



D1.4 – Barriers to the design, planning, deployment and operation of accessible and inclusive digital personalised mobility and logistics services

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Executive summary

The impact of digital mobility services on the mobility landscape is growing and users are increasingly having more options to choose from. This evolution, however, is not happening in a homogeneous way and at the same speed for all citizens. There are significant differences between various groups in society in terms of access to these services. Vulnerable-to-exclusion groups do not have the possibility to equally benefit from these services.

In order to support changes that can extend the benefits of digital mobility services and applications to the vulnerable-to-exclusion groups, it is necessary to understand what the drivers and barriers are for the development and deployment of inclusive and accessible digital mobility services from the viewpoint of developers, operators and policy makers.

In task 1.4 of the INDIMO project, we explored the drivers and barriers related to the development and deployment of accessible and inclusive digital mobility services by performing 10 deployment case studies and organising a stakeholder workshop. The case studies included desktop data collection, semi-structured interviews, and deductive thematic analysis to determine the key barriers and drivers. The 20 stakeholders interviewed were involved in the development, implementation and/or day to day operations of 10 digital mobility services throughout Europe. The case studies covered digital mobility and logistics services in the domains of car and ride-sharing, bike sharing and micro mobility, smart logistics services and multimodal routeplanners & mobility as a service. The case studies focused on the regulatory framework in effect, examined if the development process involved users (e.g. through co-creation), how inclusion and accessibility were taken into account and how data collection, protection and privacy were organised. A stakeholder workshop with 36 participants included structured brainstorming sessions to consolidate the results of the case studies, involving a wide range of policy makers, operators, developers and user organisations from different European cities and regions to identify any potential gaps in the collected information about the most important barriers and drivers.

The results of the case studies and the stakeholder workshop have pointed out the following key barriers to the deployment of inclusive and accessible digital mobility services:

- There is no regulatory framework or it does not address accessibility and inclusion sufficiently.
- Lack of trust between private and public organisations.
- Lack of user involvement and co-creation.
- Lack of knowledge among developers about potential vulnerable-to-exclusion users.
- Unstable market pushes development towards ‘typical’ users with no or limited inclusive features.
- Limited willingness to share (mobility) related data and information with public authorities and other operators.

The following drivers can help to make existing or new services more inclusive and accessible:



- Stable market conditions supported by a comprehensive regulatory framework.
- Integration into the public transport service network where minimum accessibility and inclusivity guidelines have been set.
- Consultation with users and their representatives to have more knowledge of potential users.
- Using inclusive design as a cornerstone of the service development.
- Bottom-up co-creation events.
- Modular approach for the development of services in different areas building in accessibility and inclusivity gradually.
- Open communication with other stakeholders, which includes sharing of information about best/worst practices.
- Local support schemes (subsidies or incentives) to introduce accessibility and inclusiveness features.

A further prevalent result is that the inclusiveness of a service can for some part be determined by its presence on the market and the stability of the market. Car- and ridesharing services had a more elaborate and better developed regulatory framework, had actual co-creation events, and started projects to make their services more inclusive. On the other side of the spectrum, inclusion was not part of the development process of the studied mobility-as-a-service systems. Also, other issues, mainly related to co-creation involving the public and private sector were delaying the development and had a negative impact on their usefulness and use. The other two types of services investigated, i.e. bike sharing & micro mobility and smart logistics services demonstrated some user involvement, inclusion was taken into account to a limited extent and efforts were made to develop a fair regulatory framework.

The differences between the services studied showed that there is no single method to develop more inclusive services. The issues most of the services are struggling with are similar (co-creation, communication, data-sharing etc.), but they might need different approaches depending on the type of service, region and people. The results of the analysis will help to create a framework and guidelines for developing inclusive and accessible digital mobility services, which are more aligned with the needs and expectations of vulnerable-to-exclusion groups.

Based on these findings, the Universal Design Manual and the Policy Evaluation Toolkit should address the following issues when creating guidelines for the deployment of digital mobility services: market position of the services, the regulatory framework in place, the integration of the service into the public transport service network, the diversity of the vulnerable-to-exclusion groups, knowledge about the vulnerable groups, the level of user involvement (co-creation), the fast evolution of digital mobility services and the availability of local support for ensuring accessibility and inclusiveness.

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List of acronyms

Acronym	
SSI	Semi-Structured Interviews
OCMW	Openbaar Centrum voor Maatschappelijk Welzijn (Public Centre for Social Welfare)
GA	Grant Agreement (INDIMO)
PT	Public transport
KPI	Key Performance Indicator
MaaS	Mobility as a Service
API	Application Programming Interface

1. Introduction

Task 1.4: ‘Understanding the process of the deployment of digital mobility services’, will map the process of the deployment of digital mobility services through 10 deployment case studies. Deployment means that development-process of the services is studied, the planning, different steps in development to the moment that the service is active. The services considered in the case studies consist of digitally available mobility services such as e-scooters, carpooling, food delivery, carsharing and multimodal routeplanners. Each study will identify the stakeholders involved in the planning, design, implementation and operation of the services, the way inclusion and accessibility aspects were considered, the regulatory framework in effect and the way in which the service or application was developed or deployed. Via semi-structured interviews data is gathered from the stakeholders, this data is analysed using a deductive thematic analysis method, and is used to identify the most important drivers (e.g. co-creation, bottom up approach, clear communication etc.) and overcome barriers (e.g. lack of communications, competition instead of collaboration etc.) for the deployment of inclusive digital mobility services. The results of this task are used in support of the development of the INDIMO Policy Evaluation Tool. After an introduction showing the goal and motivation for this research, the methodology is presented in chapter 2. Four major sections are described: the identification of 10 deployment case studies, identification of relevant stakeholders, the development of the interviews and the consolidation and discussion with stakeholders in the co-creation workshop. Chapter 3 is focussing on the results obtained for different services. Chapter 4 contains the main findings and lessons learned from this research.

Together with the outcomes of the other tasks of WP1, Task 1.4 will lead to a synthesis in Task 1.5. This synthesis will enable to target the major issues when developing tools in WP 2: co-creating the INDIMO Inclusive Digital Mobility Toolbox.

Vrije Universiteit Brussels is the lead for this task with contribution from ZLC (to cover logistics services) and POLIS (policy makers’ and transport authorities’ perspective) and VDI/VDE-IT (developers and policy makers’ perspective) who will support the stakeholders’ involvement and also the analysis of different stakeholder groups.

2. Methodology

The analysis is based on the **case study method**. For socio-economic research case studies are one of the principal means used to collect data (Bates et al., 1998; Robinson et al., 2003).

‘A Case study is an in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, program or system in a “real life” context’ (Simons, 2009).

In combination with his definition, Simons (2009) claims that a case study should not be seen as a method in and of itself. More accurately, it can be described as a framework that may incorporate several methods. So, case studies are pure theoretically variable-led research, which means they do not investigate a small number of variables in a large number of cases, instead a significant number of variables are studied in few cases (Thomas, 2011). During the INDIMO-project, two types of case studies are carried out: user case studies (in Task 1.2; see D1.2: User needs and requirements on a digital transport system on users) and deployment case studies. While the user case studies in Task 1.2 focus on the requirements of users towards the digital interconnected transport system, the **deployment case studies** focus on the process of the deployment of the digital mobility services from the viewpoint of the different stakeholder groups. Concretely, with these cases we will try to understand and create an overview of the drivers and barriers, requirements and needs developers, operators and policy-makers experience when attempting to develop/deploy some form of digital mobility service.

For the INDIMO deployment case studies, **four main stakeholder groups** are identified: developers, operators, policy makers and user representatives. A ‘trade-off’ between an in-depth explanatory focus as a result of a restricted number of cases and the need for generalization provided by a larger sample, is needed. Both options have their (dis)advantages, but in line with the focus on specific stakeholder groups, a limited number of 10 cases with an in-depth approach is used.

As with most research projects, there is also a strong argument for generalized data. The INDIMO-project has the objective to create various guidelines and tools that need to be transferable across Europe. It is possible to do a generalization based on one case-study to a limited extent, but since the INDIMO-project addresses many different contexts and types of digital services it is more useful to carry out multiple case studies.

We have identified seven steps in the methodology (

Figure 1). The first step is the selection of the 10 deployment case studies. Secondly, a desktop study is conducted, thirdly, for each pilot relevant stakeholders have to be identified. In step 4, semi-structured interviews (SSI) are developed and conducted with the stakeholders. Next the interviews are transcribed and analysed using the qualitative deductive thematic analysis method. In step 6 the results of the case studies are consolidated and discussed with the stakeholders. finally, the relevant data gathered from task 1.4 is compiled to support the INDIMO Policy Evaluation Tool for policy makers.



Figure 1: Process graph task 1.4

2.1 Identification of 10 deployment case studies

The **case studies** were selected based on different sources. Two sources are used to choose the best suited services for this project. As a first source, the results of D1.1 are used. This framework contains an analysis of the status and opportunities of the digitally interconnected transport system. It showed, among other, the future transport services might have, according to experts. Secondly the Grant agreement stated that case studies should cover cases such as digitally driven e-scooter services, crowd logistics services, free-floating car-sharing, on-demand ridesharing and mobility-as-a-service applications. The Madrid case, run by La Pajara, a private organisation, was already a partner within the INDIMO project and was also suitable to be used as a development case study, which made contacting them a lot easier.

The case studies have been selected taking into account the following criteria:

- Including digital mobility services that are already being deployed or are promising in terms of their future development
- Covering a great variety of digital mobility services so that we can highlight any similarities and differences in the barriers and drivers
- Having a coverage of multiple cities or regions
- Involving a variety of stakeholders

Therefore, we used the digital mobility services identified in D1.1: Analysis framework, as a starting point and identified digitally driven e-scooter services, crowd logistics services, free-floating car-sharing, on-demand ridesharing and Mobility-as-a-Service (MaaS) applications as minimum categories that should be covered by the case studies (as stated in the INDIMO Grant Agreement).

A first selection of cases is based on input from partners providing potential services, using their personal network and contacting services that comply with the criteria described above. The first contact with a potential case took place in July 2020, during the COVID-19 crisis, which possibly had a negative impact on the services willing to provide help for this research. Some reasons not to cooperate were:

- No response/not interested in the project
- Limited number of stakeholders that can be interviewed
- Mid of summer: holidays

- Service already too old, none of the original developers/operators can be interviewed

Two cases were selected in response to the current COVID-19 crisis, and some questions relating to the impact of COVID-19 were added. These cases will provide some information about how the services handle this crisis and how it has influenced their service.

2.1.1 Desktop research

In order to find initial information about the context of the possible cases, a review of several sources is conducted. Studying the context will give a more complete view on the situation, will help the researcher understand the subject and what conditions led to the current situation (Nardi, 1985). There are several methods to collect initial data:

- Online (media) analysis
- An analysis of public documents and communication (local, regional policy, transport authority)

In combination with the stakeholder-interviews, this desktop research will help to have a comprehensive analysis in the case studies. To ensure that the interviews deliver good results, knowledge of the situation in which developers, operators and policymakers work, is crucial. For the researcher this is key information to link certain findings (mobility use, type of mobility used, success/failure of services etc.) and to understand the contextual situation.

To start the collection of information about the case studies, an **online analysis** was conducted, which was to some extent focused on media sources. These sources can be written (newspapers, magazines, evaluation reports from services), online (online newspapers) and produced by broadcasted media such as television- and radio programs. We started with an online search based on several keywords related to (inclusive) digital mobility services. Based on the online sources, we identified other written sources.

The second step was an **analysis of public documents** related to the service and communication about the service, either from private operators and developers or public organisations and policy makers. These documents can consist of numerous different sources: project plans, strategic mobility plans, meeting minutes, presentations, interviews etc. We analyzed multiple sources, databases for each case study.

Most of the information collected as part of the desktop research were reports from the services which were publicly available, information available on the services' website, newspaper articles or from independent organisations.

2.2 Identification of the relevant stakeholders

For the identification of the relevant stakeholders, a **definition for a stakeholder** must be integrated within the method. A stakeholder in the singular meaning is:

"Any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman, 2010, p.46)

The responsibilities Freeman speaks of are in many cases self-imposed, meaning people impose themselves these responsibilities instead of them being imposed. Currently, two main trends are present within the definition of stakeholders. The first one is towards a narrower view on a stakeholder. Without their support the organisation, or in this case the service, would cease to exist. Secondly, and more suited with the approach in INDIMO, there is a broader view on stakeholders, which describes stakeholders as the people or organisations influenced by the performance of the service (Reed et al., 2009), including the people responsible for the operation, design etc. of the services.

The identification of the relevant stakeholders was done separately for each of the case studies. For each case, local operators, developers, policy makers and transport authorities were contacted.

2.2.1 Stakeholder analysis

For the identification of stakeholders, a **stakeholder analysis** is conducted.

"A stakeholder analysis aims to evaluate and understand stakeholders from the perspective of an organization, or to determine their relevance to a project or policy. In carrying out the analysis, questions are asked about the position, interest, influence, interrelations, networks and other characteristics of stakeholders, with reference to their past, present positions and future potential"(Ruairi Brughá & Varvasovszky, 2000, p. 1)

A stakeholder analysis provides answers to two questions when looking for stakeholders: whose interests should be considered when making a decision and why those people or groups' interests should be considered (Crosby, 1991).

The stakeholder analysis is not a single tool used to identify stakeholders but consists of multiple different methodologies (Crosby, 1991). Two methods are used to identify the deployment case study stakeholders: the snowball-mapping method and the stakeholder-led categorisation.

For each of the stakeholder groups the snowball mapping-method for identifying new stakeholders is used. The mapping starts with only one or a few stakeholders, which are asked to identify new stakeholders or groups of stakeholders and to provide contacts. This method is usually used in combination with a stakeholder analysis and semi-structured interviews. Stakeholder mapping provides an overview of the different stakeholders, but also gives an indication about the strength of the inter- and intra-stakeholder group relationships (Brughá & Varvasovszky, 2000). The existence of a relationship and the strength will have a strong influence on the development and deployment of a new digital mobility service.

To contact the stakeholders we used the snowball method, first, a primary contact is needed. This first stakeholder is ideally contacted by someone they know, this way, the chance of them participating is expected to be higher. Using personal connections or using those participating

in the INDIMO-project these primary stakeholders can be contacted. From the moment the first contact is made, the snowball method can be applied to identify other stakeholders.

For each of the cases multiple stakeholders are interviewed, their answers analysed using a deductive thematic analysis and the results discussed within the workshop. For keeping the interviews, the collection, analysis and discussion of the data manageable a limited number of interviews for each case study were planned. The initial goal was to interview three stakeholders for each of the cases using the snowball method, but due to the COVID-19 crisis and some stakeholders having a double role (e.g., both policy maker & operator), this goal was not met.

2.2.2 Types of stakeholders

Figure 2: shows the four main categories that represent the importance and influence of a certain stakeholder (Wageningen University and Research, 2012). The x-axis shows the influence of the stakeholder, e.g., a local mayor will have more influence compared to a citizen, the y-axis represents the importance of a stakeholder. Since we cannot include all stakeholders in the research, we identified the stakeholder groups that have the highest importance in the deployment of digital mobility services either with high influence (quadrant B) or low influence (quadrant A). During the development and implementation of a new digital mobility service, generally operators, developers and policy makers have significant influence and importance, so are considered part of quadrant B. The users, and especially those excluded from digital mobility services are usually situated in quadrant A, important, but with very limited influence ('victims'). We conclude that according to this scheme the best stakeholders to select for our research are from quadrant A or B.

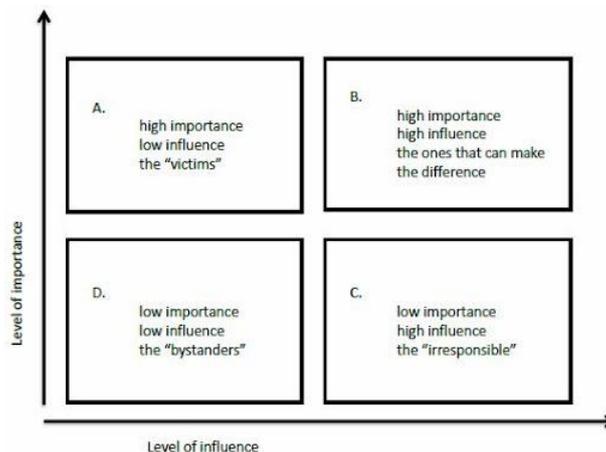


Figure 2: Influence and importance stakeholders (Source: Wageningen University and Research, 2012)

2.3 Development of interviews

The interviews with the different stakeholders provide input for the co-creation workshop and INDIMO Policy Evaluation Tool. Concretely, this means interviews are carried out that will

investigate how new digital mobility or logistics services have been introduced in European cities or regions.

The collection of data includes a combination of both quantitative (where available) and qualitative data. The data will include several aspects of the digital mobility services:

- How inclusion and accessibility aspects were taken into account
- How the regulatory framework was taken into effect
- How the service or application were developed/deployed

2.3.1 Semi-structured interviews

Personal interviews have an average response rate between 70 and 80% (Louise Barriball & While, 1994). The second most successful way to achieve a wide reach is using telephone interview, which reaches on average 96% of all homes. A disadvantage is the frequent use of telephones for sales, marketing and HR-related topics, so people tend to avoid these calls (Canada College PRIE, n.d.). This results in telephone calls having a lower response rate than the 96% of houses they reach. The response-rate using video-interviews is significantly higher than personal interviews, it is however easier to conduct in-depth conversations while having personal conversation, which most likely will lead to more accurate answers. With the quarantine in effect in many of the European countries, the response rate of people answering their phone may be higher and due to limitations to out-of-home activities, many people will have more time to complete the interview.

An interview is a conversation held with one respondent at the time and can be developed in several methods, two of them being structured or semi-structured (SSI). Conducting a structured interview will generate very structured answers, making comparisons between the answers of the stakeholders more comparable because of the strict framework used. Another advantage of using structured interviews is the standardization of the stimulus, which focusses on posing the questions in an identical manner to all participants so differences in answers are due to the stakeholder and not due to the way the questions were posed. This last assumption implies that there are no language barriers between the interviewer and among participants (Smith, 1975). Because of the international nature of the project this could raise some issues. The second method is the use of semi-structured interviews, this is an intermediate method between structured- and open interviews, meaning they consist of both open – and closed-ended answers. The structure of the dialogue with the interviewee does not specifically focus on the questions but leaves space for the participants to answer more elaborately and for the interviewer to pose ‘how’ and ‘why’-questions (Adams, 2015).

The main difference between an SSI and a structured interview is the lack of a strict framework of questions in an SSI. This also creates a more lenient approach while developing the questions since the interviewer can adapt the approach during the interview. This lack of structure is useful in situations where the context can vary between different interviewees, which creates a more

personal approach with a focus on the interviewee instead of the prepared questions. A disadvantage of SSI is the variance in answers. The lack of continuity in questions during all interviews makes the data harder to defend. After comparing both methods, we decided that the use of SSI is preferable for this research. The language barrier, in combination with unknown stakeholders and topics that are relatively new, which might require more elaborate explanations, make the SSI the more suited method. By using the SSI, we expect stakeholders to elaborate on some questions if they have extensive knowledge about the topic and thus provide us with extra information.

Interviews in general are a very efficient way to collect qualitative data and can even be used to collect a limited amount of quantitative data in the form of a Likert scale for example. It is important to keep in mind that while giving interviews many people tend to answer what they think is the socially acceptable answer and not what they really think about the subject (Brink, 1991).

With the current worldwide COVID19-problem it will prove difficult to meet people, but other means of contact are available. In this digital age, interviews can be held using applications such as GoToMeeting, Zoom and Skype or via telephone. Within the INDIMO project online interviews are conducted by video calling using the GoToMeeting application. To collect as much information as possible a deliverable template was developed so different interviewers collect their information in a predetermined format. The interviews are also recorded so these audio files can be transcribed and used as input for the coding software. In order to be conform with the current General Data Protection Rules an informed consent document was created and sent to all interviewees a couple of days before the interview was planned. If any of the contacted interviewees did not agree with the informed consent, they could cancel the interview. A detailed description about the use of the collected data was also integrated within the consent form so the participants knew in advance how, when, why and where their data would be stored.

2.3.2 Topics for semi-structured interviews

The topics considered important for understanding the way in which new digital mobility services are implemented are presented in **Error! Reference source not found.** (Goodwin, 2013; Pope, 2020; Schmeer, 1999; Wick, 2012). Depending on the type of stakeholder (developer, operator, policy maker or user group), the topics touched during the interview are slightly different. Nevertheless, the importance of maintaining continuity among the questions over all stakeholders is not to be understated. More similarity in the way questions are presented and answered will provide advantages for the analysis of the data.

