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SmartHubs

Smart Mobility Hubs as Game Changers in Transport

WP2. Review of the state of practice

T2.2. Definition of KPIs

Deliverable D 2.2

Synthesis of KPIs to evaluate mobility hubs

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Responsible partner: Vrije Universiteit Brussel (VUB)

Authors: Jesse Pappers (VUB), Lluis Martinez Ramirez (VUB), Imre Keserü (VUB)

VUB

mobi MOBILITY, LOGISTICS & AUTOMOTIVE TECHNOLOGY RESEARCH CENTRE

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1. INTRODUCTION

Mobility hubs come in different shapes and sizes and have various definitions. In the SmartHubs project, a mobility hub is defined as "a physical location where different shared transport options are offered at permanent, dedicated and well-visible locations and public or collective transport is available at walking distance." (Geurs & Münzel, 2022, p. 10). However, the goal of the SmartHubs project is to develop *smart* mobility hubs, i.e., mobility hubs that go beyond grouping different transport modes.

Besides the transport modes, smart mobility hubs also focus on digital and physical accessibility as well the inclusion of vulnerable-to-exclusion citizens in the design and use of a hub. The evaluation of mobility hubs should therefore go beyond the physical aspects such as the number of shared vehicles or the parking capacity at the hub.

Grouping different transport modes has been done for decades, for example in transit-oriented developments. However, the term 'mobility hub' is relatively new and therefore not much is known about the impact of mobility hubs. A standardized set of key performance indicators (KPIs) can help measure the performance and impact of mobility hubs. This deliverable provides a standardized set of KPIs that can help measure the performance of mobility hubs. These KPIs were identified in existing literature and evaluated in three surveys with 56 responses. These KPIs will be tested in the living labs in the SmartHubs project, which are located in Austria, Belgium, Germany, Netherlands, and Turkey. The usefulness of the KPIs does not only lay within the project, as the KPIs can be applied to any mobility hub.

1.1.Task description and relation to other tasks

The task 2.2 is part of SmartHubs work package 2 (WP2) and aims to deliver a standardised set of KPIs to measure the performance of mobility hubs across living labs. This set of KPIs was found through a literature review and has been validated in three expert surveys.

The output of this task will serve as input and guidance for WP3 (indicators for the multicriteria assessments in task 3.5), WP4 (evaluation of living labs in tasks 4.2 through 4.6), and WP5 (multidimensional performance evaluation).

1.2.Structure of the deliverable

This deliverable contains six sections and six annexes. Section 2 contains the background and literature on evaluation frameworks used in transport research and key performance indicators (KPIs) of mobility hubs. In section 3, the methodology to select and evaluate KPIs for mobility hubs is described. This is followed by an overview of the selected KPIs to evaluate mobility hubs in section 4. The results of the deliverable are summarised in section 5, which is followed by a list of references in section 6. The annexes contain a list of indicators to evaluate mobility hubs based on a literature review as well as two surveys and the survey results.

2. BACKGROUND AND LITERATURE

This section discusses the relevant literature about evaluation frameworks used in transport research. Evaluation frameworks often apply Key Performance Indicators (KPI) to measure and evaluate specific aspects of a project. To inform the selection process of relevant KPIs for evaluating mobility hubs, the type of frameworks and measurements are discussed in the following sub-sections.

2.1.Frameworks for evaluation of transportation projects

Different methodological frameworks exist for the ex-ante or ex-post evaluation of transportation projects. These frameworks include, among others, Cost-Benefit Analysis (CBA), Multi-Criteria Analysis (MCA), Social Analysis, and Decision-Analysis (Tsamboulas & Mikroudis, 2000). Especially CBA is used frequently to evaluate the expected impacts of transportation projects (Macharis & Bernardini, 2015). Methodologically, they all use variations of checklists, matrices, networks and overlay methods with the aim to assess the impact, performance, and outcome of a transportation project.

The choice of the methodology is related to the type of project and the attributes being assessed. Thus, an evaluation framework should be established to identify the elements that will be evaluated and accordingly, to select an adequate methodology with which the evaluation is conducted. In this regard, several evaluation frameworks have been developed in transport research and practice. The EFECT framework, for example, focuses on environmental impacts of transportation projects and combines CBA and MCA (Tsamboulas & Mikroudis, 2000). The NISTO framework appraises the sustainability and stakeholder preferences for mobility projects by combining MCA and MAMCA (Keseru et al., 2016). Pappers et al. (2021) have used MAMCA to evaluate the stakeholder support for small-scale urban mobility interventions.

Nevertheless, no standard framework for the evaluation of mobility hubs currently exists. In the SmartHubs project, a comprehensive set of evaluation methods are developed that aim to assess the system level impacts of the passenger and freight services at mobility hub for different population segments (in the context of work package 5 (WP5) Impact assessment of SmartHubs Living Labs). In the absence of a set of widely accepted performance indicators, it becomes necessary to produce a dedicated set of indicators to evaluate the performance and impacts of mobility hubs. The set of indicators can be based on a review of existing literature.

2.2.Key performance indicators

In general, indicators have three main objectives: simplification, quantification, and communication. They are defined as the quantified measurement of an attribute, allowing to evaluate and communicate in a simple manner (Bojković et al., 2010; Lawrence, 1997). Gudmundsson (2003) states that indicators are selected, targeted, and compressed variables expressing public concerns that are useful for decision makers. Doran (1981) states that indicators must be SMART: (a) specific, (b) measurable, (c) achievable, (d) relevant, and (e) time bound. Gillis et al. (2016) argue that indicators must be (a) specific, (b) complete, (c) measurable with precision, (d) sensitive, (e) technologically neutral, and (f) scalable.

Indicators are defined as variables representing an attribute of a system, measuring elements related to the outcome as well as the process towards an objective of the system. In urban transport, indicators enable to compare the development of systems over time and space (Gudmundsson, 2003; Litman, 2015) and serve to clearly evaluate the social, economic and environmental outcomes of transportation projects. Moreover, standardized sets of indicators can be used as evaluation frameworks across different programs and projects (Chakhtoura & Pojani, 2016).

Two types of indicators can be differentiated: descriptive indicators and performance indicators. Descriptive indicators evaluate the state of a system at a given time and are used to measure attributes at one point in time or to conduct cross-sectional evaluations. Performance indicators enable comparison of descriptive indicators at different points in time and they can be used to compare a given state to a chosen target (Chakhtoura & Pojani, 2016). An example of a descriptive indicator is the current modal split; an example of a performance indicator is the development of the modal split over time. Thus, performance indicators are more relevant to the evaluation of time-related outcomes (Jordan & Turnpenny, 2015). Nevertheless, descriptive indicators can be used to detect trends over time when updated periodically (Litman, 2007).

Performance indicators effectively enable evaluation of the attributes and outputs of specific projects. However, performance indicators that are useful in certain projects might not be suitable for a cross-sectional

comparison due to their context-related specificity (Kaparias et al., 2012). A common way to overcome this issue, is to combine individual performance indicators to create overarching measurements, referred as key performance indicators (KPIs) (Transportation Research Board, 2000; Zhou et al., 2006). KPIs provide a focus for operational and strategic improvement while creating an analytical basis for decision making, moving the attention towards what is more relevant for a type of project.

The choice of the type of indicators must consider the temporal dimension of the evaluation. However, the choice of the set of indicators must consider the scale of what will be evaluated, the context (environmental, geographical, and socioeconomic) and time of the evaluation, and the availability of data on what is being measured and evaluated (Bretagnolle, 2009; Gudmundsson, 2004).

2.3.KPIs for mobility hubs

No standard KPIs dedicated to mobility hubs have been identified so far. However, different indicators that could be used to evaluate mobility hubs can be found in previous research. For instance, Garau et al. (2015) use indicators to rank Italian cities in terms of sustainable mobility. These indicators focus on modes of transport, transport infrastructure, and digital integration. Monzón et al. (2016), analyse transport interchanges to identify relevant attributes that might be assessed such as comfort, access, reliability, frequencies of services and intermodal integration. Furthermore, the availability of travel-time and route information are also relevant attributes (Monzón et al., 2016). Bell (2019) applies a user-centred design approach to define attributes of mobility hubs that correspond to the needs of users.

3. METHODOLOGY

3.1.Searching KPIs

A set of indicators can be built in two ways: starting from scratch and constructing the different indicators or using a pre-existing set of indicators and selecting the indicators that fit best to the evaluation objective. We applied the second approach, selecting relevant indicators from existing sets of indicators found in mobility research and documents (e.g., sustainable urban mobility plans).

The attributes of mobility hubs were identified in a literature review of mobility hubs. Then, consulting further literature on sustainable and smart mobility, a longlist of indicators to measure the performance of mobility hubs was drafted. Due to the relatively recent introduction of mobility hubs in academic literature, non-academic sources (or 'grey' literature) were also consulted. The consulted documents were in English and/or French.

This section identifies attributes of mobility hubs highlighted in existing literature. Such attributes can be divided into nine categories: mobility; availability of services and attractiveness of the hub; digital dimension; accessibility; integration in a network; maintenance and quality of service; economy of the hub; social integration; and environmental dimension.

3.1.1.Mobility

In the SmartHubs project, a mobility hub has been defined as "a physical location where different shared transport options are offered at permanent, dedicated and well-visible locations and public or collective transport is available at walking distance." (Geurs & Münzel, 2022, p. 10). A mobility hub should offer several modes of transportation (Orlowski & Romanowska, 2019), facilitate transport interchange (Gillis et al., 2016); provide the necessary transport infrastructure (Shared-Use Mobility Center, 2019); supply useful information to users (Bell, 2019); and offer possibilities to purchase tickets (Garau et al., 2015).

3.1.2. Services

Additional services to transport-related infrastructure may attract more users and increase the use and improve the performance of a mobility hub. For example, mobility hubs can play a key role in urban logistics because they can be an intermediary place between warehouses and the dense city centres to distribute goods for the last or first mile. Shopping facilities and the availability of leisure activities such as a fitness club or cinema could serve to entertain users while they are waiting for their mobility service. Destination facilities such as co-working spaces can also be considered, as they can reduce commuting times and make the hub more attractive to users (Ringenson et al., 2018). The qualities of the hub as a "placemaker" could maximize the shared value and enhance usage and acceptance among residents (Geurs & Münzel, 2022, p. 24).

3.1.3. Digital dimension

Transport services increasingly rely on digital tools and interfaces for planning, booking and paying for services as well as to provide real-time information to passengers and allow passengers to provide feedback about services (Geurs & Münzel, 2022, p. 26). For mobility hubs, these digital elements can facilitate wayfinding, travel planning via the mobility hub, and booking or paying for different transport options that are available at the hub. Information about the services and facilities available at the hub should be present online and on digital screens at the hub. Travelers should be able to purchase a ticket on site or online. Other possible digital facilities include Wi-Fi connection, phone charging facilities, and QR-codes to unlock/access certain services. Special attention should be paid to digital inclusion, i.e., reducing the socio-economic and socio-demographic barriers to accessing digital mobility services for people with no or low digital literacy (Durand et al., 2021; Kenyon, 2006).

3.1.4. Accessibility

As mobility hubs are designed to make mobility easier, it is important to make the hubs accessible to all segments of the population, especially the vulnerable-to-exclusion groups who often have reduced access to transport modes. For example, reducing barriers for people in a wheelchair will increase the physical accessibility of the infrastructures and services. Affordability is also part of accessibility because if the prices of the offered mobility services are too high, certain segments of the population would be excluded from using the services available at the hub (Joint Research Centre et al., 2007). Mobility hubs should also be located in strategic places in order to give access to a large number of users. As mobility hubs have considerably evolved in recent years, it is essential to communicate about their functionalities and to promote them, in order to encourage citizens to use the services offered at the hubs (Schreier et al., 2018).

3.1.5. Network integration

A hub increases its potential when it is part of a network of hubs. The distance between the hubs depends on the services proposed and the demand or population density. The hubs should be integrated in the existing mobility network (roads, bicycle lanes, public transport itineraries, etc.) (Tafidis et al., 2017).

3.1.6. Maintenance

Maintenance is a key activity of a mobility hub. In order to attract users and to keep the hub operational, it is important to have vehicles and services in working order. It is also important to offer a good quality of

service by providing a clean environment. Besides the functioning of different mobility options and services, the hub infrastructure should also be clean and safe (Joint Research Centre et al., 2007).

3.1.7. Economy

Although profitability is not an explicit goal of mobility hubs, it is important to take the economy of the hub into account as a key activity. If the hub is not cost efficient, it will not be viable. However, the economic dimension of a hub is difficult to assess as the different mobility services as well as the infrastructure may be operated or owned by different operators (Gerlach et al., 2016). Besides the cost efficiency of the operations of the infrastructure, the cost efficiency should also be taken into account for the mobility services as well as the auxiliary services offered at the hub. Lastly, the mobility hub may also contribute to the economic welfare of the area by increasing the number of visitors to shops and other services.

3.1.8. Social integration

Whereas a regular mobility hub can be designed in a top-down fashion, the design of a smart mobility hub includes participation. Besides the transport modes, smart mobility hubs also focus on digital and physical accessibility as well the inclusion of vulnerable-to-exclusion citizens in the design and use of a hub. The involvement of vulnerable-to-exclusion populations in the participation process is especially relevant for smart mobility hubs (Geurs & Münzel, 2022). The degree of stakeholder and end-user involvement is key as participation in mobility and transport projects can take many shapes and forms (Pappers et al., 2020).

