobility-as-a-service (MaaS) app.

Figure 7: Visualization of different hub elements

The importance of the different hub elements was assessed with the question "*Which characteristics of a mobility hub are the most important for you*?"[4] and measured using a 5-point Likert scale (from very unimportant to very important). This scale was reclassified into 3 categories (unimportant, neutral, important), and Table 4 shows the ratio between the percentage of respondents who consider the element in question important or not (neutral responses have been omitted from the calculation). It shows that, for example, 5,63 times as many respondents of the full sample find the presence of information important instead of unimportant. Overall, although information and digital integration are deemed more important elements for hub design, the differences are not so large, meaning that all elements are of importance.

Table 4: Ratio of the importance of different hub elements across the living labs

	Eastern Austria	Brussels	Munich	MRDH	Full Sample
Group size	579	589	542	805	2515
a. Different mobility options	2,25	1,41	3,62	2,14	2,17
b. Different services	4,28	4,08	4,88	3,05	3,94
c. Different landscaping elements	4,31	3,42	4,65	1,43	2,99
d. Information	7,45	5,32	6,81	4,20	5,63
e. Digital integration	6,19	2,52	10,37	6,41	5,28

[4] This question (question ID Q62222) can be found on the Appendix 7.2

4.4. Willingness-to-pay for shared mobility hub elements

Table 5 shows the estimated coefficients of the mixed logit model for the full sample, for the sample in each living lab location, and different vulnerable groups. The overall model performance is expressed by McFadden rho-square values, varying between 0.072 and 0.188. The intercept values of hub alternatives 1 and 2 in the full sample, which are compared to the opt-out alternative, are significant and have similar magnitudes, indicating there was no potential left-right bias towards choosing between the alternatives (Tirachini et.al, 2017). However, some differences were found when considering specific samples (e.g., in Eastern Austria there was a preference for hub 2). More research is needed to identify the causes of this issue.

Several parameters and standard deviations (between brackets) are significant at the 95% confidence interval (marked in bold) and have expected signs (e.g., negative costs imply decreased preferences for increasing costs). Significant coefficients and standard deviations indicate significant intra and inter-individual variation in responses due to unobserved factors affecting the choice of hub physical and digital elements. In addition, all part-worth utilities were compared to the reference level within each attribute (Level 1), which was related to the worse occurrence of each attribute (e.g., no information available).

The coefficient for walking distance (3), which represents the scenario where shared modes are located within walking distance from public transport stops, was the highest (and significant) in all samples, indicating that this was the most important categorical attribute in the experiment. Information was not significant for the MRDH (N=805) and older persons (N=393) samples, which is logical since the MRDH sample contains the largest share of older respondents compared to the other living lab locations. In addition, older persons seem to value services (cafes, package lockers, information kiosks) over an attractive design (benches, trees, art). The Munich sample, which contains a large share of students, has insignificant coefficients for information (2) and walking distance (2), which indicates a higher preference for information and walking distance at its highest level (3).

Cost, which was expressed by an additional monthly cost on municipal taxes, was shown to the respondents in the experiment as a categorical attribute (0, 5 Euros, 10 Euros) but was entered in the estimation as a continuous variable. This strategy was used to capture the linear effect of cost and apply it to each estimated coefficient of the other attributes since not always the 3-attribute level of cost corresponds to a low/medium/high occurrence of other attributes (for instance, placemaking varied as level 1: no landscaping, no services; level 2: landscaping (green, benches, art); Level 3: services (cafe, package locker, information kiosk). WTP was calculated by simply taking the ratio of each coefficient over the cost variable (Greene and Ortúzar, 2002). Cost has significant coefficients in all samples (Table 5), therefore the WTP analysis will be discussed per attribute in the next pages (Figures 8 to 13).

Table 5: Estimated coefficients of the mixed logit model[5]

Attribute levels	Integration Ladder Levels	Full Sample N= 2511	Eastern Austria (N=579)	Brussels (N=589)	Munich (N=542)	MRDH (N=805)	Users of mobility hubs (N = 615)	Nonusers of mobility hubs (N = 1896)	Low income (N=534)	Low digital mobility skills (N=452)	Females (N=1277)	Mobility impaired (N=301)	Older persons (N=393)	Migrants (N=558)
Hub 1	-	**0.163 (1.78)**	-0.196 **(1.72)**	0.259 **(1.76)**	**0.739 (0.993)**	-0.161 **(2.22)**	**0.86 (0.66)**	-0.04 **(1.97)**	**0.348 (1.45)**	**-0.49 (2.53)**	0.041 **(1.85)**	-0.19 **(2.19)**	**-0.66 (2.46)**	**0.297 (1.31)**
Hub 2	-	**0.233 (1.82)**	0.009 **(1.82)**	**0.348 (1.73)**	**0.824 (1.08)**	-0.114 **(2.07)**	**0.99 (1.01)**	0.05 **(1.99)**	**0.51 (1.51)**	**-0.46 (2.47)**	0.121 (1.83)	-0.08 **(2.09)**	**-0.66 (2.38)**	**0.365 (1.3)**
Walking distance (1)	Level 0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walking distance (2)	Level 0	**0.292**	**0.51**	**0.26**	0.137	**0.301**	**0.334**	**0.266**	**0.208**	**0.151**	**0.374**	**0.138**	0.176	**0.276**
Walking distance (3)	Level 1	**1.37**	**1.62**	**1.16**	**1.15**	**1.53**	**1.23**	**1.39**	**1.15**	**0.872**	**1.39**	**1.11**	**1.33**	**1.26**
Information (1)	Level 0	0	0	0	0	0	0	0	0	0	0	0	0	0
Information (2)	Level 2	**0.165**	**0.288**	**0.254**	0.136	0.0467	**0.148**	**0.182**	**0.226**	**0.189**	**0.157**	**0.176**	0.111	**0.243**
Information (3)	Level 3	**0.253**	**0.338**	**0.405**	**0.193**	0.123	**0.299**	**0.227**	**0.314**	**0.122**	**0.257**	**0.0826**	0.194	**0.421**
Placemaking (1)	Level 0	0	0	0	0	0	0	0	0	0	0	0	0	0
Placemaking (2)	Level 3	**0.318**	**0.428**	**0.434**	**0.267**	**0.157**	**0.324**	**0.299**	**0.370**	**0.328**	**0.364**	**0.259**	0.15	**0.351**
Placemaking (3)	Level 3	**0.57**	**0.689**	**0.665**	**0.596**	**0.345**	**0.623**	**0.536**	**0.619**	**0.354**	**0.562**	**0.353**	**0.379**	**0.601**
Digital integration (1)	Level 0	0	0	0	0	0	0	0	0	0	0	0	0	0
Digital integration (2)	Level 1	**0.263**	**0.184**	**0.151**	**0.278**	**0.397**	**0.307**	**0.219**	**0.280**	**0.204**	**0.299**	**0.106**	0.143	**0.356**
Digital integration (3)	Level 2	**0.299**	**0.256**	**0.201**	**0.356**	**0.363**	**0.293**	**0.312**	**0.302**	**0.2**	**0.382**	**0.126**	0.0703	**0.387**
Cost	-	**-0.187**	**-0.202**	**-0.131**	**-0.167**	**-0.253**	**-0.119**	**-0.213**	**-0.17**	**-0.146**	**-0.195**	**-0.119**	**-0.259**	**-0.15**
McFadden's ρ^2		0.125	0.138	0.107	0.154	0.147	0.188	0.129	0.125	0.0917	0.128	0.072	0.165	0.13

[5] Significant coefficients at the 95% statistical levels are shown in **bold**.

