TRansport Innovation for disabled People needs Satisfaction

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Abstract	This report identifies the design concepts that can improve the independent mobility of persons with a disability. We identified disruptive or incremental mobility concepts that are most desirable and feasible by a Mobility Divide Index (MDI) analysis a Political, Economic, Social and Technological (PEST) analysis. Users rated the desirability of design concepts' desirability developed in Task 4.2 based on the MDI dimensions (see D4.1 Further insights were also generated about social impact of the concepts and their potential impact on accessibility. Users and transport stakeholder then discussed the political, economic, social and technological barriers and enablers affecting their implementation to assess their feasibility and their technological readiness. The analysis was undertaken in guided and moderated participatory workshops.
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Revision History

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Final version				

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Acronyms

Abbreviations	Explanation
AI	Artificial intelligence
AT	Assistive Technology
CUT	Core user team
DfA	Design for all
DoA	Description of Action
HW	Hardware
IoT	Internet of Things
LUL	Local user lead
MDI	Mobility Divide Index
PEST-analysis	Political, Economic, Social, Technological analysis
RtD	Research through design / Research through Art and Design
TRIPS	TRansport Innovation for disabled People needs Satisfaction
TRL	Technology Readiness Level
UD	Universal design
UNCRPD	United Nations' Convention on the Rights of Persons with Disabilities
WHO	World Health Organization
WP	Work package

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1. Summary

This Deliverable reports on workshops held in different European cities involving persons with disabilities, experts from the public transport sector and accessibility and assistive technology experts. The workshops aimed to analyse the desirability and feasibility of design concepts produced by the participants in the co-design workshops as described in D4.2.

Different tools were used to assess the ideas' desirability and feasibility, which were divided into disruptive innovations (big ideas) and incremental innovations. In particular, a light-MDI (see D4.1) was adopted during the workshops to assess each concept's imagined impact on the barriers that travellers with disabilities encounter. Also, the number of people likely to be affected positively by the innovation was assessed. Regarding their feasibility, the authors looked into the Technology Readiness Level (TRL) of each concept. Enablers and constraints for each concept were identified in different dimensions (Political, Economic, Social and Technological), using the so-called PEST model.

Scores were calculated to contrast the different design concepts. Nevertheless, it proved challenging to prioritise them in absolute terms for several reasons. First of all, people are different and have different needs and expectations of solutions. Secondly, local conditions differ, and innovations have to fit into existing contexts. Thirdly, criteria such as the number of people affected are attractive from a political or business point of view but risky from a social perspective as generic solutions tend to leave some individuals behind. Design-For-All or Universal Design would therefore be appropriate approaches, starting from the conditions and requirements of those experiencing the most critical barriers.

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2. Introduction

This deliverable reports on work undertaken in WP4, more specifically under Task 4.3. and Task 4.4 and should be read in conjunction with deliverable D4.2.

2.1. Objectives

WP4 serves as a bridge between WP2 and WP3 on one hand, and WP6 and WP7. In WP2, the barriers that travellers with disabilities experience have been identified with the local user teams (CUT's). In WP3, desk research into the impact of technological development on transportation trends, accessibility and assistive technology has shaped a picture of the rapidly developing technical context relevant for the TRIPS co-production activities of WP 6. The objectives of Tasks 4.2., 4.3. and 4.4. were to synthesise this information and evaluate and prioritise inclusive mobility challenges and solutions as groundwork for WP6 and WP7.