3.1.9. Environmental impact

One of the objectives of a mobility hub is to promote sustainable mobility, which is why the environmental dimension should be considered. This dimension includes the emission of greenhouse gases and other pollutants by mobility services and services at the hub. A hub should also promote mobility services that are less polluting than the use of privately owned motorised vehicles (Schemel et al., 2020). The local environmental impact of the hub can also be considered, including habitat and ecosystem disruption, land occupation by the hub and noise pollution produced by the hub.

3.2. Selecting KPIs for review

Considering the abovementioned aspects of mobility hubs, relevant indicators were searched in the literature and documented. A complete list of 97 indicators of aspects of mobility hubs and their sources identified in this section can be found in Annex 1 – Indicators to evaluate mobility hubs. The 97 KPIs contained duplicate and overlapping KPIs as well as KPIs that were not relevant to the evaluation objective. During several rounds of review by four urban mobility researchers at SmartHubs partner VUB-MOBI[1], the longlist was reduced to 85 KPIs. The list of 85 KPIs is found in Annex 2 – Survey 1.

[1] Mobility, Logistics, and Automotive Technology Research Centre

3.3.Categorisation of KPIs

The 85 selected KPIs of attributes of mobility hubs were distributed among 9 categories described above. The categories (see Table 1) cover what is physically at a hub (mobility, services, maintenance), the way a hub can be used (digital dimension, accessibility, and social integration), and the impact of a hub (economy and environmental impact).

Table 1 Description of KPI categories

No. of KPIs	Category	Description
27	Mobility	The mobility options present at a hub.
13	Services	Any additional services that are offered at a hub.
13	Digital dimension	The digital services necessary to use and/or the digital tools available at the hub.
5	Accessibility	The accessibility of a hub, also for vulnerable-to-exclusion groups.
3	Network integration	The integration of a hub in an existing network of hubs.
8	Maintenance	The maintenance of vehicles and facilities at the hub.
5	Economy	The economic impact of the hub on mobility operators as well as surrounding businesses and residents.
3	Social integration	The involvement of (non-)users in the design of the hub.
8	Environmental impact	The impact of the traffic generated/avoided by the hub on the local and global environment.

3.4.Survey 1

The purpose of the evaluation surveys was to identify the most relevant KPIs to measure the performance of the smart mobility hubs in the SmartHubs Living Labs and discard the less relevant KPIs. The evaluation was done using two consecutive surveys. The first survey was sent to the academic partners of the SmartHubs project. The second survey contained a selection of KPIs based on the outcome of the first survey and was sent to all partners in the SmartHubs project including transport operators and authorities.

The first survey was sent to the 34 academic partners of the SmartHubs project to evaluate the usefulness and feasibility of the 85 KPIs (see Annex 2 – Survey 1). The respondents could also add any missing KPIs. 16 experts from 5 European countries (see Table 2) and 11 institutions filled in the survey. All but three respondents were involved in a SmartHubs Living Lab (see Table 3). Half of the respondents (n=8) were experts in the field of mobility and transport, but the survey was also completed by political scientists (n=2) and computer scientists (n=2).

Table 2 Location of respondents – survey 1

Country	No.
Austria	9
Belgium	2
Germany	3
Italy	1
Netherlands	1
Total	16

Table 3 Involvement of respondents in SmartHubs Living Labs – survey 1

Country	SmartHubs Living Lab	No.
Belgium	Anderlecht	2
Austria	Bruno Marek Allee	8
	Seestadt Nord	7
	Tullnerfeld	6
Netherlands	Haagse Markt	1
	Leyenburg	1
	Schiedam	1
	Slinge	1
Germany	TUM	1
None of the above		3
Other		1

Two criteria to evaluate the KPIs were selected: usefulness and feasibility. Feasibility is the ease with which data can be obtained in order to calculate the KPI; usefulness is the extent that the KPI reflects the impact of a smart mobility hub (Litman, 2007). The respondents evaluated the usefulness and feasibility of the KPIs considering the context of their SmartHubs Living Lab (if applicable). For each KPI, respondents could evaluate whether it was usable and feasible by selecting 'yes', 'to a limited extent', 'no', or 'I don't know'. Three 'easter egg' questions (i.e., questions not related to mobility hubs) were also added to the survey to ensure respondents did not randomly select answers without reading the question.

A feasibility score and a usability score were calculated for each KPI. One point was allocated to a KPI each time a respondent answered 'yes', with 0.5 points for 'to a limited extent' and 0 points for 'no'. The answers 'I don't know' were excluded from the analysis. The number of points was then divided by the total number of respondents that had scored the KPI (again excluding the response 'I don't know'). The feasibility and usability scores were calculated using the following formula:

$$\frac{(1 \text{ x no. of 'yes'}) + (0.5 \text{ x no. of 'to a limited extent'}) + (0 \text{ x no. of 'no'})}{\text{(Sum of respondents that select 'yes', 'to a limited extent', or 'no')}}$$

The selection process reduced the number of KPIs from 85 to 50 (see Table 4). The selection threshold was set at 60% for both the feasibility and usability scores. This meant that in order to be selected for a second round of review, a KPI needed to have a feasibility score of 60% or more as well as a usability score of 60% or more. 43 KPIs met the 60% threshold. However, 10 KPIs with a feasibility or usability score below 60% were also selected to maintain a better distribution of KPIs across different categories[2]. A further 15 KPIs

[2] Without this intervention, 'Maintenance' would only have 1 KPI, 'Accessibility' 2 KPIs, and 'Services' 3 KPIs.

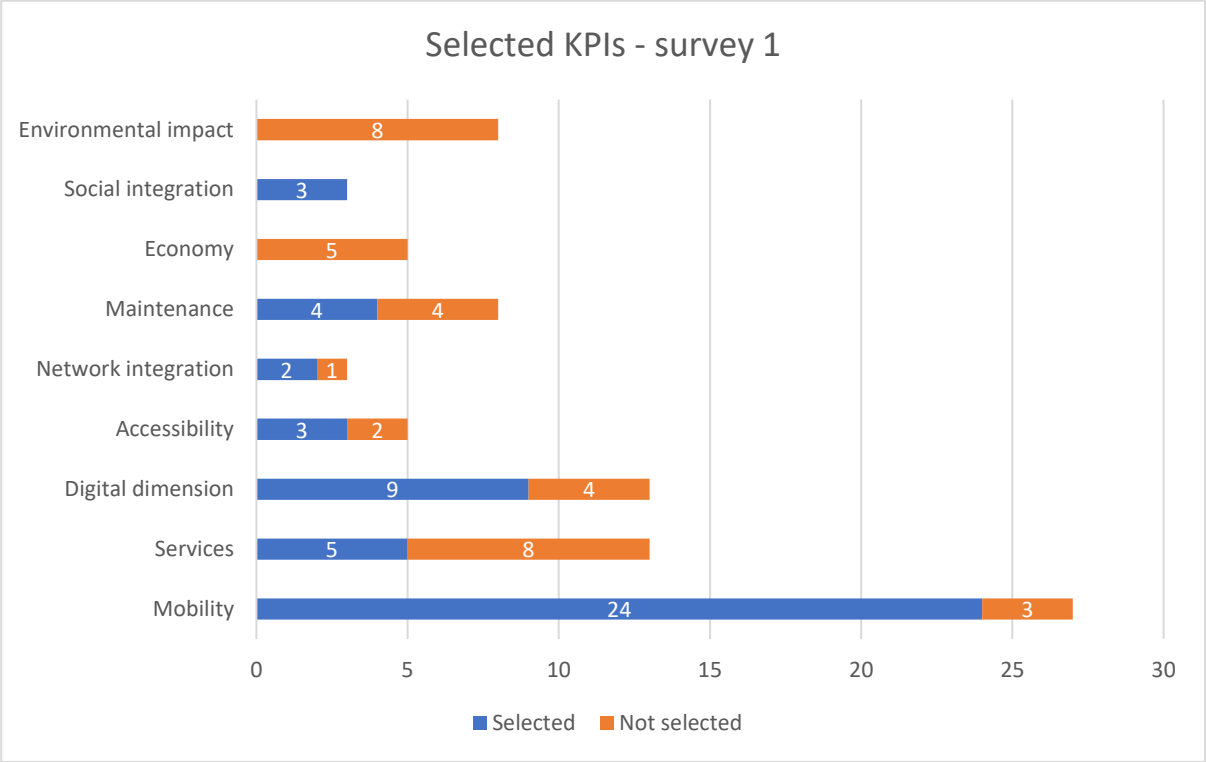
were suggested by respondents, of which 1 was included in the second survey after having been reviewed by the researchers at SmartHubs partner VUB-MOBI. Lastly, 4 duplicate or overlapping KPIs were removed, bringing the total to 50 KPIs. The feasibility scores of all KPIs can be found in Annex 3 – Results survey 1.

Table 4 Selection of KPIs after first survey

Steps	No.
KPIs in survey 1	85
KPIs meeting the 60% feasibility and usability thresholds	43
KPIs selected despite not meeting the thresholds	10
KPIs suggested by respondents	1
Duplicate/overlapping KPIs removed	4
KPIs in survey 2	50

The selection of KPIs per category can be seen in Figure 1. None of the KPIs in the categories 'environmental impact' and 'economy' met the 60% feasibility and usability thresholds. The category 'services' was reduced from 13 to 5 KPIs. It is possible that the KPIs in the categories 'environmental impact' and 'economy' were not clear enough, as many respondents selected the answer category 'I don't know' for these KPIs. For example, 63% of respondents selected 'I don't know' when evaluating the feasibility of the environmental impact KPI 'well-to-wheels emissions of all modes at the hub'.

Figure 1 Selected and non-selected KPIs per category



3.5.Survey 2

A second survey was sent to all 60 members of the SmartHubs project to evaluate the usefulness and feasibility of 50 KPIs (see Annex 4 – Survey 2). The project partners included academic researchers as well as transport operators, operators of mobility hubs, and policy makers. 26 experts from 6 countries (see Table 5) and 19 institutions filled in the survey. All but two respondents were involved in a SmartHubs Living Lab (see Table 6). Nearly all respondents (n=19) are experts in the field of mobility and transport, but the survey was also completed by experts in urban planning (n=3) and computer science (n=2) (as respondents could select more than one expertise, the number of expertise is greater than the number of respondents).

Table 5 Location of respondents – survey 2

Country	No.
Austria	8
Belgium	4
Germany	3
Italy	1
Netherlands	9
Turkey	1
Total	26

Table 6 Involvement of respondents in SmartHubs Living Labs – survey 2

Country	SmartHubs Living Lab	No.
Belgium	Anderlecht	4
Austria	Bruno Marek Allee	4
	Seestadt Nord	7
	Tullnerfeld	2
Netherlands	Haagse Markt	6
	Leyenburg	6
	Schiedam	5
	Slinge	5
Turkey	Beylikdüzü	1
Germany	TUM	2
None of the above		2
Other		1

As in the first survey, two criteria to evaluate the 50 KPIs were selected: usefulness and feasibility. All but 5 KPIs passed the 60% thresholds for the usefulness and feasibility scores (see Annex 5 – Results survey 2). As those 5 KPIs all had a feasibility or usability score of just below the thresholds of 60%, it was decided to keep them in the list of KPIs. Therefore, this second round of the surveys served as a validation of the first selection round and confirmed the choices made.

3.6.Reviewed categorisation of KPIs

After review by the research team at VUB-MOBI, the number of KPI categories was reduced to 6 (see Table 7). The two KPIs in the category 'network integration' were moved to the category 'mobility'. Furthermore, 11 KPIs from the category 'mobility' were moved to other, more relevant categories. Moreover, 'social integration' was renamed 'democratic integration' for better coherence between the deliverables in WP2.

Lastly, four KPIs of the category 'maintenance' were moved to the new category 'safety and security' and the remaining KPI in the category 'maintenance' was moved to the category 'mobility'.

Table 7 Description of KPI categories after reviewed categorization

No. of KPIs	Category	Description
15	Mobility	The mobility options present at a hub.
11	Services	Any additional services that are offered at a hub.
10	Digital dimension	The digital services necessary to use and/or the digital tools available at the hub.
5	Accessibility	The accessibility of a hub for vulnerable-to-exclusion groups.
5	Safety and security	The traffic safety and security near a mobility hub.
4	Democratic integration	The involvement of (non-)users in the design and use of the hub.

3.7.Survey 3

During the validation and selection of KPIs to evaluate smart mobility hubs, it emerged that KPIs related to the level of democratic integration of mobility hubs were lacking. As detailed in SmartHubs Deliverable 2.1, democratic integration refers to the involvement, representation, and engagement of stakeholders and users in the setup and the maintenance of a mobility hub (Geurs & Münzel, 2022). Following discussions within the SmartHubs project consortium, 7 KPIs on democratic integration of mobility hubs were identified and added to the category 'democratic integration'.