Figure 8 shows the estimated WTP for the different hub elements for the full sample, and by each living lab separately. It shows that respondents in all samples are willing to pay the most for walking distance and the least for digital integration and information. As discussed previously, the MRDH sample contains the largest share of older persons, and these are less willing to pay for all attributes when compared to the other groups. The Brussels sample has the highest willingness to pay for all attributes, except for digital integration, which may be due to the higher share of low digital mobility skilled respondents in this sample.

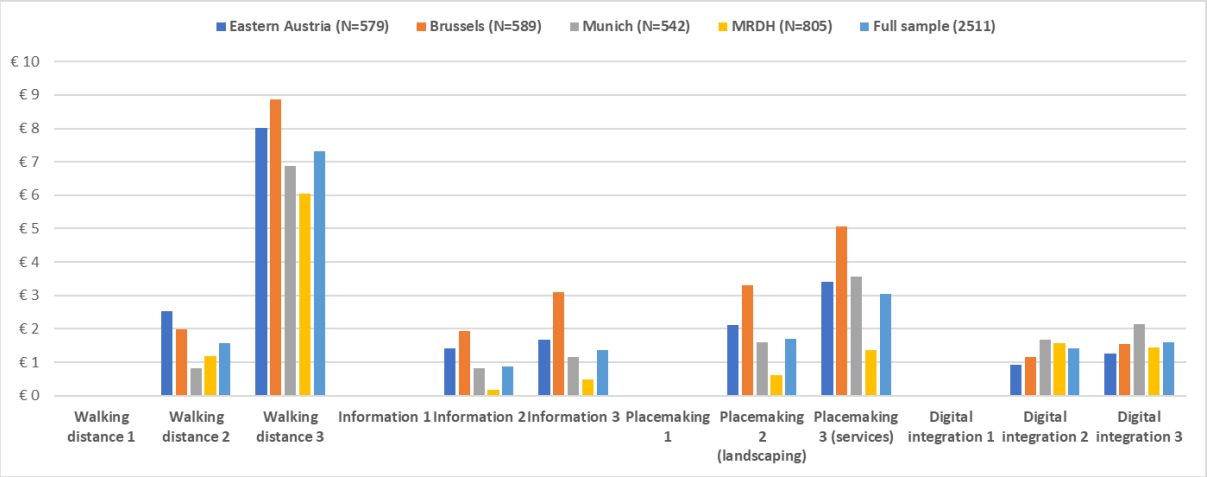

Figure 8: WTP for hub design elements by different living lab locations

Figure 9 shows the WTP for different hub elements and different population segments, irrespective of the living lab location. It also confirms that walking distance has the highest WTP, and information and digital integration the lowest. Users of mobility hubs have the highest WTP values in all cases, which is a logical finding since they are probably more positive towards the usefulness of a shared mobility hub for their daily travel. The first level of each element is zero because that was a situation where this element was not present at the hub.

The WTP is high for migrants and low-income groups, which, can be explained by the high share of student-migrant in the sample (28%). More explanation about the effect of this sample on the results is in Appendix 7.1.

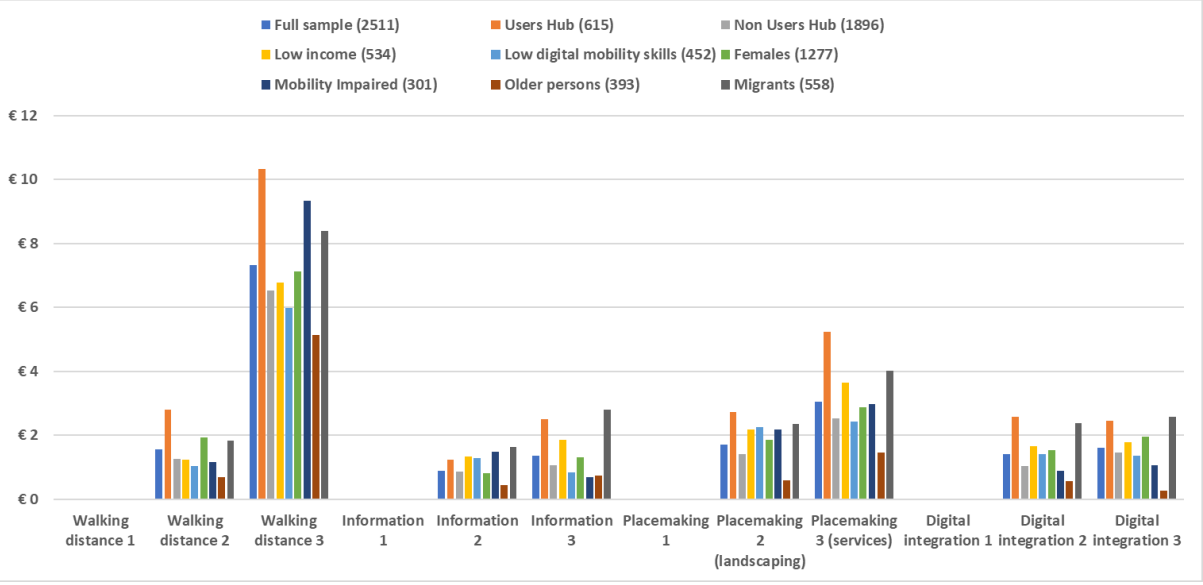

Figure 9: WTP for hub design elements by different vulnerable groups

In Figures 10 to 14, the WTP for each hub element will be discussed in detail, to highlight the differences between the user groups.

Figure 10 shows the WTP for walking distance. This attribute reflects the importance of proximity between shared modes and a public transport stop, with “walking distance 1” being a situation with complete separation between shared modes and public transport stops, “walking distance 2” the shared modes are placed together, but not within walking distance from a public transport stop, and “walking distance 3” shared modes and public transport are located within walking distance from each other. The highest WTP was estimated for users of mobility hubs and the lowest for older persons. The WTP is higher for walking distance level 3, and the highest for users of mobility hubs, which is a logical finding since these are the current users of mobility hubs, and probably can better appreciate the importance of proximity.

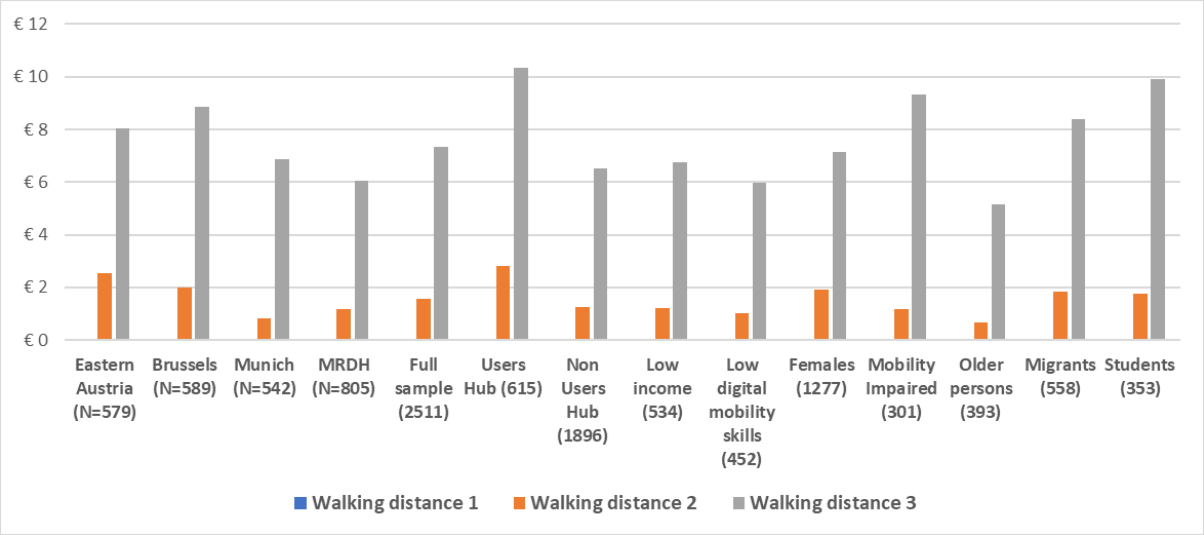

Figure 10: WTP for Physical Integration (walking distance)

Figure 11 shows the WTP regarding the information present at mobility hubs. On “Information 1”, no information is present, while on “Information 2”, only signage is present, and “Information 3” presents a situation with signage and a digital display with real-time information for the modes available at the hub. Even though WTP is lower when compared to the previously shown walking distance attribute, the same pattern holds - users of mobility hubs have the highest WTP, and older persons and those with difficulty walking the lowest. The effect of the student-migrant sample is also observed here, with higher WTP for low-income respondents and migrants. In general, respondents value the addition of the digital display as an enriching element of information on a hub, considering the highest coefficients and WTP for Level 3.