Aspect	Developers	Operators	Policy makers	User groups
Undertaking appropriate planning	x	x	x	
Securing political support	x	x		

Engagement with the other stakeholders to develop suited app					x
Understanding target groups and populations	x		x		x
Identifying and securing finance for development, operations	x		x		
Maintenance and management			x		x
Effective collection, evaluation, documentation and communication of data			x		x
Was quality infrastructure delivered that is fit for purpose?	x		x		
How were inclusion aspects taken into account?	x		x		x
Was a license provided for developing/operating a service?	x		x		
What were the main barriers/drivers up until the service was deployed (planning, development, testing)?	x				x
What were the main barriers/drivers from the moment the service was deployed?			x		x
cybersecurity/personal data protection	x		x		x
Ethical framework developed (in relation with personal data protection)	x		x		x
COVID-19 related questions*					

*for COVID-19 cases

Table 1: Aspects suitable for SSI for each of the stakeholder groups

The questions for the SSI (Appendix 1) are based on the topics in **Error! Reference source not found.** and were developed as an interview guide. This structure is to be followed during the interview, each of the selected topics is touched during the interview, but since this is a semi-structured interview, there is room for more elaboration on certain topics. This can be the case when the interviewer or stakeholder considers a certain topic very relevant or when more explanation is needed. Table 2 shows which questions each of the stakeholder groups has to answer, the COVID-19 related questions have also been added to the table but are only meant for the COVID-19 related cases in Brussels and Madrid. The table with all questions can be found in appendix 1.

Stakeholder	Questions to be answered
Developers	1,2,3,4,5,6,7,8,9,10,11,12,15,16,17, 19, 25
Operators	2,3,4,5,6,7,8,9,10,13, 14, 15,16,17,19, 20, 21
Policy makers	3,4,6,7,10,12,17,19 22, 23, 24
User groups	4,10,17,18,19

Table 2: Questions for each stakeholder group

2.3.3 Analysis of the SSI

The analysis of the interviews consists of different steps. The overall method used is the deductive thematic analysis method, as explained in the work of Braun and Clarke (2006, p. 79). The authors describe the thematic method as an independent qualitative method that can be defined as “a method for identifying, analysing and reporting patterns (themes) within data. It minimally organises and describes your data set in (rich) detail.” “The way in which the thematic analysis is conducted strongly depends on the data, context and constraints of the data analysis phase and the researcher’s personal style of work, but in general can be brought back to the following six steps” (E. Boyatzis, 1998, p.87):

- **Familiarizing yourself with your data:** transcribing data using the recorded interviews and the debriefing templates, reading and re-reading the data, noting down initial ideas.
- **Generating initial codes:** coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
- **Searching for themes:** collating codes into potential themes, gathering all data relevant to each potential theme.
- **Reviewing themes:** checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic ‘map’ of the analysis.



- **Defining and naming themes:** ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme.
- **Producing the report:** the final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

Before starting the first step of the analysis, several decisions, considerations about the way the analysis will be conducted, have to be made. What counts as a theme? Is the goal to create a wide description of the data set or a more detailed insight in one specific aspect? Is the pattern analysis performed from an induction point of view (bottom up) or in a theoretic and inductive way (top down)? Is the analysis at the semantic or latent level? These choices will all have an influence on the results yielded.

The analysis is used to create and analyse different themes within the results of the semi-structured interviews. “A theme captures something important about the data in relation to the research question, and represents some level of patterned response or meaning within the data set” (Braun & Clarke, 2006, p. 82). The use of codes in the analysis of qualitative interviews is linked with the use of different themes. Earlier research stated that themes are not present in the data, but rather in the head of the researcher. They will not emerge out of nowhere, but already reside in your head as a result of thinking about the data and creating links as the data is understood (Anzul et al., 2003, p205-6). Meaning themes do not become apparent by simple passive analysis, an active role of the researcher is pivotal in finding themes, linking them and later on describing their role within the research.

The **first two steps** of the analysis of the qualitative data are familiarization with the content, and development and generation of potential codes. These initial codes determine what aspects of the data are considered relevant or interesting. The codes to be used for the analysis were, for some part, already determined within the Grant Agreement for the INDIMO project, therefore the method used is described as a deductive thematic analysis. No specific codes were decided in the GA, but certain topics were selected, based on which the codes were for some part developed. After the initial coding, **step three** consists of the actual determination of the themes across the datasets. The way in which the themes are selected is not a rigid, fixed method, but is flexible, something the researcher can influence and is, at least for some part, influenced by the researcher’s choices and interpretation.

Once it is determined how themes are selected, consistency in selecting the theme throughout the entire dataset is crucial. INDIMO is a multi-partner project, so multiple researchers work on this task. Keeping in mind the importance of consistency, a standard selection method is discussed and used among all partners. Furthermore, it is important to acknowledge that the influence of a theme is not to be measured in a quantifiable way, meaning that the number of times something is mentioned in the interviews not necessarily means it will be a key theme.



Step four of the analysis is the review of the previously selected candidate themes in step three so that there is cohesion between the data within one theme and clear, determinable differences between them (Braun & Clarke, 2006). Each of the interviews is categorized within one of the four topics, car - & ridesharing, micro mobility, smart logistics and multimodal routeplanners & MaaS. There are too many differences between the topics to analyse and compare them, therefore the interviews are split up according to the topic they were researching.

When the selection of the themes is finished, they are named, defined and explained in **step five**. The analysis of any of the themes needs to fit in with the broader overall data and related to the research questions. The themes themselves can be split into sub-themes if necessary: e.g. the theme ‘micro-mobility’ can be subdivided as ‘last-mile solution, multimodal mobility’ and ‘expensive, discarded’. The **final step** is the writing of a deliverable, due in December 2020, as part of the INDIMO-project. This date has been changes to March 2021 because of delays caused by the COVID-19 crisis.

2.3.4 Thematic coding tools

As explained earlier in section 2.3.3, several different methods of analysis are introduced. Table 3 shows the tools and their advantages and disadvantages. The first tool is the use of coding software, which is a qualitative, deductive, thematic analysis method for transcription, coding and interpretation of the data. In this case, the NVivo coding software is used for the initial analysis of the transcribed audio files. The second tool is the manual analysis method of journaling. Journaling is based on writing thought processes and ideas the researcher has about a text, it contains manual annotation and highlighting of the data. The written down thought process and ideas are defined as “memos”. The third method is based on the use of verbatims, verbatims are direct quotes of the interviewed. Selecting these pieces of relevant discourse is useful to illustrate concepts and dimensions that are significant to the research (Braun & Clark, 2006).

Table 3: Tools for deductive thematic analysis

Coding Tool	Advantages	Disadvantages
Coding by software (CAQDAS & NVivo)	<ul style="list-style-type: none"> - The analysis is very thorough, through codes book that is condensed into a manageable list - A physical project file (which contains the raw data and the analysis) can be shared with others 	<ul style="list-style-type: none"> - Expensive - Requires some learning of the software - Can feel restrictive

<p>Journaling</p>	<ul style="list-style-type: none"> - The process encourages reflection through the writing of detailed notes - Researchers have a record of how they arrived at their themes - The analysis is cheap and flexible 	<ul style="list-style-type: none"> - Individually based more than collaboratively based
<p>Use of verbatims</p>	<ul style="list-style-type: none"> - Since they are direct words of the respondent, they carry a lot of strength. - It's a way of summarizing a collective meaning on some fragment of speech. - Especially attractive with large number of respondents and long testimonies. 	<ul style="list-style-type: none"> - When you select something, you also decide to leave other things behind. - Not all the verbatim can exactly fit into a dimension for which you may be forced to repeat the verbatim to illustrate different dimensions.

For this report, the use of analytic software is preferred. By using NVivo it is possible to analyse the interviews in a structured and thorough manner. This also provides an easier opportunity to digitally share the analysis and results with other researchers within the project compared to the analogic analysis methods. For a good presentation of the results, verbatims are also used to strengthen certain claims made based on the input from both the interviews and the workshop.

2.3.5 Development of thematic analysis codes

During the initial stage of the analysis, the desktop research was used to create a first summary of the context in each of the cases. This provided some of the initial information for the development of the semi-structured interviews and for the codes used within the deductive thematic analysis. During the actual thematic analysis some additional codes were added to complement the predefined ones. In Table 4, all codes are split up in two categories: “primary coding topics” and “secondary coding topics” which are respectively the initial topics selected for the thematic analysis and the topics developed during the thematic analysis itself, based on new information collected during the analysis of the interview.

Primary coding topics	Secondary coding topics
Regulatory framework	Future ideas and concepts
Inclusion aspects	Financial aspects
Data-protection/-collection and privacy	Business as usual (BAU) development
Co-creation aspects	COV- 19 related aspects
	General drivers for development
	General barriers for development
	Expectations of INDIMO Policy Evaluation Tool

Table 4: Thematic analysis codes

2.3.6 Definition of thematic codes

Each of the codes implies an important concept in the development of the digital, inclusive transport system and will be defined in this section. Each of the codes will be defined as they are used within the INDIMO project.

Code	Description
Regulatory framework (or legal)	A combination of quasi-legal instruments that have no legal force, such as (non-)binding resolutions, declarations, and guidelines created by governments and private organizations (Druzin, 2017) and regulations based on instruments that have legal power.
Inclusion-related aspects	The socio-economic and demographic barriers/drivers that may prevent/help people from/to using digital transport services (INCLUSION, 2019), which will be covered by the term inclusivity or inclusiveness used interchangeably in INDIMO. For this thematic analysis, all aspect leading to people being excluded from a service will be considered aspects related to ‘inclusion’.
Expectations of the INDIMO Policy Evaluation Tool	The final goal of this report is to provide input for the development of the INDIMO Policy Evaluation Tool. This tool, in the form of a checklist, will help policy makers evaluate digital transport systems and provide them with

	the necessary information to choose the services best suited for their needs.
Drivers for development	Circumstances, stakeholders and any other aspects that have a positive impact on the development of (inclusive) digital transport services.
Barriers for development	Circumstances, stakeholders and any other aspect that have a negative impact on the development of (inclusive) digital transport services.
Co-creation aspects	Co-creation is the concept where a development process is not only done by the developers, but significant user input is also considered, from other stakeholders and end-users.
Collection of mobility data	The data collected related to transport (mobility and logistics), specific data (specific areas, focus groups etc.), how the data are collected and why the data are collected is considered. How, why and for what purpose data is collected is important for privacy related topics, but also for sharing mobility data between operators, developers and policy makers. Shared data between stakeholders will help to advance the development of mobility services.
Future ideas and concepts	Useful insights from experts that show potential for the future and could have an impact on the service and its users to make it more accessible/inclusive.
Financial aspects	Most of the providers/developers within the digital transport system are private organisations with a motive to make a profit, therefore the financial aspects e.g., the initial budget, subsidies etc. have a major impact if aspects of inclusiveness are introduced to the services.
Business as usual (BAU) development	Examples and/or statements that imply a lack of inclusiveness, accessibility and co-creation during the development or use of the digital transport system.
Data protection and privacy aspects	The protection of users and their data is important for the safety of users. Regulation for data protection and privacy determine what safeguards organisations have to comply

	to for the use of personal data. This topic will help to understand what steps organisations took to protect the data of users.
COVID- 19 related aspects	In some of the cases the influence of the COVID-19 crisis is studied more in detail to understand its impact on the digital transport system and to have an impression of the resilience of the market.

Table 5: Definition of thematic code

2.4 Consolidation and discussion with stakeholders (co-creation workshop)

On October 6th, 2020 INDIMO organised an interactive online co-creation workshop to consolidate and discuss the first results from the stakeholder interviews with external experts in mobility and logistics services consisting of transport and logistic service operators, software developers, policy makers, mobility researchers. These workshop participants were gathered through INDIMO consortium partner networks, personal contact network of INDIMO researchers in the domain of digital mobility and logistic services. Furthermore, some of stakeholder interviewees participated in the workshop. Because of the variety in participants, several different views were present during the workshop, which resulted in a broadened view on each topic. The total number of participants was 36, not including all partners present from INDIMO. There are two main reasons that could have influenced the number of attendees: first, several other webinars related to drivers and barriers of inclusive and accessible car- and ride sharing services are organized during that period. Secondly, a short introduction of INDIMO had already been presented at several of those webinars leading to people thinking they already heard everything.

The objective of the workshop was to present and discuss the insights gathered in the case studies that INDIMO partners have been conducting for the last few months through desktop research and interviews with key stakeholders across Europe to identify the most important barriers and drivers to the design, planning, deployment and operation of accessible and inclusive digital personalized mobility and logistics services.

The organization of the workshop was strongly influenced by the current COVID-19 pandemic situation. Physical meetings were not possible, so this workshop took place using the online interactive platform Vitero. Using an online platform creates several barriers for the content and the smooth running of the workshop: limited communications, possibility of background interference, technical difficulties etc. Among the many disadvantages of online meetings there were some benefits: no transport needed to be organised, no travel budget was needed and the potential amount of people participating was higher. The agenda for the workshop is presented in Table 6, the detailed version (including speakers etc.) is available in Appendix 2.

Timeline	Topic
09:50	Opening of the online platform
10:00	Welcome and introduction sessions
11:30	Breakout room discussion on drivers/barriers/issues: Participants will discuss barriers and drivers to implementing digital mobility solutions and possible strategies to overcome them in four breakout (see 4 topics) rooms using interactive tools.
12:55	Stakeholders' expectations from the INDIMO policy evaluation tool
13:10	Findings and conclusions on breakroom discussions
14:00	End of workshop

Table 6: Agenda workshop

The participants chose one out of four different breakout rooms, each with a specific subject. The breakout rooms were used because of the number of people attending the workshop, a discussion is not possible in large groups. Also, most people were not interested in all the topics, but rather in one or two. By dividing the discussions in four topics, participants chose the topic they preferred.

It was hard to have a productive online discussion with many people, so the number of participants for each of the rooms was limited. This meant there was a chance that certain participants were not able to participate in their room of choice. The four options each represent a different type of digital mobility services but were all approached from a digital and inclusive perspective:

- **Car- and ridesharing**
- **Bike sharing and micro-mobility**
- **Smart logistics services**
- **Multimodal routeplanners and MaaS applications.**

The information gathered from the interviews and desktop research was used as a baseline for the meeting. It consisted of barriers and drivers for development and implementation. Two main aspects were addressed. The general barriers and drivers found in multiple interviews from the different stakeholders were discussed first. They were presented in an introduction session with all participants present. Afterwards the second phase of the workshop started going more into detail per topic. Breakout rooms were used for these 90min discussions. External experts were asked to rank the considered drivers & barriers according to their importance (Figure 3) **Error! Reference source not found.** After the ranking, the participants were asked to identify extra barriers (Figure 4). Potential solutions/strategies to tackle these barriers (to an inclusive service) were also discussed (Figure 5). In the final session of the workshop, the findings from all four

breakout rooms were presented. The results from these discussions are presented in Section 3. Results.

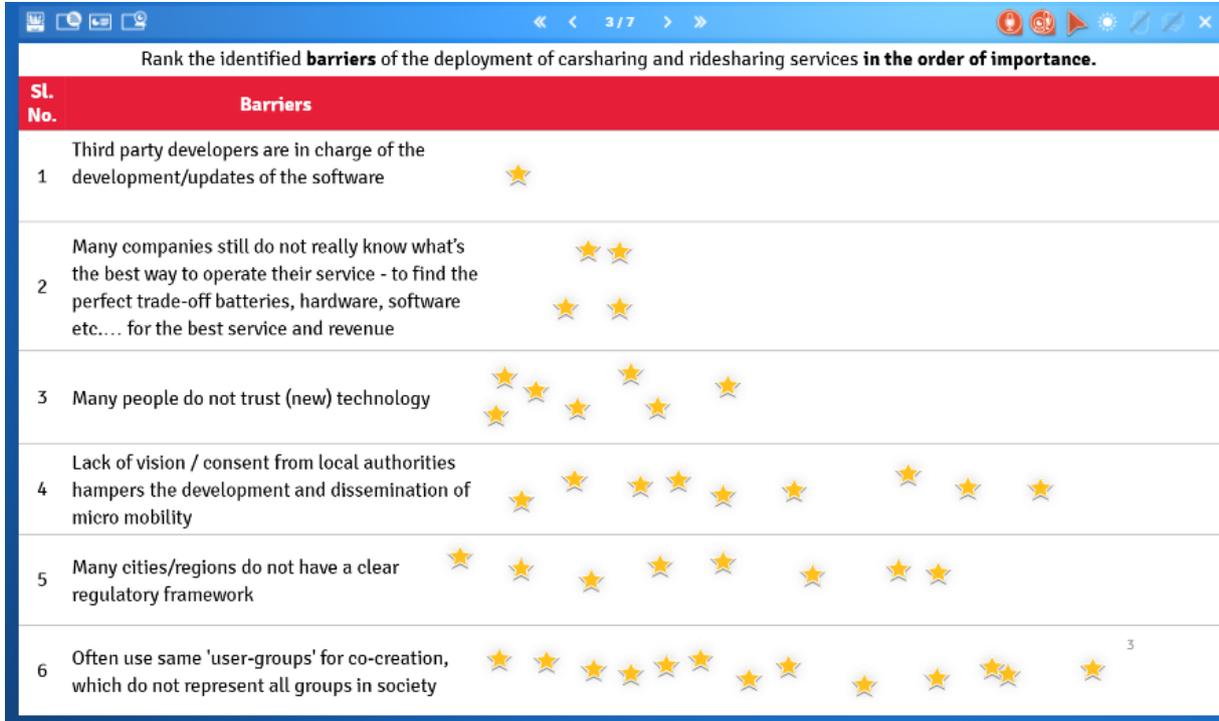


Figure 3: Screenshot ranked barriers to an inclusive digital transport system in co-creation workshop

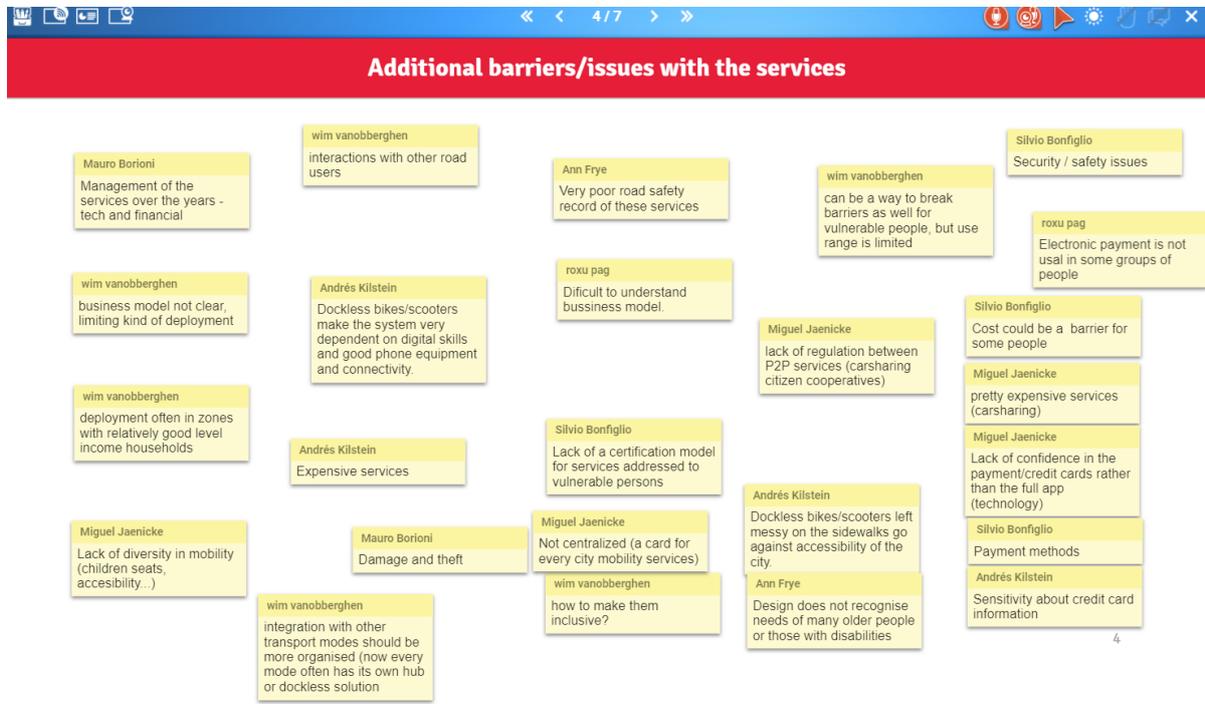


Figure 4: Screenshot new potential barriers to an inclusive digital transport system by experts in co-creation workshop

Sl. No.	Barriers	Strategies to overcome the barriers
1	Third party developers are in charge of the development/updates of the software	Miguel Jaenicke try to implement local software entities with clear and transparent regulations
2	Many companies still do not really know what's the best way to operate their service - to find the perfect trade-off batteries, hardware, software etc.... for the best service and revenue	wim vanobberghen co-creation wim vanobberghen integration/exchange platform Silvio Bonfiglio Collaboration with users organizations
3	Many people do not trust (new) technology	Andrés Kilstein Giving alternatives such as totems and cards additionally to the app. Miguel Jaenicke Take care on the personal data and payment methods to increase confidence (not hacking, phishing...) Ann Frye Older people in particular need one to one support to understand and build confidence Mauro Borioni On road events to let people try
4	Lack of vision / consent from local authorities hampers the development and dissemination of micro mobility	Andrés Kilstein Bike sharing should be presented as an alternative to mobility, and not only for recreational purposes. Silvio Bonfiglio To define an integrated plan related to mobility wim vanobberghen focus also on local entrepreneurship Andrés Kilstein Govs should be convinced by the fact that micromobility alleviates pressure on mainstream transport systems
5	Many cities regulatory framework	roxu pag European policy focus in this kind of services wim vanobberghen follow best practices in other cities Miguel Jaenicke The regulation always go slower than the social innovation so have devices and teams that could get the upcoming changes Ann Frye A clear regulatory framework would in tern build confidence among potential vulnerable users Silvio Bonfiglio To define a common legal framework at least at regional level wim vanobberghen co-create vision with city authority Jaenicke
6	Often use same 'user-groups' for co-creation, which do not represent all groups in society	A real effort to include other groups and audiences into the user design process, no matter their income or status mauro borioni Work with schools (and parents) roxu pag Sortition groups to have more inclusive vision of the city Ann Frye wider use of media to inform and encourage wider participation

Figure 5: Screenshot potential solutions for barriers to inclusive digital transport system in co-creation workshop

During the co-creation workshop, the car- and ridesharing breakout room was the least popular, only 5 people attended. The other rooms were more popular and attracted eight to ten external experts. In combination with two or three members of INDIMO this resulted in the groups being large enough for a productive discussion.