A third survey was sent to the 39 academic members of the SmartHubs project to evaluate the usefulness and feasibility of these 7 KPIs (see Annex 6 – Survey 3). 14 experts from 5 countries (see Table 8) and 9 institutions filled in the survey. All but two respondents were involved in a SmartHubs Living Lab (see Annex 7 – Results survey 3).

). Many respondents (n=9) are experts in the field of mobility and transport, but the survey was also completed by experts in user interface and user experience design (n=1) and a computer scientist (n=1).

Table 8 Location of respondents – survey 3

Country	No.
Austria	7
Belgium	4
Germany	1
Italy	1
Netherlands	1
Total	15

Table 9 Involvement of respondents in SmartHubs Living Labs – survey 3

Country	SmartHubs Living Lab	No.
Belgium	Anderlecht	6
Austria	Bruno Marek Allee	2
	Seestadt Nord	4
	Tullnerfeld	1
Netherlands	Haagse Markt	3
	Leyenburg	1
	Schiedam	1
	Slinge	1
Turkey	Beylikdüzü	2
Germany	TUM	3
None of the above		2

As in the first two surveys, the same two criteria to evaluate the 7 KPIs were selected: usefulness and feasibility. 4 KPIs passed the 60% thresholds for the usefulness and feasibility scores (see Annex 7 – Results survey 3).

4. RESULTS: LIST OF KPIS

This section provides an overview of the selected KPIs and explains them.

Two surveys reduced the original 97 KPIs to 50, after which another survey resulted in 4 new KPIs and thus a total of 54 KPIs. Not all KPIs are equally relevant to the different SmartHubs Living Labs (or to mobility hubs in general). Therefore, the KPIs have been divided into three groups based on their feasibility and usability scores: core KPIs, non-essential KPIs, and local/regional KPIs. The core KPIs are highly relevant to all SmartHubs Living Labs and should therefore be part of the evaluation of each SmartHubs Living Lab. Non-essential KPIs are not necessarily relevant to all SmartHubs Living Labs and should only be part of the evaluation in locations where they are relevant. Local or regional KPIs are only relevant in some SmartHubs Living Labs.

Due to the setup of the project and the surveys, there is a geographical bias in the survey results. All but 2 of the 56 respondents in the three surveys work and live in a Western European country. Especially respondents from Austria were overrepresented with 27 responses, and 11 responses came from the Netherlands. While the geographical bias does not imply the results presented in this deliverable are incorrect, it should be stressed that more geographical variety in respondents could influence the results.

4.1.Core KPIs

Core KPIs have a usability score of at least 75% and a feasibility score of at least 75%. The 25 KPIs that meet these thresholds are found in the categories 'mobility' (8), 'services' (3), 'digital dimension' (7), and accessibility' (4), safety and security (1), and democratic integration (2) (see Table 10).

Table 10 List of core KPIs (greener is higher, redder is lower)

No.	Category	KPI	Feasibility	Usability
1	Mobility	Public transport frequency	98%	80%
4	Mobility	Number of transportation modes at the hub	98%	87%
7	Mobility	Number of public places adapted to leave a bicycle/moped/scooter	85%	84%
8	Mobility	Number of vehicles available at the hub	84%	88%
9	Mobility	Possibility to buy ticket that combines several modes	85%	90%
12	Mobility	Availability of drop-off/pick-up points for taxi/carpooling/ridesharing/ridesourcing	89%	78%
13	Mobility	Integration with local/regional/national transport policy	83%	92%
14	Mobility	Number of hubs in the network	85%	75%
18	Services	Presence of overview of location and explanation of mobility options	96%	84%
20	Services	Availability of ticket machines	92%	77%
23	Services	Spaces adapted to pick up packages	87%	77%
27	Digital dimension	Availability of digital ticketing	98%	86%
29	Digital dimension	Presence of a digital map to find locations of modal options	94%	85%
30	Digital dimension	Availability of real-time departure and arrival information for public transport	98%	90%
31	Digital dimension	Availability of real-time information about shared mobility options	86%	88%
32	Digital dimension	Possibility to plan a trip in which all modes at the hub are compared	86%	90%
33	Digital dimension	Possibility for users to unlock transport modes and facilities e.g. using a smartphone, a code, a card	88%	88%

36	Digital dimension	Number of applications/subscriptions necessary for full use of the hub and its services	76%	78%
38	Accessibility	Presence of overview of information for people with disabilities	88%	87%
39	Accessibility	Accessibility of the digital services for people with disabilities	75%	82%
40	Accessibility	Accessibility of transport modes for people with disabilities	76%	88%
41	Accessibility	Accessibility of hub for people with disabilities	80%	88%
45	Safety and security	Proportion of secure bicycle parking	77%	82%
49	Democratic integration	The involvement of (representatives of) vulnerable-to-exclusion citizens in designing the hub	77%	79%
53	Democratic integration	Number of in-person participation opportunities	86%	75%

4.2.Non-essential KPIs

Non-essential KPIs have a usability score of less than 75% and/or a feasibility score of less than 75%. The 32 KPIs that meet these thresholds are found in the categories 'mobility' (7), 'services' (8), 'digital dimension' (3), and accessibility' (1), safety and security (4), and democratic integration (9) (see Table 11).

Table 11 List of non-essential KPIs (greener is higher, redder is lower)

No.	Category	KPI	Feasibility	Usability
2	Mobility	Number of passengers transferring through the hub	71%	90%
3	Mobility	Modal split	71%	92%
5	Mobility	Average and maximum waiting time during a transfer	55%	80%
6	Mobility	Crowding at the mobility hub	55%	66%
10	Mobility	Parking capacity at the hub	88%	71%
11	Mobility	Availability of kiss&ride places	91%	64%
15	Mobility	Hub network density and length	70%	78%
16	Services	Quality of the waiting infrastructures	77%	73%
17	Services	Presence of printed timetable displays	94%	70%

19	Services	Presence of overview of location of points of interest near hub	89%	70%
21	Services	Quality of the ticketing service	60%	74%
22	Services	Spaces adapted to storing items (e.g., left luggage facilities)	78%	67%
24	Services	Amenities adapted for delivery vehicles (unloading)	75%	56%
25	Services	Presence of commercial activities	91%	69%
26	Services	Availability of toilets	94%	69%
28	Digital dimension	Presence of digital manuals explaining use of modal options	91%	74%
34	Digital dimension	Presence of free wireless internet	91%	65%
35	Digital dimension	Availability of QR codes for fast registration and use of mobility options	91%	67%
37	Accessibility	Quality of wayfinding within the hub	61%	86%
42	Safety and security	Quality of public lighting	80%	73%
43	Safety and security	Number of accidents at the hub	71%	60%
44	Safety and security	Perceived risk of crime in urban transport	65%	58%
46	Safety and security	Coverage of CCTV cameras	70%	54%
47	Democratic integration	User satisfaction with public transport	70%	86%
48	Democratic integration	The number of citizens participating in the design of the hub	75%	65%
50	Democratic integration	The number of ways users can submit suggestions or complaints	84%	69%
51	Democratic integration	Number of dialogic participation opportunities	81%	73%
52	Democratic integration	Number of one-directional participation opportunities	82%	68%
54	Democratic integration	Number of online/digital participation opportunities	86%	68%

55	Democratic integration	Number of online announcements	96%	46%
56	Democratic integration	Number of printed announcements	86%	38%
57	Democratic integration	Number of on-site announcements	93%	46%

4.3.Local/regional KPIs

Some non-essential KPIs had a usability score of at least 75% and a feasibility score of at least 75% in certain SmartHubs Living Labs. Table 12 shows how many non-essential KPIs received a usability score of at least 75% and a feasibility score of at least 75% per SmartHubs Living Lab. The complete list of non-essential KPIs that are relevant to some SmartHubs Living Labs can be found in Annex 8 – Local/regional KPIs.

Table 12 Number of non-essential KPIs with usability and feasibility scores of >=75% per Living Lab

Location	No. of non-essential KPIs
Netherlands – Haage Markt	14
Netherlands – Leyenburg	14
Netherlands – Schiedam	16
Netherlands – Slinge	21
Belgium – Anderlecht	11
Austria – Bruno Marek Allee	5
Austria – Seestadt Nord	6
Austria - Tullnerfeld	7
Germany – TUM	19
Turkey - Beylikdüzü	18

4.4.KPIs, measurement units and measurement methods

The previous sections have shown which KPIs are relevant for the evaluation of mobility hubs, based on three rounds of expert surveys. Knowing *what* to evaluate is the first step. Knowing *how* to obtain information to evaluate is the second step. We have therefore identified four ways to measure a KPI: desktop research, observation, questionnaire surveys and interviews. All KPIs and their proposed measurement units and measurement methods can be found in Table 13 below. The names of the KPIs have been edited for clarity.

Desktop research, i.e., collecting and analysing secondary data, is sufficient for KPIs where the data is already collected by third parties. These data should be obtained from transport authorities and organisations.

Observation is necessary to assess whether the hub has features such as real-time information about shared mobility options. This can also include traffic and passenger counts, traveller tracing, vehicle tracing, and camera observation. Observation might also be necessary to assess the level of accessibility of the hub: can people with disabilities or with limited digital skills use the hub? Observation might also be necessary to evaluate the involvement of (vulnerable-to-exclusion) citizens in the design of the hub as well as the quality and maintenance of the hub.

Questionnaire surveys might be necessary in KPIs that reflect the users' perspective. For example, KPIs such as the quality of the waiting infrastructures and the perceived risk of crime in urban transport are difficult to assess using desktop research or observation. Instead, users' opinions and experiences can be collected using surveys.

The involvement of (vulnerable-to-exclusion) citizens in designing the hub might not be assessed using desktop research, observation, or surveys. Here, interviews with the people organising the participation process might be necessary to assess this KPI.

Table 13 List of KPIs with measurement units and measurement methods

No.	Category	Type	KPI	Measurement unit	Measurement method
1	Mobility	Core	Public transport frequency	No. of departures/hour	Desktop research
2	Mobility	Non-essential	Number of passengers transferring through the hub	No. of passengers exiting one vehicle and entering another	Desktop research Observation
3	Mobility	Non-essential	Modal split	No. of passengers arriving and departing per transport mode	Desktop research Observation
4	Mobility	Core	Number of transportation modes at the hub	No. of modes (incl. private, public, and shared modes)	Desktop research
5	Mobility	Non-essential	Average and maximum waiting time during a transfer	Minutes	Observation Survey Desktop research
6	Mobility	Non-essential	Crowding at the mobility hub	No. of passengers transferring through the hub per timeframe	Observation Surveys
7	Mobility	Core	Number of parking places adapted for a bicycle/moped/scooter	Number	Desktop research Observation
8	Mobility	Core	Number of vehicles available at the hub	No. of vehicles per transport mode	Desktop research Observation
9	Mobility	Core	Possibility to buy ticket that combines several modes	Yes or no	Desktop research
10	Mobility	Non-essential	Parking capacity at the hub	Number of parking places for cars (private and shared)	Desktop research Observation
11	Mobility	Non-essential	Availability of kiss&ride places to drop off/pick up passengers	Yes or no	Observation
12	Mobility	Core	Availability of drop-off/pick-up points for taxi/carpooling/ridesharing/ridesourcing	Yes or no	Desktop research Observation

13	Mobility	Core	Integration of hubs with local/regional/national transport policy	Yes or no	Desktop research
14	Mobility	Core	Number of hubs in the network	No. of hubs of the same brand/organisation	Observation
15	Mobility	Non-essential	Hub network density and reach	Hubs per area Distance between furthest hubs	Desktop research
16	Services	Non-essential	Quality of the waiting infrastructures	Presence of covered waiting areas/shelters Score	Observation Survey
17	Services	Non-essential	Presence of printed timetable displays	Yes or no	Desktop research Observation
18	Services	Core	Presence of display with the overview of location and explanation of mobility options available at the hub	Yes or no	Desktop research Observation
19	Services	Non-essential	Presence of display with overview of points of interest near hub	Yes or no	Desktop research Observation
20	Services	Core	Availability of ticket machines	Yes or no	Desktop research Observation
21	Services	Non-essential	Quality of the ticketing service	Score	Survey
22	Services	Non-essential	Spaces adapted to storing items (e.g., left luggage facilities)	Yes or no	Desktop research Observation
23	Services	Core	Spaces adapted to pick up packages	Yes or no	Observation
24	Services	Non-essential	Amenities adapted for freight vehicles to unload (e.g., to deliver parcels to parcel lockers)	Yes or no	Observation
25	Services	Non-essential	Presence of commercial activities (e.g., shops and businesses)	Yes or no	Desktop research Observation
26	Services	Non-essential	Availability of toilets	Yes or no	Desktop research Observation