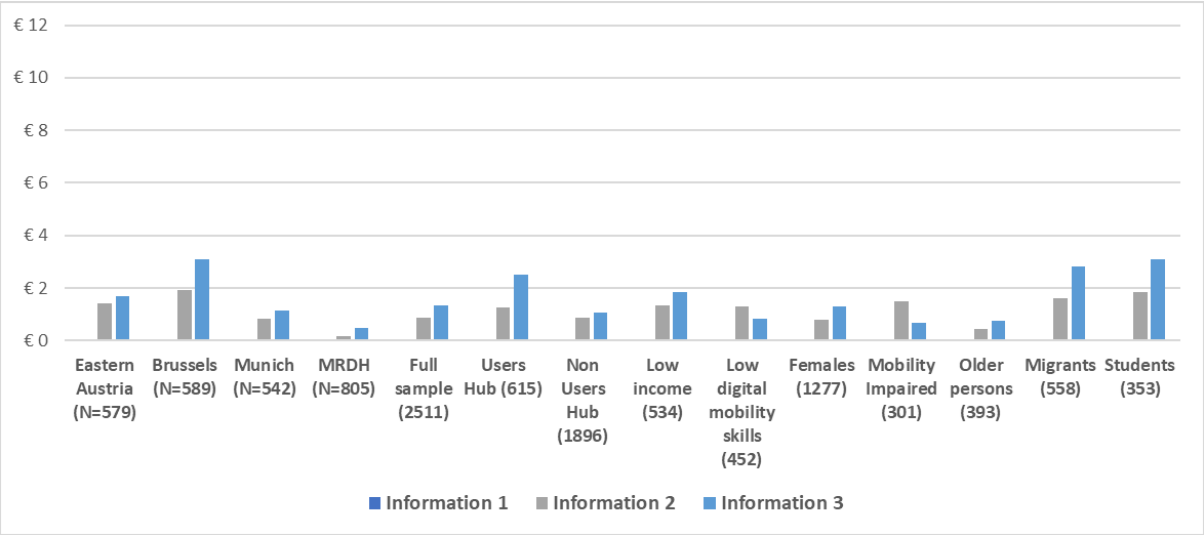

Figure 11: WTP for Physical Integration (information)

Figure 12 presents the WTP for two different placemaking strategies: "Placemaking 2" represents the attractiveness of the landscape (benches, trees, and art) while "Placemaking 3" refers to the presence of non-mobility-related services at the hub (e.g., parcel point or coffee corner). "Placemaking 1" none of these features are present in the hub. This is the only attribute in the experiment that does not have an increase in quality as attribute levels increase. In this case, the idea is to observe the trade-off between landscape and services. The same pattern as observed in the previous elements is observed here: higher WTP for users of mobility hubs, followed by the low-income/migrants (with a high proportion of students) and lower WTP for older persons and those with difficulties walking. WTP is the second highest for this attribute which indicates that placemaking strategies are more valued than information and digital integration.

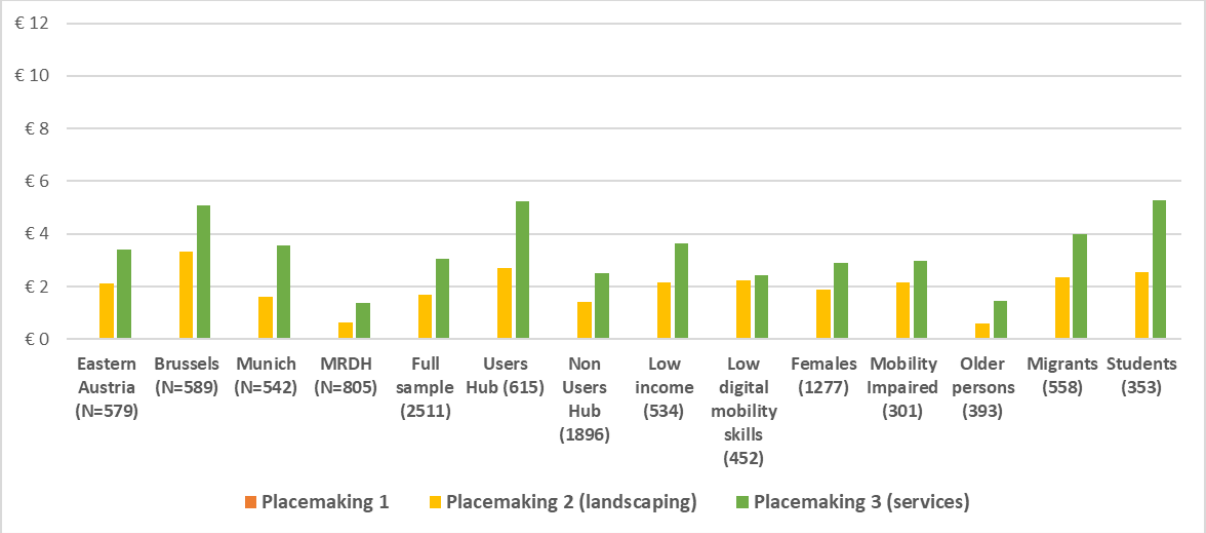

Figure 12: WTP for Physical Integration (placemaking)

Figure 13 shows the WTP results for digital integration. Overall, WTP is low for this attribute. The migrant sample shows the highest WTP (even higher than users of mobility hubs), but again, it is important to note that students (with low-income and migration backgrounds) are over-represented. Persons with low digital mobility skills, older and with walking difficulty have a low WTP for this attribute, which is a logical finding.

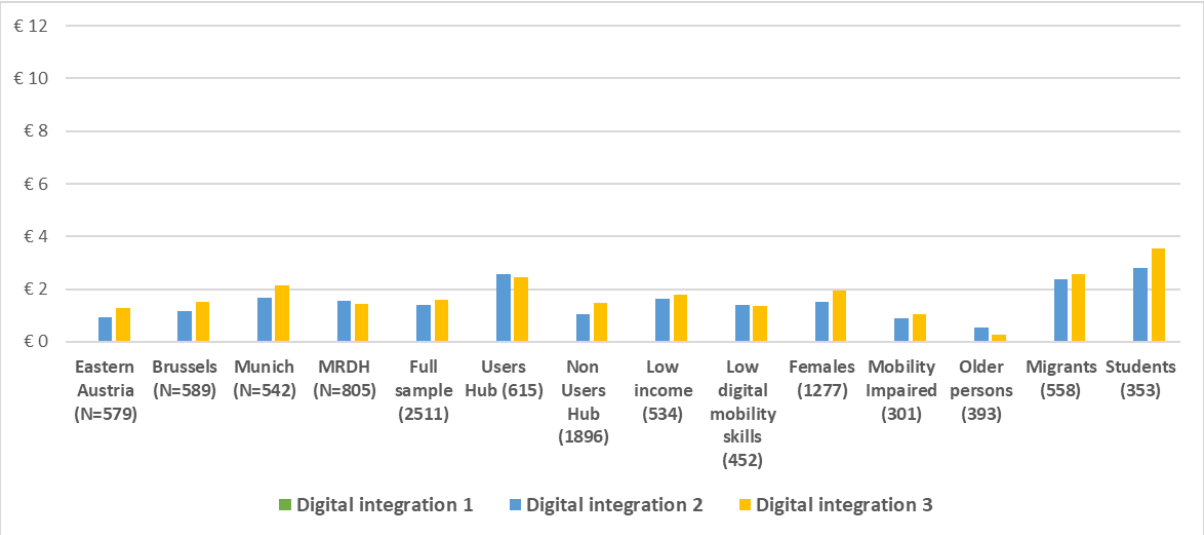

Figure 13: WTP for Digital Integration

4.5. Relative importance of shared mobility hub elements

This section compares the ranking of shared mobility hub elements when considering the importance of elements without a cost trade-off (Section 4.3) and with the WTP assessment, which adds a cost trade-off (Section 4.4).