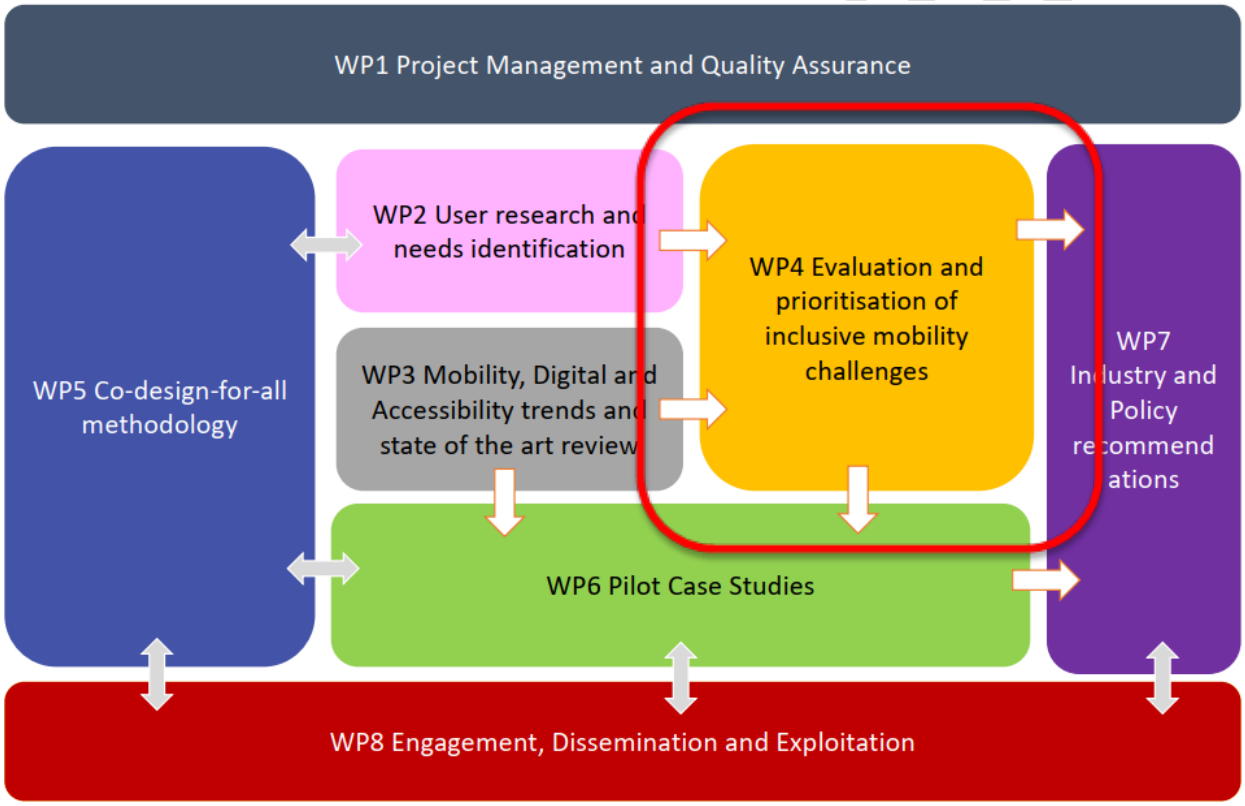

Figure 1 Workstreams within the TRIPS project

A co-design and co-production methodology was chosen and implemented for workshops with different stakeholder groups, focused on developing design concepts for inclusive mobility and transportation (T4.2.) and identifying the institutional and broader barriers for their realisation (T4.3.). In the description of action (DoA) Task 4.2. sought to conduct "five sandboxing workshops" to:

- assess the accessibility of future mobility solutions (as identified in WP3) and anticipate unmet needs and

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- explore plausible innovations across transport, ICT and accessibility to address them".

Task 4.2 would bring together "30 users, transport, ICT and accessibility experts to review mobility solutions together and co-develop Design Concepts of future mobility solutions that are equally accessible, intuitive and friendly to all users". Task 4.3. promised "a series of workshops (5) for institutional actors with users' participation to discuss the institutional barriers to the appropriation and implementation of suggested technologies and discuss potential solutions. Users will also participate in these workshops to understand the practical implications and offer alternative solutions and ideas acceptable by the community. This will result in both cost and benefits analysis of a list of mobility solutions, assessing their TRL levels, indicating the transport ecosystem's likelihood and readiness to adopt them. Alongside this, there will be a list of contextual, policy, social, cultural and other factors beyond the agency of the ecosystem that should be resolved to unlock their adoption. They will inform a list of policy recommendations for validation and inclusion in the roadmap developed in WP7."

According to the DoA, Task 4.4 should lead to a Prioritised List of Potential Inclusive Mobility Solutions, ready to be handed over to WP6 for scoping the work in the pilot cities/regions, in conjunction with the implementation of the new metric (Ref. the MDI as developed under Task 4.1 / D4.1.) to measure the accessibility level of a transport system from the point of view of the disabled users.

2.2. Task implementation challenges

Four factors have majorly impacted the implementation of the tasks as per the DoA, leading to an adaptation of the original approach.