27	Digital dimension	Core	Availability of digital ticketing (incl. mobile applications, smartcards, and digital ticket machines) per service provider and/or hub operator	Yes or no	Desktop research Observation
28	Digital dimension	Non-essential	Presence of digital manuals explaining use of modal options at the hub	Yes or no	Desktop research Observation
29	Digital dimension	Core	Presence of a digital map to find locations of modal options at the hub	Yes or no	Desktop research Observation
30	Digital dimension	Core	Availability of real-time departure and arrival information for public transport at the hub	Yes or no	Desktop research Observation
31	Digital dimension	Core	Availability of real-time information about the availability of shared mobility options	Yes or no	Desktop research Observation
32	Digital dimension	Core	Possibility to plan a trip in a digital travel planner in which all modes available at the hub are taken into consideration	Yes or no	Desktop research Observation
33	Digital dimension	Core	Possibility for users to unlock vehicles and facilities, e.g. using a smartphone, a code, a card	Yes or no	Desktop research
34	Digital dimension	Non-essential	Presence of free wireless internet	Yes or no	Desktop research Observation
35	Digital dimension	Non-essential	Availability of QR codes for fast user registration and use of mobility options	Yes or no	Desktop research Observation
36	Digital dimension	Core	Number of applications/subscriptions necessary for full use of the hub and its services	Number	Desktop research Observation
37	Accessibility	Non-essential	Quality of wayfinding within the hub	Score	Observation Survey
38	Accessibility	Core	Presence of physical or digital overview of information for people with disabilities	Yes or no	Observation
39	Accessibility	Core	Accessibility of the digital mobility services and facilities at the hub for people with disabilities	Score	Observation Survey

40	Accessibility	Core	Accessibility of transport modes for people with disabilities	Score	Observation Survey
41	Accessibility	Core	Accessibility of hub facilities for people with disabilities	Score	Observation Survey
42	Safety and security	Non-essential	Quality of public lighting	Score	Observation Survey
43	Safety and security	Non-essential	Number of accidents at the hub	Number	Desktop research
44	Safety and security	Non-essential	Perceived risk of crime	Score	Survey
45	Safety and security	Core	Proportion of secure bicycle parking	Percentage of bicycle parking places whose access is restricted to bicycle owners compared to all bicycle parking places	Observation
46	Safety and security	Non-essential	Security cameras in operation	Yes or no	Desktop research Observation
47	Democratic integration	Non-essential	User satisfaction with public and shared transport	Score	Survey
48	Democratic integration	Non-essential	The number of citizens participating in the design of the hub	Number	Desktop research Observation
49	Democratic integration	Core	The involvement of (representatives of) vulnerable-to-exclusion citizens in designing the hub	Number Score	Observation Interviews
50	Democratic integration	Non-essential	The number of ways users can submit suggestions or complaints	Number	Observation Desktop research
51	Democratic integration	Non-essential	Number of dialogic participation opportunities	Number	Observation Desktop research

					Interviews
52	Democratic integration	Non-essential	Number of one-directional participation opportunities	Number	Observation Desktop research Interviews
53	Democratic integration	Core	Number of in-person participation opportunities	Number	Observation Desktop research Interviews
54	Democratic integration	Non-essential	Number of online/digital participation opportunities	Number	Observation Desktop research Interviews
55	Democratic integration	Non-essential	Number of online announcements	Number	Observation Desktop research Interviews
56	Democratic integration	Non-essential	Number of printed announcements	Number	Observation Desktop research Interviews
57	Democratic integration	Non-essential	Number of on-site announcements	Number	Observation Desktop research Interviews

5. CONCLUSIONS AND NEXT STEPS

Mobility hubs are a relatively new phenomenon and therefore not much is known about the impact of mobility hubs. This deliverable provides a list of key performance indicators (KPIs) to evaluate the state, performance, and impact of mobility hubs. The descriptive KPIs indicate the state of a mobility hub and can be used to make comparison between mobility hubs. The performance KPIs can be used to detect trends over time.

In total, 56 KPIs have been validated by the SmartHubs consortium via three subsequent surveys with respectively 16, 26, and 14 respondents. The respondents indicated whether a KPI reflected the impact of a SmartHub (usefulness) and the ease with which the data necessary to calculate the KPI could be obtained (feasibility).

Different dimensions should be considered when evaluating the performance and impact of a mobility hub. The mobility and services at the hub are important, but so are the digital dimension and the accessibility of the hub. The safety and security of passengers at the hub should be evaluated, as should the democratic integration of the hub.

The KPIs identified in this document will be tested in real-life settings in mobility hubs in work package 4 (WP4) of the SmartHubs project within the next two years. These hubs are located in the Netherlands, Belgium, Austria, Germany, and Turkey.

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ANNEX 1 – INDICATORS TO EVALUATE MOBILITY HUBS

Table 14 Indicators to evaluate mobility hubs

Key activity	Sub-activity	Sub-activity 2	Sub-activity 3	No.	Indicator	Source
Mobility hub	Offer several modes of transportation	Public transport		1.1.1.1	Satisfaction with public transport indicator	(European Commission, 2020)
				1.1.1.2	Occupancy rates	(Joint Research Centre et al., 2007)
				1.1.1.3	PT frequency	(Tafidis et al., 2017)
				1.1.1.4	Passenger punctuality	(Île-de-France Mobilités, 2019)
				1.1.1.5	Delay of PT	(Deloitte, 2021)
		Mobility options		1.1.2.1	Volume of passengers transferring through the hub by mode	(Joint Research Centre et al., 2007)
				1.1.2.2	Penetration of the mobility options	(Orlowski & Romanowska, 2019)
				1.1.2.3	Modal split	(Joint Research Centre et al., 2007)

		Intermodality	1.1.2.4.1	Number of trips transferring through the hub with 2 or more modes of transportation	(Joint Research Centre et al., 2007)
			1.1.2.4.2	Average and maximum waiting time during a transfer	(Orlowski & Romanowska, 2019)
			1.1.2.4.3	Quality of wayfinding within the hub	Own research
			1.1.2.4.4	Crowding at the mobility hub	Own research
		Amenities for micro-mobility options at the hub	1.1.2.5.1	Ratio of the number of public places adapted to leave a bicycle/moped/scooter to the total number of places	(Orlowski & Romanowska, 2019)
			1.1.2.5.2	Ratio of the number of repair points to the area of the city	(Orlowski & Romanowska, 2019)
			1.1.2.5.3	Ratio of the number of integration nodes adapted for bicycles/moped/scooters to the total number of interchange nodes	(Orlowski & Romanowska, 2019)
	Sharing		1.1.3.1	Number of shared vehicles per number of inhabitants of the area concerned	(Garau et al., 2015)
			1.1.3.2	Number of sharing stations per number of inhabitants of the area concerned	(Garau et al., 2015)
	Renting		1.1.4	Same as 1.1.3.1 and 1.1.3.2.	Own research
	Car-pooling, ridesharing, or taxi		1.1.5	Promotion of ridesharing activities.	(Ringenson et al., 2018)

Facilitate intermodality	Grouping of mobility gateways		1.2.1.1	Number of modes of transportation in the same hub	Own research
			1.2.1.2	Intermodal transfer time	(Gillis et al., 2016)
	Combined tickets		1.2.2	Possibility to buy tickets combining several modes	Own research
Provide infrastructures	Mobility infrastructures		1.3.1.	Capacity of the hub transport infrastructures, by mode and by type of infrastructure (number of passenger-km / t-km…)	(Joint Research Centre et al., 2007)
	Parking		1.3.2.1	(Bicycle) parking availability at the hub	(Tafidis et al., 2017)
			1.3.2.2	Quality of parking spaces at the hub	(Orlowski & Romanowska, 2019)
			1.3.2.3	Availability of drop-off zones for cars	Own research
	Intermodality infrastructures		1.3.3	Multimodal integration: availability of mobility modes and list of all interchanges and relevant modes combinations	(European Commission, 2020)
	Waiting infrastructures		1.3.4	Quality of the waiting infrastructures	

	Adapted infrastructures		1.3.5	Proportion of the infrastructures of the hub where accessibility has been facilitated for individuals who would otherwise be unable to use them. This includes accessibility of moving assets (vehicles), of stops and stations, and of ticket machines and offices.	(European Commission, 2020)
			1.3.6	Proportion of public transport stops with a shelter/bench	Own research
			1.3.7	Availability of drop-off/pick-up points for carpooling, ridesharing, and ride sourcing	Own research
			1.3.8	Quality of public lighting	Own research
Supply information	Timetables		1.4.1	Presence and share of infrastructures/vehicles providing information; presence of information in case of unplanned circumstances (e.g., strikes); share of informational infrastructures for users with accessibility barriers	(Garau et al., 2015; Orlowski & Romanowska, 2019)
	Location of the mobility options				
	Location of the ticketing counters				
	Local points of interest				
	Explanation about the mobility options				
	Adapted information				
			1.4.2	Availability of central information desk/office	Own research

	Offer payment possibilities			1.5.1	Quality of the ticketing service	(Île-de-France Mobilités, 2019)
		Payment at counters		1.5.2.1	Availability of ticket machines	(Île-de-France Mobilités, 2019)
				1.5.2.2	Accessibility of ticket machines	(Île-de-France Mobilités, 2019)
		Digital payment		1.5.3	Availability and accessibility of digital sales services	(Île-de-France Mobilités, 2019)
Services and attractiveness of the hub	Logistics	Spaces to send, receive and stock packages		2.1.1.1	Space to receive deliveries	(Atelier parisien d'urbanisme, 2014)
				2.1.1.2	Spaces adapted to stock packages	(Atelier parisien d'urbanisme, 2014)
				2.1.1.3	Spaces adapted to pick up packages	(Atelier parisien d'urbanisme, 2014)
		Options to carry and deliver packages		2.1.2.1	Amenities adapted for delivering vehicles (unloading)	(Atelier parisien d'urbanisme, 2014)

			2.1.2.2	Amenities adapted to carry packages	(Atelier parisien d'urbanisme, 2014)
Leisure activities	Catering		2.2.1	Presence and availability of catering services	Own research
	Commercial activities		2.2.2	Commercial activities diversity indicator (see indicator 4.3.2)	Own research
	Diverse activities	Restrooms	2.2.3.1	Availability of toilets in the hub	(Île-de-France Mobilités, 2019)
			2.2.3.2	Accessibility of restrooms	(Île-de-France Mobilités, 2019)
			2.2.3.3	Cleanliness of restrooms	(Île-de-France Mobilités, 2019)
Supply information			2.3	Similar to indicator 1.4	Own research
Co-working spaces			2.4.1	Presence of co-working spaces	Own research
			2.4.2	Size of the co-working spaces (number of places)	Own research
			2.4.3	Quality and accessibility of the co-working spaces	Own research

	Attractivity of the hub			2.5.1	Perceived satisfaction of public spaces	(European Commission, 2020)
				2.5.2	Quality of the contact with the passengers	(Île-de-France Mobilités, 2019)
Digital dimension	Information available online and on digital screens in the hub	Timetables		3.1	See indicator 1.4.1 + other dimensions: • Presence of digital manuals for use of modal options • Presence of a digital roadmap to find locations of modal options • Availability of real-time departure and arrival information for public transport • Availability of real-time occupancy of parking places • Availability of real-time information about shared mobility option (e.g., shared bikes)	Own research
		Locations of the mobility options				
		Instructions on the prices and the payment methods				
		Instructions on the use of mobility options/services				
	Possibility to book/pay online			3.2	Possibility to book/pay online	Own research
	Digital facilities at the mobility hub	Automated ways to buy tickets and to plan a trip		3.3.1.1	See indicators 1.6.2.1 and 1.6.2.2	Own research
				3.3.1.2	Possibility to plan a trip	Own research
		Unlock facilities with a smartphone/code/card		3.3.2	Possibility to unlock facilities (bikes, shared cars...) without an external intervention (e.g., with a smartphone, a code, a card...)	Own research
		Wi-Fi, phone charging		3.3.3.1	Presence of free Wi-Fi	Own research

				3.3.3.2	Presence of facilities to charge electronic devices (locker boxes or plugs)	Own research
				3.3.3.3	Performance of the Wi-Fi network	(Ashmore & Price, 2019)
				3.3.4.1	Presence of other digital services (e.g., mobility hub pillar with internet connection)	Own research
				3.3.4.2	Availability of QR-codes for quick subscription on the applications or use of mobility options	Own research
				3.4.1	Proportion of users of the hub owning a smartphone/having access to the Internet	Own research
				3.4.2	Number of applications/subscriptions necessary for full use of the hub and its services	Own research
Accessibility	Accessibility of the infrastructures			4.1	Quality of transport for disadvantaged people (disabled, low incomes, children, etc…)	(Joint Research Centre et al., 2007)
	Localization of the hub			4.2.1	Share of population with appropriate access to the hub	(European Commission, 2020)

				4.2.2	Urban function diversity indicator: mix of spatial functions in an area, creating proximity of mutual interrelated	(European Commission, 2020)
	Digital accessibility			4.4	Accessibility of the digital services	Own research
Network integration	Number of hubs			5.1	Area covered by the hubs	(Ringenson et al., 2018)
	Distance between the hubs			5.2	Distance between the hubs	Own research
	Critical mass			5.3.1	Number of registered users at the hub	(Ringenson et al., 2018)
				5.3.2	Number of actual users	(Ringenson et al., 2018)
	Integration in the mobility network			5.4	Network density and length (by mode)	(Tafidis et al., 2017)
Maintenance and quality of service	Good functioning			6.1	Average age of the vehicle fleet	(Joint Research Centre et al., 2007)
	Minimal number of machines in working order			6.2	Size of the vehicle fleet	(Joint Research Centre et al., 2007)
	Quality of the infrastructures	Cleanliness		6.3.1	Cleanliness by space (like indicator 2.2.3.3)	Own research