When a cost trade-off is not considered, which was measured with a Likert scale questions (see Section 4.3), results indicate that respondents of the full sample consider the presence of information and digital integration as the two most important shared mobility hub elements. However, the differences are not large enough between the first and fifth-ranked elements. This means that without a cost trade-off, all elements are considered almost equally important.

However, when there is a cost trade-off, i.e., with the addition of the cost attribute in the stated preference experiment, respondents of the full sample are willing to pay €7.32 for a shared mobility hub with different shared modes provided within walking distance to a public transport stop. The differences in WTP are much larger than compared with the Likert scale question, where WTP for placemaking is €3.04, followed by digital integration (€1.59) and information (€1.35).

The results for information and walking distance are reversed when comparing both analyses (Likert scale question versus the WTP assessment). The same holds for digital integration, which is the second most important element without considering a cost trade-off, while when there is a trade-off, respondents are less willing to pay for such a feature. Placemaking strategies are ranked in middle positions, indicating that these are “good to have” but not “need to have” elements of shared mobility hubs.

5. CONCLUSION

This deliverable focused on assessing the relative importance of different shared mobility hub design elements. A standardised survey was developed and applied among users and residents in different areas, including a stated preference experiment, to examine trade-offs between integration dimensions and the WTP for different attributes of hubs.

The results underscore a disparity between the attributes most valued by respondents and their WTP for them, which holds significance in the planning and functioning of mobility hubs. Although elements such as information and digital integration were indicated as prerequisites for a successful shared mobility hub, respondents are not willing to pay for it, indicating that these would have to be arranged

by the government and/or transport operators. Respondents are more willing to pay for shared mobility and public transport within walking distance from one another or for placemaking strategies (such as services or landscaping), which are more evident elements related to the physical integration (and design) of hubs.

Reflecting upon the Integration Ladder developed by Geurs et al. (2024), which was used to derive the attributes and levels of the stated preference experiment, a hub to be considered "smart" had to score level 2 in all three levels of integration. Our findings highlight the importance of integrating shared mobility as a first/last mile in combination with public transport systems, which is classified as Level 1 in the integration ladder. Even though the presence of information increases the visibility of hubs, and MaaS is seen as an enabler of digital integration of multimodal transport offered at the hub (Rongen et al., 2022), contributing to the smartness of a hub, the WTP assessment indicates that respondents are less willing to pay for higher levels of integration, required to be a smart hub. Placemaking strategies are on Level 3 of the Integration Ladder (physical integration), contributing to the attractiveness of the hub. However, its importance should not be overestimated based on the results of our study. An attractive hub may have a positive effect in increasing the ridership of public transport (and shared modes) but could also bring externalities and nuisance if people start using benches as places to stay.

The analysis of the sample of vulnerable-to-exclusion groups is relevant for an equity assessment of mobility hubs, as discussed more extensively in **Deliverable 5.3** (Garritsen et al. 2024). Public transit agencies should seize opportunities to improve urban mobility for all users through collaboration and public-private partnerships, including integration of service, information, and payment methods (Feigon & Murphy, 2016). However, our results for the vulnerable groups reflect the recruitment strategy applied in the different living labs, which led to an overestimation of students, particularly those with migration backgrounds, thus confounding the effect of income, occupation, and migration backgrounds.

Another limitation of this study should be noted. In the stated preference experiment, the elements are analysed separately (information, walking distance, etc), while in the Integration Ladder levels are cumulative, i.e., a hub only scores Level 2 of smartness if both information and walking distance are at level 2. Therefore, a direct interpretation with the Integration Ladder is not possible - the WTP estimation allows the analysis of the trade-offs between the elements. In addition, democratic integration is missing from the stated preference experiment, because, as mentioned previously, it is related to the planning process that ideally, should occur before the design and implementation of the mobility hub. In addition, it was not deemed realistic to analyse the effects of higher levels of participation with a willingness to pay assessment.

The inclusion of spatial contextual factors to the model estimation (such as population density, proximity to public transport stops, land use mixedness, etc), would allow the derivation of local policy recommendations for the planning and design of future shared mobility hubs. Previous research empirically suggests that built-environment variables affect travel behaviour (e.g. Handy, 1996) and travel mode choice, which in turn, would impact shared mobility hub use. The challenge was the harmonization of the data in the four different living lab locations. This remains a task for future research. In addition, more comprehensive stated preference experiments including the democratic integration dimension would allow exploring whether participation also influences the preferences for shared mobility hubs.

6. ACKNOWLEDGEMENTS

The authors thank Roxani Gkavra, Yusak Susilo and Oliver Roider (University of Natural Resources and Life Sciences, BOKU) for their contributions to the SmartHubs survey and revising this deliverable,

together with the team of UNIBO. Thanks to Julien Chiquet for gathering the spatial data, and all SmartHubs partners for their efforts in revising and distributing the survey in all living lab locations.

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8. APPENDIX

8.1.Impact of student sub-sample (SmartHubs Deliverable 5.3, Equity Assessment)

The vulnerable groups are not homogeneous across the living labs. Especially the group of migrants (i.e. people not born in their country of residence) differs across the living labs, potentially caused by the large share of students in the Munich sample.

Within the report, students are included in every analysis and not treated differently. In this section of the appendix, the potential impact of the student sub-sample on the results will be discussed.

A1. Sub-groups of migrants and students

Table 7 shows how the share of students is skewed to the migrant sample living less than 10 years in the country of residence, with 53% of them being a student, impacting the interpretation of results. 69% of the respondents classified as migrant in Munich, are currently a student (28% in the general sample). The student-migrants have different travel patterns than the non-student migrants: they are more frequent users of public transport and less frequent users of the car (based on significant adjusted z-scores), pointing out the difficulty of considering a vulnerable group as one, homogeneous group with similar travel patterns and mobility barriers.

Table 6 Crosstab of migrant characteristics and student population

Categories determining migration	**Non-student**		**Student**	
Born in the country of residence	N = 1769	90.4%	N = 188	9.6%
Not born, living > 10 years*	N = 265	93.3%	N = 19	6.7%
Not born, living < 10 years*	N = 117	46.8%	N = 133	53.2%
Valid responses	N = 2151	86.4%	N = 340	13.6%

Note: *classified as migrant V2E group.

A2. Sub-groups of income and students

13% of the full sample is currently a student. Table 8 shows that of the low-income V2E group, almost 34% a students, while students are almost not represented in the medium- or high-income groups (less than 6%). Like section A.1., students with low-income have a different travel behaviour than non-students with low income: they are relatively frequent users of PT, use shared two-wheelers more often and are less frequent users of the car.