Creating a more modular approach (see four topics) will be helpful to create a Policy Evaluation Tool suited for all types of digital mobility. By analyzing these results separately, we can compare the results and find differences between sectors. If, after the analysis, no significant differences are found between the four groups, the modular approach can be ignored, and a general Policy Evaluation Tool can be developed based on the results of this deliverable.

The data collected from the case studies and the co-creation workshop were used to support the INDIMO Policy Evaluation Tool for policy makers to define realistic pathways for the implementation of the Universal Design Manual for Digital Mobility.

3. Results

The results are compiled in two main sections. First, the selected services that will serve as a case study are presented. Secondly the results for each of the topics (car- & ridesharing, bike sharing and micro mobility, smart logistics services and multimodal routeplanners & MaaS) and the co-creation workshop are discussed. As mentioned above, the cases are not discussed one by one, but rather are grouped into the four topics to be able to use a more modular approach during the development of the INDIMO policy evaluation tool. In this section each of the cases is

explained, as well as the selection process for finding the suited stakeholders. The sections have the same structure, first the services are described, and relevant information is added; the type of service, rating, comments, age, users, payment options, potential inclusion related aspects etc. The introduction to each service will create a better understanding of the selected services and their contextual situation.

The data for each of the topics collected using interviews and a co-creation workshop, will be discussed and after which the consolidated results will be presented. The codes, developed during the analysis of the interviews are mostly based on the aspects considered relevant according to the grant agreement of the INDIMO-project and were developed during the preliminary analysis of the data. The interview codes are presented for each of the four types of mobility services that were studied (car- & ridesharing, micro mobility and bike sharing, smart logistics services and multimodal routeplanners and MaaS) Not all codes are discussed and thus analysed in every interview for several reasons: lack of knowledge about a topic, not being allowed to share the information for confidentiality, financial or competitive reasons.

As was mentioned in the methodology, the input for the workshop was created based on the preliminary findings mentioned during the interviews. Therefore, some overlap in the discussion of the results is expected.

3.1 Selection of cases and related stakeholders

Table 7 shows the ten services that were selected to serve as case studies. The initial contact with a first group of the cases (Cycle logistics, BKK FUTAR, HSV Switch & Citypack) was made using the network from the INDIMO partners, secondly services were also contacted using the personal network (Mobitwin, Mobile locker, Cambio & HIVE). Thirdly, some of the services were contacted using the contact information on their website (HSL & Jeasy). Contact with the first two groups was achieved by contacting one of the stakeholders related to the services. In most cases the first contact was made with one of the four main stakeholders. Once a first stakeholder was contacted, the snowball-method was used to find other relevant stakeholders willing to participate in an interview.

Over the period of half a year, 22 stakeholder organisations, linked to a mobility or logistics service, were contacted to participate in this project. Finally, 10 suited cases were selected with 18 interviewees willing to participate. In addition two interviews with the POLIS network (a network of European cities and regions cooperating for innovative transport solutions) and with Door2Door(a digital mobility application developer), were also included in the latest phase of the research to fill in some gaps or to elaborate on certain themes. Reasons for not participating were: organisations had no time, were not involved enough in the development/operations of the service or simply were not interested or did not respond to our call.

Case study title	Location	Description	Developer	Operator	Policy maker & advising organisations
Cycle logistics	Madrid – Spain	To test and improve the users' and the couriers' experience with the existing Coopcycle platform to deliver goods and food to people with mobility and time constraints issues.	Developers Coopcycle	Bike couriers Madrid VLC (La Pajara)	City of Madrid
BKK FUTAR routeplanner	Budapest - Hungary	Multimodal routeplanner with a focus on the use of public transport within the city of Budapest	BKK FUTAR	BKK FUTAR	City of Budapest
Mobitwin	Flanders	Mobility service by elderly people for elderly people with limited mobility: INCLUSION	Taxistop	MOBAR Gent	OCMW Oudenaarde ¹
Mobile Locker	Belgium	Digital lockers located near station, mobility hubs and other transport hubs where packages can be dropped off and picked up using a smartphone	CEO Mobile Locker	CEO Mobile locker	AGORIA
Cambio	Brussels - Belgium	Shared Mobility service with a focus on people with limited mobility, mostly elderly	/	Cambio	Brussels Mobility (in charge of

¹ OCMW: Openbaar Centrum voor Maatschappelijk Welzijn (Public Centre for Social Welfare)

					mobility projects (Brussels region)
HIVE	Lisbon - Portugal	Micro-mobility provider in Lisbon, as well as in many other European cities.	/	Operator Hive	City of Lisbon
HSL	Helsinki - Finland	A multimodal mobility application developed for the city of Helsinki by their regional transport organisation	/	Helsingin seudun liikenne	Regional transport organisation
HVV switch	Hamburg - Germany	Hamburger Verkehrsverbund: The app can be used to buy tickets as well as to book and pay for rides with the ridesharing service MOIA.	/	Hamburger Hochbahn AG	Hamburger Hochbahn AG
Jeasy	Belgium	A multimodal routeplanner, currently focusing on intermodal commuting, with the goal to become a MaaS for Belgium	Jeasy developer	/	/
Citypack	Valencia - Spain	Introduction of smart lockers near public transport in order to decrease last mile delivery and to provide help to public transport users for connected trips.	/	/	Ferrocarrils de la Generalitat Valencian

Table 7: Selected cases and stakeholders

3.2 Car- and ridesharing

The topic of car-and ridesharing is the first of four topics and is covered by two case studies, Cambio and Mobitwin, which respectively included two and three interviews (Table 8). For Cambio, a developer/operator and a policy maker from Brussels Mobility, the regional administration responsible for mobility were interviewed. For the Mobitwin case, three interviews took place with a developer, an operator and a user group representative. During the interview for the Cambio case some extra questions were touched related to the current COVID-19 crisis and the impact it had on carsharing in Belgium. For the Brussels Capital region, a framework was developed related to shared mobility. There are no specific demands in the framework related to inclusive digital mobility, but some general accessibility and inclusion-related remarks are included e.g. a clear and accessible subscription system should be in place, the operator can also choose to make the cars available without the need for a subscription (Belgisch staatsblad, 2016). This regulation shows that efforts are made to develop an accessible and easy to use system, but as following interviews will confirm, these regulations still need to be further developed, implemented and their impact verified.

Case	Type of stakeholder	Duration interview (min)	Date of interview
Cambio	Developer/Operator	70:42	01/09/'20
	Policy maker	68:19	09/09/'20
Mobitwin	Developer	69:40	25/08/'20
	Operator	33:20	25/09/'20
	User group representative people with limited mobility*	Approximately 30:00	30/09/'20

*Interview data was corrupt; no transcription was possible

Table 8: Interviews ride- & carsharing

Car- and ridesharing were the first services introduced as part of the shared mobility system. The station-based carsharing service ‘Cambio’ was founded in Germany and gradually became active in Belgium. It was first introduced in Wallonia in 2002 and by 2004 it was present in the three regions in Belgium. The current Cambio fleet has 1450 cars available in 50 Belgian cities, servicing over 46 000 users of which 15 000 are professional users. Cambio is the only Belgian car-sharing service allowing reservations via their call centres or using a web browser or a smartphone application, this is the only service providing these options. The call centres are still considered to be crucial, due to clients preferring a reservation by phone. The application (Figure

6) was introduced in 2012 and is available in Dutch, German, English and French on both IOS and Android. Compared to many other applications, this app doesn't require much memory, which makes it more accessible for people with older smartphones. Via the app the users can make a reservation for a shared car in their own neighbourhood or on the other side of the country, might this be needed. In major cities there are multiple stations where the cars can be picked up. In smaller towns the service is often not available yet, but the number of stations is growing. To make a reservation, users need to subscribe to the service, after that, it only takes a few steps to reserve a car. The app has an integrated payment system linked with the bank account from the user working with both credit card as well as with the standard banking card. The application received a rating of 4,3/5, based on 572 people voting (iPhone App Store) and 4,6/5 from more than 3000 votes in the Android application store. The positive score is supported by most comments/remarks on the application that are rather positive and indicate that the application is 'intuitive', 'easy to use', 'clear'. Some negative comments were present as well. They mostly mentioned some difficulties selecting the right hours for the reservation, especially when selecting the moment the reservation has to stop. Another remark is the need for users to pay a guarantee when subscribing to the service for the first time, if no damage is done this amount is refunded when a user cancels the subscription. In order for Cambio to stay in touch with their users and to identify issues, they perform an annual 'happiness'- survey among their users. The results of this survey are collected, managed and analysed by Cambio itself. They also take part in more extensive research into the use of their service, which is done in collaboration with the Vrije Universiteit Brussel.

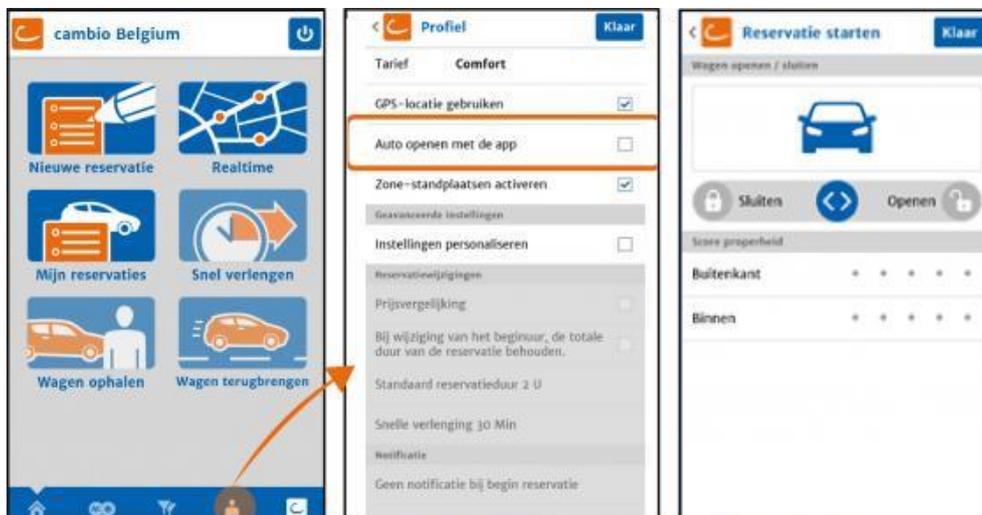


Figure 6: Screenshots Cambio app Flanders (Cambio.be)

Mobitwin is an application developed for a ridesharing service: 'Minder Mobielen Centrale' or MMC. The MMC is a socially engaged service, provided in many Belgian municipalities, of which the first one was founded in 1982. Now there are 275 local desks, with 3000 drivers providing mobility and sometimes logistics services to 40 000 elderly people with limited mobility. Using

the app (Figure 7), the users can choose upon reservation between different voluntary drivers to take them to and from their destination. The riders on the other hand can select when they are available as a driver. Both groups can also select some specifications e.g. I have a dog, I am in a wheelchair, no dogs allowed in the car etc. The driver works on a voluntary basis, only the actual costs of the ride are claimed.

The people operating the call centres and service itself were social workers, which meant they could not only inform us about the operational issues of the service and app, but also give an insight in the needs of vulnerable people. Each year about 400 000 trips are made for a total of 10.5 million kilometres. In 2019, as part of the HORIZON2020 project INCLUSION, an application was developed by Taxistop vzw. The goal was to take away some of the work and pressure on the local desks, which are operated by the OCMW (local social institutes). These organisations originally did not receive extra resources to perform these tasks related to operating a call centre for a mobility service. The development of the ‘Mobitwin-app’ was meant to, slowly, push both users and drivers toward the digital applications instead of the call centres. In order to estimate the effect, a test period was introduced. The application was tested in the cities Ghent and Dendermonde, both situated in the Province of East-Flanders. It is still available at this moment, the use however has diminished since the end of the INCLUSION project. This application is still quite new and focuses on a specific niche. This results in a low number of downloads and not enough people rating the app for the app-store to display a score out of five. For the ride- & carsharing topic, 5 interviews provided input: two related to the Cambio case and three for the Mobitwin case. The audio and video recording from the interview with the user group representative for the Mobitwin case was corrupt so could not be transcribed and analysed. The debriefing template, containing the most relevant remarks is available and was used as a source of information.

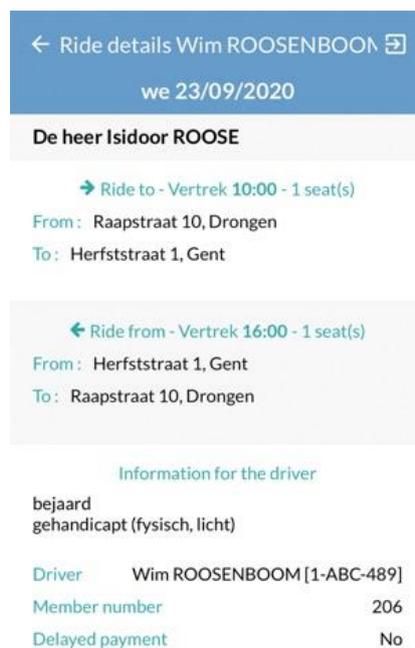


Figure 7: Screenshot Mobitwin app (Mobitwin.be)

3.2.1 Interviews

During the analysis of the interviews, it became clear that there is a lot of overlap between the different codes. Many of the barriers and drivers are related to multiple codes (table 9). This shows the interaction between many of the codes and how multiple issues leading to non-inclusive digital services are intertwined. Most of the interviews focused on the interview guide, which was developed focusing on 4 main topics: the need for a regulatory framework, how inclusion aspects were taken into account, how co-creation initiatives were organized and the protection of data and privacy.

Codes	Codes from the interview
Regulatory framework	<p>Drivers</p> <ul style="list-style-type: none"> - Local government helps with marketing and spreading of information - A national framework is in place - Government provided help during COVID-19 by suspending payment of car insurance - Financial burden related to the investment and installation of shared cars is in some cases shared with local government - Political support not necessarily needed (especially with established service providers) <hr/> <p>Barriers</p> <ul style="list-style-type: none"> - Inclusion-related measures deployed by operators by own initiative, not enforced by government
Inclusion aspects	<p>Drivers</p> <ul style="list-style-type: none"> - Call centres provide easy access - Relatively low initial subscription cost - Personal contact when making reservations - Personal approach to customer service - More and more migrants find the way to shared car services - No need for credit card - Personal handling of complaints - Personal guidance in case of problems with reservations, insurance, etc. - Feedback option on application (not only in app store) <hr/> <p>Barriers</p> <ul style="list-style-type: none"> - Too few options for elderly people to get an introduction/education about digital applications, especially when they are limited in their mobility - Elderly people are reluctant to adopt new technologies



- New technological development changes the ‘speed of life’ for elderly and for migrants
- Knowledge about ride- & carsharing still very limited among lower educated citizens
- Digital tools can increase feelings of loneliness
- Knowledge about vulnerable to exclusion groups among developers/operators is (even) for carsharing very limited

Drivers

- Expectations of mobility for each group differs and should be taken into account
- Help from (local) government during development stage of service
- Cashback systems instigate more involvement from local governments
- Collaboration with other shared mobility providers or public transport – link to multimodality
- Collaboration with universities/ research groups for collection of data
- Early involvement in app development and clear communications lead to larger involvement and reluctant users are keener to test/use the app
- Extensive testing with a mixed audience before introducing new developments (all steps for making a reservation should be tested with focus groups)
- User groups representatives are easier to reach and can provide crucial input for app development

Co-creation

Barriers

- Some groups in society are very hard to reach for surveys or any other info- or co-creation event
- Change comes very slowly in many cases
- Third party app development can have impact on service, application, marketing
- Knowledge about needs/issues of vulnerable to exclusion groups is considered ‘needed’ by developers when it is not present
- Very hard to develop a service suited for everyone



Data protection and privacy & collection	Drivers	- More personal information is shared when using personal connection (especially when users feel need for personal contact)
	Barriers	- Elderly people often do not understand the implications of online data sharing

Table 9: Coding from interviews car- and ridesharing

As mentioned above, car- and ridesharing services are the oldest types of shared mobility studied in this project. This results in a **regulatory framework** that is older and has been further developed and adapted compared to other services. During the interviews it was noticeable that the developers/operators have been in the business for a longer time and that the market is more stable. Because of that stability and the fact that carsharing is already quite popular, it has been present in all major Belgian cities for quite some time. Cambio is already so established and popular that small and medium-sized cities contact them to provide their service, while it was the other way around for many years. The Cambio operator explicitly stated: “we do not actively go to cities or villages anymore to pro-actively promote carsharing, we don’t need to” and “...even without local political support it is possible for us to have a viable service... we have so many clients already that local government would be criticised if they push us out”. The regulatory framework is therefor also quite elaborate, as was mentioned above, there are regulations about the possibility and ease to make reservations.

Several aspects related to **inclusion** have already been introduced within carsharing-services, mostly focusing on providing a service available in multiple neighbourhoods within the city. Much fewer adaptations have been made based on digital inclusivity, financial inclusivity etc. For Cambio, this is different, their main ‘inclusivity’-aspect is embedded in the core of the service: the call service. On their website they also explicitly mention they want to provide a service that is affordable for all (Cambio Flanders, 2020). For lots of groups in society the lack of a decent introduction, explanation, guidance is one of the main reasons they cannot use these services. Especially now, during the COVID-19 crisis the digitalization is moving at an even faster pace, which could lead to even more people missing the boat of the digital mobility transport system.

The current focus of inclusivity is mostly lacking on the digital aspects, only few measures directly related to inclusion of vulnerable-to-exclusion groups were found. Umbrella organisations such as ‘Autodelen.net’, which promote any form of sustainable mobility in Flanders mentions the inclusiveness aspect of shared mobility, but digital inclusivity is not mentioned (Autodelen.net, 2020). The interviewee from the Cambio operator also said that not only the digital exclusion of lower educated citizens is an issue to use their service, but general knowledge about carsharing is lacking: “When you speak for a group with a lot of highly educated people, nine out of ten will know the brand ‘Cambio’, if you mention ‘Cambio’ in a group with lower educated citizens, that number drops to one or two out of ten and they admit not actually knowing the service or principle but rather they have seen one of their cars once. They don’t really know the purpose, use or benefits.” This shows that even though there is a lot of digital marketing

for similar services, the vulnerable-to-exclusion groups are not reached. "... most of our users have enjoyed a higher education and have a decent, but not particularly high income. The blue-collar workers are the smallest groups in our customer database, which means we do not reach this groups, although the service is especially suited for those with a lower-than-average income". Those people who could mostly benefit from services like carsharing are barely or not reached.

Co-creation and the strongly related bottom-up method for development of services could lead to a more inclusive service. One of the operators of the Mobitwin app, whose primary job was actually that of a social worker, said: "knowledge of vulnerable to exclusion groups is low among developers" and this was confirmed by the developer of the service who stated that: "One of the lessons learned after the initial project was the need for more knowledge about the vulnerable user groups and the need for more co-creative development." The issues of app development and co-creation are not that easily solved according to the stakeholders because of several reasons: first, it is very hard for developers to reach vulnerable to exclusion groups, secondly, there is lot of difficulty to find enough people to have a large enough group and thirdly, activating and persuading 'vulnerable' groups to participate in e.g. testing phases has proven a major issue.

For the **data-protection and privacy** of different partners in a digital environment there are several issues that can be addressed according to the stakeholders. First, it is important that the implications of data sharing are made available and understandable for all users. Elderly people do not have the knowledge about the amount of private data they share. Secondly, they are rather keen on personal connection which led in some cases in sharing too much personal information. The operators from Mobitwin complained in multiple cases about the users having access to personal phone-numbers of the voluntary drivers (which is sometimes allowed in case of emergency): "Once they had the private numbers of a driver they liked, they started calling them directly instead of using the digital or phone-based reservation methods, which led to drivers being called during periods they were not 'active' as a driver."

Carsharing is the best-known form of shared mobility, this might also have been the reason for many services to quickly re-adapt during the COVID-19 pandemic. Cambio could easily change their subscription to make it possible for essential workers to use the service easily, also longer 'rental' periods up to one week were allowed, which helped to lower the fear for unhygienic or unsafe vehicles. They are also among the most financially stable shared services leading to them being able to take the blow from the COVID-19 crisis. Also, Mobitwin was quickly able to switch the focus of their service. During the first Belgian lockdown period the service started delivering food and groceries to the elderly and those who have issues with physical mobility. This shows both services, and many similar to those are able to adapt and provide a crucial service to many vulnerable to exclusion citizens. No significant changes were needed on the Cambio-app, so change could be instigated rather quickly. The operator did state that it would have been more difficult if software changes were needed, especially since Cambio Germany, which is considered a third party, is in charge of the app development.