1. The pandemic has made it impossible to organise the co-design and co-production workshops as initially planned: in a central location using the maximum engagement tools to involve participants and stimulate their creative thinking. This has led to the decision to move all envisaged workshops online and to abandon the centralised approach.
2. The wish to involve as many stakeholders as possible, especially persons with disabilities, and lower the barriers to participation. This has led to the decision to focus on workshops in the TRIPS project's national languages, namely Portuguese, Swedish, Bulgarian, Croatian, Italian, French and English. It has been possible to reach three crucial objectives: involving more people, facilitating co-design by removing linguistic barriers, particularly for users, and supporting the dissemination of the project at the national level.
3. The strategic goal was to build both content connections between WP2 and WP6 and provide continuity in the involvement in the project implementation. It would have been against the project's nature to foster co-production, not to involve persons with disabilities and transportation providers working in WP6 to evaluate and prioritise the innovative ideas coming from WP4.
4. The awareness that "prioritisation" is difficult when the group of transportation service users is not homogeneous. Neither are the contextual factors in the cities that determine the feasibility of solutions. The only factors that reasonably can inform prioritisation are the Technology Readiness Level and the expected impact

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and incidence criteria. However, where a degree of consistency across cities can be identified, a concept is applicable in the broadest range of settings. Those ideas are given additional weighting to inform the prioritised list. Such ideas are likely to be of interest to the most significant number of locations and, hence, can access the broader markets and potentially reduce unit cost.

2.3. Method

As a result, we organised data collection in a series of two distinct but related workshops: the first focused on brainstorming innovative solutions for inclusive mobility and transportation, the second on screening these solutions based on drivers and barriers to their realisation, as well as on their potential impact. The first workshop resulted in a list of current challenges experienced by disabled travellers and innovative ideas for their solution (presented in D4.2). The second workshop resulted in an analysis of the feasibility and desirability of these solutions, presented here.

The workshops comprised users from the CUT teams as well as local representatives of the transport ecosystem. They were held in French for participants in Brussels, in Portuguese for participants in Lisbon), in Swedish for participants in Stockholm, in Bulgarian for our participants in Sofia), in Croatian form our participants in Zagreb, and in Italian for our participants in Bologna and in Cagliari. A pilot workshop in English which involved an audience drawn from across Europe. For a detailed description of workshop participants, recruitment, methods of engagement, workshop agenda's, reflections on implementation, and the description of design solutions developed, please refer to Deliverable 4.2.

In this deliverable (D4.3.), we merely report on the feasibility and desirability analysis of these ideas, thus coming to a prioritisation depending on the different criteria applied.

It is worth noting, that to ensure this report is informed by as many authentic "voices" as possible, only minor linguistic editing on the information from the original national workshop reports was applied and only in those cases where the proper understanding of the concepts was at risk. Where information was completed by the research team responsible for this report, the additional text is coloured in red.

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3. Workshop outcomes

3.1. Data analysis process

Two main tools have been used to collect data during the workshops.
The MDI methodology, as developed under Task 4.1. of the TRIPS project, has been used to capture information on the **"desirability"** of the solutions as co-designed by the workshop participants (see 2.2. for more details).
The PEST (Political, Economic, Social, Technological) Analysis methodology has been used to identify the barriers to developing and implementing each solution (Grant & Jordan, 2012). Together with its Technology Readiness Level, this analysis provides an assessment of the **"feasibility"** of the solution (see 2.2. for more details).
The raw data from the workshops, collected with these two tools, have been further analysed according to the following procedures:

- To have a better idea of the **similarities between the concepts**:

  -Classifications of the design concepts based on different criteria.
  -Clustering of concepts based on their nature.

- To compare the concepts regarding their **possible impac**t on barriers and desirability:

  -Unique MDI scores have been calculated for the concepts applying a weighting factor for each of the light-MDI dimensions.
  -A value has been attributed to the number of people likely to be positively affected by the innovation.

- To assess **the feasibility** of each concept:

  -The Technology Readiness Level of each concept has been determined.
  -The PEST analysis of the different clusters of concepts have been aggregated and harmonised.

3.2. Data Collection Tools

The Mobility Divide Index

The Mobility Divide Index (MDI) methodology has been designed in Task 4.1 to measure the gap that citizens with access needs must overcome to use a particular mode of transport in the same way as non-disabled citizens do.
In line with the TRIPS ethos, the MDI has been built through the *co-design* approach. This directly involved end-users (primarily members of the local user teams in the seven partner cities) in the index design process to facilitate interactive communication to investigate and prioritise the main variables influencing their travel experience. This methodology resulted in a multi-dimensional index comprising a set of factors organised

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under six discreet dimensions (**autonomy**, **travel time**, **comfort**, **safety**, **convenience** and **affordability**) that in combination reflect different facets of the mobility divide.