Table 7 Crosstab of income levels and student population

Categories determining income	**Non-student**		**Student**	
Low*	N = 354	66.2%	N = 181	33.8%
Medium	N = 1191	94.4%	N = 70	5.6%
High	N = 311	94.2%	N = 19	5.8%
Valid responses[+]	N = 1856	87.3%	N = 270	12.7%

Note: *classified as low-income V2E group. [+] Number of valid responses differ between Table 21 and 22 due to excluding respondents answering, 'prefer not to say'.

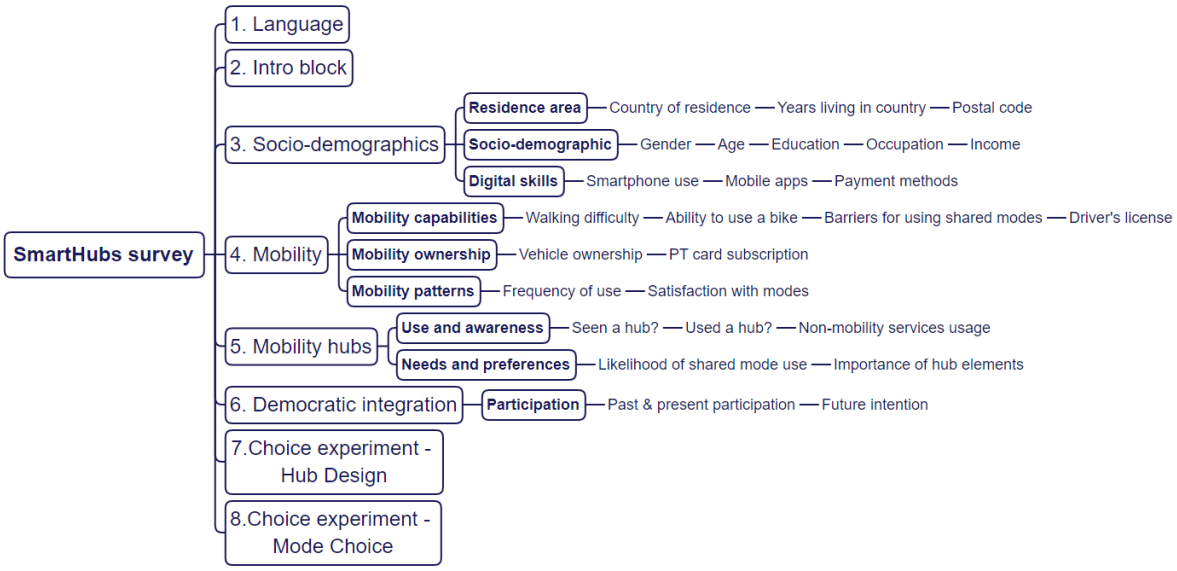
A3. Intention to use shared modes at hubs for students

There is a significant difference between students and non-students in the intention to use shared modes. More specifically, the percentage of respondents having a positive intention to use the shared e-bike, bike, moped and e-scooter is significantly higher for students compared to non-students. This difference is visualised in Figure 18. Intention to use the shared car or cargo bike is not significantly higher.

This analysis, together with the findings of sections A.1. and A.2., suggests that the student sample has a significant impact on the results of both the migrants and low-income V2E groups. This should be considered when interpreting the results of those groups as it could be expected that without considering the students, the intention to use shared modes is lower for migrants and low-income citizens who are not a student.

8.2.The full SmartHubs survey

The full questionnaire of the SmartHubs survey is attached on the following pages. The setup of the survey sections is presented in the figure below. The numbers correspond with the sections of the survey.



This survey was developed by the University of Twente (The Netherlands) and the University of Natural Resources and Life Sciences (BOKU) (Vienna, Austria) in December 2022, as part of the SmartHubs Project. Implemented on Qualtrics by the researchers: Roxani Gkavra (roxani.gkavra@boku.ac.at) and Dr. Anna Grigolon (a.b.grigolon@utwente.nl).

The full survey can be found on the upcoming pages.

1. Language				
ID	Question	Answer Type	Answer set	Routing
Q605	Language/Sprache/Taal/Langue	Drop-down list	Deutsch English Français Nederlands Nederlands-België	-

2. Intro Block				
ID	Question	Answer Type	Answer set	Routing
Q5	Country of residence	Select one	○ Austria ○ Belgium ○ Germany ○ The Netherlands	Q605
Introduction	**Thank you for your interest in our survey!** The SmartHubs project aims to examine how mobility hubs (dedicated on-street locations where travellers can choose from different shared mobility and public transport options) can be a game changer toward inclusive sustainable urban mobility and accessibility. For the design of an ideal mobility hub, citizens' desires and needs are heard. Public transport and shared modes (bikes, scooters or cars) are available for you. There are services available such as public toilets, information kiosks, waiting areas, and urban gardens. You can plan, book, and pay for a trip combining different modes of transport using one smartphone app.  To participate in the survey, you must be older than 16 years. The survey will take around 20 minutes. Further information on the SmartHubs project can be found online at the project website You can also contact us by emailing the responsible researchers Dr Anna Grigolon and Roxani Gkavra at smarthubs@boku.ac.at			

Q30	Consent: Your participation is voluntary: you are not obliged to take part and in case you refuse, this will have no consequences for you. After starting the survey, you can quit at any time and you do not have to provide a reason for doing so. The collection and processing of data are by the legal principles imposed by the European General Data Protection Regulation (GDPR). In addition, any data collected from you will be anonymised and will be stored and used only for the purposes of the Smarthubs project.	Select one	I hereby confirm that my participation in this survey is voluntary, that I have been adequately informed about the purpose of the study, and that I can withdraw my participation from this survey at any time for any reason.	-

3. Socio-Demographics				
ID	Question	Answer Type	Answer set	Routing
Gender	Gender	Select one	○ Female ○ Male ○ Other ○ Prefer not to say	-
Age	Age (in years).	Text box	○	-
Years living	How many years have you lived in [Q5]?	Select one	○ I was born in [Q5] ○ More than 10 years but I was not born here ○ 6-10 years ○ 1-5 years ○ Less than 1 year ○ Prefer not to say	-
Zipcode home	What is the postcode of your home location in [Q5]?	Text box		-
Education	What is the highest level of education you have completed?	Select one	○ Compulsory education or less ○ High school graduate ○ Senior high school ○ University undergraduate degree ○ MSc/MA/PhD or other equal level ○ Other	-

Occupation	What is your main occupation status?	Select one	○ Employed (working full/part time) ○ Self-employed (working full/part time) ○ Working in household or other unpaid activity ○ Student ○ In retirement ○ Unemployed ○ Unable to work	
Income	What is your net household income per month?	Select one	○ Up to 1600 Euros ○ 1601-3200 Euros ○ 3201-4800 Euros ○ 4801-6400 Euros ○ >6401 Euros ○ Do not know	
Home office	How often do you work from home on average?	Select one	○ Never ○ Less than 1 day per month ○ 1 to 3 days per month ○ 1 to 3 days per week ○ 4 or more days per week	Occupation→Employed (working full/part time) OR →Self-employed (working full/part time)
adults	Number of adults (at least 18 years old) in your household?	Select one	○ 1 ○ 2 ○ More than 2	
kids	Number of non-adult members (children, teenagers) in your household?	Select one	○ None ○ 1 ○ 2 ○ More than 2	
Smartphone usage	Do you have a smartphone with internet connection?	Select one	○ Yes ○ Yes, but I use it only for calls/ messaging and other offline activities ○ No	-
nophone	Which of the following have you used in the last	Multiple choice	☐ Credit card to purchase goods at a store/supermarket ☐ Credit card to shop online ☐ Credit card to purchase transportation tickets	Smartphone usage → No OR → Yes, but I use it only for calls/ messaging and other offline activities

	year? Select all that apply.			
withphone	For which of the following functions have you used your smartphone within the last year?	Multiple choice	☐ App to transfer money to someone ☐ App to plan a trip with your own vehicle (car, bicycle) or walking (for example, Google maps) ☐ App to plan a trip by public transport ☐ App to buy tickets or seat reservation for public transport ☐ App to reserve/book/pay for a shared vehicle (bike, car, scooter) ☐ None of the above	Smartphone usage → Yes