		Safety	Accidents	6.3.2.1	Number of accidents at the hub	Own research
				6.3.2.2	Percentage of infrastructures in fair/good condition	(Joint Research Centre et al., 2007)
		Security	Aggressions	6.3.3.1.1	Perceived risk of crime and passenger security in urban transport	(European Commission, 2020)
				6.3.3.1.2	Number of crimes reported in the mobility hub per year	Own research
				6.3.3.2.1	Proportion of secure bicycle parking	Own research
				6.3.3.2.2	Coverage of CCTV	Own research
Economy of the hub	Profitability			7.1.1	Average revenue per user	(Ringenson et al., 2018)
				7.1.2	Cost-revenue ratio	Own research
				7.1.3	Percentage of subsidies for the operation costs	Own research
	Participation to the welfare of the area			7.2.1	Increase of sales in the urban area	Own research
				7.2.2	Increase of jobs in the urban area	Own research
Environmental impact	Evaluation of transport emissions			8.1.1	Air pollutant emissions of all passenger and freight transport modes in the hub	(European Commission, 2020)

			8.1.2	Well-to-wheels greenhouse gas emissions by all urban area passenger and freight transport modes	(Joint Research Centre et al., 2007)
			8.1.3	Proportion of vehicle fleet meeting certain air and noise emission standards (by mode)	(European Commission, 2020)
Energy efficiency and use of renewable energies			8.2	Total energy use by urban transport per passenger km and tonne km (annual average over all modes or annual average by mode)	(Joint Research Centre et al., 2007)
Reducing impacts on environmental resources	Habitat and ecosystem disruption		8.3.1	Proximity of transport infrastructures to protected areas	(European Commission, 2020)
	Land occupied by the hub		8.3.2	Proportion of land use, taken by all hub transport modes, including direct and indirect uses	(European Commission, 2020)
Limitation of the noise generated by the mobility hub			8.4.1	Percentage of population hindered by the hub transport noise	(Atelier parisien d'urbanisme, 2014)
			8.4.2	Soundproofing of the hub	(Atelier parisien d'urbanisme, 2014)

ANNEX 2 – SURVEY 1

Dear SmartHubs partner,

In the project, key performance indicators (KPIs) will be used to appraise smart mobility hubs. VUB has drafted a longlist of KPIs. **Your task is to evaluate these KPIs**. This should take you approximately **20 minutes**.

Thank you in advance for your participation!

Kind regards,

Prof. Dr. Imre Keserü
Hannes Delaere
Jesse Pappers

P.S.: You can contact Jesse at jesse.pappers@vub.be if there are any questions or remarks about this survey.

In this project, a **key performance indicator** (KPI) measures an aspect of a smart mobility hub.

Your task is to **evaluate the KPIs that will be used to evaluate smart mobility hubs**. You will evaluate the KPIs on two criteria: the feasibility and the usefulness.
Feasibility is the ease with which data can be obtained in order to calculate the KPI.

Usefulness the extent that the KPI reflects the impact of a SmartHub.

What is your field of expertise?

Which institution do you work for?

- ○ ACUR: TU Wien - Artifact-based Computing & User Research
- ○ AML/IVS: Aspern Mobility Lab/TU Wien
- ○ AND: Anderlecht Municipality
- ○ BOKU: University of Natural Resources and Life Sciences
- ○ IVS: TU Wien - Transport System Planning
- ○ LFL: Lojika Field Labs
- ○ Mopoint
- ○ Mpact

- ○ UNIBO: University of Bologna
- ○ UT: University of Twente
- ○ TUM: Technical University of Munich
- ○ VUB: Vrije Universiteit Brussel
- ○ Other: _____

Which criterion matches the following statement:
The ease with which data can be obtained in order to calculate the KPI.

- ○ Feasibility
- ○ Usefulness

Which criterion matches the following statement:
The extent that the KPI reflects the impact of a SmartHub.

- ○ Feasibility
- ○ Usefulness

Which SmartHub(s) are you involved in?
Multiple answers are possible

- ○ Anderlecht, Belgium
- ○ Beylikdüzü, Turkey
- ○ Bruno Marek Allee, Austria
- ○ Haagse Markt, Netherlands
- ○ Leyenburg, Netherlands
- ○ Schiedam, Netherlands
- ○ Seestadt Nord, Austria
- ○ Slinge, Netherlands
- ○ Tullnerfeld, Austria
- ○ TUM, Germany
- ○ ⊗None of the above
- ○ Other _____

One last comment before you start the evaluation.

When evaluating the feasibility of a KPI, please evaluate the feasibility of this KPI for 'your' hub(s) (if applicable). Your hub(s) is/are: ${Q5/ChoiceGroup/SelectedChoices}.

Please indicate the feasibility and usefulness of each KPI related to **mobility** at the hub.
N.B.: PT = public transport

	Feasibility *Can the data with which the KPI is calculated be obtained?*				**Usefulness** *Does the KPI reflect the impact of a SmartHub?*			
	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know
User satisfaction with PT	○	○	○	○	○	○	○	○
Occupancy rates of PT	○	○	○	○	○	○	○	○
PT frequency	○	○	○	○	○	○	○	○
Delay of PT	○	○	○	○	○	○	○	○
Number of passengers transferring through the hub	○	○	○	○	○	○	○	○
Modal split	○	○	○	○	○	○	○	○
Number of transportation modes at the hub	○	○	○	○	○	○	○	○
Average and maximum waiting time during a transfer	○	○	○	○	○	○	○	○
Quality of wayfinding within the hub	○	○	○	○	○	○	○	○
Crowding at the mobility hub	○	○	○	○	○	○	○	○

Number of public places adapted to leave a bicycle/moped/scooter	○	○	○	○	○	○	○	○
Number of bicycle repair points	○	○	○	○	○	○	○	○
Number of vehicles available at the hub	○	○	○	○	○	○	○	○
Possibility to buy ticket that combines several modes	○	○	○	○	○	○	○	○
Parking capacity at the hub	○	○	○	○	○	○	○	○
Quality of parking spaces at the hub	○	○	○	○	○	○	○	○
Availability of kiss&ride places	○	○	○	○	○	○	○	○
Quality of the waiting infrastructures	○	○	○	○	○	○	○	○
Availability of drop-off/pick-up points for taxi/carpooling/ridesharing/ridesourcing	○	○	○	○	○	○	○	○
Quality of public lighting	○	○	○	○	○	○	○	○
Presence of printed timetable displays	○	○	○	○	○	○	○	○
Presence of overview of location and explanation of mobility options	○	○	○	○	○	○	○	○

Presence of overview of location of points of interest near hub	○	○	○	○	○	○	○	○
Presence of overview of information for people with disabilities	○	○	○	○	○	○	○	○
Availability of ticket machines	○	○	○	○	○	○	○	○
Quality of the ticketing service	○	○	○	○	○	○	○	○
Availability of digital ticketing	○	○	○	○	○	○	○	○

Please indicate the feasibility and usefulness of each KPI related to **services and attractiveness** of the hub.

	Feasibility *Can the data with which the KPI is calculated be obtained?*				**Usefulness** *Does the KPI reflect the impact of a SmartHub?*			
	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know
Spaces adapted to storing items *(e.g., left luggage facilities)*	○	○	○	○	○	○	○	○
Spaces adapted to pick up packages	○	○	○	○	○	○	○	○
Amenities adapted for delivery vehicles (unloading)	○	○	○	○	○	○	○	○
Possibility to purchase drinks and food	○	○	○	○	○	○	○	○
Presence of commercial activities	○	○	○	○	○	○	○	○

Hey! Are you still paying attention? Select 'Yes'.	○	○	○	○	○	○	○	○
Availability of toilets	○	○	○	○	○	○	○	○
Accessibility of toilets for people with disabilities	○	○	○	○	○	○	○	○
Cleanliness of restrooms	○	○	○	○	○	○	○	○
Presence of co-working spaces	○	○	○	○	○	○	○	○
Size of the co-working spaces	○	○	○	○	○	○	○	○
Quality of the co-working spaces	○	○	○	○	○	○	○	○
Accessibility of the co-working spaces for people with disabilities	○	○	○	○	○	○	○	○
Perceived satisfaction of public spaces	○	○	○	○	○	○	○	○

Please indicate the feasibility and usefulness of each KPI related to **digital dimension** of the hub.

	Feasibility *Can the data with which the KPI is calculated be obtained?*				**Usefulness** *Does the KPI reflect the impact of a SmartHub?*			
	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know
Presence of digital manuals explaining use of modal options	○	○	○	○	○	○	○	○
Presence of a digital map to find locations of modal options	○	○	○	○	○	○	○	○

Availability of real-time departure and arrival information for public transport	○	○	○	○	○	○	○	○
Availability of real-time occupancy of parking places	○	○	○	○	○	○	○	○
Availability of real-time information about shared mobility options	○	○	○	○	○	○	○	○
Possibility to plan a trip in which all modes at the hub are compared	○	○	○	○	○	○	○	○
Possibility for users to unlock transport modes and facilities *e.g. using a smartphone, a code, a card*	○	○	○	○	○	○	○	○
Presence of free wireless internet	○	○	○	○	○	○	○	○
Performance of the wifi network	○	○	○	○	○	○	○	○
Presence of facilities to charge electronic devices	○	○	○	○	○	○	○	○
Availability of QR codes for fast registration and use of mobility options	○	○	○	○	○	○	○	○
Proportion of users of the hub owning a smartphone	○	○	○	○	○	○	○	○
Number of applications/subscriptions necessary for full use of the hub and its services	○	○	○	○	○	○	○	○

Please indicate the feasibility and usefulness of each KPI related to **accessibility** of the hub.

	Feasibility *Can the data with which the KPI is calculated be obtained?*				**Usefulness** *Does the KPI reflect the impact of a SmartHub?*			
	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know
Quality of transport for vulnerable people (disabled, low incomes, children, etc…)	○	○	○	○	○	○	○	○
Accessibility of the digital services for people with disabilities	○	○	○	○	○	○	○	○
Accessibility of transport modes for people with disabilities	○	○	○	○	○	○	○	○
Accessibility of hub for people with disabilities	○	○	○	○	○	○	○	○
Accessibility of ticket machines for people with disabilities	○	○	○	○	○	○	○	○

Please indicate the feasibility and usefulness of each KPI related to **network integration** of the hub.

	Feasibility *Can the data with which the KPI is calculated be obtained?*				**Usefulness** *Does the KPI reflect the impact of a SmartHub?*			
	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know

Number of hubs in the network	○	○	○	○	○	○	○	○
Number of users in all hubs in the network	○	○	○	○	○	○	○	○
Hey! Does the sun revolve around the earth? Select 'No'.	○	○	○	○	○	○	○	○
Hub network density and length	○	○	○	○	○	○	○	○

Please indicate the feasibility and usefulness of each KPI related to **maintenance** of the hub.

	Feasibility *Can the data with which the KPI is calculated be obtained?*				**Usefulness** *Does the KPI reflect the impact of a SmartHub?*			
	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know
Average age of the vehicle fleet that services the hub	○	○	○	○	○	○	○	○
Cleanliness of the hub	○	○	○	○	○	○	○	○
Number of accidents at the hub	○	○	○	○	○	○	○	○
Condition of road infrastructure near hub	○	○	○	○	○	○	○	○
Perceived risk of crime and passenger security in urban transport	○	○	○	○	○	○	○	○

Number of crimes reported in the mobility hub per year	○	○	○	○	○	○	○	○
Proportion of secure bicycle parking	○	○	○	○	○	○	○	○
Coverage of CCTV cameras	○	○	○	○	○	○	○	○

Please indicate the feasibility and usefulness of each KPI related to the **economy** of the hub.

	Feasibility *Can the data with which the KPI is calculated be obtained?*				**Usefulness** *Does the KPI reflect the impact of a SmartHub?*			
	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know
Average revenue per user for mobility operators	○	○	○	○	○	○	○	○
Cost-revenue ratio per mode	○	○	○	○	○	○	○	○
Percentage of subsidies for the operation costs	○	○	○	○	○	○	○	○
Increase of sales at shops in the urban area due to hub	○	○	○	○	○	○	○	○
Hey! Is the earth flat? Select 'I don't know'.	○	○	○	○	○	○	○	○
Increase in the number of jobs in the urban area due to hub	○	○	○	○	○	○	○	○

Please indicate the feasibility and usefulness of each KPI related to the **social integration** of the hub.

	Feasibility *Can the data with which the KPI is calculated be obtained?*				**Usefulness** *Does the KPI reflect the impact of a SmartHub?*			
	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know
The number of citizens participating in the design of the hub	○	○	○	○	○	○	○	○
The involvement of (representatives of) vulnerable-to-exclusion citizens in designing the hub	○	○	○	○	○	○	○	○
The number of ways users can submit suggestions or complaints	○	○	○	○	○	○	○	○

Please indicate the feasibility and usefulness of each KPI related to the **environmental impact** of the hub.