Based on the assumption that both dimensions and factors could have different weights for the overall MDI score, an online survey was designed and launched to collect information on the importance given by people with access needs to the MDI dimensions and factors. (For more details about the MDI final weights and algorithm, please refer to D4.1.)

This methodology will be applied in WP6 to guide the assessment of the current accessibility level of local transport systems selected in each city as pilot cases. Secondly, it will be applied in Task 6.3 to measure the impact of the inclusive mobility solutions designed, prototyped, and developed into pilot demonstrators (Task 6.2).

The MDI was also designed to make data actionable from an operational perspective either by transport and urban planners or by transport providers and operators, encouraging recommendations for policymaking, new directions for service innovation, proposed improvements and practical advice.

For the workshops under consideration here, a "Light-MDI" protocol was designed in Task 4.1. This protocol translated the MDI dimensions into simple, user-friendly questions that allowed users to express their positive expectations and concerns. This version of the MDI motivated the users to focus on **autonomy**, **travel time**, **comfort**, **safety**, **convenience** and **affordability** and discuss differences in expectations to reveal assumptions about the design and help participants voice, record, and resolve those (see D2.2).

An additional dimension on **personal data protection** was also included in the protocol. In contrast, the MDI factors associated with each dimension were excluded from consideration because the design concepts as produced in the workshops are not developed enough to permit detailed assessment.
The "Light-MDI" also served to prioritise design concepts based on user desirability. This, along with the PEST analysis, formed the innovation priorities for workshop participants.

PEST analysis

This analysis allows stakeholders to explore critical areas from their perspective in a safe environment as part of co-design. PEST analysis requires participants to consider the political, economic, social, and technological factors that enable or hinder implementation.[2] It is most effective in exploring the context within which the innovation is being introduced to consider the issues that will influence success. Analysis of the strengths and weaknesses of design concepts and consideration of the factors that would influence successful implementation was undertaken in each city through a PEST analysis. Often the influences that facilitate innovation can be leveraged as mitigations to address any barriers to implementation identified. Hence, such analysis often combines with a SWOT analysis, i.e. analysis of the strengths, weaknesses, opportunities, and

[2] https://en.wikipedia.org/wiki/PEST_analysis

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threats to support and enhance innovation planning and identify mitigations to address barriers.

Political factors look at public policy and/or legislation that impacts delivery, including the suppliers' requirements and users' needs. Areas of policy that may particularly affect an organisation might include equality, inclusion, discrimination and environmental policy. The political climate and will of a nation or region and international relations or commitments can also influence success.
Economic factors explore the financial costs and benefits of the change, including wider economics and the impact of interest and exchange rates, economic growth, supply and demand, inflation and recession. Social factors might include demographics and age distribution, cultural attitudes, and workplace and lifestyle trends. Public and governmental attitudes towards people with a disability and their rights are also critical in this analysis. Technological factors explore the use and development of technologies that can be implemented to enhance or form the basis of the innovation. These also include consideration of risks such as privacy, infrastructure needs and accessible design. Government spending on research and development may impact this area also.

3.3. List of innovative design concepts

The design concepts considered were developed during co-design workshops and described in deliverable D4.2. To facilitate their analysis, we divided them into two groups: “Disruptive innovations” (also called “Big Ideas”) and “Incremental Innovations”.

The overview table (see table 1) presents all design concepts.
We have given each concept a unique identifier code. The code is thus composed of a:

- the letter B = big idea or I = incremental idea
- a country code (BE = Belgium, BG = Bulgaria, EU = European, HR = Croatia, IT=Italy, PO = Portugal, SE = Sweden)
- a serial number.

Information on the country where the concept has been developed and discussed was deemed crucial not to lose the connection with the specific local context in which the solution has been designed.

For further descriptive analysis of each concept, the following information is provided in Table 1:

- The short descriptive name of the concept (as taken from D4.2)
- The main beneficiary group in case the concept will be realised, based on the primary functional domains causing activity limitations (e.g. Movement (Motor), Seeing (Vision), Hearing, Mental, Speech) (WHO, 2002). In case the concept brings benefits for all people (e.g. design for all), the word “All” is used.
- The phases of the journey most likely affected.
- The innovative technologies involved in the concept as described in D3.2.
- Information on whether there is a light-MDI available or not (see section 2.2.).
- Information on whether there is a PEST analysis available or not (see section 2.2).