<table>
<tr><th colspan="5">4. Mobility</th></tr>
<tr><th>ID</th><th>Question</th><th>Answer Type</th><th>Answer set</th><th>Routing</th></tr>
<tr><td>Q142</td><td>Which of the following vehicles are available for you to use in your household?</td><td>Multiple choice; text</td><td>☐ Bike
☐ E-bike
☐ Car
☐ Moped/Motorcycle
☐ *E-scooter (except NL)
☐ Other (please specify)
☐ None of the above</td><td>*Q5 → is not NL</td></tr>
<tr><td>Q82</td><td>How many cars do you own in your household?</td><td>Select one</td><td>○ 1
○ 2
○ More than 2</td><td>-</td></tr>
<tr><td>Q13</td><td>Do you have any physical difficulty when walking?</td><td>Select one</td><td>○ No
○ Yes</td><td>-</td></tr>
<tr><td>Q14</td><td>What kind of assistance do you use when walking?</td><td>Multiple choice; text</td><td>☐ I do not use any assistance
☐ Wheelchair
☐ Rollator
☐ Mobility scooter
☐ A service dog
☐ Caretaker
☐ Other, please specify</td><td>Q13→ Yes</td></tr>
<tr><td>Q8</td><td>Can you ride an e-scooter?  </td><td>Select one</td><td>○ No
○ Yes
○ Do not know/have never tried</td><td>Q5 → is Austria OR Belgium OR Germany</td></tr>
<tr><td>Q32</td><td>How often do you use the vehicles you own in your household?</td><td>Matrix table</td><td><table><tr><th></th><th>4 or more days per week</th><th>1-3 days per week</th><th>1-3 days per month</th><th>1-11 days per year</th><th>Never</th></tr><tr><td>Car as a driver or passenger</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>E-scooter</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Bike/e-bike</td><td></td><td></td><td></td><td></td><td></td></tr></table></td><td>Q142→bike OR e-bike OR Car OR Moped/Motorcycle
Q142→ e-bike IF
Q5→ not NL</td></tr>
</table>

			Moped/motorcycle	
Q153	How often do you walk to reach activities (excluding leisure walks)?	Select one	○ 4 or more days per week ○ 1-3 days per week ○ 1-3 days per month ○ 1-11 days per year ○ Never	-
shared_modes_intro	In the remaining of the survey many questions will refer to Shared transport modes:  Shared bike/e-bike: provides users with access to bicycles at a variety of pick-up and drop-off locations. Bikes are available via an application, a customer card, or a machine.  Shared e-scooter: allows access to e-scooters at various locations. E-scooters are available via an application, a customer card, or at a machine.  Shared car: usually offered at dedicated locations. Users need to have a driving license. Payment is common via an application, an online account on a website or at a machine.  Shared moped/scooter: allows access to mopeds/scooters at various locations. Most commonly, people can access a scooter via a mobile application.  Shared cargo bike/e-bike: provides users with access to cargo bicycles at a variety of pick-up and drop-off locations. Cargo bikes are available via an application, a customer card, or at a machine.			Q5→ Austria, Germany, Belgium

shared_modes_intro_NL	In the remaining of the survey many questions will refer to Shared transport modes:  Shared bike/e-bike: provides users with access to bicycles at a variety of pick-up and drop-off locations. Bikes are available via an application, a customer card, or a machine.  Shared car: usually offered at dedicated locations. Users need to have a driving license. Payment is common via an application, an online account on a website or at a machine.  Shared moped/scooter: allows access to mopeds/scooters at various locations. Most commonly, people can access a scooter via a mobile application.  Shared cargo bike/e-bike: provides users with access to cargo bicycles at a variety of pick-up and drop-off locations. Cargo bikes are available via an application, a customer card, or at a machine									Q5→ is NL
Q39	How often do you travel by the modes listed below?	Matrix table		4 or more days per week	1-3 days per week	1-3 days per month	1-11 days per year	Never		* Q5→ is not NL
			Taxi/Uber							

<table>
<tr><td></td><td></td><td></td><td>
<table>
<tr><td>Bus, tram, metro</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Train</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>*Shared e-scooter</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Shared bike/e-bike</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Shared moped/motorcycle</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Shared car as driver or passenger</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>Q38</td><td>How satisfied are you overall with travelling by the following modes in your everyday life?</td><td>Matrix table</td><td>
<table>
<tr><td></td><td>Very dissatisfied</td><td>Dissatisfied</td><td>Neutral</td><td>Satisfied</td><td>Very satisfied</td></tr>
<tr><td>Bus, Tram, Metro</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Own car</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Own bike</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td><td></td><td>Q142</td></tr>
<tr><td>Q59a</td><td>What are the main reasons why you never travelled by shared e-scooter in the last year? Check all that apply</td><td>Multiple choice; text</td><td colspan="2">☐ Have never heard of it
☐ It is too expensive
☐ I have to walk to far to reach a vehicle
☐ I think it is too dangerous
☐ I do not trust using this vehicle
☐ I do not feel that this vehicle can fulfil any of my travel needs
☐ I tried in the past and was disappointed with the experience
☐ I prefer using my own vehicle</td><td>Q5→ is not NL AND
Q39 →e-scooter is NEVER</td></tr>
</table>

			☐ Other (please specify)	
Q198	What are the main reasons why you never travelled by **shared scooter/moped** in the last year? Check all that apply	Multiple choice; text	☐ Have never heard of it ☐ It is too expensive ☐ I have to walk to far to reach a vehicle ☐ I think it is too dangerous ☐ I do not trust using this vehicle ☐ I do not feel that this vehicle can fulfil any of my travel needs ☐ I tried in the past and was disappointed with the experience ☐ I prefer using my own vehicle Other (please specify)	Q39 →shared moped/motorcycle is NEVER
Q42	What are the main reasons why you never travelled by shared car in the last year? Check all that apply	Multiple choice; text	☐ Have never heard of it ☐ It is too expensive ☐ I have to walk to far to reach a vehicle ☐ I think it is too dangerous ☐ I do not trust using this vehicle ☐ I do not feel that this vehicle can fulfil any of my travel needs ☐ I tried in the past and was disappointed with the experience ☐ I prefer using my own vehicle Other (please specify)	Q39 →shared car is NEVER
Q43	What are the main reasons why you never travelled by **shared bike/e-bike** in the last year? Check all that apply	Multiple choice; text	☐ Have never heard of it ☐ It is too expensive ☐ I have to walk to far to reach a vehicle ☐ I think it is too dangerous ☐ I do not trust using this vehicle ☐ I do not feel that this vehicle can fulfil any of my travel needs ☐ I tried in the past and was disappointed with the experience ☐ I prefer using my own vehicle Other (please specify)	Q39 →shared bike/e-bike is NEVER

5. Mobility hubs: awareness and future use				
ID	Question	Answer Type	Answer set	Routing
Q143a	This part of the survey is focused on mobility hubs. A mobility hub can be a small neighborhood hub or a large hub at a train station, with different services and features: 1. Shared modes (bike, scooter, car) and public transport (bus, tram, metro, train) within walking distance 2. Digital display with live information and signage for all modes 3. An attractive hub design (with landscaping features (benches, art, green) and services (cafe, information kiosk, parcel locker) 4. An integrated mobile application for planning, booking and paying different transport modes  Examples from Austria:  			Q5→ Austria
Q143b	This part of the survey is focused on mobility hubs. A mobility hub can be a small neighbourhood hub or a large hub at a train station, with different services and features: 1. Shared modes (bike, scooter, car) and public transport (bus, tram, metro, train) within walking distance			Q5→ Netherlands