The Mobitwin app was tested among elderly people in 2019 and after being introduced to the service many of them downloaded the app and used it a few times, but afterwards actual use of

the app was negligible. Many considered it too difficult with too many options. A completely different reaction came from the social and healthcare workers in elderly homes, who considered the app a very useful tool. Not only could they make reservations much faster, but they also had more information available about the trips they planned for inhabitants and afterwards had an easy to access to an overview of the trips. This one case shows how difficult it will be, even with bottom-up methods and co-creation events to develop an application suited to all users. We can also ask ourselves if the change towards a fully digitalized service is coming too fast for certain groups in society. Both the operators and the developer of the Mobitwin app said that “...the applications-based service might simply come 10 years too early”, especially if you consider providing the service specifically to elderly and individuals excluded from digitalized services. The operator and developer from the Mobitwin app also used ‘the speed of life’, meaning the pace at which activities are organised and performed in the modern society. Many of the elderly people did not feel the need for things to go faster and to change their habitual behaviour of making a phone call to reserve a ride. The operators from both services said that there was need for better guidance and understanding of those specific groups.

3.2.2 Results from the co-creation workshop

Error! Reference source not found. and Table 11 respectively show the drivers and barriers for the car- & ridesharing services. According to the experts of the co-creation workshop, the highest ranked driver is the local support of authorities. During the interviews, it was mentioned though that local support is not always needed anymore. The difference can be explained by the fact that the stakeholders interviewed were working for services which were already quite established in Flanders. The input during the workshop was also provided from experts from other European countries, of which some are only just starting with the introduction of shared mobility. A logical deduction is that the local support is, indeed, similar as with other services, important when a new service is introduced and not that well known in that region/country. Secondly, data collection and management for studies, further development etc. are best done by or in association with an organization with the necessary knowledge. Two other drivers that also received four votes are the need for pre-/post deployment co-creation sessions and the need for re-occurring co-creation.

The main barrier to creating an inclusive car- and ridesharing service, according to the external experts is the lack of connection among the developers with vulnerable to exclusion users, which can be directly linked with the drivers from Table 10, showing co-creation is one of the main drivers for a more inclusive service. Secondly, the experts estimate suspicion about new technology is still a main barrier for many users. From an inclusive point of view this is something that can be eliminated with increased communications to those groups that are reluctant towards the digitalization e.g. interactive information sessions and courses. The third barrier is related to the second one. It points out the importance of personal connections for many groups in our society.



Sl. No.	Drivers (# of votes received)
1	A good relationship with the local authorities creates a positive environment to develop shared mobility services (15)
2	For data collection/management it is better to use organizations with the necessary knowledge/skills (4)
2	Post-deployment co-creation should be combined with pre-deployment co-creation (with a focus on the app) (4)
2	Recurring co-creation for any major software/hardware development/change (4)
5	In house development: faster and more tailored to the needs of the users (3)
6	Use of applications instead of call-centers makes for a lower workload (0)

Table 10: Drivers for car-/ridesharing ranked by experts

Sl. No.	Barriers (# of votes received)
1	Developers do not really have any connection to many of the vulnerable to exclusion groups (14)
2	Users are often suspicious of new technologies, especially groups vulnerable to exclusion (7)
2	Lack of personal approach/call-centers makes for a less inclusive app (7)
4	Operators are often reluctant to share information with local authorities (4)
5	Not enough resources to check if operators adhere to agreements made (3)
6	App development by third parties is slower and less tailored (1)

Table 11: Barriers for car-/ridesharing ranked by experts

Table 12 shows the potential strategies to overcome the barriers to an inclusive service, based on the input of the co-creation workshop. Keeping in mind the ranking in **Error! Reference source not found.**, the main issue to be addressed is the lack of connection between users and developers. The external experts suggested several approaches to tackle this issue: more funding for research on best practices, as this might show how to develop such services in an efficient way, and also the use of peer groups is mentioned again. The strategies for the lack of trust in new technologies are also similar as mentioned during the interviews, the need for a phone service is



also mentioned here and as proven with the Mobitwin case, collaboration with local organisations has a big impact on the local adoption rate. The need for a personal approach, combined with a call centre, are needed in the initial phases of the services introduction, but their impact and use decrease over time. The lack of trust in (local) governments to handle information is a mayor issue for operators. The experts suggested a regulatory framework for sharing of information of any kind between cities, operators and other services such as MaaS. Sharing of information is not only creating trust issues between the private and public sector, but also within the private sector there is a lack of trust to share information. One of the potential causes for this is the fear among operators to lose their market share if their competition gets relevant information about their service. This could possibly be solved with the introduction of a regulatory framework with a focus on the shared information between organisations.

Sl. No.	Barriers	Strategies to overcome barriers
1	Developers do not really have any connection with many of the vulnerable to exclusion groups	External funding for research on best practices for these groups, use different peer groups during development
2	Users are often suspicious of new technologies (especially groups vulnerable to exclusion: elderly, lower financial social classes...)	Promote the service locally to residents, give information, offer phone support in the beginning, partner with local organisations, educate
3	Lack of personal approach/call centres make for a less inclusive and accessible app.	Experience has shown that with time, the need of call-center support reduces
4	Operators are often reluctant to share information with local authority	Make a European framework for (shared) mobility providers
5	Not enough resources to check if operators adhere to the agreements made	/
6	App development by third parties is slower and less tailored (often less inclusive)	Set inclusivity regulations, higher funding will lead to more inclusive applications without competitive disadvantages

Table 12: Strategies to overcome barriers to inclusive car- and ridesharing services by the experts during the co-creation workshop

Lastly, the barriers suggested by the experts during the co-creation workshop are presented in Table 13. The additional barriers are quite similar to the barriers from the interviews. Funding of mobility§ services is currently focusing on short term, pilot projects, but there is need for more and continuous financing for long-term projects. The regulatory framework, which was considered to be appropriate in Belgium, is still lacking in many other European regions and

cities. And even though the ‘peak-car’ phenomenon may lead to less car use in some countries, there is still a cultural push towards private car-ownership in many other countries.

Sl. No.	Additional barriers/ issues with the service
1	Lack of clear regulation
2	Safety concerns (physical and digital)
3	Funding, financial risks, high entry cost, creating viable business case is hard (especially in rural areas)
4	Lack of trust in strangers (elderly people), lack of awareness, lack of critical mass
5	Current focus is on pilot projects, not on long term programs
6	Not having drivers’ licenses, culture (favors private cars)

Table 13: Additional barriers/ issues car- and ridesharing

3.2.3 Synthesis of results

For the regulatory framework there was a clear contradiction between the Belgian interviewees and the European experts in the co-creation workshop showing the major differences between European countries. Within the sector of the car- and ridesharing services, there were a lot of differences between the different services, which could be explained by a different mission for the MMC (ridesharing for elderly people with limited mobility) and Cambio (carsharing). The other aspects that were considered to be barriers for a more inclusive digital transport system were present both in the interviews and during the co-creation workshop. The lack of knowledge about potential user groups, and especially those vulnerable to exclusion, indicated by developers is the main issue according to stakeholders at both ends of the spectrum. As a solution for the lack of knowledge, many of the interviewees and experts had similar ideas: more intensive information events with education/guidance for people with lacking skills. The availability of information and education should then be combined with intensive co-creation events which should lead to a better match between the developed products and the needs of users. The more knowledge people gain about the services and the more specifically about the digital part, the more fear and rejection will make place for acceptance of digital services.

For the financial aspects the impact of COVID-19 is different for each service. Services such as Cambio and Mobitwin are financially stable and have not experienced major financial issues due to the COVID-19 crisis. Because of their ability to change their service quite rapidly, they managed to create revenue and provide a useful service to the users.

Some other less prevalent barriers were mentioned as well: the speed of life when working with digital applications is for some groups just too fast, the financial needs for services like this are not that accessible, furthermore the reluctance to use applications, share data and provide information to third parties still scares a lot of, mainly elderly, people. Door2door, one of the

INDIMO partners, identified another barrier, while developing and running their ride sharing services. It was sometimes too difficult for users to understand the rate structure, having too many options. Although many of these services provide some good solutions to make their services more inclusive with user centric design, such as availability for blind people, for differently abled people, people without driver's license, those without smartphones, there is still a lot of work to be done. But as was stated earlier, all stakeholders interviewed, acknowledged the same needs and issues to move forward towards a more inclusive digital transport system.

3.3 Bike sharing and micro mobility

For the micro-mobility related services, three interviews were performed: two with stakeholders of the HIVE e-scooters in Lisbon and one with a policy maker for micro-mobility services in Brussels (listed in Table 14). HIVE (part of Free Now), a free-floating e-scooter service, started in Lisbon in 2018 and is part of the Daimler group. They introduced 600 shared e-scooters in the city and are even expanding, combined with the introduction of extra e-scooters, they also put a lot of effort in close collaboration with other local organisations and especially with local policy makers (Hinchliffe, 2018). Aside from Lisbon, HIVE-scooters are also available in cities across Europe (Vienna, Berlin, London, Manchester etc.). Hive provides their service at prices, similar to other shared e-scooter services: there is a €1,00 start price and a charge of €0,15/minute (this varies depending on the city). Lisbon is currently using a soft regulatory framework to attract providers of shared mobility. New providers arriving have to agree to a certain set of rules and if they do, they can operate in the city up to three years under this license.

The Free Now application has a rather high user score in the iPhone Application Store: 4.7/5, on 930 votes, in the Android Play Store the app was rated 4,2/5 by more than 150 000 users. Most comments on the application from users are (very) positive and confirmed the user friendliness of the application. The few negative comments are focused on the wrong display of prices and the number of bugs, causing the application to freeze and some difficulties finding a GPS signal. The application has no noteworthy aspects related to inclusion, except for the number of languages available (strongly linked of course with the countries they are active in). The app can be used in 11 languages, with the Catalan language included.

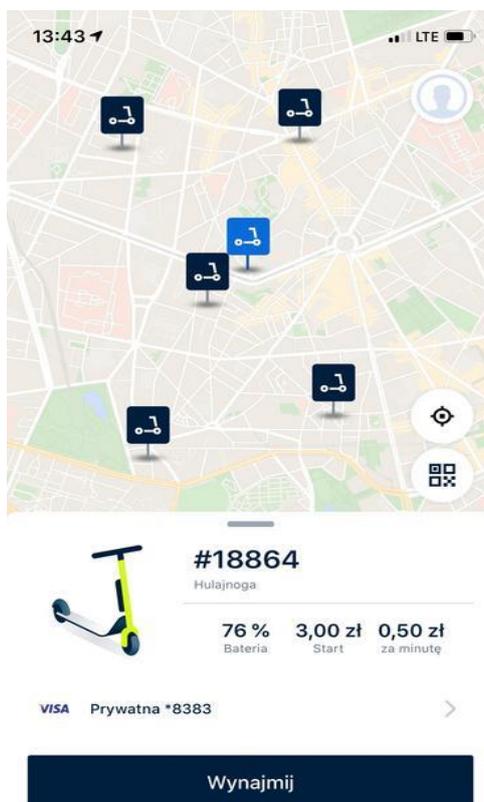


Figure 8: Screenshot HIVE app (Appadvice.com)

For the Brussels’ case no provider of micro mobility was willing to take part in the research. During the interview with the policy maker, some questions related to the operation of a micro mobility or shared bike service were answered since the Brussels Region also has its own public shared bike scheme ‘Villo’. Villo is a station-based bike sharing service provided by the Brussels municipality. The service currently offers about 5000 bikes stalled in 360 stations all over the Brussels Region. Blue bike is also present at all train stations in Brussels providing station based shared bikes. Villo and Blue bike are the two best known providers of shared bikes, but other services are present in the city as well: Swapfiets (a service providing a bike, when it breaks, users can pick up a replacement), Billy Bike (1000 electric bikes), Cozywheels (peer to peer sharing electric (cargo) bikes, previously from Cozycar).

Next to bike sharing schemes, there are also plenty of free-floating scooters present in the city such as Dott, Lime and Bird (Brussel Mobiliteit, 2020). Bird was already present in the city from 2018 till the winter of 2019 after which they retracted their scooters until November 2020. The company restarted their service in Brussels with 200 e-scooters (Belga, 2020). Hive and Tier used to have e-scooters in the city as well, but due to the competition and financial difficulties they have left Brussels in 2019. Even though providers have left the city, the scooters are still widely used by more than 100 000 users, but there is also a lot of criticism because of their impact on the public space and especially related to safety issues when used on sidewalks, as they often are (Wallemacq, 2019).

Due to several reasons e.g. COVID-19, lack of contacts, lack of interest etc. no actual developer could be interviewed for this case. The information about the development of HIVE is based on one operator (who was only partly involved in the development).

Case	Type of stakeholder	Duration interview (min)	Date of interview
Brussels micro mobility & shared bikes	Policy maker	68:19	09/09/'20
	Operator/ developer	51:25	02/09/'20
HIVE – Lisbon (Free Now)	Policy maker Lisbon	44:57	20/10/'20

Table 14: Interviews micro mobility & bike sharing

3.3.1 Interviews

Table 15 shows the data collected from the interviews. Although no actual bike provider was interviewed, the free-floating bikes have similar issues as the free-floating e-scooters. The experts in the workshop considered their barriers and strategies to overcome these barriers applicable to both e-scooters and shared bikes.

Codes	Data from the interviews
Regulatory framework	Drivers <ul style="list-style-type: none"> - Soft regulatory framework attracts more providers - Soft shared mobility regulations combined with hard (public space) regulations provide ‘power’ to local authority - Hard regulations provide the opportunity for a clear set of rules, which are easier to control
	Barriers <ul style="list-style-type: none"> - Nation-wide development leads to lack of local context - Policy makers have not enough knowledge about the service so they can develop decent regulations - Lack of framework for digital inclusiveness - Lack of information among developers about potential user groups for development inclusive service
	Drivers <ul style="list-style-type: none"> - Use of local organisation makes for a better acceptance of a mobility service

Inclusion aspects	Barriers	<ul style="list-style-type: none"> - Use of existing social groups to take part in discussions about the development and operation of mobility services (e.g. unions)
		<ul style="list-style-type: none"> - Developers and operators do not have enough money available to develop and provide services for vulnerable to exclusion groups (e.g. people with limited financial means, no credit card, no digital knowledge) - Not enough knowledge about the vulnerable to exclusion groups - Most aspects related to inclusion are physical, not digital (e.g. blind people)
Co-creation	Drivers	<ul style="list-style-type: none"> - Co-creation with potential users is considered to be a very good source of information by operators and policy makers - Co-creation between city and operator leads to a better service - Connections between operators and other service providers (e.g. MaaS)
		Barriers
Data protection and privacy & collection	Drivers	
		Barriers

Table 15: Coding from interviews shared bikes and micro-mobility

The first aspect discussed is the way in which the **regulatory framework** is being developed in the two cases and how this might impact the digital inclusivity of the service. Many European countries have developed some sort of regulatory framework for shared mobility. The regulatory framework is often developed at a national level, but in many cases, also at a city-level (Eltis, 2020). Both for Brussels and Lisbon, a regional policy has been developed. This has not yet been fine-tuned so there are still a lot of gaps, also related to the limited knowledge (about use, impact, (dis)advantages) policy makers often have about the types of services. Both have some form of regulations to increase the accessibility and inclusiveness of the services provided in their city, but they are based on physical accessibility rather than digital accessibility and inclusiveness. In Brussels and Lisbon, the regulatory framework was primarily developed for car- and ridesharing services, only later on micro mobility and bike sharing were added. Although a lot of efforts have been made for the continuous development of the framework, the Brussels policy maker stated that the framework is still not as extensive enough and is a bit outdated.

Lisbon was one of the early adopters within the shared & digital mobility market, the city chose a soft regulation approach which made the city more approachable for operators, which resulted in a large number of operators wanting to operate in Lisbon. This was also confirmed by the interviewed operator: “I think the approach of Lisbon it just gives the benefit of the doubt for the companies to come.” These types of regulations were combined with hard regulations such as the city’s parking regulations prohibiting vehicles to park on the sidewalks. When the local government received complaints from elderly people and people who are visually impaired taking issue with all the scooters on the sidewalk the city used their parking regulations to prohibit scooters being parked on the sidewalk.

Due to regulations, such as hard parking regulations, which have effect on the way in which e.g. e-scooters are used in public space, the city can still impose their will on the e-scooter providers. A second reason why the regulations were soft, was because of a lack of knowledge about micro-mobility at the time when the regulations were developed, hard regulations simply require more knowledge about the sector and its effects on society and public space. In Brussels a stricter, license-based approach was adopted.

For introducing inclusive measures, knowledge is still too limited to understand which of these approaches is best suited to implement a more accessible and inclusive transport system. The Lisbon policy makers said: “...we wanted to welcome them (the providers), but at same time, we wanted to regulate market. But we didn't know how, because we didn't know the business, so what we needed was what we call today a soft regulation”. Although Brussels imposes a hard approach, the Brussels’ policy maker stated that, many cities (incl. Brussels) do not have the funding or personnel to monitor if all the digital transport services operating in the city comply to those regulations.

Strongly related to the regulatory framework is the introduction of measures for a more **inclusive service**. The main issue the interviewees mentioned was the instability of the market and the fact that, although it evolves quickly, it is still a niche-product, which leads to the providers/developers wanting to develop the service in its totality, with only a (very) limited focus

on the digital inclusivity of the service. For operators, developers and policy makers the development of a good ‘general’ service, within a reasonable regulatory framework that is financially stable is currently the main goal. Both policy makers did acknowledge that research into more inclusive services is needed, but as stated before, it is currently not possible due to lack of knowledge and financial resources. It was considered as a failure of policy by both policy makers. Although in general no massive attempts or regulations are made to change this on a large scale, some financial-inclusivity aspects are considered, such as 30 min free e-scooter time for inhabitants of Lisbon with limited financial means, hoping this would show the opportunity micro-mobility can provide for these people. The operator stated that the aspect of financial stability is currently the number one priority, which is, when keeping in mind that the market is volatile, and the interviews were conducted midst the COVID-19 pandemic, the expected motivation. Compared to the shared car market, it shows that financial and market stability leaves room for more inclusive development. It was mentioned by stakeholders for both topics that if financial or market stability is not present, not many developers and/or operators are willing to spend a lot of money on inclusiveness.

Co-creation and communication will result in better relations between the developers, operators and stakeholders, which has a positive impact on the service. In both cities, information events are organized by the local authority for people to learn about the new services and their digital aspects, and when asked, all stakeholder groups interviewed consider the input from end-users as being important and having a positive effect on the match what is being developed and what is needed, but also admitted that this type of cooperation is still lacking in many cases.

There are two main issues concerning the co-creation or info-events, first there is the composition of the group knowing about and attending these events and secondly, many of these events, as described by the Brussels policy maker, are rather info-events, where information that has already been decided is shared with social organisations (e.g. unions, local social groups, neighbourhood groups, etc.). Certain groups in society (e.g. older people, migrants, people with limited education) are not as easily reached and as a result, their opinion and issues are not heard. So, these workshops will have a positive effect on the service, but many vulnerable groups are still overlooked. In Brussels some of these issues are being tackled by involving social organizations in the info-events (e.g. private organizations, workers unions etc.), policy makers hope that by introducing these organizations to the development of the services they will get wider support, and the service developed will be better tailored to the needs of different groups within society. One of the reasons the Brussels policy maker linked this issue mainly to limited resources: “... there's always been an issue with resources. We have limited people, and it's not easy to hire somebody to work on the topic, we'll have to prioritise”.

According to the Brussels policy maker, the concept of **data-protection and privacy** will also become an important matter for the creation of better digital mobility services. The stakeholder stated: “Well, it's (the exchange of data and protection) definitely a work in progress, this trust issue between private sector and public authority, and public transport operator as well, actually, it's definitely something that we have to address.” The Lisbon operator stated that, for the moment, not that much data is collected. “We don't do that much of data like customer segmentation. Because I mean, if Free now as a global app is not old yet, right. Only in beginning

of this year, we merged it. So, it's a new concept. And to be quite frank right now, it's more about male, female, age groups, nationalities. So, we're barely scratching the surface of the data collection. So, we don't have the massive things that you would see...." One of the major arguments against intensive data collection given by the Lisbon operator was: "... we have a less pressure to collect massive data. And, I think it's good because it just takes a very big risk in terms of data management." The same issue comes up in each of the interviews, data-collection is hard, the advantages are not always very clear, lack of trust, lack of knowledge, not enough resources for specific data collection. When asked for a vision on future data collection and especially management, the operator did not think intensive collection of data (e.g. data about vulnerable groups, specific people, areas etc.) will become the standard: "... I can't really tell much of how the future data management is going to be, but my personal opinion is it will be probably not be done, because, like I said, I can't see that benefit to know the level of detail that we see on other types of apps (e.g. social media)... So, my personal opinion is that there's not much, there's not much to dig". This vision, however, is not shared with policy makers, they see a lot of potential in data collection and management.

3.3.2 Results from the co-creation workshop

The breakout room for micro mobility involved 8 external experts. The barriers and drivers to inclusive services identified during the interviews and ranked by the external experts during the co-creation workshop are presented in **Error! Reference source not found.** And Table 17.