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Table 1 Overview table of all design concepts

Concept code	Design Concepts short descriptive name	Main beneficiary group(s)	Phase(s) of journey	Relevant Technologies implied	MDI available	PEST available
B-BE01	Smart platform/robot/ramp	Motor	Boarding, Interchange	Robotics and Automation, Advanced human-machine interaction techniques	YES	YES
B-BG01	Adaptive jeep-transformer car	All	All	Futuristic, Robotic (morphing)	YES	YES
B-BG02	An autonomous car for individual rent and use	All	All	Robotics and Automation, AI – Machine Learning, Big Data Analytics, Geolocation	YES	YES
B-BG03	"Levitating" wheelchair	All	All	Geolocation, Robotics and Automation, AI – Automated Speech Recognition and Natural Language Processing	YES	YES
B-BG04	Socially interactive and inclusive public transport	All	Boarding, Onboard experience	-	YES	YES
B-BG05	Assistive robot to facilitate the boarding of transportation means	Motor	Transport access point experience, Boarding, Interchange	Robotics and Automation	NO	NO
B-EU01	Smart Mobility Cane	Vision	Travel to access point, Interchange	Geolocation, Robotics and Automation, AI – Automated Speech Recognition and Natural Language Processing	YES	YES
B-EU02	Accessible cable car	All	Boarding	AI & AR	YES	YES
B-EU03	Mobile walkways city network	All	All	Geolocation, Automation and Robotics	YES	YES
B-EU04	Assistive buddy robot	All	Transport access point experience, Onboard experience, Interchange	Automation and Robotics, AI – Automated Speech Recognition and Natural Language Processing, Geolocation	YES	NO
B-EU05	Autonomous motorcycle - wheelchair transporter	Motor	All	Automation and Robotics, Geolocation	YES	YES
B-IT01	Robo-Taxi with universal access and on-call service	All	All	Automation and Robotics, AI, Big Data Analytics, AI – Automated Speech Recognition and Natural Language Processing, Geolocation	YES	YES
B-IT02	LIDAR 3D Reconstruction of the Environment	Vision Mental	All	Geolocation, Ai – Machine Learning, Big Data Analytics, AR & VR	YES	YES

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I-BE01	Travel planner	All	Journey Planning	Big Data Analytics, Geolocation, AI – Automated Speech Recognition and Natural Language Processing,	YES	YES
I-BE02	Vocal assistant	All	Onboard experience, Interchange	AI – Automated Speech Recognition and Natural Language Processing,	YES	NO
I-BE03	Smart bracelet	All	Transport access point experience, Interchange	Big Data Analytics, Geolocation, AI – Automated Speech Recognition and Natural Language Processing	YES	NO
I-BG01	Context and user-friendly app for accessible planning and city travels	All	All	Big Data Analytics, Geolocation, AI – Automated Speech Recognition and Natural Language Processing,	YES	YES
I-EU01	Smart Navigation Tool	All	All	Big Data Analytics, Geolocation, AI – Automated Speech Recognition and Natural Language Processing	YES	YES
I-EU02	Ramps remote control for self-boarding	Motor	Boarding	AI – Automated Speech Recognition and Natural Language Processing,	YES	NO
I-EU03	A fully accessible downtown pedestrian zone	All	All	-	YES	YES
I-EU04	Accessible parking app	Motor	Getting the desired destination	Geolocation, Big Data Analytics	YES	YES
I-HR01	Integrated information system in public transport	All	All	AI – Automated Speech Recognition and Natural Language Processing	YES	YES
I-IT01	SMARTMAPP: App for navigation specifically for the visually impaired and blind	Vision	All	AI – Automated Speech Recognition and Natural Language Processing, Geolocation	YES	YES
I-IT02	Wearable accessibility	All	All	AI – Automated Speech Recognition and Natural Language Processing	YES	YES
I-IT03	Smart Glass Accessibility	Motor, Hearing, Mental	All	AI – Automated Speech Recognition and Natural Language Processing, Geolocation	YES	YES
I-IT04	I Go Where I Want - VaDo.V.	All	All	AI – Automated Speech Recognition and Natural Language Processing, Geolocation	YES	YES
I-IT05	App-accessible	Motor	Journey Planning, Travel to the access point	AI – Automated Speech Recognition and Natural Language Processing, Geolocation	YES	YES
I-IT06	Mixed reality	All	All	AR & VR	YES	YES
I-IT07	Connettiamoci (Let's connect)	All	Journey Planning	AI – Automated Speech Recognition and Natural Language Processing, Geolocation	YES	YES