	Feasibility *Can the data with which the KPI is calculated be obtained?*				**Usefulness** *Does the KPI reflect the impact of a SmartHub?*			
	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know
Air pollutant emissions of all modes at the hub	○	○	○	○	○	○	○	○
Proportion of vehicle fleet meeting air and noise emission standards	○	○	○	○	○	○	○	○

Well-to-wheels emissions of all modes at the hub	○	○	○	○	○	○	○	○
Total energy use per mode per passenger km	○	○	○	○	○	○	○	○
Proximity of hub to protected areas	○	○	○	○	○	○	○	○
Land occupied by the hub	○	○	○	○	○	○	○	○
Percentage of population hindered by noise emissions generated by hub	○	○	○	○	○	○	○	○
Sound-proofing of the hub	○	○	○	○	○	○	○	○

Which KPIs to evaluate Smart Mobility Hubs were missing (if any)?

_____

_____

_____

_____

_____

Do you have any other remarks regarding this survey?

_____

_____

_____

_____

ANNEX 3 – RESULTS SURVEY 1

Table 15 Results survey 1 (greener is higher, redder is lower)

Number	Category	KPI	Feasibility	Usability
1	Mobility	PT frequency	100%	67%
2	Mobility	Quality of the waiting infrastructures	87%	88%
3	Mobility	Availability of kiss&ride places	87%	67%
4	Mobility	Quality of public lighting	73%	63%
5	Mobility	Quality of wayfinding within the hub	71%	97%
6	Mobility	Presence of overview of information for people with disabilities	96%	88%
7	Mobility	Availability of digital ticketing	83%	91%
8	Mobility	User satisfaction with PT	65%	75%
9	Mobility	Quality of parking spaces at the hub	77%	43%
10	Mobility	Quality of the ticketing service	71%	78%
11	Mobility	Average and maximum waiting time during a transfer	50%	72%
12	Mobility	Availability of ticket machines	97%	88%
13	Mobility	Availability of drop-off/pick-up points for taxi/carpooling/ridesharing/ridesourcing	91%	94%
14	Mobility	Parking capacity at the hub	93%	69%
15	Mobility	Number of public places adapted to leave a bicycle/moped/scooter	97%	77%
16	Mobility	Presence of overview of location and explanation of mobility options	93%	100%
17	Mobility	Number of transportation modes at the hub	100%	81%
18	Mobility	Number of vehicles available at the hub	97%	84%
19	Mobility	Crowding at the mobility hub	70%	63%
20	Mobility	Presence of printed timetable displays	96%	61%
21	Mobility	Number of bicycle repair points	94%	50%
22	Mobility	Modal split	71%	84%

23	Mobility	Occupancy rates of PT	54%	80%
24	Mobility	Number of passengers transferring through the hub	54%	91%
25	Mobility	Delay of PT	58%	41%
26	Mobility	Presence of overview of location of points of interest near hub	100%	77%
27	Mobility	Possibility to buy ticket that combines several modes	89%	93%
28	Services	Perceived satisfaction of public spaces	55%	82%
29	Services	Possibility to purchase drinks and food	94%	73%
30	Services	Accessibility of toilets for people with disabilities	87%	72%
31	Services	Amenities adapted for delivery vehicles (unloading)	83%	54%
32	Services	Availability of toilets	90%	72%
33	Services	Cleanliness of restrooms	50%	60%
34	Services	Spaces adapted to pick up packages	82%	67%
35	Services	Presence of commercial activities	97%	57%
36	Services	Quality of the co-working spaces	58%	44%
37	Services	Accessibility of the co-working spaces for people with disabilities	73%	50%
38	Services	Size of the co-working spaces	62%	31%
39	Services	Presence of co-working spaces	73%	43%
40	Services	Spaces adapted to storing items (e.g., left luggage facilities)	86%	72%
41	Digital dimension	Availability of QR codes for fast registration and use of mobility options	71%	67%
42	Digital dimension	Availability of real-time departure and arrival information for public transport	85%	94%
43	Digital dimension	Availability of real-time occupancy of parking places	54%	60%
44	Digital dimension	Presence of digital manuals explaining use of modal options	87%	81%

45	Digital dimension	Possibility for users to unlock transport modes and facilities e.g. using a smartphone, a code, a card	75%	96%
46	Digital dimension	Presence of a digital map to find locations of modal options	93%	91%
47	Digital dimension	Number of applications/subscriptions necessary for full use of the hub and its services	65%	81%
48	Digital dimension	Availability of real-time information about shared mobility options	68%	97%
49	Digital dimension	Presence of facilities to charge electronic devices	73%	50%
50	Digital dimension	Possibility to plan a trip in which all modes at the hub are compared	63%	86%
51	Digital dimension	Performance of the wifi network	54%	56%
52	Digital dimension	Proportion of users of the hub owning a smartphone	31%	46%
53	Digital dimension	Presence of free wireless internet	92%	59%
54	Accessibility	Quality of transport for vulnerable people (disabled, low incomes, children, etc…)	46%	77%
55	Accessibility	Accessibility of transport modes for people with disabilities	65%	87%
56	Accessibility	Accessibility of ticket machines for people with disabilities	68%	87%
57	Accessibility	Accessibility of hub for people with disabilities	70%	93%
58	Accessibility	Accessibility of the digital services for people with disabilities	58%	81%
59	Network integration	Number of hubs in the network	81%	79%
60	Network integration	Number of users in all hubs in the network	45%	90%
61	Network integration	Hub network density and length	71%	70%
62	Maintenance	Coverage of CCTV cameras	63%	45%
63	Maintenance	Number of accidents at the hub	56%	53%

64	Maintenance	Number of crimes reported in the mobility hub per year	50%	46%
65	Maintenance	Cleanliness of the hub	46%	59%
66	Maintenance	Perceived risk of crime and passenger security in urban transport	45%	73%
67	Maintenance	Proportion of secure bicycle parking	75%	84%
68	Maintenance	Average age of the vehicle fleet that services the hub	58%	46%
69	Maintenance	Condition of road infrastructure near hub	57%	40%
70	Economy	Cost-revenue ratio per mode	38%	67%
71	Economy	Percentage of subsidies for the operation costs	56%	54%
72	Economy	Average revenue per user for mobility operators	20%	57%
73	Economy	Increase in the number of jobs in the urban area due to hub	11%	50%
74	Economy	Increase of sales at shops in the urban area due to hub	18%	57%
75	Social integration	The number of citizens participating in the design of the hub	71%	66%
76	Social integration	The number of ways users can submit suggestions or complaints	80%	69%
77	Social integration	The involvement of (representatives of) vulnerable-to-exclusion citizens in designing the hub	64%	63%
78	Environmental impact	Proximity of hub to protected areas	73%	29%
79	Environmental impact	Percentage of population hindered by noise emissions generated by hub	25%	46%
80	Environmental impact	Well-to-wheels emissions of all modes at the hub	25%	50%
81	Environmental impact	Sound-proofing of the hub	45%	50%
82	Environmental impact	Land occupied by the hub	75%	41%
83	Environmental impact	Air pollutant emissions of all modes at the hub	36%	63%

84	Environmental impact	Total energy use per mode per passenger km	44%	63%
85	Environmental impact	Proportion of vehicle fleet meeting air and noise emission standards	42%	57%

ANNEX 4 – SURVEY 2

Dear SmartHubs partner,

In the SmartHubs project, key performance indicators (KPIs) will be used to appraise smart mobility hubs. In a previous survey, project partners evaluated a long-list of KPIs. This first evaluation has resulted in a selection of 50 KPIs. **Your task is to evaluate these 50 KPIs**. This should take you approximately **15 minutes**.

Thank you in advance for your participation!

Kind regards,

Prof. Dr. Imre Keserü
Hannes Delaere
Lluis Martinez
Jesse Pappers

P.S.: You can contact Jesse at jesse.pappers@vub.be if there are any questions or remarks about this survey.

In this project, a **key performance indicator** (KPI) measures an aspect of a smart mobility hub.

Your task is to **evaluate the KPIs that will be used to evaluate smart mobility hubs**. You will evaluate the KPIs on two criteria: the feasibility and the usefulness.
Feasibility is the ease with which data can be obtained in order to calculate the KPI.

Usefulness the extent that the KPI reflects the impact of a SmartHub.

What is your field of expertise?

_____

Which institution do you work for?

- ○ ACUR: TU Wien - Artifact-based Computing & User Research
- ○ AML/IVS: Aspern Mobility Lab/TU Wien
- ○ Aspern.mobil LAB
- ○ BOKU: University of Natural Resources and Life Sciences
- ○ Federal Government of Lower Austria
- ○ ITS Vienna Region
- ○ IVS: TU Wien - Transport System Planning
- ○ Mobility Lab Graz
- ○ Mopoint
- ○ SUM: Stadt-Umland-Management Wien-Niederösterreich

- ○ Wien 3420 Aspern Development AG
- ○ AND: Anderlecht Municipality
- ○ Brussels Mobility
- ○ Mpact
- ○ VUB: Vrije Universiteit Brussel
- ○ City of Munich
- ○ MVV: Munich Public Transport Association
- ○ TUM: Technical University of Munich
- ○ UPS
- ○ WWU: University of Münster
- ○ UNIBO: University of Bologna
- ○ CROW
- ○ HTM Personenvervoer
- ○ MRDH: Metropolitan Region Rotterdam The Hague
- ○ NS Stations
- ○ RET
- ○ Rotterdam Municipality
- ○ The Hague Municipality
- ○ UT: University of Twente
- ○ IMM: Istanbul Metropolitan Municipality
- ○ LFL: Lojika Field Labs
- ○ Other: _____

Which criterion matches the following statement:
The ease with which data can be obtained in order to calculate the KPI.

- ○ Feasibility
- ○ Usefulness

Which criterion matches the following statement:
The extent that the KPI reflects the impact of a SmartHub.

- ○ Feasibility
- ○ Usefulness

Which SmartHub(s) are you involved in?
Multiple answers are possible

- ○ Anderlecht
- ○ Bruno Marek Allee
- ○ Seestadt Nord
- ○ Tullnerfeld
- ○ Haagse Markt
- ○ Leyenburg
- ○ Schiedam
- ○ Slinge
- ○ Beylikdüzü
- ○ TUM
- ○ ⊗None of the above
- ○ Other _____

One last comment before you start the evaluation.

When evaluating the feasibility of a KPI, please evaluate the feasibility of this KPI for 'your' hub(s) (if applicable).

Your hub(s) is/are: ${Q5/ChoiceGroup/SelectedChoices}.

Please indicate the feasibility and usefulness of each KPI related to **mobility** at the hub.
N.B.: PT = public transport

	Feasibility *Can the data with which the KPI is calculated be obtained?*				**Usefulness** *Does the KPI reflect the impact of a SmartHub?*			
	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know
User satisfaction with PT	○	○	○	○	○	○	○	○
PT frequency	○	○	○	○	○	○	○	○
Number of passengers transferring through the hub	○	○	○	○	○	○	○	○
Modal split	○	○	○	○	○	○	○	○
Number of transportation modes at the hub	○	○	○	○	○	○	○	○
Average and maximum waiting time during a transfer	○	○	○	○	○	○	○	○
Quality of wayfinding within the hub	○	○	○	○	○	○	○	○
Crowding at the mobility hub	○	○	○	○	○	○	○	○
Number of public places adapted to leave a bicycle/moped/scooter	○	○	○	○	○	○	○	○

Number of vehicles available at the hub	○	○	○	○	○	○	○	○
Possibility to buy ticket that combines several modes	○	○	○	○	○	○	○	○
Parking capacity at the hub	○	○	○	○	○	○	○	○
Availability of kiss&ride places	○	○	○	○	○	○	○	○
Quality of the waiting infrastructures	○	○	○	○	○	○	○	○
Availability of drop-off/pick-up points for taxi/carpooling/ridesharing/ridesourcing	○	○	○	○	○	○	○	○
Quality of public lighting	○	○	○	○	○	○	○	○
Presence of printed timetable displays	○	○	○	○	○	○	○	○
Presence of overview of location and explanation of mobility options	○	○	○	○	○	○	○	○
Presence of overview of location of points of interest near hub	○	○	○	○	○	○	○	○
Presence of overview of information for people with disabilities	○	○	○	○	○	○	○	○

Availability of ticket machines	○	○	○	○	○	○	○	○
Quality of the ticketing service	○	○	○	○	○	○	○	○
Availability of digital ticketing	○	○	○	○	○	○	○	○
Integration with local/regional/national transport policy	○	○	○	○	○	○	○	○

Please indicate the feasibility and usefulness of each KPI related to **services and attractiveness** of the hub.

	Feasibility *Can the data with which the KPI is calculated be obtained?*				**Usefulness** *Does the KPI reflect the impact of a SmartHub?*			
	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know
Spaces adapted to storing items *(e.g., left luggage facilities)*	○	○	○	○	○	○	○	○
Spaces adapted to pick up packages	○	○	○	○	○	○	○	○
Amenities adapted for delivery vehicles (unloading)	○	○	○	○	○	○	○	○
Presence of commercial activities	○	○	○	○	○	○	○	○

Hey! Are you still paying attention? Select 'Yes'.	○	○	○	○	○	○	○	○
Availability of toilets	○	○	○	○	○	○	○	○

Please indicate the feasibility and usefulness of each KPI related to **digital dimension** of the hub.