	2. Digital display with live information and signage for all modes 3. An attractive hub design (with landscaping features (benches, art, green) and services (cafe, information kiosk, parcel locker) 4. An integrated mobile application for planning, booking and paying different transport modes  Example from the Netherlands: 	
Q143c	This part of the survey is focused on mobility hubs. A mobility hub can be a small neighbourhood hub or a large hub at a train station, with different services and features: 1. Shared modes (bike, scooter, car) and public transport (bus, tram, metro, train) within walking distance 2. Digital display with live information and signage for all modes 3. An attractive hub design (with landscaping features (benches, art, green) and services (cafe, information kiosk, parcel locker) 4. An integrated mobile application for planning, booking and paying different transport modes	Q5→ Germany

	 Examples from Germany:  	
Q143**a** (should have been d)	This part of the survey is focused on mobility hubs. A mobility hub can be a small neighbourhood hub or a large hub at a train station, with different services and features: 1. Shared modes (bike, scooter, car) and public transport (bus, tram, metro, train) within walking distance 2. Digital display with live information and signage for all modes 3. An attractive hub design (with landscaping features (benches, art, green) and services (cafe, information kiosk, parcel locker) 4. An integrated mobile application for planning, booking and paying different transport modes	Q5→ Belgium

<table>
<tr><td></td><td colspan="3"> 

Example from Belgium:
 
</td><td></td></tr>
<tr><td>Q49</td><td>Have you ever seen a mobility hub during your daily trips in [Q5]?</td><td>Select one</td><td>○ No
○ Yes
○ I’m not sure</td><td></td></tr>
<tr><td>Q50</td><td>Have you ever used a mode of transport at a mobility hub in [Q5]?</td><td>Select one</td><td>○ No
○ Yes
○ I’m not sure</td><td>Q49→Yes</td></tr>
<tr><td>Q52</td><td>You have indicated that you travel by public transport and/or shared modes.</td><td>Matrix table</td><td><table><tr><td></td><td>None</td><td>A few</td><td>About half of them</td><td>Most of them</td><td>All</td></tr></table></td><td>Q50→Yes
Q39</td></tr>
</table>

	How many of your trips with these modes of transport started or ended at a mobility hub?		Bus, tram, metro					* Q5→ NOT NL
			Train					
			*Shared e-scooter					
			Shared bike/e-bike					
			Shared moped/motorcycle					
			Shared car as driver or passenger					
Q154	Out of all the mobility hubs trips that you conducted by **shared e-scooter**, how many were for each trip purpose?	Matrix table		None	A few	About half of them	Most of them	All	Q50→Yes AND Q52 → shared e-scooter
			To/from Work					
			To/from Education					
			To/from Shopping					
			To/from Leisure					
Q156	Out of all the mobility hubs trips that you conducted by **shared car**, how many were for each trip purpose?	Matrix table		None	A few	About half of them	Most of them	All	Q50→Yes AND Q52 → shared car
			To/from Work					

			To/from Education						
			To/from Shopping						
			To/from Leisure						
Q157	Out of all the mobility hubs trips that you conducted by **shared bike/e-bike**, how many were for each trip purpose?	Matrix table		None	A few	About half of them	Most of them	All	Q50→Yes AND Q52 → shared bike/e-bike
			To/from Work						
			To/from Education						
			To/from Shopping						
			To/from Leisure						
	Out of all the mobility hubs trips that you conducted by **shared scooter/motorcycle**, how many were for each trip purpose?	Matrix table		None	A few	About half of them	Most of them	All	Q50→Yes AND Q52 → shared scooter/motorcycle
			To/from Work						
			To/from Education						
			To/from Shopping						
			To/from Leisure						

Q59	How likely is it that you will use the modes below in case they are present at mobility hubs in your area in the future?	Matrix table		Very unlikely	Unlikely	Neutral	Likely	Very likely
			Shared car					
			*Shared e-scooter					
			Shared bike					
			Shared e-bike					
			Shared cargo bike					
			Shared e-moped					
Q62222	Which characteristics of a mobility hub are the most important for you?	Matrix table		Extremely unimportant	Unimportant	Neutral	Important	Extremely important
			Different shared mobility options					
			Availability of different services					
			An attractive design					
			Information (digital display, signage)					
			One mobile app to plan, book and pay for using different modes of transport					

<table>
<tr>
<td>Q66</td>
<td>Latest mobility hub trip

Please provide information on your most recent trip during which you used any mode(s) of a mobility hub.

Modes of transports

Select all the modes that you used across your trip in the order that you used them. In case you used only a single mode, fill in only the information on the 1st mode.

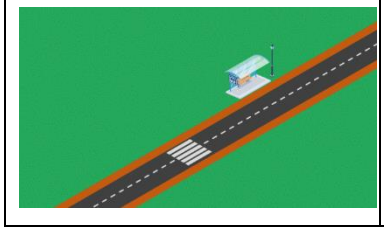
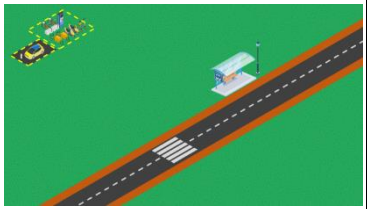
Note: walking is also considered a separate mode of transport</td>
<td>Side by side</td>
<td>
<table>
<tr><td></td><td>Mode of transport</td><td>Trip duration</td></tr>
<tr><td>1st mode</td><td>(drop-down list)</td><td>(drop-down list)</td></tr>
<tr><td>2nd mode</td><td></td><td></td></tr>
<tr><td>3rd mode</td><td></td><td></td></tr>
<tr><td>4th mode</td><td></td><td></td></tr>
<tr><td>5th mode</td><td></td><td></td></tr>
</table>

Modes of transport: own bike, own car, shared bike, shared e-scooter, shared car, public transport, walking, other

Trip duration: up to 10min, 11-20min, More than 20min
</td>
<td>Q50→yes</td>
</tr>
<tr>
<td>Q92</td>
<td>In case that the shared modes were not available for your latest trip, which mode(s) could you have used alternatively to conduct the trip? Select all that apply</td>
<td>Multiple choice</td>
<td>☐ Own bike
☐ Own car
☐ Own e-scooter
☐ Walking
☐ Public transport
☐ Could not have conducted the trip
☐ Other, specify:</td>
<td>Q66</td>
</tr>
</table>

6. Democratic Integration				
ID	Question	Answer Type	Answer set	Routing
Dem1	Have you ever been involved in plans to improve mobility offers in your neighbourhood?	Select one	○ Never ○ Yes	
Dem2	What best describes your participation?	Select one	○ Got information in a workshop/public hearing ○ Got information on a proposal and provided feedback on it in a workshop/survey ○ Proposed solutions to a specific problem in a workshop/similar event ○ Collectively identified issue(s) and proposed solutions ○ Ongoing cooperation to identify issue(s) and develop solutions ○ Other type of participation process	Dem1→Yes
Dem3	How was your input/participation valued? Select all that apply	Multiple choice	☐ My input wasn't heard ☐ My input was valued ☐ I received feedback on how my input was used ☐ I still participate in an ongoing cooperation/network of citizens	Dem2
Dem4	How would you like to participate in decision-making to improve the mobility offers in your neighbourhood in the future? Select all that apply	Multiple choice	☐ Get information in a workshop/public hearing without providing input ☐ Get information on a proposal and provide feedback on it in a workshop/survey ☐ Propose solution(s) to a specific problem in a workshop./similar event ☐ Cooperate to identify issue(s) and develop solutions ☐ Cooperate to identify issue(s) and develop solutions regularly ☐ Other type of participation process ☐ I do not wish to participate in any process in the future	
Dem5	And at which planning phase(s)?	Multiple choice	☐ Working together on a solution for a specific issue ☐ Working together on a proposal for a new overall planning strategy ☐ Feedback to a plan of a responsible organization e.g. municipality, mobility provider ☐ Other planning phase (please specify)	Dem 4→ I do not wish to participate in any process in the future IS NOT SELECTED