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I-IT08	Intelligent Bus Stop	All	Transport access point experience, Boarding	AI – Automated Speech Recognition and Natural Language Processing, Geolocation, Big Data Analytics, Augmented Reality	YES	YES
I-PO01	Adapted eScooter	Motor	All	Automation and Robotics, Geolocation	NO	YES
I-PO02	Route planner and information App for PRM	Motor	Journey Planning	AI – Automated Speech Recognition and Natural Language Processing, Geolocation	YES	YES
I-SE01	Accessible design of transport	Motor	Boarding, On board experience	all	YES	YES
I-SE02	Identifying and overview of the flex area	Motor	Journey Planning	to be determined	YES	YES

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3.4. Clustering of design concepts

Recent technological developments, such as these described in D3.2, enable the proposed design concepts. The column "Relevant Technologies implied" in table 1 outlines which technologies are needed for implementing the proposed solutions. Figure 2, presents the technological advancements included in innovative mobility systems as reviewed in D3.2. It is worth noting that compared to that analysis, our participants considered Intelligent vehicles, virtual assistants, wayfinding technologies, and assistive robots, were among the proposed solutions, while excluded gamification and social media, from consideration.

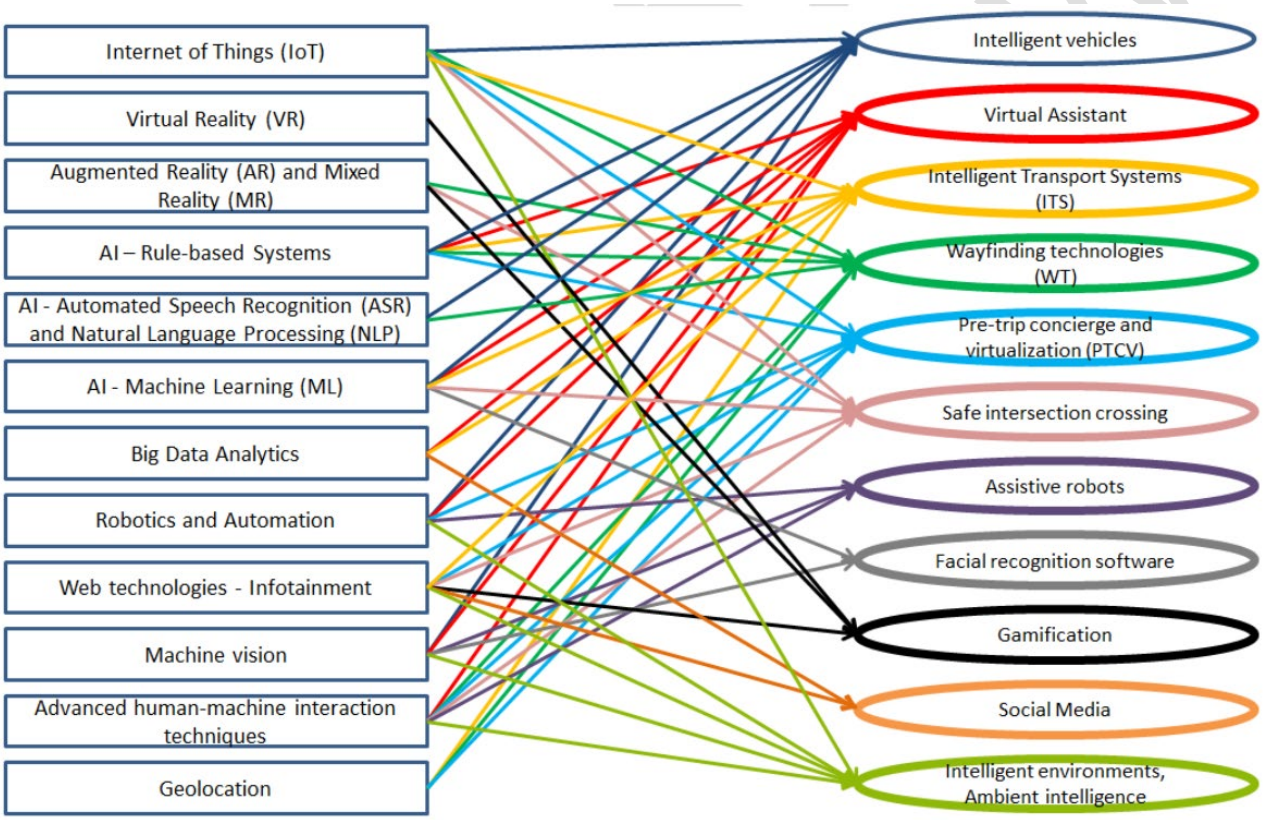

Figure 2 Overview of relevant innovative technologies and application areas from D3.2