	Feasibility *Can the data with which the KPI is calculated be obtained?*				**Usefulness** *Does the KPI reflect the impact of a SmartHub?*			
	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know
Presence of digital manuals explaining use of modal options	○	○	○	○	○	○	○	○
Presence of a digital map to find locations of modal options	○	○	○	○	○	○	○	○
Availability of real-time departure and arrival information for public transport	○	○	○	○	○	○	○	○
Availability of real-time information about shared mobility options	○	○	○	○	○	○	○	○
Possibility to plan a trip in which all modes at the hub are compared	○	○	○	○	○	○	○	○
Possibility for users to unlock transport modes and facilities *e.g. using a smartphone, a code, a card*	○	○	○	○	○	○	○	○

Presence of free wireless internet	○	○	○	○	○	○	○	○
Availability of QR codes for fast registration and use of mobility options	○	○	○	○	○	○	○	○
Number of applications/subscriptions necessary for full use of the hub and its services	○	○	○	○	○	○	○	○

Please indicate the feasibility and usefulness of each KPI related to **accessibility** of the hub.

	Feasibility *Can the data with which the KPI is calculated be obtained?*				**Usefulness** *Does the KPI reflect the impact of a SmartHub?*			
	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know
Accessibility of the digital services for people with disabilities	○	○	○	○	○	○	○	○
Accessibility of transport modes for people with disabilities	○	○	○	○	○	○	○	○
Accessibility of hub for people with disabilities	○	○	○	○	○	○	○	○

Please indicate the feasibility and usefulness of each KPI related to **network integration** of the hub.

	Feasibility *Can the data with which the KPI is calculated be obtained?*	**Usefulness** *Does the KPI reflect the impact of a SmartHub?*

	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know
Number of hubs in the network	○	○	○	○	○	○	○	○
Hey! Is Pluto a planet? Select 'No'.	○	○	○	○	○	○	○	○
Hub network density and length	○	○	○	○	○	○	○	○

Please indicate the feasibility and usefulness of each KPI related to **maintenance** of the hub.

	Feasibility *Can the data with which the KPI is calculated be obtained?*				**Usefulness** *Does the KPI reflect the impact of a SmartHub?*			
	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know
Number of accidents at the hub	○	○	○	○	○	○	○	○
Perceived risk of crime in urban transport	○	○	○	○	○	○	○	○
Proportion of secure bicycle parking	○	○	○	○	○	○	○	○
Coverage of CCTV cameras	○	○	○	○	○	○	○	○

Please indicate the feasibility and usefulness of each KPI related to the **social integration** of the hub.

	Feasibility *Can the data with which the KPI is calculated be obtained?*				**Usefulness** *Does the KPI reflect the impact of a SmartHub?*			
	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know
The number of citizens participating in the design of the hub	○	○	○	○	○	○	○	○
The involvement of (representatives of) vulnerable-to-exclusion citizens in designing the hub	○	○	○	○	○	○	○	○
The number of ways users can submit suggestions or complaints	○	○	○	○	○	○	○	○

Which KPIs to evaluate Smart Mobility Hubs were missing (if any)?

_____

_____

_____

_____

_____

ANNEX 5 – RESULTS SURVEY 2

Table 16 Results survey 2 (greener is higher, redder is lower)

Number	Category	KPI	Feasibility	Usability
1	Mobility	PT frequency	98%	80%
2	Mobility	Number of passengers transferring through the hub	71%	90%
3	Mobility	Modal split	71%	92%
4	Mobility	Number of transportation modes at the hub	98%	87%
5	Mobility	Average and maximum waiting time during a transfer	55%	80%
6	Mobility	Crowding at the mobility hub	55%	66%
7	Mobility	Number of public places adapted to leave a bicycle/moped/scooter	85%	84%
8	Mobility	Number of vehicles available at the hub	84%	88%
9	Mobility	Possibility to buy ticket that combines several modes	85%	90%
10	Mobility	Parking capacity at the hub	88%	71%
11	Mobility	Availability of kiss&ride places	91%	64%
12	Mobility	Availability of drop-off/pick-up points for taxi/carpooling/ridesharing/ridesourcing	89%	78%
13	Mobility	Integration with local/regional/national transport policy	83%	92%
14	Mobility	Number of hubs in the network	85%	75%
15	Mobility	Hub network density and length	70%	78%
16	Services	Quality of the waiting infrastructures	77%	73%
17	Services	Presence of printed timetable displays	94%	70%
18	Services	Presence of overview of location and explanation of mobility options	96%	84%
19	Services	Presence of overview of location of points of interest near hub	89%	70%
20	Services	Availability of ticket machines	92%	77%
21	Services	Quality of the ticketing service	60%	74%

22	Services	Spaces adapted to storing items (e.g., left luggage facilities)	78%	67%
23	Services	Spaces adapted to pick up packages	87%	77%
24	Services	Amenities adapted for delivery vehicles (unloading)	75%	56%
25	Services	Presence of commercial activities	91%	69%
26	Services	Availability of toilets	94%	69%
27	Digital dimension	Availability of digital ticketing	98%	86%
28	Digital dimension	Presence of digital manuals explaining use of modal options	91%	74%
29	Digital dimension	Presence of a digital map to find locations of modal options	94%	85%
30	Digital dimension	Availability of real-time departure and arrival information for public transport	98%	90%
31	Digital dimension	Availability of real-time information about shared mobility options	86%	88%
32	Digital dimension	Possibility to plan a trip in which all modes at the hub are compared	86%	90%
33	Digital dimension	Possibility for users to unlock transport modes and facilities e.g. using a smartphone, a code, a card	88%	88%
34	Digital dimension	Presence of free wireless internet	91%	65%
35	Digital dimension	Availability of QR codes for fast registration and use of mobility options	91%	67%
36	Digital dimension	Number of applications/subscriptions necessary for full use of the hub and its services	76%	78%
37	Accessibility	Quality of wayfinding within the hub	61%	86%
38	Accessibility	Presence of overview of information for people with disabilities	88%	87%
39	Accessibility	Accessibility of the digital services for people with disabilities	75%	82%
40	Accessibility	Accessibility of transport modes for people with disabilities	76%	88%
41	Accessibility	Accessibility of hub for people with disabilities	80%	88%

42	Safety and security	Quality of public lighting	80%	73%
43	Safety and security	Number of accidents at the hub	71%	60%
44	Safety and security	Perceived risk of crime in urban transport	65%	58%
45	Safety and security	Proportion of secure bicycle parking	77%	82%
46	Safety and security	Coverage of CCTV cameras	70%	54%
47	Democratic integration	User satisfaction with PT	70%	86%
48	Democratic integration	The number of citizens participating in the design of the hub	75%	65%
49	Democratic integration	The involvement of (representatives of) vulnerable-to-exclusion citizens in designing the hub	77%	79%
50	Democratic integration	The number of ways users can submit suggestions or complaints	84%	69%

ANNEX 6 – SURVEY 3

Dear SmartHubs partner,

In the SmartHubs project, key performance indicators (KPIs) will be used to appraise smart mobility hubs. In two previous surveys, project partners reduced the number of KPIs for mobility hubs from 87 to 50.

After discussion between project partners, it appeared that some KPIs related to the democratic/participatory integration of mobility hubs were missing. We therefore **ask you to evaluate 7 more KPIs on democratic integration**. This should take you approximately **2 minutes**.

Thank you in advance for your participation!

Kind regards,

Prof. Dr. Imre Keserü
Hannes Delaere
Lluis Martinez
Jesse Pappers

P.S.: You can contact Jesse at jesse.pappers@vub.be if there are any questions or remarks about this survey.

In this project, a **key performance indicator** (KPI) measures an aspect of a smart mobility hub.

Your task is to **evaluate the KPIs that will be used to evaluate smart mobility hubs**. You will evaluate the KPIs on two criteria: the feasibility and the usefulness.
Feasibility is the ease with which data can be obtained in order to calculate the KPI.

Usefulness the extent that the KPI reflects the impact of a SmartHub.

What is your field of expertise?

_____

Which institution do you work for?

- ○ ACUR: TU Wien - Artifact-based Computing & User Research
- ○ AML/IVS: Aspern Mobility Lab/TU Wien
- ○ Aspern.mobil LAB
- ○ BOKU: University of Natural Resources and Life Sciences
- ○ Federal Government of Lower Austria
- ○ ITS Vienna Region
- ○ IVS: TU Wien - Transport System Planning
- ○ Mobility Lab Graz
- ○ Mopoint

- ○ SUM: Stadt-Umland-Management Wien-Niederösterreich
- ○ Wien 3420 Aspern Development AG
- ○ AND: Anderlecht Municipality
- ○ Brussels Mobility
- ○ Mpact
- ○ VUB: Vrije Universiteit Brussel
- ○ City of Munich
- ○ MVV: Munich Public Transport Association
- ○ TUM: Technical University of Munich
- ○ UPS
- ○ WWU: University of Münster
- ○ UNIBO: University of Bologna
- ○ CROW
- ○ HTM Personenvervoer
- ○ MRDH: Metropolitan Region Rotterdam The Hague
- ○ NS Stations
- ○ RET
- ○ Rotterdam Municipality
- ○ The Hague Municipality
- ○ UT: University of Twente
- ○ IMM: Istanbul Metropolitan Municipality
- ○ LFL: Lojika Field Labs
- ○ Other: _____

Which criterion matches the following statement:
The ease with which data can be obtained in order to calculate the KPI.

- ○ Feasibility
- ○ Usefulness

Which criterion matches the following statement:
The extent that the KPI reflects the impact of a SmartHub.

- ○ Feasibility
- ○ Usefulness

Which SmartHub(s) are you involved in?
Multiple answers are possible

- ○ Anderlecht
- ○ Bruno Marek Allee
- ○ Seestadt Nord
- ○ Tullnerfeld
- ○ Haagse Markt
- ○ Leyenburg
- ○ Schiedam
- ○ Slinge
- ○ Beylikdüzü
- ○ TUM
- ○ ⊗None of the above
- ○ Other _____

One last comment before you start the evaluation.

When evaluating the feasibility of a KPI, please evaluate the feasibility of this KPI for 'your' hub(s) (if applicable).

Your hub(s) is/are: ${Q5/ChoiceGroup/SelectedChoices}.

Please indicate the feasibility and usefulness of each KPI related to the **democratic integration** of the hub.

	Feasibility *Can the data with which the KPI is calculated be obtained?*				**Usefulness** *Does the KPI reflect the impact of a SmartHub?*			
	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know
Number of dialogic participation opportunities. *Participants provide input and immediately receive a response; deliberate exchange is possible*	○	○	○	○	○	○	○	○
Number of one-directional participation opportunities. *Participation facilitators provide information without giving participation takers ability to directly react (e.g., information event). Participants provide input without immediately receiving a response (e.g., filling out a survey)*	○	○	○	○	○	○	○	○
Number of in-person participation opportunities. *E.g., workshops, interviews, information booths on the street*	○	○	○	○	○	○	○	○
Number of online/digital participation opportunities. *E.g., via a website, online participation tools, social media*	○	○	○	○	○	○	○	○

Please indicate the feasibility and usefulness of each KPI related to the **democratic integration** of the hub.

	Feasibility *Can the data with which the KPI is calculated be obtained?*				**Usefulness** *Does the KPI reflect the impact of a SmartHub?*			
	Yes	To a limited extent	No	I don't know	Yes	To a limited extent	No	I don't know
Number of online announcements. *E.g., on social media, websites*	○	○	○	○	○	○	○	○
Number of printed announcements. *E.g., in local newspapers, distributing flyers*	○	○	○	○	○	○	○	○
Number of on-site announcements. *E.g., via billboards or banners in the street*	○	○	○	○	○	○	○	○

ANNEX 7 – RESULTS SURVEY 3

Table 17 Results survey 3 (greener is higher, redder is lower)

Number	Category	KPI	Feasibility	Usability
51	Democratic integration	Number of dialogic participation opportunities	81%	73%
52	Democratic integration	Number of one-directional participation opportunities	82%	68%
53	Democratic integration	Number of in-person participation opportunities	86%	75%
54	Democratic integration	Number of online/digital participation opportunities	86%	68%
55	Democratic integration	Number of online announcements	96%	46%
56	Democratic integration	Number of printed announcements	86%	38%
57	Democratic integration	Number of on-site announcements	93%	46%

ANNEX 8 – LOCAL/REGIONAL KPIS

Netherlands – Haagse Markt

The 6 respondents of survey 2 and the 3 respondents of survey 3 from the SmartHubs Living Lab Haagse Markt in The Hague, Netherlands, gave 14 non-essential KPIs a feasibility score and a usability score of at least 75%. These non-essential KPIs are found in the categories 'mobility' (2), 'services' (6), 'digital dimension' (2), 'safety and security' (2), and 'democratic integration' (3).