Based on the results from ranking the drivers and barriers, the experts consider support and close co-operation with policy makers pivotal during the development and implementation of new mobility services, as was already done in some cases both in Brussels and in Lisbon. The contact between operators, developers and policy makers is considered to be the most important one, and in many cases also the only way co-creation is implemented in the development phase of a service. Similarly, one of the barriers considered to be very influential on the lack of inclusive development is the composition of the user-groups involved during the development of micro-mobility services. So even though information events and sometimes co-creation events with end-users are organized, the composition is usually the same and consists of higher-educated, white, middle-class citizens. In Lisbon, based on the information from HIVE, co-creation and communication is very good, but in other cases they claimed the lack of vision and commitment in some of the cities stalls the development of the service. The experts in the workshop also considered this as an important barrier. During the workshop, a broader media presence, and a specific focus on finding the groups that are vulnerable to exclusion were two potential solutions to reach these vulnerable groups. This however required more funding not many cities have.

Many cities now welcome micro-mobility solutions and consider it as something that could have a positive influence on mobility in the city, certainly in combination with the quest for a greener and more livable city. One more important driver to mention is the combination between public transport and micro-mobility, which was, in both the interviews and the co-creation, a viable solution to unimodal traffic problems. For this to be a feasible option, first, two things need to happen, the presence of micro-mobility should be linked to the public transport network and



financially it should be possible to use one payment method, which creates a lot of difficulties: public transport is a subsidized public service, while in almost all cases micro-mobility is privately owned and has a profit motive. For the combination of public transport and micro-mobility to be successful, it will need to be accessible to all and some form of regulatory framework is needed.

Trust and safety-related issues are important to some groups: elderly people, people with limited digital knowledge, women and people with different cultural backgrounds.

Sl. No.	Drivers (# of votes received)
1	Support and close co-operation with local policy makers (18)
2	Growing cities are pressed to solve their transportation crisis amid rising concern around gas-powered emissions (9)
3	Micro-mobility is very suited for first-/last mile mobility (8)
4	Solo commute in COVID-19 time makes people feel more secure (4)
5	Free floating services provide a more evenly spread accessibility of the services in the urban area (3)
6	In house development initializes faster and more suited change in the app development, it also makes an app more personal and linked with the company (0)

Table 16: Drivers shared bikes and micro mobility ranked by experts

Sl. No.	Barriers (# of votes received)
1	Often use same 'user-groups' for co-creation, which do not represent all groups in society (13)
2	Lack of vision/consent from local authorities hampers the development and dissemination of micro-mobility (9)
3	Many cities/regions do not have a clear regulatory framework (8)
4	Many people do not trust (new) technology (7)
5	Many companies still do not really know what's the best way to operate their service (4)
6	Third party developers are in charge of the development/updates of the software (1)

Table 17: Barriers shared bikes and micro mobility ranked by experts



The potential strategies to overcome the barriers, provided by the experts in **Error! Reference source not found.** are the results of a breakroom session during the co-creation workshop. The role of co-creation in the development and implementation was very clearly based on the barriers and drivers described by the interviewees. The experts providing solutions for the barriers suggested some form of co-creation as the solutions for four of the barriers. Except for barrier 4 and 6, all strategies contain some form of co-creative initiatives, both with potential end-users and with the local government as (part of) the solution.

Sl. No.	Barriers	Strategies to overcome the barriers
1	Third party developers are in charge of the development/updates of the software	Try to include local software developers
2	Many companies still do not really know what's the best way to operate their service - to find the perfect trade-off, hardware, software etc.	Co-creation is key Exchange among operators (best practice, integration)
3	Many people do not trust (new) technology	Gamification Increase confidence (payment methods, personal data) Let people do try-outs(roadshow)
4	Lack of vision / consent from local authorities hampers the development and dissemination of micro mobility	Role of micro mobility in sustainable mobility should be (made) clear.
5	Many cities/regions do not have a clear regulatory framework	Exchange best practice Clear regulatory framework to increase trust Co-create vision with city
6	Often use same 'user-groups' for co-creation, which do not represent all groups in society	Make effort to include vulnerable people Wider use of media Identify specific vulnerable groups

Table 18: Strategies to overcome barriers to inclusive bike sharing and micro mobility services by the experts during the co-creation workshop

Besides ranking already existing barriers and drivers and potential solutions, the external experts were also asked to provide other barriers they experienced in the field Table 19. The integration of other services and integration and standardisation of payment systems shows the need and push towards more MaaS-like systems, which is present in many of the shared services. The need for a better, more uniform regulatory framework is again considered to be very important. Two barriers can be linked to the need for and lacking of an inclusive digital transport system: users

need digital skills to be able to access the service and according to some experts, there is no even deployment of these services throughout the city, which leads to certain neighbourhoods and thus people not having the same access as others.

Sl. No.	Additional barriers/issues with the services
1	Cost and payment methods (credit card, electronic payment)
2	Lack of regulation, disorder in public space, problem for the disabled/older people
3	Integration with other services is missing
4	Almost all such services rely on digital skills
5	Deployment often only in zones with good level of income
6	Business model is difficult to understand and volatile

Table 19: Additional barriers shared bikes and micro mobility

3.3.3 Synthesis of results

After discussing both the interviews and the output from the co-creation workshop, the following can be concluded. According to the interviews and the workshop, several aspects should be considered when developing potential guidelines for the development and introduction of micro-mobility and shared bikes. The most important one is **co-creation**; at any time, a significant decision is made during the development or at any moment changes are made after the implementation of the service. This co-creation should happen in two ways: first, there should be very close and intense cooperation between significant stakeholder-groups: developer, operator, policy makers. In addition to these groups, other organisations could also be contacted: organization specialized in data collection and management, potential MaaS-like systems, police, local social organizations etc. Secondly, potential end users should be contacted to give input at certain stages of development and during the decision process to introduce change, special attention should be given to those groups vulnerable to exclusion. Co-operation with local social organizations will provide necessary knowledge and skills to contact these groups.

Secondly, a good **regulatory framework**, which is clear and simple is necessary. The interviewees and experts present at the workshop explicitly stated that it will help both policy makers and providers of shared mobility services. Micro-mobility and shared bikes in the free-floating system are rather new compared to many other shared services. The concept of free floating is very advantageous for many of the users, but for the city or region it creates a lot of challenges. A clear regulatory framework, with either soft or hard regulations will help to decrease the massive impact these services have on the public space, while still being able to provide an adequate service for the users. The introduction of a suited regulatory framework should be present in any city and preferably would be exchangeable and easily modifiable according to a specific spatial and social context. This framework should also contain clear rules for the **collection of mobility**

data and for the protection of personal information. Exchange of these data will help to provide a better service for the users and can be used to see areas or user groups that are under- or overserved to create a more fair and inclusive system. Based on the information from both the interviews and co-creation workshop it could be concluded that data-collection probably will become a major player in shared mobility as well. How it should happen and the potential it has for better, more inclusive services cannot be said, the opinions from the stakeholders differed to much in this case.

These three main aspects will help to introduce a more fair and inclusive digital transport system. If data about ‘vulnerable to exclusion’ groups is collected, input from all stakeholders is consulted and this information is used to develop a suited regulatory framework, better service could be provided for the users.

When comparing the different topics, including the barriers and drivers to an inclusive digital service for each of them, a lot of similar drivers and barriers are present when compared with those from car- and ridesharing. This paper will be the base for the development of the INDIMO Policy Evaluation tool, so the more overlap present, the less differences there will be in the evaluation process for these services, which will make the toolbox easier to operate.

3.4 Smart logistics services

Two types of logistics are studied, first there are smart lockers, in Valencia and the ‘Mobile Lockers’ in Flanders, and the delivery of goods using (cargo)bikes in Madrid (Figure 9). Logistics services struggle with several aspects related to digital inclusion (e.g. how do blind people access lockers, how does someone without a smartphone order food and how can last mile package delivery become lucrative, but also available for all?). For the Citypack lockers in Valencia a city representative, who was involved in the deployment of the lockers was interviewed. For Mobile Locker, their CEO responded the questions from both a developer and an operator point of view. For the Coopcycle case in Madrid, three people were interviewed, a developer, a policy maker and an operator. The Coopcycle case is a cooperative service, focusing on food delivery using (cargo)bikes. Some of the issues related to the delivery of food in cities, which has grown exponentially over the years, were dominating the news for quite some time, especially related to the Coopcycle case in Madrid. In September 2020 the Spanish supreme court ruled that drivers for services like Deliveroo and Glovo are not self-employed and should therefore have certain rights e.g. sick leave, holidays etc. (Gómez, 2020). The court only ruled in favor of the drivers in 2020 after many cases were dismissed in other courts. The Coopcycle service was developed in 2017 as a response to the initial problems that surfaced related to the ‘self-employment’ status of the drivers for other good-delivery services. The service started to grow in the beginning of 2018, right after the movement and protests against Deliveroo. La Pajara, the cooperative bike operator, started working on their first collaboration projects and helped customers to fight against the working conditions of mainstreaming platform models (security, abuse, holidays, sick pay) inside national and international networks and associations. For this case a developer, operator and local policy maker were interviewed (Table 20). The application is available on both

Android and iOS, on the Android platform the app has been downloaded more than 5000 times, for iOS no data about the downloads is available. In the Android application store, the app received a 4,3 rating out of five, but this is only based on 35 reviews, for IOS, again no data is available.

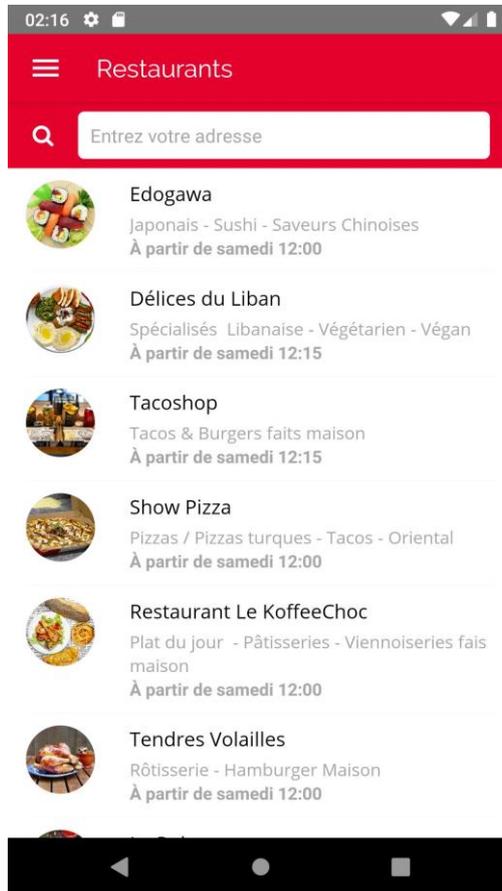


Figure 9: Screenshot Coopcycle app (Coopcycle.org)

The applications and service itself were developed by ‘activists’, within Coopcycle with a major focus on developing fair services for which they are active on two levels: “I did not talk about it, but it is very strong in Coopcycle that we are fighting for riders’ rights, so for example we went to workshops with the riders’ unions at the EU parliament last year.” Because of its foundation within the political activist-scene, Coopcycle have developed their own framework to protect their riders and customers.

The second case study is also based in Spain and was developed as part of the European Horizon2020 project SPROUT in the city of Valencia. The development and operations are performed with ‘Ferrocarrils de la Generalitat Valencian’ (local public transport agency) and ‘Fundación Valenciaport’ (the local seaport organisation). The use of lockers, provided by Citypack, for the last-mile delivery give operators more flexibility as it decreases the operational costs and reduce the failed home deliveries. To the city level, it reduces the urban freight vehicles occupying the public space and traffic jumps. These parcel lockers are commonly installed in

private spaces (eg. Malls, petrol-stations, neighbourhoods). But in this project, public infrastructures as metro stations opened the adoption of this service to any commuter using the metro. The two first lockers were installed in the Colon and Xativa metro stations in the city of Valencia. Since the lockers have only been installed for a limited time, no data about use or the type of users is available. The only data available is the results on google when looking for information about the lockers, which were quite significant, 1360 results are produced.

The third and last logistics service is a Flemish private locker service named Mobile Locker, providing very large variety of smart lockers. The idea was developed in 2012 and has grown to become a high-end provider of lockers for all types of events and locations. Contrary to many other providers, they can provide tailored lockers developed in collaboration with the customer, which can be a (local) government, an organization or a company in need of solving issues with their package flow. The original idea was to develop moveable lockers, but now they also provide lockers suited for last mile delivery and to help develop the sharing economy. These lockers are permanent and provide, next to the logistic aspect, also some extra services, such as WIFI, cellphone charger on solar energy, etc. For the use of a locker, not even an application is needed. Just by scanning the QR (quick response) code, someone can use the service. This option makes the lockers more inclusive; no new application needs to be downloaded, no space on the internal memory of the phone and it lowers the barrier to use the service even only once.

Case	Type of stakeholder	Duration interview (min)	Date of interview
Madrid – La Pajara - Coopcycle	Developer (Cyclelogistics)	57:11	15/09/'20
	Operator (La Pjara)	1:44	27/08/'20
	Policy maker (CCOO)	31:12	15/09/'20
Valencia locker	Policy maker	51:25	02/10/'20
Mobile locker	Developer/Operator	29:50	17/09/20
	Policy maker*	/	05/10/20

*Interview data was corrupt; no transcription was possible

Table 20: Interviews Smart Logistics Services

3.4.1 Interviews

In Table 22, Table 23 the drivers and barriers are presented and described related to the logistics cases for this research.



Codes		Codes from the interviews
Regulatory framework	Drivers	<ul style="list-style-type: none"> - Lobbying for better framework for the drivers - Lobby with different groups and focus on different levels of government - Rules about even distribution of smart lockers across different areas in the city
	Barriers	<ul style="list-style-type: none"> - Delivery companies rather have ‘self-employed’ drivers - Lack of any framework related to digital inclusion - Installation issues related to smart lockers in public space
Inclusion aspects	Drivers	<ul style="list-style-type: none"> - Some aspects related to physical accessibility - Phone and email services for ordering food - A lot of lobbying - Creating public awareness about certain issues - Option to pay cash when using a smart locker - Working together with social organisations fighting for an inclusive society - Translation of information to local dialects for elderly people - Focus on inclusion among the drivers - Focus on link between public transport and location of lockers
	Barriers	<ul style="list-style-type: none"> - Evenly distributing lockers in multiple neighbourhoods in the city - Development of ‘inclusive’ lockers not profitable - It is hard to develop lockers suited for everyone - A certain amount of orders needs to be made in order for the service to be profitable - Currently more focus on accessibility (and not on digital inclusion) - Certain neighbourhoods are harder to reach, so more orders are needed to be profitable - Lack of access to technology among vulnerable to exclusion people (e.g., smartphones, digital skills)
Co-creation	Drivers	<ul style="list-style-type: none"> - Lockers can be co-created with the customers



		<ul style="list-style-type: none"> - Food delivery focused on working with small local shops and restaurants - Develop a certain 'view' on how economics should be approached (providing fair wages, providing service to all citizens even though this might not be that economically attractive)
	Barriers	<ul style="list-style-type: none"> - Topic is not yet present within the locker market, there is a need for more focus on tailor made solutions
Data protection and privacy & collection	Drivers	<ul style="list-style-type: none"> - Only necessary data for the service to work is collected: location, phone number etc. - Drivers can be tracked at any moment by the consumer - Collection of data related to a locker provides information to adapt the service to the consumers' needs - Results based on data are only to be used inside the company, no publications are possible in any way - Analysis of use is quite general so no links with socio-economic data of users
	Barriers	<ul style="list-style-type: none"> - No online databases to collect and store information

Table 21: Coding from interviews Smart Logistics

For logistics services, the development of a **legal framework** is less clear compared to the mobility cases. There have been problems with the status of riders, their pay and the social and job protection they enjoyed while working (Gómez, 2020). Although some form of legal framework is present in any of the cities where these services are active, none of the interviewees could give a clear answer on the content of that framework. The Madrid policy maker claimed that there was a plan for a decent regulatory framework to protect the riders but could not go into detail about the content or when this framework might be ready. "...let's say these legal problems that have been occurring and that lately seem to be clarifying...." Except for a potential regulatory framework to protect the drivers, there is no such framework to protect the customers, no rules were mentioned to be able to access vulnerable to exclusion groups. From Coopcycle itself, they focus on the wellbeing of their drivers, for which they have a strict framework themselves, but also try to be an inclusive service.

For the Spanish logistics services, no elaborate regulatory framework has been clearly defined, and except for policy developed within organisations (e.g. Coopcycle) no framework related to digital exclusion is present. Similar, the Belgian policy makers did not mention the existence of a legal framework related to good delivery by lockers, they provide a rather supportive role without too much interference in the way the market is run. The developer of the Mobile Locker

system claimed that, with the current status of the market, “The government should be involved as less as possible.” but also stated that the lack of profits in the last mile is caused by the prices that are too low, which could be adapted with a regulatory framework developed on a nation-level. Inclusion wise there are some general rules, related to access of screens in public places for people in a wheelchair, but no recommendations of rules have been drafted from a digital exclusion point of view.

Generally speaking, no clear framework has been developed, although several of the interviewees said there were plans (e.g. policy makers) for a regulatory framework in which only very few aspects related to digital inclusion were mentioned. That lack can be explained by the urge to create a decent service, which is in the first place accessible to the broader public. Secondly, and especially related to lockers, the profit in last and first mile delivery is negligible, so before a profit can be made on these deliveries, not many investments are going to be made for a more (digital) inclusive system. If compared to a carsharing- service, which is much more established, with a clear legal framework and many more initiatives towards an inclusive system, it could be said that, with due time, smart logistics services will also focus on a more inclusive approach.

Often closely related to the lack of a regulatory framework is the limited factors promoting (digital) inclusiveness. Efforts for the development of a **digital inclusive** service are very limited from a policy point of view, in both the Spanish and Belgian cases (and this is applicable in Europe) there were some efforts toward inclusion, mostly related to the accessibility of buildings and services as regulated by the government (e.g. screen displays should be accessible for people in a wheelchair). “There are a lot of technical norms and legal regulations of universal accessibility that emanates from the technical- and accessibility commissions. Both for any mobility issue and for buildings or services, there is law and there are regulations and technical provisions, they are all mandatory.”

Initiatives for a more digital inclusive system are not mandatory and not really promoted as well. Coopcycle, being a quite inclusive organisation, has some aspects they are working on to create a more inclusive service. Reservations are possible using the phone, cash can always be used for payment and when neighbourhoods are too far away to make delivery profitable, they try and work out a solution. This was corroborated by the policy maker, who acknowledged the problem: “Limited access to technologies, well it seems that everyone handles smartphones, handles laptops, handles the internet, handles apps, but this is not true, we know it well, this is not true.” And “this is often, logically related to economic power, ... but also groups that suffer from cultural or generational distance.” But except for acknowledging the issue, nothing much is happening to solve it: “There are citizens, neighbourhoods, association initiatives, CCOO (confederación sindical de comités obreiras, in English: trade union confederation of workers' committees) has given a lot of money to, not doing it directly, ... with the objectives of serving, bringing food, solving the digital gap of students, etc. But everything is insufficient because even government initiatives are few and far between, municipal initiatives depend a lot on each municipality, they are not the same in all municipalities and autonomous ones are very scarce in the case of Madrid.” Based on these inputs it could be concluded that there is a structural

problem, rather than only the lack of funds and initiatives. Especially services like Coopcycle are trying to have enough income to stay viable, but also to provide a fair service to all citizens.

The lockers in Valencia are developed by the public railway organisation and are therefore located near train stations. The link between these stations and the lockers creates a more inclusive story. People with more limited mobility due to not having a car have more difficulty to combine trips and to carry goods and food home after work for example. The combination with lockers, where both food and goods could be delivered, provide not only the users with benefits, but also reduces stress on the public transport. If fewer (connected) trips related to shopping need to be made, there are less people using the public transport. Also, public transport does not favour one group above other, so the lockers are available to a broad spectrum of society. The Valencia policy maker stated that: “Because groups risking social exclusion, who are currently in a condition of vulnerability, also need access to the service. Another thing is that a solution is not going to be put in place so that people who are not used to using technologies can’t use the service... In the end for a user to use a locker he/she has to know how to buy and you have to know how to send your purchase to the locker. But being in a subway station, it has a more inclusive vision because it reaches more users....” This shows that efforts are done to improve the accessibility for people vulnerable to exclusion, but also that a certain digital knowledge from the users is expected and necessary for using their service.

For the smart logistics services, there is still a lack of rules, efforts and methods to make the services more (digitally) inclusive. Most of the efforts made towards this goal are own initiatives from the companies, rather than regulated by policy makers.

For smart logistics services, **co-creation** could be a potential solution for some of the earlier mentioned issues, keeping in mind that for a more elaborate and better regulated framework, co-creation solely with potential users will not suffice. A bottom-up approach, combined with close collaboration with developers, operators and especially the policy makers (both at local level and above) are necessary to achieve an inclusive regulated service. The issue here, is that during the development of the services, certainly the lockers, a very limited amount of co-creation is part of the development process.

During the interviews, co-creation was only mentioned a few times even though it is embedded in the development of the Coopcycle service, which is co-owned by everyone participating within the business and therefore is submitted to a lot of different viewpoints. The co-creation part is mainly based on the input from the riders, who were underrepresented before this service was developed. Before and during the development of the lockers in the city of Valencia, potential users were asked to provide input, but no further comments were made about this during the interview.