The design concepts proposed were clustered along two dimensions:

1) state of development, based on the maturity of technologies involved
2) groups of people addressed, based on the variety of access needs catered for

The former acted as a proxy of feasibility while the latter as a proxy of social impact. As shown in figure 3, four fields emerge. Most of the proposed mobility solutions are assigned to the field "incremental innovation – all people", followed by "disruptive innovations – all people", such as assistive buddy robots or autonomous motorcycles.

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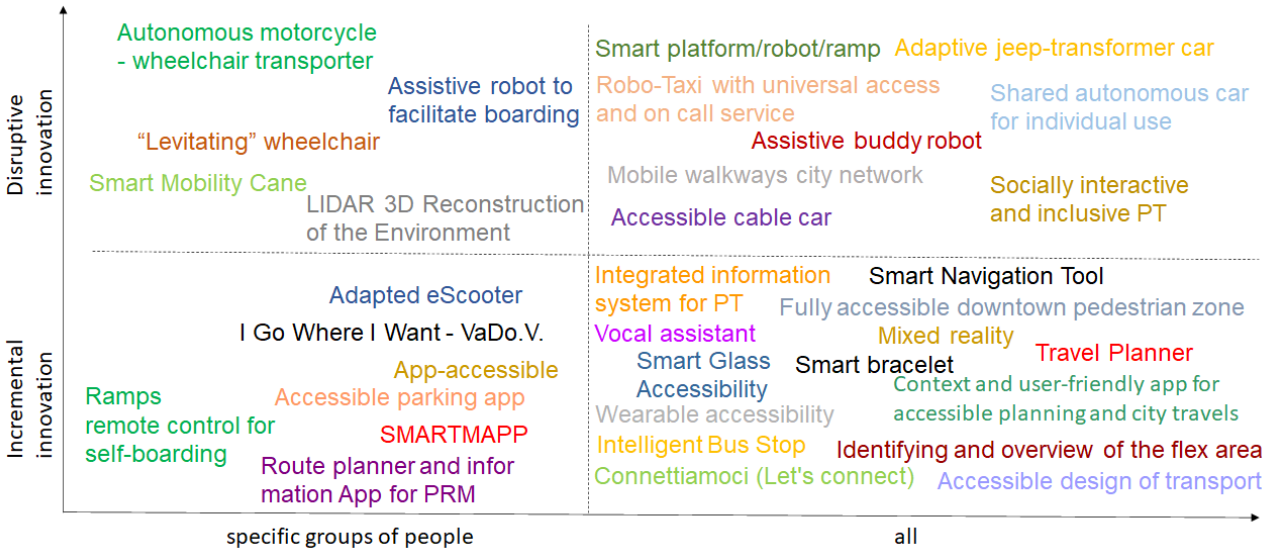

Figure 3 Mapping of the design concepts based on their level of innovation and incidence.

With respect to feasibility, the future implementation of the **Big Ideas** depends on the wider technology-driven infrastructure update in the mobility sector. Keyword association on the set of Big Ideas reveal the following (see figure 4). Two main drivers in technological innovation emerge:

- AI and Autonomous Driving technologies are in rapid development in the automotive sector (e.g. ADAS already available in cars in the market). These innovations are mainly based on edge computing and machine learning algorithms.
- Robotic and drone technologies benefit from the miniaturisation of motors, sensor fusion, advanced mechanics and control solutions (based on edge computing and high-speed networks).