Table 18 KPIs for Haagse Markt (greener is higher, redder is lower)

No.	Category	KPI	Feasibility	Usability
2	Mobility	Number of passengers transferring through the hub	83%	83%
10	Mobility	Parking capacity at the hub	83%	75%
16	Services	Quality of the waiting infrastructures	75%	83%
17	Services	Presence of printed timetable displays	100%	75%
22	Services	Spaces adapted to storing items (e.g., left luggage facilities)	83%	92%
24	Services	Amenities adapted for delivery vehicles (unloading)	83%	80%
25	Services	Presence of commercial activities	92%	100%
26	Services	Availability of toilets	75%	100%
28	Digital dimension	Presence of digital manuals explaining use of modal options	92%	75%
35	Digital dimension	Availability of QR codes for fast registration and use of mobility options	83%	90%
44	Safety and security	Perceived risk of crime in urban transport	83%	83%
46	Safety and security	Coverage of CCTV cameras	92%	75%
47	Democratic integration	User satisfaction with public transport	92%	83%

48	Democratic integration	The number of citizens participating in the design of the hub	92%	83%
51	Democratic integration	Number of dialogic participation opportunities	100%	83%

Netherlands – Leyenburg

The 6 respondents of survey 2 and the 1 respondent of survey 3 from the SmartHubs Living Lab Leyenburg in The Hague, Netherlands, gave 14 non-essential KPIs a feasibility score and a usability score of at least 75%. These non-essential KPIs are found in the categories 'mobility' (2), 'services' (6), 'digital dimension' (2), 'safety and security' (2), and 'democratic integration' (2).

Table 19 KPIs for Leyenburg (greener is higher, redder is lower)

No.	Category	KPI	Feasibility	Usability
2	Mobility	Number of passengers transferring through the hub	83%	83%
10	Mobility	Parking capacity at the hub	83%	75%
16	Services	Quality of the waiting infrastructures	75%	83%
17	Services	Presence of printed timetable displays	100%	75%
22	Services	Spaces adapted to storing items (e.g., left luggage facilities)	83%	92%
24	Services	Amenities adapted for delivery vehicles (unloading)	83%	80%
25	Services	Presence of commercial activities	92%	100%
26	Services	Availability of toilets	75%	100%
28	Digital dimension	Presence of digital manuals explaining use of modal options	92%	75%
35	Digital dimension	Availability of QR codes for fast registration and use of mobility options	83%	90%
44	Safety and security	Perceived risk of crime in urban transport	83%	83%

46	Safety and security	Coverage of CCTV cameras	92%	75%
47	Democratic integration	User satisfaction with public transport	92%	83%
48	Democratic integration	The number of citizens participating in the design of the hub	92%	83%

Netherlands – Schiedam

The 5 respondents of survey 2 and the 1 respondent of survey 3 from the SmartHubs Living Lab Schiedam in Schiedam, Netherlands, gave 16 non-essential KPIs a feasibility score and a usability score of at least 75%. These non-essential KPIs are found in the categories 'mobility' (2), 'services' (6), 'digital dimension' (2), 'safety and security' (3), and 'democratic integration' (3).

Table 20 KPIs for Schiedam (greener is higher, redder is lower)

No.	Category	KPI	Feasibility	Usability
2	Mobility	Number of passengers transferring through the hub	80%	90%
15	Mobility	Hub network density and length	80%	100%
16	Services	Quality of the waiting infrastructures	80%	80%
17	Services	Presence of printed timetable displays	100%	88%
22	Services	Spaces adapted to storing items (e.g., left luggage facilities)	80%	90%
24	Services	Amenities adapted for delivery vehicles (unloading)	90%	75%
25	Services	Presence of commercial activities	90%	100%
26	Services	Availability of toilets	80%	100%
28	Digital dimension	Presence of digital manuals explaining use of modal options	90%	88%
35	Digital dimension	Availability of QR codes for fast registration and use of mobility options	80%	100%

42	Safety and security	Quality of public lighting	80%	90%
44	Safety and security	Perceived risk of crime in urban transport	80%	80%
46	Safety and security	Coverage of CCTV cameras	90%	80%
47	Democratic integration	User satisfaction with public transport	80%	80%
48	Democratic integration	The number of citizens participating in the design of the hub	100%	90%
50	Democratic integration	The number of ways users can submit suggestions or complaints	100%	80%

Netherlands – Slinge

The 5 respondents of survey 2 and the 1 respondent of survey 3 from the SmartHubs Living Lab Slinge in Rotterdam, Netherlands, gave 21 non-essential KPIs a feasibility score and a usability score of at least 75%. These non-essential KPIs are found in the categories 'mobility' (5), 'services' (6), 'digital dimension' (3), accessibility (1), 'safety and security' (4), and 'democratic integration' (2).

Table 21 KPIs for Slinge (greener is higher, redder is lower)

No.	Category	KPI	Feasibility	Usability
2	Mobility	Number of passengers transferring through the hub	88%	90%
3	Mobility	Modal split	75%	90%
10	Mobility	Parking capacity at the hub	80%	80%
11	Mobility	Availability of kiss&ride places	100%	80%
15	Mobility	Hub network density and length	80%	90%
16	Services	Quality of the waiting infrastructures	80%	90%
17	Services	Presence of printed timetable displays	100%	90%

22	Services	Spaces adapted to storing items (e.g., left luggage facilities)	90%	100%
24	Services	Amenities adapted for delivery vehicles (unloading)	90%	88%
25	Services	Presence of commercial activities	90%	100%
26	Services	Availability of toilets	75%	100%
28	Digital dimension	Presence of digital manuals explaining use of modal options	90%	80%
34	Digital dimension	Presence of free wireless internet	80%	100%
35	Digital dimension	Availability of QR codes for fast registration and use of mobility options	90%	100%
37	Accessibility	Quality of wayfinding within the hub	75%	90%
42	Safety and security	Quality of public lighting	80%	90%
43	Safety and security	Number of accidents at the hub	80%	88%
44	Safety and security	Perceived risk of crime in urban transport	88%	90%
46	Safety and security	Coverage of CCTV cameras	100%	80%
47	Democratic integration	User satisfaction with public transport	88%	90%
48	Democratic integration	The number of citizens participating in the design of the hub	100%	90%

Belgium – Anderlecht

The 4 respondents of survey 2 and the 6 respondents of survey 3 from the SmartHubs Living Lab Anderlecht in Brussels Capital Region, Belgium, gave 11 non-essential KPIs a feasibility score and a usability score of at least 75%. These non-essential KPIs are found in the categories 'mobility' (3), 'services' (4), 'digital dimension' (2), 'safety and security' (1), and 'democratic integration' (4).

Table 22 KPIs for Anderlecht (greener is higher, redder is lower)

No.	Category	KPI	Feasibility	Usability
3	Mobility	Modal split	83%	100%
11	Mobility	Availability of kiss&ride places	88%	75%
15	Mobility	Hub network density and length	100%	100%
16	Services	Quality of the waiting infrastructures	75%	88%
24	Services	Amenities adapted for delivery vehicles (unloading)	100%	75%
25	Services	Presence of commercial activities	100%	100%
26	Services	Availability of toilets	100%	88%
34	Digital dimension	Presence of free wireless internet	75%	100%
35	Digital dimension	Availability of QR codes for fast registration and use of mobility options	88%	100%
44	Safety and security	Perceived risk of crime in urban transport	88%	88%
48	Democratic integration	The number of citizens participating in the design of the hub	100%	100%
51	Democratic integration	Number of dialogic participation opportunities.	92%	75%
52	Democratic integration	Number of one-directional participation opportunities.	83%	75%
54	Democratic integration	Number of online/digital participation opportunities.	92%	83%

Austria – Bruno Marek Allee

The 4 respondents of survey 2 and the 2 respondents of survey 3 from the SmartHubs Living Lab Bruno Marek Allee in Vienna, Austria, gave 5 non-essential KPIs a feasibility score and a usability score of at least 75%. These non-essential KPIs are found in the categories 'services' (2), 'safety and security' (1), and 'democratic integration' (2).

Table 23 KPIs for Bruno Marek Allee (greener is higher, redder is lower)

No.	Category	KPI	Feasibility	Usability
22	Services	Spaces adapted to storing items (e.g., left luggage facilities)	88%	75%
24	Services	Amenities adapted for delivery vehicles (unloading)	75%	88%
46	Safety and security	Coverage of CCTV cameras	75%	88%
48	Democratic integration	The number of citizens participating in the design of the hub	100%	75%
52	Democratic integration	Number of one-directional participation opportunities.	75%	75%

Austria – Seestadt Nord

The 7 respondents of survey 2 and the 4 respondents of survey 3 from the SmartHubs Living Lab Seestadt Nord in Vienna, Austria, gave 6 non-essential KPIs a feasibility score and a usability score of at least 75%. These non-essential KPIs are found in the categories 'services' (3), 'safety and security' (1), and 'democratic integration' (2).

Table 24 KPIs for Seestadt Nord (greener is higher, redder is lower)

No.	Category	KPI	Feasibility	Usability
22	Services	Spaces adapted to storing items (e.g., left luggage facilities)	92%	75%
25	Services	Presence of commercial activities	75%	83%
26	Services	Availability of toilets	79%	100%
46	Safety and security	Coverage of CCTV cameras	75%	93%
48	Democratic integration	The number of citizens participating in the design of the hub	75%	86%
51	Democratic integration	Number of dialogic participation opportunities	88%	88%

Austria – Tullnerfeld

The 2 respondents of survey 2 and the 1 respondent of survey 3 from the SmartHubs Living Lab Tullnerfeld in Vienna, Austria, gave 7 non-essential KPIs a feasibility score and a usability score of at least 75%. These non-essential KPIs are found in the categories 'services' (3), 'accessibility (1), 'safety and security' (1), and 'democratic integration' (2).

Table 25 KPIs for Tullnerfeld (greener is higher, redder is lower)

No.	Category	KPI	Feasibility	Usability
19	Services	Presence of overview of location of points of interest near hub	75%	75%
22	Services	Spaces adapted to storing items (e.g., left luggage facilities)	75%	100%
24	Services	Amenities adapted for delivery vehicles (unloading)	75%	100%
37	Accessibility	Quality of wayfinding within the hub	100%	75%
46	Safety and security	Coverage of CCTV cameras	100%	75%
48	Democratic integration	The number of citizens participating in the design of the hub	100%	75%
54	Democratic integration	Number of online/digital participation opportunities	100%	100%

Germany – TUM

The 2 respondents of survey 2 and the 3 respondents of survey 3 from the SmartHubs Living Lab Technische Universität München in Munich, Germany, gave 19 non-essential KPIs a feasibility score and a usability score of at least 75%. These non-essential KPIs are found in the categories 'mobility' (2), 'services' (7), 'digital dimension' (1), 'safety and security' (4), and 'democratic integration' (5).

Table 26 KPIs for TUM (greener is higher, redder is lower)

No.	Category	KPI	Feasibility	Usability
3	Mobility	Modal split	100%	100%

10	Mobility	Parking capacity at the hub	100%	100%
17	Services	Presence of printed timetable displays	100%	75%
19	Services	Presence of overview of location of points of interest near hub	100%	100%
21	Services	Quality of the ticketing service	100%	75%
22	Services	Spaces adapted to storing items (e.g., left luggage facilities)	75%	100%
24	Services	Amenities adapted for delivery vehicles (unloading)	100%	100%
25	Services	Presence of commercial activities	100%	75%
26	Services	Availability of toilets	75%	100%
28	Digital dimension	Presence of digital manuals explaining use of modal options	100%	100%
42	Safety and security	Quality of public lighting	75%	100%
43	Safety and security	Number of accidents at the hub	75%	100%
44	Safety and security	Perceived risk of crime in urban transport	100%	100%
46	Safety and security	Coverage of CCTV cameras	100%	100%
48	Democratic integration	The number of citizens participating in the design of the hub	100%	75%
50	Democratic integration	The number of ways users can submit suggestions or complaints	75%	100%
51	Democratic integration	Number of dialogic participation opportunities.	100%	100%
54	Democratic integration	Number of online/digital participation opportunities.	83%	83%

55	Democratic integration	Number of online announcements.	100%	75%

Turkey – Beylikdüzü

The 1 respondent of survey 2 and the 2 respondents of survey 3 from the SmartHubs Living Lab Beylikdüzü in Istanbul, Turkey, gave 18 non-essential KPIs a feasibility score and a usability score of at least 75%. These non-essential KPIs are found in the categories 'mobility' (1), 'services' (4), 'digital dimension' (3), 'safety and security' (4), and 'democratic integration' (6).

Table 27 KPIs for Beylikdüzü (greener is higher, redder is lower)

No.	Category	KPI	Feasibility	Usability
2	Mobility	Number of passengers transferring through the hub	100%	100%
17	Services	Presence of printed timetable displays	100%	100%
22	Services	Spaces adapted to storing items (e.g., left luggage facilities)	100%	100%
25	Services	Presence of commercial activities	100%	100%
26	Services	Availability of toilets	100%	100%
28	Digital dimension	Presence of digital manuals explaining use of modal options	100%	100%
34	Digital dimension	Presence of free wireless internet	100%	100%
35	Digital dimension	Availability of QR codes for fast registration and use of mobility options	100%	100%
42	Safety and security	Quality of public lighting	100%	100%
43	Safety and security	Number of accidents at the hub	100%	100%
44	Safety and security	Perceived risk of crime in urban transport	100%	100%

46	Safety and security	Coverage of CCTV cameras	100%	100%
47	Democratic integration	User satisfaction with public transport	100%	100%
50	Democratic integration	The number of ways users can submit suggestions or complaints	100%	100%
51	Democratic integration	Number of dialogic participation opportunities	100%	100%
54	Democratic integration	Number of online/digital participation opportunities	100%	75%
55	Democratic integration	Number of online announcements	100%	75%
57	Democratic integration	Number of on-site announcements	75%	75%