La Pajara have a very close relationship with the developers of their service (Coopcycle) which results in good communications and faster response to errors. They receive a lot of input for the further development of their application and service from their riders and customers. The more users they have, the more input is created and this gives a good view on what is needed to make a better service: “It is a good thing that the more users you have, the more they validate it, the more it is tested and the more errors are seen.” As was said above, collaboration with other

organisations is pivotal to the business idea of Coopcycle. For the development of the service, they worked together with an organisation specialised in promoting cooperatives: “It is a cooperative that is dedicated to promoting the creation of new cooperatives and then, what we did was initially invoice as ImpulsaCoop and test if the project was viable...” Their vision on this form of cooperation was very positive and gave them the time to learn, create a network and discover alternative ways of thinking and working.

Related to the lockers, co-creation is very limited or even absent. The lockers from Mobile lockers are developed with input during the prototyping, if the project is big enough. Actual input during the design and development process was not present in both cases. Co-creation with other organisations were present in both cases due to the complexity of smart lockers. For both cases, the lockers and software, were developed by a third party because of the high cost and knowledge needed for the development. In the Valencia case, data was also collected by a specialised company so they could find the best areas to deploy the service and to find out what the acceptance rate is.

The fourth main aspect is **data protection and privacy**, which is very different for the bike delivery and the lockers. In the case of the lockers, the collected personal data in both cases is rather limited and mostly focused on the use of the lockers. The main goal is to advance the way in which the service works, which is done in two ways. First, general data is collected from the locker (time, use, which types of lockers, duration etc.), this data is used by both providers, and is especially useful when the developer is in charge of the actual locker (e.g. when it is not bought by a government for example, but is installed on their own initiative). Secondly, and this was mainly the case for the lockers in Valencia, a lot of studies were performed to find out what the reach of the lockers was, meaning the area that was serviced by these lockers, to evaluate how profitable they were. They contacted an organisation specialised in these studies and used the data to determine where the lockers would be best located within the city. The policy maker for Valencia said: “Since it was a data intensive project and of course, but come on, it was only me who used and had access to that data and it was for their benefit, it was not going to be published or anything.” Which led to the users providing a lot of information about the acceptance level of the lockers. Coopcycle was not that busy with data collection, their focus was primarily on the creation of a fair system for the drivers and customers. When providing home deliveries some basic information is necessary for the services to run. That information was collected, but not shared or used for any reasons except for the delivery of the goods.

3.4.2 Results from the co-creation workshop

The ranking of the barriers and drivers for goods delivery are presented in Table 22 and Table 23. There is always some overlap present between the data collected from the interviews and the data collected from the workshop, this is especially the case for the goods delivery. There are, compared to the other workshops, considerably more barriers and drivers, resulting in some of them not being discussed in this paper. For this workshop 8 external experts attended.

The most relevant driver according to the experts to promote goods delivery by (cargo)bikes or by using lockers is the introduction of low emission zones. These zones prohibit all forms of motorised transport that don't comply with the emission rules from entering specific parts of the city, mostly the city center. Although this might have a positive impact on the use of the lockers, the question remains if this will benefit all inhabitants. Those people who can afford a recent car, can still enter the city center, people with more limited financial means and older vehicles will be pushed towards using public transport and these lockers. This could have a negative impact on the mobility of those people. For people that were already using public transport combined with the many parcel delivery vans that are flooding the city, especially during COVID-19 quarantine periods, this can be a good driver to find a sustainable solution for these issues. The second driver has a social aspect and can be linked with the lack of regulatory framework as discussed in the interviews. The lack of regulation for decent treatment of riders has been front news in multiple European cities, which led to changes in the regulations to protect these riders. Help and lobbying by organisations such as Coopcycle in Madrid have helped to create a better framework, they approached the problem from two sides, they promoted inclusive employment for their riders and inclusive deliveries (e.g. payment method and service area), nevertheless there is still a lot of room for better defined and more inclusive regulations. The different points of view also show us that there has to be a regulatory framework in place for all the people who are affected by services like these. Except for the last driver, all other drivers have received two votes, showing experts consider them all equally important for the further development of the services. Related to COVID-19, goods delivery by (cargo)bikes became much more popular among the population. Also, co-creation, which was almost non-existing in the studied cases, and good communication need to be addressed, this is also confirmed by driver no. 6, stating apps are better developed when, not only the developer, but the operators provide input as well. Another crucial driver for a fair, inclusive system, is the fair value sharing among all participants in the process for home delivery of goods and food.

The framework for regulations and fair treatment of riders can be considered the biggest barrier for the system of goods delivery by bike. The other barriers are rather similar to those of the other services. The feasibility is always an issue with new, revolutionary services. There is a need for more collaboration among the developers and operators to create more personalised and tailored services, answering the needs of that city or region. A driver is the lack of a profit motive in cases of delivery cooperatives like CoopCycle, which should result in a service purely developed to help the people and hopefully will lead to a more inclusive system, instead of a focus on making as much money as possible.

Sl. No.	Drivers (# of votes received)
1	Low emission zones (7)
2	Motivation from volunteers against the poor working condition of riders in cities (4)
3	Social distance and restaurants constraints may help activate the service. (2)

4	Co-creation: Users with the same concerns and principles that share needs as the main contributor to pivot conventional business models (2)
5	Interaction channel for users, directly at their home locations. It ensures the delivery of services even in the least reachable peripheral areas of the country (e.g. small municipalities) (2)
6	Software meets operators' requirements because they have a say in what is developed. (2)
7	Unwanted loneliness is increasing. Reasons are the digital and technological gaps, economic conditions and COVID. (2)
8	Fair value sharing (2)
9	Rise of e-commerce: logistics applications of lockers, linked to smart and customized services (1)

Table 22: Drivers smart logistics services as ranked by experts

Sl. No.	Barriers (# of votes received)
1	There is a legal framework that recognizes riders as false self-employed. (10)
2	Economic feasibility Being the system administrators (8)
3	Third party developers are in charge of the development/updates of the software Not profit-oriented. Sources are mainly public funds. (5)
4	Integration with the existing processes and technologies and technical infrastructure and need for mechanisms of mutual authentication and transaction synchronization (1)

Table 23: Barriers smart logistics services as ranked by experts

Strategies are developed by the experts during the workshop in response to the barriers to inclusive logistics services (Table 24). The first strategy, for o the way in which riders are treated is the development of a set of EU-regulations, with the additional incentive to push towards more cooperative organisations where financial profit is only one of the goals of the company, together with fair sharing of value among all participants. A similar solution was suggested to overcome the lack of financial means within the system. For solving the development issue, again cooperation is suggested, in combination with actual open-source application development, which also makes it possible to share this software outside of the project. The public sharing of software has the potential to become a standard when other, starting initiatives, can access this without having to invest heavily in an initial application for their service. For the final barrier, no specific strategies were developed, but there is a strong link with the open-source software, which would eventually lead to the development of new services with the integration of existing

technologies. The sharing of information, software and knowledge, by participating in a cooperative is exactly what is happening with Cyclelogistics and it seems to be a well thought out system which is currently working very well.

Sl. No.	Barriers	Strategies to overcome the barriers
1	There is legal framework that recognizes riders as false self-employed.	Clear legal framework (EU-Level) to foster little businesses Make exploitative working models illegal, create cooperatives and other sustainable business models
2	Economic feasibility Being the system administrators	Distribute systems administration (i.e. build cooperation's)
3	Third party developers are in charge of the development/updates of the software Not profit-oriented. Sources are mainly public funds.	Become self-sustainable vs. Funding programs to strengthen local business Widen up the developer community around the software (open source)
4	Integration with the existing processes and technologies and technical infrastructure and need for mechanisms of mutual authentication and transaction synchronization	

Table 24: Strategies to overcome barriers to inclusive Smart Logistics services by the experts during the co-creation workshop

Sl. No.	Additional barriers/issues with the services
1	Unfair competition to venture capital-Platforms
2	Information on the (existence of) services is crucial, esp. for vulnerable people
3	The cost of digital services vs. other ways to have the same service
4	Data security uncertainties
5	Less human interaction with digital services
6	Shortage of vehicles (bikes/cargo bikes) since COVID-19
7	Accepting cash (no credit cards) exposes the platforms to "fake orders"

Table 25: Additional barriers/issues with smart logistics systems

The additional barriers, according to the experts participating in the workshop, are listed in Table 25. The most important barrier mentioned, is the consideration that services backed by venture capital pose unfair competition to cooperative services such as Coopcycle. Ideally, the presence of a regulatory framework could provide the opportunity for multiple financial or business models to be used next to each other. Similar to all digitalised services, apart from the financial cost; there are three other issues that also have a major impact on smart logistics services: the lack of human interaction, the issues with data security and the difficulties of reaching vulnerable-to-exclusion groups with information about the service. The lack of human interaction is something that, especially with the use of lockers, seems inherent to the digital system. It creates more issues for people with limited knowledge about the system or elderly people, who mostly, at first, don't trust the service. Someone explaining and helping them might convince them to use the service. Today, there are a lot of options to transport goods/food in the city, often the non-sustainable forms e.g. scooters and delivery vans are often able to deliver services faster (compared to bikes) and closer to home (compared to the lockers) and both are often cheaper compared to their sustainable alternative. This results in many people still preferring these services, which slows the transformation to a digital sustainable urban logistics centre.

3.4.3 Synthesis of results

The synthesised results of the logistics services are primarily focused on the need for a regulatory framework at different levels. First there is need for better regulations about the role of the riders within bike delivery services, secondly a better regulatory framework for the sector is required, with attention to the difference between cooperative initiatives and the venture capitalist firms on the market. Close collaboration between government, operators and developers is necessary in this case in order to create a regulatory framework so it's possible to have viable service on the market, but also so that fair value sharing is at the core of the system. After the creation of a regulatory framework, the collaboration should continue so the stakeholders can react quickly when changes or adaptations are needed (e.g. public space use, availability etc.). Co-creation wise, the communication between operators and developers needs to be more elaborate to solve issues with app development and changes. Compared to car-/ridesharing and the bike sharing and micro mobility barriers, co-creation with potential end users was much less present in the logistics cases. Except for the cooperative approach from Cyclelogistics there was no real co-creation with end users. One of the consequences of this is that the lockers were not very inclusive for people vulnerable to exclusion. The priority is to make the service profitable, inclusivity was not their main concern. For data collection, it was the other way around, in both cases a lot of data was collected. For the lockers this was done before installation, for Mobile Locker this was the case when they themselves were installing the locker and maintaining it. It was also notable that during the interview with the Cyclelogistics stakeholders, there was a lot of enthusiasm to share software, data with other organisations, cities to install fair systems everywhere.

3.5 Multimodal routeplanner and MaaS

For this part focusing on multimodal routeplanners and Mobility as a Service or MaaS systems four cases are studied, the BKK FUTAR app Budapest, the HVV Switch app, used in Hamburg, the HSL MaaS app from Helsinki and Jeasy, a new MaaS developer active in Belgium (Figure 10).



Figure 10: Screenshot HVV Switch app

The first case is a multimodal application for the city of Hamburg. It is a mobile app, named Switch, operated by Hamburger Hochbahn AG and the ‘Hamburger Verkehrsverbund’ (HVV), the local Transport Association that makes moving around Hamburg easier and faster (Figure 10). With this app it is possible to buy HVV tickets and book your ride with MOIA (local car sharing service) with just one registration. HVV is a company that coordinates the public transport system in and around Hamburg, Germany. With HVV tickets it is possible to avail and transfer between rail, bus and ferry services. The application has been in development for several years but was only available as a beta version from December 2019. The full application was only available from 2020 onwards, in German and English. The app has been scored by 200 people and received 3,7/5. The app does not have multiple payment options, the only option is PayPal. If users don’t have a PayPal-account they can always buy tickets at the kiosks or ticket vending machines.

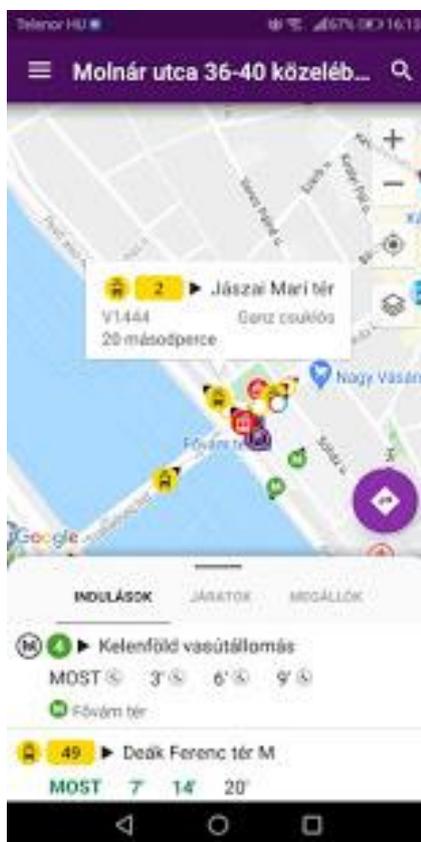


Figure 11: Screenshot BKK FUTAR app

The second case study took place in Budapest (Hungary) where the BKK FUTÁR service was studied (Figure 11). The application is a multimodal route-planning service mainly focusing on tram- and bus-use, but it can be used also for subway. For each of the modal options, real-time information has been integrated in the application and webservice, a main difference with the ‘Switch’-app is the lack of an integrated payment option. The BKK FUTÁR app is very useful for tourists as well and is quite widely promoted as such. The app is available in 2 languages, English and Hungarian, so for tourists this might cause some issues. The space needed on the internal drive of the smartphone is quite limited with 35MB, so this should not cause problems for people with older devices. A score out of five is not available revealed in the App store, but for Android, the users gave the application a score of 3,8/5 based on almost 7000 votes. A web-based version of the service is available as well, leading to more people having access to the service. The application provides real-time information about the mobility services and their stops, also information about ticket vending machines and kiosks is available. Another function on the app is the possibility to select some public transport stops as a ‘favourite’ making them easier to access and displays information immediately for that particular stop. Features like this provide easier access for elderly people, or people with limited digital skills. In general comments are rather positive, although some remarks cover crashes of the app. The latest comments from the developers state that the issues crashing the application are fixed.

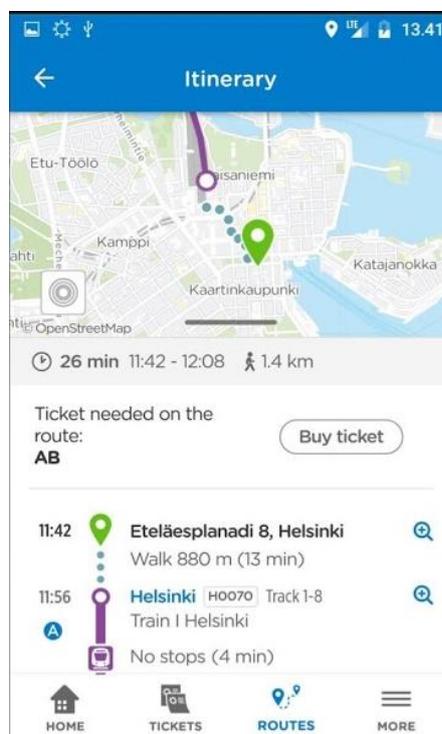


Figure 12: Screenshot HSL app

The third service is HSL (Helsingin Seudun Liikenne or Helsinki regional transport) Public transport application used in the city of Helsinki and the surrounding areas (Figure 12). Helsinki is a leading example for multimodal and sustainable urban mobility and the HSL app is a good example showing apps can be developed and with other services integrated: the app contains fully integrated real time information and payment systems (debit- or credit card or by using your phone bill) in combination with other relevant information e.g. where drinkable water taps are installed. The application is not a full-option MaaS app because of its focus on public transport (e.g. in comparison with Whim from MaaS Global). The application is available in the iOS Appstore and Google Play store, but also in the more recently developed Huawei 'App Gallery'. The application is available in three languages (English, Finnish and Swedish) and has been downloaded over 1 million times. In the Android Play the app has a score of 3.3/5 by 5500 voters, for the Apple Play store no data is available. No notable comments were present in the Play store.

The last service is the multimodal routeplanner Jeasy (Figure 13) which is currently only available in the Belgian business to business (B2B) market, focusing on multimodal commuting. Jeasy has developed an application that, based on preferences (e.g. shortest route, cheapest, environmentally friendly) from the user, presents a multimodal route for commuters. While they are currently only working with companies or organisations, there is already a beta-testing version for users available on the website. An application is in development but is not yet available. The service was originally founded in 2017 as 'Joyn Joyn' but has since changed its

name to Jeasy. One of the strong suits of the Jeasy service is the integration of MaaS in the Belgian mobility budget. This is a budget which employees can use to organise their mobility, until recently this was in almost all cases used to finance a company car, but due to MaaS and multimodal mobility this trend is changing. By dividing the mobility budget over multiple modal

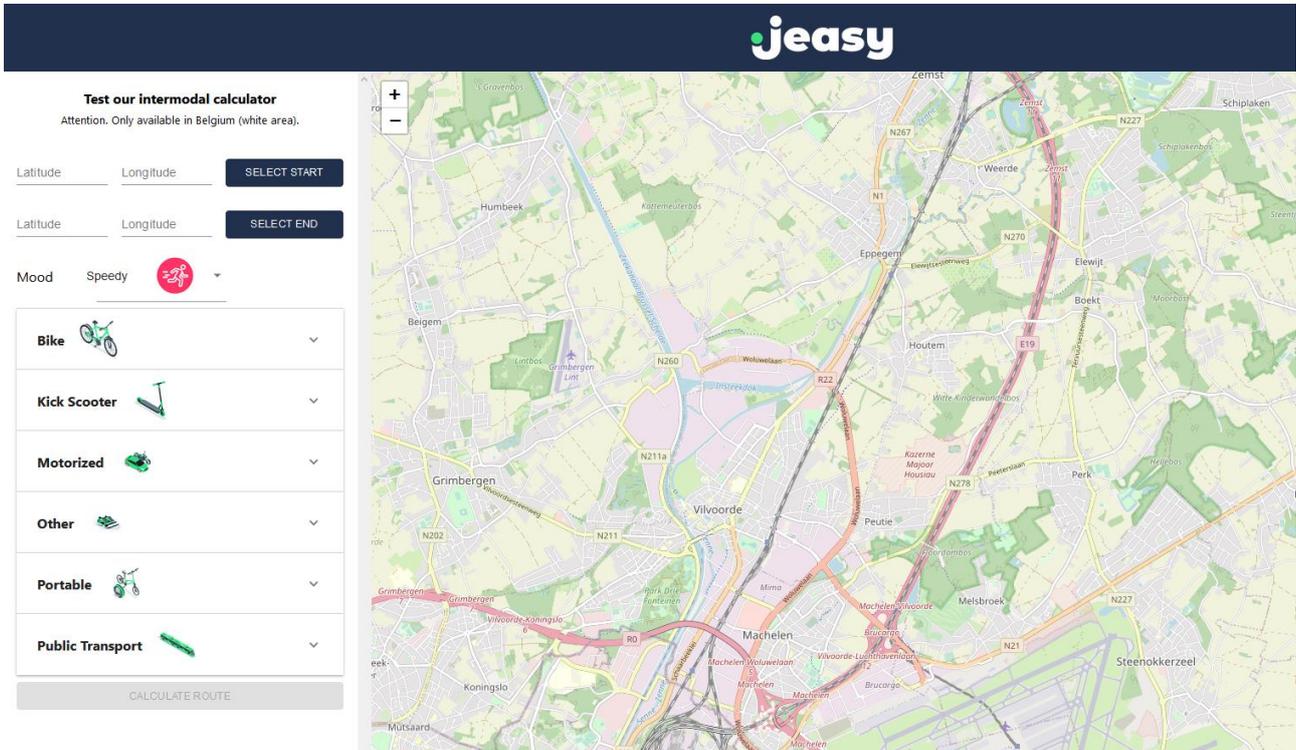


Figure 13: Screenshot Jeasy web-app

options, employees usually travel cheap and intermodal.

Case	Type of stakeholder	Duration interview (min)	Date of interview
BKK FUTAR	Developer	88:51	14/10/'20
	Operator/Policy maker	86:13	02/10/'20
Hamburg 'Switch'	Policy makers	71:08	31/08/'20
MaaS Helsinki	Operator/Policy maker	80:35	01/10/'20
Jeasy	Developer	54:39	07/12/'20

Table 26: Interviews Multimodal routeplanners & MaaS

3.5.1 Interviews

Table 27 shows the drivers and barriers related to the development process of multimodal routeplanners and MaaS. There are more barriers/drivers compared to the other topics because of the recent and fast development of MaaS-like systems, the large amount of data and information that is needed and because of strong debates about the development of new tools. Another point of discussion is the relationship between public and private initiatives. Table 7 showed that both private and public organisations have introduced multimodal routeplanners or MaaS or are at least on their way to do so.