<table>
<tr><th colspan="5">7. Stated Preference Experiment – Hub Design</th></tr>
<tr><th>ID</th><th>Question</th><th>Answer Type</th><th>Answer set</th><th>Routing</th></tr>
<tr><td>SP_UT Intro</td><td colspan="4">In this part of the survey, we are interested in understanding your preferences for different elements of mobility hubs.
Please analyse the figures below carefully. We consider 5 hub elements, each varying according to 3 levels:

1. Modes available
<table><tr><td>Level 1: public transport stop only (shared modes are all scattered and not within walking distance)
  </td><td>Level 2: shared modes are placed together, but not within walking distance from public transport stop
  </td><td>Level 3: public transport stop and shared modes at walking distance
  </td></tr></table>
2. Information
<table><tr><td>Level 1: no signage, no digital display</td><td>Level 2: signage for all modes
  </td><td>Level 3: digital display and signage
  </td></tr></table>
3. Design</td></tr>
</table>

Level 1: no landscaping, no services	Level 2: landscaping (green, benches, art) 	Level 3: services (cafe, package locker, information kiosk) 

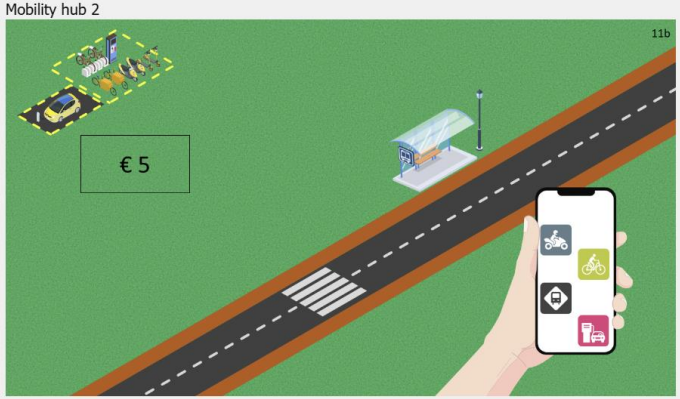
4. Mobile app

Level 1: No integration between the modes. 	Level 2: modes are integrated for trip planning. 	Level 3: modes are fully integrated for trip planning, booking and payment. 

5. Cost

Level 1: No increase in monthly municipal taxes 	Level 2: 5 euros per month extra in municipal taxes 	Level 3: 10 euros per month extra in municipal taxes 

<table>
<tr><td></td><td colspan="4">The following 6 questions will show you two hypothetical mobility hubs. You are asked to choose one that best represents your preferences.</td></tr>
<tr><th>ID</th><th>Question</th><th>Answer Type</th><th>Answer set</th><th>Selection criteria</th></tr>
<tr><td>CS11 (EXAMPLE)</td><td>The table shows two mobility hubs with different characteristics and represented (below) as figures.<table><tr><td></td><td>Mobility hub 1</td><td>Mobility hub 2</td></tr><tr><td>Modes available</td><td>shared modes are placed together, but not within walking distance from public transport stop</td><td>shared modes are placed together, but not within walking distance from public transport stop</td></tr><tr><td>Information</td><td>signage for all modes</td><td>no signage, no digital display</td></tr><tr><td>Design</td><td>landscaping (green, benches, art)</td><td>no landscaping, no services</td></tr><tr><td>Mobile App</td><td>modes are integrated for trip planning</td><td>no integration between the modes</td></tr><tr><td>Costs</td><td>5 euros per month extra in municipal taxes</td><td>5 euros per month extra in municipal taxes</td></tr></table></td><td>Select one</td><td>○ Mobility hub 1
○ Mobility hub 2
○ None</td><td>A random selection of 6 out of 36 CS (choice sets) per respondent.</td></tr>
</table>

	Which mobility hub would you choose? Mobility hub 1  Mobility hub 2  None of these			

8. Stated Preference Experiment – Mode Choice (BOKU)				
ID	Question	Answer Type	Answer set	Routing
Ref1	In the next questions please provide some information on the latest trip you conducted by one of the following modes. The trip that you consider should have been between 500 meter (0.5km) and			

	10000 meter (10 km): - Own car (driver or passenger) - Own bike - Public transport - Walking			
Ref2	Mode of transport?	Select one	○ Own car (driver or passenger) ○ Own bike ○ Public transport Walking	
Ref3	Main trip purpose?	Select one	○ From/to work ○ From/to education ○ From/to shopping ○ From/to leisure	
Ref4	How long was your trip, in meters? For example, 1km=1000meters.	Numeric text input		
Ref5	How many minutes did you walk to reach the **public transport stop**? Please fill in **only the rounded number of minutes**, for example 9.	Numeric text input		Ref2→ Public transport
Ref11	How did you pay for your trip?	Select one	○ I bought a ticket for this trip. ○ I payed via a subscription such as an annual/monthly card or similar.	Ref2→ Public transport
Ref6	Total trip cost (in Euros)?	Numeric text input		Ref2→ Public transport and Ref11→ I bought a ticket for this trip.
Ref8	How many minutes did you wait at the public transport stop? Please fill in **only the rounded number of minutes**, for example 5	Numeric text input		Ref2→ Public transport
Ref9	How many minutes did you walk to reach your **own car**? Please fill in **only the rounded number of minutes**, for example 9.	Numeric text input		Ref2→ Own car

Ref7	Which of the following best describe the circumstances of your trip? Select all that apply	Multiple choice	○ Travelling alone ○ Travelling with a child/children ○ Travelling with at least one more adult ○ Great weather conditions ○ Unpleasant weather conditions	
SPintro	In the next 6 questions, we ask you to answer what mode would you choose under different hypothetical scenarios. The scenarios vary in terms of transport modes available for you and the characteristics of these modes (travel time, waiting time, access time, cost, payment method). For all scenarios, imagine a trip in the future that will be similar to the trip you just described: A trip • From/to Work • Travelling alone In total, you will face six(6) different scenarios.			
ID	Question	Answer Type	Answer set	Selection criteria

SPcar1_1 (Choice task example for country of residence: Austria, Germany, or Belgium. In case of location in the Netherlands, instead of an e-scooter, an e-moped was presented.)	**New scenario!** For your trip, you can choose any of the modes below. They are all available for you to travel by. Make sure you check the time (minutes), cost (€), and payment method values before you decide which transport mode you prefer for this new trip. **Shared modes** Bike / Car / E-scooter / Public transport / Own Car Travel time: 27 min / 12 min / 24 min / 16 min / 12 min Walking time to the vehicle: 3.5 min / 3.5 min / 3.5 min / 3.5 min / 2 min Waiting time for the vehicle: 1.5 min / 3 min / 0 min / 1 min / - Cost: 0.9 € / 2.3 € / 4.8 € / 1.2 € / 5.5 € Payment only via a mobile app: No / Yes / No / No / - Which transport mode do you prefer in this scenario? ○ Shared bike ○ Shared car ○ Shared e-scooter ○ Public transport ○ Own Car 1) Based on the mode in Ref1, people are assigned to one out of three sets of blocks. The first set is for reference trips by walking or by own bike, the second and third are for reference trips by public transport and own car, respectively. 2) A random selection of one block out of 12 available blocks in the assigned set. Each block consists of 6 choice tasks/questions.	Select one	○ Shared bike ○ Shared car ○ Shared e-scooter ○ Public transport ○ Own car	