Codes	Codes from interviews
Regulatory framework	<p>Drivers</p> <ul style="list-style-type: none"> - Mobility budget shows advantages of MaaS over private car ownership - Mobility budget with MaaS fits within the regulatory framework of commuting - Using tenders to impose regulations on MaaS and other mobility providers - Develop KPI's by policy makers for the operators - Operators should keep management apps in own possession
	<p>Barriers</p> <ul style="list-style-type: none"> - No general framework for data sharing among operators, cities and countries - No regulatory framework about 'rules and expectations' for MaaS - No tender/license needed to operate MaaS-like services
Inclusion aspects	<p>Drivers</p> <ul style="list-style-type: none"> - App (API) can be linked with other apps (e.g. app development for mobility with a wheelchair) - Wide range of personal preferences available, so best tailored (intermodal) solution - Sharing of information with the operator is possible via the app, multimedia and telephone - Step-by-step inclusion (first viability, then inclusivity) - Admitting limited knowledge about potential user groups and collecting information about the vulnerable groups - Option to put an amount of money on MaaS app to use at will instead of subscriptions being the only option - Use of physical travel card which can be uploaded at kiosks and vending machines

	<ul style="list-style-type: none"> - Release applications on all platforms (Apple, Android, Huawei) - Co- creation with specific users - Maintain a personal connection with vulnerable users - Allow offline use of the application (downloadable content) - Anti-corona act: cheaper tickets
Barriers	<ul style="list-style-type: none"> - It's a difficult service and market, so initial focus is on biggest target groups and afterwards specific focus on vulnerable people - Tailored app with many options makes it more difficult to work with - Generational differences in vision about MaaS and multimodal commuting - For a workable multimodal routeplanner, more common ground needs to be found - Intentionally not providing multiple payment methods - Intentional exclusion of people without smartphone - Goal of satisfaction: 95% of the people (main user groups)
Co-creation	<ul style="list-style-type: none"> - Collaboration with universities for development AI technology - In depth surveys and interviews with future customers - Co-create with experts in user-experience - Co-creation with any potential user in combination with the local policy makers
Drivers	<ul style="list-style-type: none"> - Acknowledgement for users when co-creating the app results in more positive attitude towards the app and service - Sharing of knowledge and data with other cities, organisations - Standardised (weekly) meetings with stakeholder groups - Give possibility for other apps to introduce your service (through API's)
Barriers	<ul style="list-style-type: none"> - Start-ups need to be patient for political support and collaboration (especially if they are very innovative) - Each European country and many cities are financing the development of their own MaaS - Lack of information shared among operators and developers

		<ul style="list-style-type: none"> - MaaS for commuting influences the salary from employees so companies are very careful with the introduction - Third party developers change very fast, so no continuity. Involvement in the product is more limited - Policy makers and politicians sometimes have their own agenda's - Co-creation often limited to organisations, companies, not focused on users - Private companies do not like introduction of public MaaS schemes
Data protection and privacy & collection	Drivers	<ul style="list-style-type: none"> - Data is anonymised - Lot of data is only available on the smartphone of the customer - Anonymised information is stored - Kilometre allowance can be linked with application, without sharing when and where the data was collected (e.g. when you arrive and leave your work) - Collect data about every new development or step taken in development process (from customers) - Sharing of all data and knowledge, except when it contains personal info - Provide short term services without registration - Combine qualitative and quantitative research
	Barriers	<ul style="list-style-type: none"> - Location sharing is crucial when using intermodal route-planning - All information related to your mobility in one application - Better tailored route planning -> need for more personal info - When sharing feedback detailed personal info is often needed to explain a certain issue

Table 27: Coding from interviews multimodal routeplanners & MaaS

The **regulatory framework** for routeplanners or MaaS varied strongly in different cities and between the organisations. None of the operators mentioned a strict regulatory framework which they had to take into account. For the three (semi-) public organisations (BKK FUAR, Switch and HSL) there were however some general rules, mostly focusing on providing a service for

‘everyone’, ‘the general or broad public’, although this was not always supported by other claims about their target groups: “...with 6 type of tickets you get 95% of all people satisfied.”, “...we have a very focused target group namely the users who know what they want.” Their approach is in line with the comments about the lacking regulations about the expectations from the city, regions they are operating in, the lack of (inter)national regulations about data sharing and the lack of standards. The Jeasy app tries to overcome this issue by using API’s (Application Program Interface) to introduce their service into other applications. HSL tries to solve part of this issue by releasing licenses for limited time with some aspects of control (similar to KPI’s). If providers of mobility services do not meet these predetermined KPI’s, they are no longer allowed to work within the city or region.

Inclusion seems to be quite the challenge for multimodal routeplanners and MaaS-systems. None of the interviewees could indicate that they were considering specific groups of people vulnerable to exclusion. In general, the public services were being developed for all people, but as stated above this was not 100% the case. However, the developer from Jeasy approached inclusive design in another way, as part of a stepwise evolution of their service, which is, from a financial point of view a logical choice: “...they cannot work or it is difficult to work with what we should consider those groups (vulnerable to exclusion), as you said, people with finance challenges or people that are migrants...we should include them. But, to make a service successful, you start with the biggest group.”. Also, the stakeholder considered it very important to collect information about excluded groups and to broaden their knowledge about the excluded groups and how they can be approached. It’s also clear that different stakeholders were focusing on different aspects of inclusion, Jeasy, working in the B2B market, wants all employees to benefit from the advantages of the mobility budget, in combination with MaaS, which could replace company-cars, so they were interested to see how generational differences would impact the preferences people had.

Co-creation is present in a very limited manner for the development of routeplanners and MaaS-systems. According to the Helsinki policy maker it is a very competitive market where both private and public organisations are active. The first difference between both is the development. For Jeasy it is an ‘in-house’ development, for the other services the development and coding itself is carried out by specialised ‘third-parties’, which in some cases results in the developers having almost no input contentwise, next to only developing an app as ordered by the operator, and in other cases results in the lack of collaboration in the app development. “...the first step was to find a partner with whom we could do this and it was also clear that we didn’t want to do the app development ourselves.” and “So what we are buying outside is just the coding force. So those people who will code the application or some web services. But I would say that their role is not that much... they are just coding.”. It is clarified by the HSL policy maker why their involvement is kept to a minimum: “So they can be the different people this year different people next year. And I don’t see the need for them to participate to the actual development process, at least not at the moment.”. Although this might change in time. In all the cases it was also clear that co-creation with potential end users was not really considered, rather they did interviews and surveys to see how many people were using a service, how often and how satisfied people were using the service: “We concentrated essentially on a few co-workers and then on the

enterprises which were involved anyway in the development, thus not necessarily were regular users involved directly in the app development.” And from Jeasy: “No, not with users. But those that are involved within the companies that have signed with us, we have a regular review meeting, qualitative review meeting on how they experienced the Jeasy business pack...”. Similar answers and remarks were made by the other stakeholders, Jeasy however, did claim they could provide an API’s to other organisations (e.g. representing vulnerable user groups) in order for them to use the MaaS application in combination with the app for the vulnerable users. Jeasy, because of their B2B market, claimed part of the lack of co-creation with end-users is due to the employees not being allowed to spend a lot of time to do interviews, surveys and co-creation sessions during the working hours: “You know, sometimes you can do a workshop of 90 minutes, with 15 users, sandwiches and coffee and then you have the feedback. But the employers are not specifically willing that the employees spend a lot of time for that and to co-create.... I don't think so because it's a lot of money for them (the employers), all those people (employees) spending time on that.”

It also becomes clear that the speed of development of services is very different for the public service compared to the private sector. In the first group there are more stakeholders, more boards and development moves at lower pace compared to the private initiatives which was considered a barrier by the developer from Jeasy: “We aim in the same direction, but we have a shorter timeframe. We are quicker, and that's normal. So, it's not the blame to the political. But when we arrive, and also companies go to talk to the politician, they come with a request on something that is already challenged today. And the politicians didn't realise that, so they have to think about it and make things move on it. And so over a couple of years that you lose in that fact, it's not by losing, but you have to be patient as a start-up.” Nevertheless, these conversations with policy makers and city representatives are considered useful by the developer: “... every time we knocked on a door, we reached a discussion that was constructive, not always providing what we expected, but at least it was constructive, positive and so forth.” This gave the impression that the slower pace at which policies change related to these services had as a result that close co-creation was not a real possibility at the moment. For the public organisations in Helsinki, Hamburg and Budapest, there are already much more conversations, discussions at hand before changes can be made. This is, at least for some part the results of the organisational structure within public organisations: “...it's considered as similar to a municipality, but since we have nine different member municipalities, so we have our own board, which is there are politicians sitting there, and those politicians come from different member municipalities and City Council's different city council's in each member municipality....”

All of the stakeholders mentioned similar aspects about co-creation, if it was present, it was mostly in a very limited capacity, and could rather be defined as collaboration between companies, mostly in the form of tenders or assignments. Data are collected with a focus to create a usable and decent service, but this is mainly done using surveys, interviews and not by organising actual co-creation sessions. Multiple organisations also mentioned their interest to provide access to those people who were currently excluded. As confirmed by Jeasy: because of the newness, competition and volatility of the market the main focus is on the ‘masses’ to create a viable service, which can later on, stepwise, become more digitally inclusive. An important

aspect to end with is the need for data sharing among MaaS developers and especially with the operators, whose information is needed to create an integrated payment and information system required for a fully functioning MaaS.

Data collection, protection & privacy are very relevant in the case of multimodal routeplanners and MaaS-systems, similar to data collection, protection & privacy when providing door to door logistics services. In order for these services to work at their best, a lot of personal information is needed: preferences, skills, needs, expectations etc. This was also acknowledged by the stakeholders as described above. There is quite some data collection from the users to provide a better tailored service, and, compared to the other services seems to be analysed more in-depth : “So, both quantitative and qualitative. Surveys, research, academic research, but I would say that both quantitative methods, so we do in queries to our customer database, we analyse the customer data and look how people how they are buying travel and behaving in different parts of the region, what services they are buying.”. HSL makes all the data they collect available to external organisations, all anonymised and according to GDPR and privacy rules.

Another thing pointed out by the HSL policy maker is the need for shared data and information about routeplanners and MaaS-systems. This was also strongly confirmed by the Jeasy developer. When asked about European guidelines, almost all interviewees confirmed that if the EU wants decent MaaS systems, there is a need for standardised data sharing. Currently, data sharing is already present and is performed according to the EU-regulations: “Since we are a public authority, ah, you know, in theory, everything of all, all data, everything in HSL is public. Unless it includes some sort of personal data or something like that”, but in many cases this framework needs to be elaborated. In the Hamburg case the importance of data protection was also confirmed: “We also have a corresponding data protection officer who is in very close contact with data protection colleagues in the Free Hanseatic City of Hamburg, i.e. that's the framework on the one hand. On the other hand, we have a lot of people who are very sensitive, especially from the professional side, but also from the technical side.” “...relevant data and experiences from our colleagues abroad, which, for example, it's always very fruitful and insightful, share experiences and insights with the colleagues from other public transport authorities in Scandinavian countries and in EU countries.” “However, at the moment this is still too limited and services are being developed in all countries and even cities: I would have hoped that Europe would bring forth guidelines for all countries in all cities to work the same way. It's not yet done, it's far from that. So that we have to work on each city, city by city connecting the dots connecting the partners, applying the local rules, and we go for it.”, and also: “What I do see is that countries are working alone, so they don't work with other countries and that within those countries, cities are working alone. Antwerp does not have the same expectations from the MaaS players than in Brussels.”

3.5.2 Results from the co-creation workshop

Similar to the other services, the multimodal routeplanners and MaaS-systems were discussed in and co-creation workshop with external experts. For this breakroom, 10 external experts gave their vision on certain drivers and barriers and suggested other potential difficulties Table 28 &

Error! Reference source not found. show the ranked drivers and barriers. There are quite some drivers and barriers, so only the most relevant ones will be discussed in more detail.

As has already been said in all the interviews, close collaboration is crucial to develop a proper digital transport system. Based on the interviews, the regulations (e.g. for data sharing and standardisations) and support, usually a result of policy making, are lacking for these types of services, even more than for the previously discussed topics. But due to the difference in the speed of the development and decision-making process between private organisations and the government this driver was not actually relevant according to the Jeasy developer. Secondly, the experts suggested more response from users when a new service is introduced, for motivational reasons and, in combination with feedback from users this will motivate developers/operators to push for an even better developed and operated service. The need for user acceptance was seen as an important driver by the interviewees as well. The third driver shows that the experts in the workshop considered co-creation to be important, while many of the interviewees claimed this was not the case, at least not at this time. When comparing the answers from during the workshop and interviewees it can be concluded that co-creation on both levels (both stakeholders and (vulnerable) users) is important for the creation of inclusive multimodal routeplanners and MaaS-systems, but that at this time it's not possible to introduce this method in every step of the development (e.g. because of lack of funds, knowledge, time).

Sl. No.	Drivers (# of votes received)
1	Good political support across the political spectrum (11)
2	Sense of achievement for creating something that can serve the community better (especially valid when a solution is novel in a city), good feedback from users (9)
3	Flexible, agile and bottom-up approach, scope of getting user inputs due to reiterative process (9)
4	Citizen support for participatory planning to consider needs of all (7)
5	Development through co-creation sessions (4)
6	Expansion as a central theme (means of payment, more sharing services etc.) (3)
7	Good support and co-ordination with the operator (3)
8	Strict deadline for the project, availability of EU funding, big project, more than enough financial support (1)
9	Route planner worked better than expected creating a motivation to work for the successive stages of creating a better app and installing advanced equipment (1)

Table 28: Drivers multimodal routeplanners & MaaS as ranked by experts

The first barrier is in line with some of the important drivers mentioned above and shows the need for more data about and from the users. It is very useful to notice the difference in opinion about data collection between the interviews and the workshop, while many of these experts work in the same sectors. The second barrier has not been mentioned earlier and confirms the idea that the impact MaaS will have on the mobility landscape is currently overestimated and expectations should be tempered. The difference in vision between the private and public vision is one of the topics that was also confirmed in the interviews and, similar to barrier 4 could, at least for some part, be solved if communications between the public and private and within the private sector improved. In combination with a clear regulation for sharing data and standards, better communications should have a positive influence on the currently overestimated impact of MaaS and multimodal routeplanners. Another barrier which needs to be overcome to achieve this goal was the need for a better alignment of the development- and decision-making speed in both sectors. Some other barriers worth mentioning are the need for more resources, especially after the initial development phases, political consensus about the mobile ticketing system, and integration of different payment methods (online and as well as offline to the extent possible) in the apps.

Sl. No.	Barriers (# of votes received)
1	Lack of knowledge of user reaction and total usage -> over planning (10)
2	Usage is lower than expected in many cases – Users need extra motivation to change behaviour (8)
3	Conflict of motivations among public and private operators (8)
4	Operators are not often willing to share a lot of information/data (7)
5	Cities have limited resources to create services like MaaS (6)
6	No political consensus regarding the mobile ticketing system (4)
7	A fully integrated MaaS app is not available yet (3)
8	Strict (more than needed) UI requirements from operator (1)
9	Subcontracting took long time, Vehicle on-board equipment needed for the system to run took long time to arrive
10	First time working on such a project (new company): acts as a motivation too

Table 29: Barriers multimodal routeplanners & MaaS as ranked by experts

The first strategy (Table 30) is another confirmation that there is consensus on the idea that more data sharing and closer collaboration with and between cities could be an effective measure for the lack of use of MaaS and multimodal routeplanners. Some of the strategies for the second barrier, such as the combination with public transport or making car use more inconvenient, are already implemented in certain cities and regions. But also how cities and operators

communicate will have an influence on the perception people have of MaaS-like systems, which will impact potential behavioural change towards multimodal transport systems. Another strategy is to empathize with the future users of the service. As was mentioned in quite some interviews, co-creation of a service is crucial and will help to empathize with those users for the creation of a user-friendly digital transport system. Barriers three and four have also been mentioned a few times and concern the need for better regulations. To overcome the uncertainty about the ticketing systems, one suggestion again refers to the need for clear regulation. One of the issues is that, in order to share best practices of a variety of aspects related to mobility services, there is a need for enough good examples that are at least for some part transferable. Although the number of cities having a successful MaaS-like system is limited, a change is coming and more and more cities start with similar projects.

Sl. No.	Barriers	Strategies to overcome the barriers
1	Lack of knowledge of user reaction and total usage -> over planning	Important that developers/providers share info on impact of their services on the (potential) users Empathize with users
2	Usage is lower than expected in many cases – Users need extra motivation to change behaviour	It may depend on how the recommendations to use MaaS are made and relevant Make car use more inconvenient Make users know better what MaaS can offer Intermodal MaaS needs to be used jointly with Public Transport that is the mass transport system New marketing techniques, targeted to specific groups Bottom-up approach, fit their needs
3	Conflict of motivations among public and private operators	Cities need policy framework, under which conditions they will facilitate MaaS Legal framework, need to supply mobility for all Share best practice frameworks
4	Operators are not often willing to share a lot of information/data	Make a legal framework, use data as method of payment for operators, make operators interested in participation
5	Cities have limited resources to create services like MaaS	Create showcases of cities who have successfully created MaaS systems
6	No political consensus regarding the mobile ticketing system	Force the introduction of mobile ticketing Understand current ticketing and pricing strategy per city to establish a ‘base’ ticketing possibility Co-create between cities with operators and experts

7	A fully integrated MaaS app is not available yet	Due to operators not willing to share user control
8	Strict (more than needed) UI requirements from operator	Agile user research and citizen involvement in early stages of the design process
9	Subcontracting took long time, Vehicle on-board equipment needed for the system to run took long time to arrive	/
10	First time working on such a project (new company): acts as a motivation too	/

Table 30: Strategies to overcome barriers to inclusive multimodal routeplanners and MaaS by the experts during the co-creation workshop

The large number of additional barriers and issues (Table 31) shows that although the services look promising, a lot of issues in need of solving still remain. Even though a lot of strategies were already presented in Table 30, some barriers remain very hard to overcome. The lack of trust and in-depth collaboration among stakeholders, the need for control of the service, the lack of trust from users, etc... will require a lot of effort, good communication and close collaboration if a solution is to be found. As with better relations and resources, data and knowledge might be shared between public and private sector and between cities for the further development of these system.

Sl. No.	Additional barriers/issues with the service
1	Integration of all services for MaaS is simply not possible due to partners wanting to keep control
2	Cities should have an attitude towards mobility data, how to own it, what to do with, how working with data can raise the quality of the services
3	Integration of payment into a MaaS app for mobility providers is very expensive
4	Organizational framework of MaaS (e.g. who should operate it) is often not clear
5	Using MaaS should be easier than using a private car This could break standard behaviour
6	The push/pull to move people to use new mobility services is important. Not only the mobility needs and user-friendly apps.
7	Information sharing and transfer between design/development partners in stakeholder framework

8	Traditional problem of trust in multimodal transport is translated to digital multimodal transport
9	Needs for app developers to demonstrate to cities that they meet public policy goals
10	Difficult to supply information user needs
11	Usability of user-facing tools can be comprised due to technical development restrictions/requirements
12	How to be assured that all laps of the travel are accessible to me before paying the ticket
13	Privacy, security in data-ownership and transfer of user-facing data amongst partners and operators
14	Hard to convince MaaS partners/providers to give discounts which make MaaS attractive
15	The 'false' perception that if you arrange multimodal MaaS by yourself it is cheaper
16	Balancing the needs for personal space vs shared space in 'flow' moments also considering pandemic

Table 31: Additional barriers/issues multimodal routeplanners & MaaS

3.5.3 Synthesis of the results

For the MaaS services and multimodal routeplanners the main issue is the lack of trust between the public and private sector and between developers and operators. All parties agreed that a regulatory framework for data sharing will provide clarity, however none of the interviewees provided actual options on how the framework should look, what rules are needed etc. Sharing or dividing data results in a division of power, the companies providing the data might even feel like they are losing their power, which was confirmed by some of the interviewees whom pointed out the difficulties to determine ownership over that data. A second issue is the lack of co-creation across all these services with the goals to create an inclusive service. Some of the services simply do not want to provide a service too all potential users, some do, but without the effort of creating real initiatives, that have significant impact. The example from Jeasy confirmed that even though it might not seem useful, a positive attitude towards collaboration with the public sector has proven useful to them, the same can be said about their studies focusing on collecting data about different potential user groups in society. Another issue is the lack of knowledge about the service among the potential users, so more and clearer information must be communicated so people are aware of and understand services like these. All of these issues result in the conclusion that multimodal routeplanners and MaaS-systems are in rapid development, but currently lack strong cooperation among stakeholders and between stakeholders and potential users, resulting in services which are not inclusive.

4. Conclusion

4.1 Main findings

The results of this task will be used to define the contents of the Universal Design Manual for Digital Mobility and Logistics Services (D2.1) as well as to start the development of the Policy evaluation tool in Task 2.5. The barriers and drivers identified through the case studies will be used to identify what issues the Universal Design Manual and the Policy Evaluation Tool need to address in order to provide a comprehensive and relevant blueprint for inclusive and accessible digital mobility services in the future.

We have identified a number of common requirements, needs and challenges of policy makers, operators and developers that are relevant for all types of services investigated. These barriers and drivers are related to the **market position of the services, the regulatory framework in place, the integration of the service into the public transport service network, the diversity of the vulnerable-to-exclusion groups, knowledge about the vulnerable groups, the level of user involvement (co-creation), the fast evolution of digital mobility services and the availability of local support for ensuring accessibility and inclusiveness, communication and collaboration between stakeholders.** A short overview of the most relevant of these aspects and data from the interviewees are presented in table 32.

4.1.1 Market position

The **market position** of a service is defined by how established an operator is in a local market i.e. how long it has been operating, how many users it reaches, if it makes profits and what its position is compared to the competitors.

In a more stable and predictable market, there is a long-term growth potential for service operators. Operators that have already been established a long time ago are more inclined to gradually introduce new, more accessible or inclusive features of their services especially when a certain level of profitability and market share has been achieved. This has been observed by the interviewed car-sharing operators. In contrast, if the market is volatile with many players appearing and disappearing in a short time period, and with uncertain profitability, the focus of the market players is short-term profit maximalization that may exclude any accessibility and inclusivity features. The regulatory framework (see below) can have a significant impact on the market development by limiting for example the maximum number of operators, introducing licensing fees and minimum service requirements.

4.1.2 Regulatory framework

The **regulatory framework** can set minimum service requirements in terms of accessibility and inclusiveness. It can also contain requirements for sharing service data, define key performance

indicators and require collaboration between complementary services. Current frameworks in the case studies focus primarily on the regulations related to operators keeping to certain rules e.g. parking regulations, regulations related to use of public space, speed regulations etc., the topics of accessibility and inclusivity are not usually covered. The regulatory frameworks are often adapted to just one type of digital mobility service, usually the one that was introduced as the first one (usually car sharing). The frameworks are then extended to other types of services, but often not addressing the specificities of these new services (e.g. e-scooters).

In case of delivery services where the digital platform is used by both the couriers and the end-customers, also the couriers providing the service are in need of a good regulatory framework in order to work under fair conditions.

For the development of MaaS, there is a lot of uncertainty about the way in which the framework should evolve. Clear regulations about the management and analysis of service data, the trust needed to share this data between private companies and with the public sector are lacking. This lack of clear guidelines created islands of developers and operators who do not share mobility data. They sometimes even use data protection as an excuse, fearing they will lose their market share. This leads to parallel development of similar services and affects the impact each of these services has. A clear EU wide regulatory framework on data specification and sharing, containing the use of API's which will facilitate communication between different applications, can be useful in this regard. At the same time, the desirable prioritization of certain transport modes in MaaS and physical integration of MaaS need to be kept in mind while framing regulatory frameworks.

4.1.3 Integration into the public transport service network

Related to the regulatory framework, **the integration of the digital service into the public transport service network** may act as a major driver for accessibility and inclusion. Once a service is considered a 'public service', it needs to be available for all citizens, it needs to comply with minimum accessibility standards and eventually also with a regulated pricing system (as is the case with taxis in many cities). This integration can act as a stimulus and as an external requirement to improve the accessibility and inclusiveness of a service. For the inclusiveness of the service the integration will have to be easily accessible for everyone, but probably there will also be need for physical possibilities to make reservations for a certain service.

4.1.4 Diversity of vulnerable to exclusion groups

The **diversity of vulnerable to exclusion groups** means that operators and developers need to develop modular strategies to address the needs of all vulnerable groups. This may be a considerable cost and effort. Therefore, most companies need to prioritise and introduce accessibility and inclusion features gradually. Each service has its broader target group, and the aim is not that all services would be accessible to everyone and every time (i.e. a scooter service will probably never be aimed at physically disabled people) as long as a (public) alternative exists e.g. public transport.

4.1.5 Knowledge about vulnerable groups

Knowledge about the needs and requirements of vulnerable to exclusion groups is limited among operators and developers. This aspect was observed among all developers and operators of the different services studied and it was also confirmed by the user group representatives. This problem can be partly explained by the lack of knowledge among potential users having a limited understanding of the service and how they operate. Certain groups are also very hard to reach by operators or developers for introduction events, and certainly for testing or co-creation events, which are mostly attended by highly educated, middle class citizens.

There is usually more knowledge about the needs of people with physical disabilities, therefore, features related to physical access to services and applications are present in some existing digital services. In the past decades, more attention has been given to guidelines and regulations ensuring physical accessibility. So far, there has been almost no attention to digital inclusion (e.g. affordability, spatial accessibility) except when it is a part of the mission of the developer/operator, as is the case for the Mobitwin case in Belgium. There is currently no or limited interest from the operators to explore why certain groups of society do not use their services. They are mainly interested in market expansion, focusing on target groups and areas that can provide sufficient profit margins. Data collected through the digital applications can help to improve the understanding of the needs of the users and non-users for developers and operators. Also, very often data showing that certain population groups cannot access a service are missing. This is mostly due to volatility of the market and the providers' urge to serve their current users best. One potential solution is the introduction of a strong regulatory framework to ensure operators and developers provide services that are more digitally inclusive, however this proves difficult for emerging services. Several minimum criteria can be used to analysis wither the needs for vulnerable to exclusion groups are met.

Combining data from multiple operators and other sources (e.g. statistical databases of local authorities) could expand the possibilities for the analysis of users' needs and for the identification of non-users. Sharing of mobility data is a very sensitive topic for all the services that were studied. The fear for sharing data is twofold. Firstly, many private providers of digital mobility do not trust private and public organisations in terms of sharing their data. This also showed in the lack of close collaboration between the public and private sector. Secondly, many providers are afraid they will lose their market share to competitors when sharing information, so they all rather keep their data. There are some exceptions, the providers belonging to HSL have made their data publicly available. Such data sharing can also be required by the regulatory framework.

4.1.6 The level of user involvement (co-creation)

The level of user involvement (co-creation) in the development of new services remains a key issue. The importance of involving (potential future) users in the development of applications and services has been mentioned as a key requirement by most stakeholders. Many organizations already collect data from users, mostly related to the use of the service, and they

also make changes to the service based on the data. However, actual co-creation, i.e. the involvement of the users in the design of multiple aspects of a service or application is limited.

User involvement can be very diverse. From the case studies we identified several approaches which can act as **drivers** for creating more inclusive and accessible services:

- Coopcycle co-created the service based on the ideas of activists fighting for the rights of the riders and uses open platforms to gather data from their users and riders;
- HSL is open to share knowledge and data with other projects or cities;
- Cambio organizes test periods with limited number of users to test and, if needed, make adaptations;
- HIVE has created a very fruitful relationship with the city of Lisbon, the inhabitants, other providers, local police, which has a positive effect on the development of the service.

There are, however, also many barriers. A **barrier** to co-creation is that many potential users have very limited knowledge about the service, showing there is still a lack of decent introduction, explanation and guidance for groups who have no access to the digital transport system. It is possible that for **some groups** it is very hard to make the transition from physical to digital services, as was proven in the Mobitwin case, which showed that elderly people have a hard time to trust and adapt to new digitalized technologies.

Collaboration with local organisations (as part of the user/stakeholder involvement) can help developers to gain insights into the needs of vulnerable groups, as illustrated by the Mobitwin case, the Madrid case, where specific attention was given to vulnerable groups.

4.1.7 Quick evolution of digital mobility services

The **fast evolution of digital mobility services** has an impact on the suitability of the regulatory framework, the knowledge about user needs and the time and money invested into co-creation. The regulatory framework very often cannot anticipate the fast changes in business models and the appearance of new technologies. The fast market development does not leave enough time for user need assessment and co-creation. Very often services are deployed on a trial-and-error basis using cities as testing grounds.

4.1.8 Local support schemes

If the new digital services serve wider societal and environmental goals, **subsidies or incentives** from public authorities at local and national levels to the service providers could serve as a driver in the early market development phase on condition that accessible and inclusive features of the service are introduced. Developing solutions in PPP model (people, planet profit model) in order to meet accessibility, inclusivity and equity goals could also be a solution.

4.1.9 Communication between stakeholders

The lack of communication between stakeholders can act as a significant barrier to develop inclusive and accessible services. An open communication approach could include sharing information about best/worst practices, a stakeholder forum, regular meetings and an open data policy.

Type of service	Service name	Regulatory framework	Co-creation	Inclusivity	Data collection/ protection and privacy	Other relevant aspects
Car-ridesharing &	Cambio Brussels	<ul style="list-style-type: none"> A regulatory framework is present in most cases, usually on a national level. 	<ul style="list-style-type: none"> Services are unknown among vulnerable to exclusion groups and not enough accessible communication. 	<ul style="list-style-type: none"> Knowledge about vulnerable groups too limited Depending on service different attempts: call center, cheap, personal approach, test-events. Digitally contacting elderly is hard 	<ul style="list-style-type: none"> Only mobility related data, with limited use, especially about vulnerable to exclusion users 	<ul style="list-style-type: none"> Internal or third party app development influences flexibility.
	Mobitwin	<ul style="list-style-type: none"> The framework is present due to stability market and is starting to push towards more inclusive services, but this is not mandatory in case of digital inclusivity. 	<ul style="list-style-type: none"> Rather info-events and introductions. Homogeneity of 'test-groups': highly educated and white. Post-development co-creation events are important. 		<ul style="list-style-type: none"> Elderly people have trouble understanding privacy related issues and don't understand importance of GDPR. 	<ul style="list-style-type: none"> Users are suspicious towards new technologies. Lack of resources for research towards inclusion vulnerable people.
Bike sharing and micro mobility	HIVE Lisbon	<ul style="list-style-type: none"> Regulatory framework is regional and based on carsharing framework, so not always suited to micro mobility. 	<ul style="list-style-type: none"> Lack of funding and instability of market make providers focus on 'easy to reach' users, in order to be financially feasible. 	<ul style="list-style-type: none"> Small steps are taken towards a more inclusive service, but no regulations are present to push towards more inclusivity. 	<ul style="list-style-type: none"> Data collection is very limited and is not really used for analysis. 	<ul style="list-style-type: none"> Impact on public space is major, affecting elderly people, blind people etc.
	Brussels Mobility	<ul style="list-style-type: none"> Knowledge about service among policy makers is too limited. Both hard or soft regulations are adopted to control micro mobility. 	<ul style="list-style-type: none"> More frequent and intensive communication between stakeholders and with users. In most cases there is a lack of communication with local authority. 	<ul style="list-style-type: none"> Need for smartphone and credit card in almost all cases. Link with public transport and use of one payment method 	<ul style="list-style-type: none"> Contradicting vision on use of data: in detail or rather a general approach. Data is needed to address impact on public space 	<ul style="list-style-type: none"> Young and volatile market was severely impacted during COVID-19 crisis. Main focus on financial revenue.

Smart Logistics services	La Pajara Madrid	<ul style="list-style-type: none"> No national regulatory framework for the protection of couriers, initiative by organisations themselves. 	<ul style="list-style-type: none"> Co-creation during development with riders created more fair value sharing. All neighbourhoods are provided for without extra cost 	<ul style="list-style-type: none"> Acknowledgement of need for more inclusive services, but lack of funding and knowledge. Similar to the regulations, there are no rules to make the service more inclusive. If inclusivity is not introduced by the developer/operator, it is not present in the service. 	<ul style="list-style-type: none"> Only information relevant to delivery is stored, but not used for any other purpose. 	<ul style="list-style-type: none"> Locker providers showed no intention for the development of inclusive services, rather focus on the financial aspects, this was not the case for the public provider.
	Mobile Locker	<ul style="list-style-type: none"> No consensus on need and purpose of regulatory framework among different services 	<ul style="list-style-type: none"> Except for the location, there are not that many measures towards an inclusive service. No collaboration with users or other organisations present. 			
	Citypack Valencia Lockers					
Multimodal routeplanners & MaaS	HSL	<ul style="list-style-type: none"> No relevant regulatory framework was present 	<ul style="list-style-type: none"> Isolated development simultaneously in different cities Different development speed in private vs. public organisations. Closer cooperation with users necessary 	<ul style="list-style-type: none"> No measures were mentioned by operators or developers. Public organisations develop services for all inhabitants, but this goal is not often reached. Service still unknown 	<ul style="list-style-type: none"> Fear that sharing data will lead to advantage for competitors Lack of trust in public services handling data. 	<ul style="list-style-type: none"> Public service, open data sharing with other cities is becoming more important. Unfair competition between private and public development
	HVV Switch					
	BKK FUTAR					
	Jeasy					

Table 32: Synthesis results

4.2 Lessons learned

The lessons learned is a reflection on the process leading up to the development of the results as they are described above. During different steps of this process some difficulties were experienced, which influenced the research process. The remarks below can be considered as guidelines and tips for other researchers thinking about developing a similar future research. The lessons will be separated according to the steps in the process they had an impact on. These steps are based on the methodology.

4.2.1 Identification of 10 deployment case studies

- The number of organizations/people responding to invitations to participate in an interview was lower than what was earlier expected. This is perhaps because they did not see any added incentive for them or their organization in spending time participating in an interview. Concerns regarding sharing information about their product development might have played a part as well.
- Contact more cases than what might seem necessary so that later-on choices can be made regarding the cases that best suit the objectives of the research.

4.2.2 Identification of the relevant stakeholders

- Convince stakeholders of the importance of the research so they feel more enthusiastic to participate in the same.
- Try and keep their attention during the interviews (e.g. don't make them too long).
- Clearly state to the interviewee that he/she can leave questions open if they can't/do not want to answer.
- Let the interviewee choose when the interview takes place.
- Send the interview questions beforehand to the interviewees. This is helpful from multiple perspectives. Since most of the questions deal with events that happened in the past (e.g. the barriers and drivers they faced while deploying the service), interviewees might find it difficult to recall and answer them on spot. Also, if questions are shared beforehand interviewee can collect information from his/her colleagues for some questions before appearing in the interview if and when needed.

4.2.3 Development of the interviews

- The decision-making process regarding the questions is difficult and time consuming but is a very crucial step
- Asking to many questions results in the interview being too long which will increase analysis time, this might also result in answers that are not very useful regarding your topic



- Try and find a specific topic that needs explaining by that specific stakeholder and ask yourself if this question will help with that, if not, delete it
- Sometimes interviewees can't answer a question directly, give them the opportunity to answer it on their own time (e.g. through email), this will provide more complete answers
- Transcription software helps but is not perfect. This is especially clear when transcribing other languages than English.
- if needed cues can be given to the interviewees, but not to the extent so that it guides his answers

4.2.4 Consolidation and discussion with stakeholders

- Limit the number of people in discussion groups
- Limit the number of time presenting results, try and make it as interactive as possible
- Keep the expert panel as wide as possible, to have input from different points of view

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6. Appendix

6.1 Appendix 1: SSI questions

1. What were the main stages in this development (what are the stages to apply for permission, implementation)
 - a. Was a planning made?
 - b. Could you keep to the planning?
 - c. If not, what were the main barriers causing delays? (lacking knowledge, difficult relations, planning too strict, etc.)
2. Securing political support
 - a. did you ask for support from municipality, the administrative environment, etc?
 - i. was there a stage for this in the planning (see question 1 stages of development)?
 - b. Did this support have any positive (or negative) effect? If so, what effect did it have?
3. Understanding target groups and populations
 - a. Did you feel like you understood all the potential user groups?
 - b. How did you achieve knowledge about potential end-users?
4. Engagement with other stakeholders and the public
 - a. Was there any form of collaboration with the other stakeholders?
 - b. Was there any form of co-creation with potential end-users?
 - i. In what form was this co-creation (on-line, meetings, work sessions, etc.)
 - ii. What profiles were part of the co-creation phase? (link to the profiles developed within the INDIMO project)
 - iii. What was the main input from these co-creation sessions?
5. Identifying and securing finance;
 - a. Where did the financing come from and in what form was it (product e.g. buying the bikes, service e.g. with PT)
 - b. What were the requests in return for this investment?
 - c. Was the financing sufficient?
 - i. If not, what was the reason? (underestimation costs, barriers drove up costs...-
 - d. Was there any other form of financing?



- e. Is there a link present to the financing and a specific focus on a potential user group (e.g. municipality demands more access to shared cars for people with limited physical abilities)
6. Effective collection, evaluation, documentation and communication of data → data containing information about user group' expectations, needs etc.
 - a. Was any data collected before the development of the service/application?
 - b. Was any data collected during the development of the service/application?
 - c. Was any data collected after the implementation of the service/application?
 - d. If yes in any of previous cases:
 - i. What type of data was collected?
7. Was a license/concession provided to the operator/developer for operating this service?
 - a. Was this achieved by using a competitive tender?
8. What were the main barriers up until the service was deployed (planning, development, testing)?
9. What were the main drivers up until the service was deployed (planning, development, testing)?
10. Was a quality application/services created?
 - a. If not, what were the weak suits?
 - b. If yes, what are the strong suits?
11. During the development, were any (digital) inclusion related aspects considered?
 - a. In what phase was this (before, during, after development)
 - b. What form of (digital) exclusion was noticed?
 - c. How was responded to this?
 - d. Did you consider the response adequate?
 - i. Why or why not?
12. Was there a requirement from the city/region in terms of accessibility and inclusion that were taken into account when developing the service?
 - a. Were there any legal requirements related to inclusivity and accessibility that had to be taken into account?
 - b. What form of (digital) exclusion was present?
 - c. How was responded to this?
 - d. Did you consider this response adequate?
 - i. Why or why not?
13. What were the main drivers for the operators from the moment the service was deployed?





14. What were the main barriers for the operators from the moment the service was deployed?
15. How were cyber security and personal data protection considered?
16. Does this service create enough revenue (break-even, profit)? Could a more diverse group of users lead to more profit?
17. Do you have any expectations from EU wide guidelines: what is essential, would it be helpful, useful? - all
18. Does this app/service answers to the needs of the groups you represent?
19. Rate the services between 1 and 5, ranging from very bad to very good. What were the strong/weak points.

For analysing the influence the COVID-19 pandemic had on the use of these services, and to assess if and how organisations reacted to this unexpected event, several COVID-19 related questions have been developed.

20. Regarding COVID-19, how was / is demand affected?
 - a. How do you cope with this variation in demand?
 - b. How did you adapt your service offer?
 - c. Or was a restructuring of resources necessary (hiring more people), adjustments of working hours, changes to the app.
 - d. How do you look back on these adaptations/this restructuring? Would you do anything different if you can go back in time? Why? Which adaptations do you think had a positive effect in handling the effect of the Covid-19 pandemic?
 - e. Has the quality of the service been affected (More time needed for pickup /delivery, less drivers, more drivers, arrival time at the delivery point)?
 - f. How is the increase in last-mile services due to COVID being managed?
 - g. Did you receive new customers/users during the COVID-19 crisis who did not use the service before?
If so, are you aware of the profile of these users (e.g. young/old; people with special needs etc., specific area of the city, specific types of orders)?
 - h. Did you receive more requests from users for help or assistance in using the service and the application during the COVID-19 crises? If so, what kind help requests?
 - i. Do you think that the service provides benefits to vulnerable population groups (*list target groups in pilot*) during the COVID-19 crisis? If so, what benefits?
21. Have you implemented safety measures?
 - a. Has a protocol been generated at the institutional (you mean at the level of the company?) level? Would you like one to be implemented?
 - b. Have you informed the user of the security measures previously? Are the users informed of the measures, if not, do you inform them?
 - c. Has the software application included a section →special adaptations for COVID? If so what kind of adaptations (e.g. popup message, special news etc.)
22. How is the increase in last-mile services due to COVID being managed?



23. Have minimum safety protocols been defined for handling / delivery by COVID?
 - a. If yes, which ones? Do you consider them sufficient? Why not?
 - b. If no, do you think it is necessary to define a protocol or can the operators/developers design it freely?
24. Do you think that the service provides benefits to vulnerable population groups (*list target groups in pilot*) during the COVID-19 crisis? If so, what benefits?
25. Have you adapted the application to contemplate information related to COVID? Delivery protocols?
 - a. Yes, how have you developed it? Have you defined it in collaboration with users
 - b. No, do you think it is necessary?
 - c. Did you experience any issues in the software application due to e.g. increased demand, uncertain users, etc.? If so, what issues? How were these issues solved?
 - d. Did you receive more requests from users for help or assistance in using the service and the application during the COVID-19 crises? If so, what kind help requests?



6.2 Appendix 2: Detailed agenda co-creation workshop

1st INDIMO Co-Creation Workshop on

Identification of barriers for the design, planning, deployment and operation of an inclusive digital transport system

06 October 2020, 10.00 - 14.00 CEST

Online (Vitero platform)

Access link: <https://vms.vitero.de/vitero/start.htm?s=20093d04&c=1439&vi=1>

Agenda

09:50 – Opening of the online platform

- You are welcome to join to become familiar with the Vitero online platform

10:00 – Welcome and introduction session

- Welcome, aims of the workshop (*Imre Keseru – VUB MOBI*)
- Technical summary on Vitero platform (*Annette Randhahn – VDI/VDE-IT*)
- Introduction to the INDIMO project (*Imre Keseru – VUB MOBI*)
- Co-creation in INDIMO (*Floridea Di Ciommo – cambiaMO*)
- Presentation of the case studies and lessons learned (*Hannes Delaere, Samyajit Basu – VUB MOBI, Carolina Cipres – ZLC*)
- Instructions for the breakout groups (*Samyajit Basu – VUB MOBI*)

11:20 - 11:30 Break

11:30 – Group discussions on drivers/barriers/issues

Participants will discuss barriers and drivers to implement digital mobility solutions and possible strategies to overcome them in four breakout rooms using interactive tools.

The breakout group themes will be:

1. Carsharing and ridesharing services (*Hannes Delaere – VUB MOBI, Sabina Asanova – Polis*)
2. Shared bike and micro-mobility services (*Imre Keseru – VUB MOBI, Sandra Lima – EPF*)
3. Multimodal route planning services and mobility as a service (*Samyajit Basu – VUB MOBI, Rebecca Hueting – DBL*)
4. Smart logistics services (*Carolina Cipres -ZLC, Annette Randhahn – VDI/VDE-IT*)

12:10 - 12:50 Lunch break

12:50 – Stakeholders' expectations from the INDIMO policy evaluation tool

- Interactive session (*Hannes Delaere, Imre Keseru – VUB MOBI*)
- Summary and discussion (*Imre Keseru – VUB MOBI*)

13:10 – Findings and conclusions

- Findings of each breakout group (*discussion moderators*)
- Conclusions and next steps (*Imre Keseru – VUB MOBI*)

14:00 – End of workshop