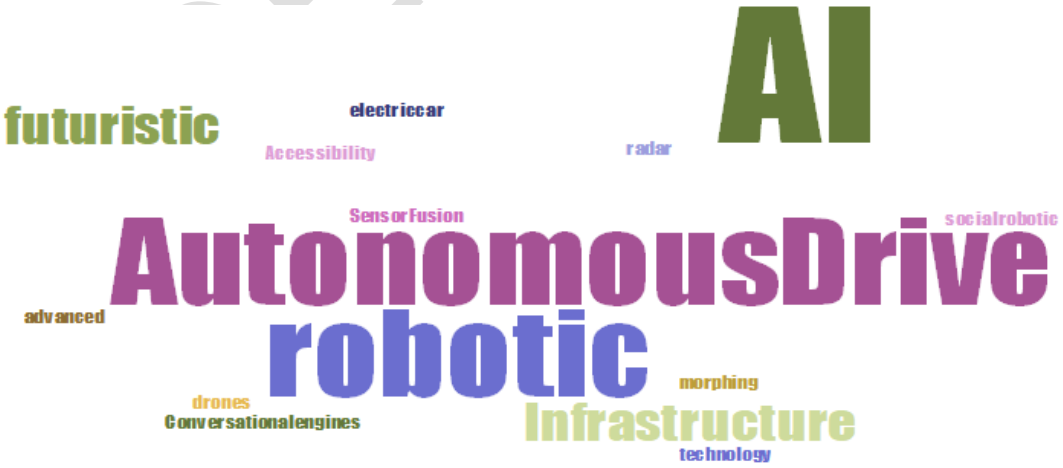

Figure 4 Word-cloud for most common technologies of disruptive innovation big ideas

It is fundamental that these technologies and their application areas ensure interoperability and accessibility. The latter especially has not to be taken for granted.

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Projects such as TRIPS should insist on universal design and co-creation to guarantee access to these applications by the broadest possible user groups.

Incremental innovations, on the other hand, require the following (see figure 5) according to our keyword associations. The image shows the prevalence of ideas based on App's, followed by hardware and IoT. Apps were associated with access to services available through and on mobile devices: geo-localisation, low power communication Near Field Communication, 4G-5G data connection, camera and video capabilities, power for data storing and elaboration. IoT was associated mainly with personal usage and improvements in services offered by the transportation provider and infrastructure improvements. Although from different groups of users and cities, most of the ideas converge towards an evolved version of personal travel assistance (updated in real-time, accessing several information databases) as the next incremental innovation, adding several features (accessibility options, integration with leisure/shopping information):

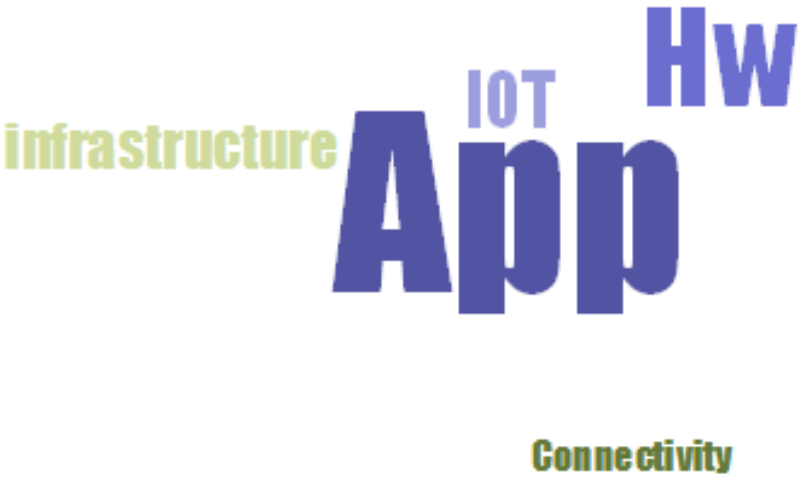

Figure 5 Word-cloud for most common technologies of incremental innovation ideas

The ideas are also divided by the researchers and placed into a four-quadrant space, evidencing:

- "Tangible" vs "Intangible" solution (e.g. predominantly Hardware or Software based): this distinction refers to the relevance of software versus hardware components of an idea (e.g. the more weight the software component has compared to the hardware, the more the solution is defined as intangible); a distinction which impacts on several factors related to feasibility (cost, time-to-market, exportability).
- Collective use vs Individual use: this distinction refers to the number of users who can use the same solution.

The quadrant suggests 6 distinct groups of designed concepts clustered around an evident affinity in objectives and features.

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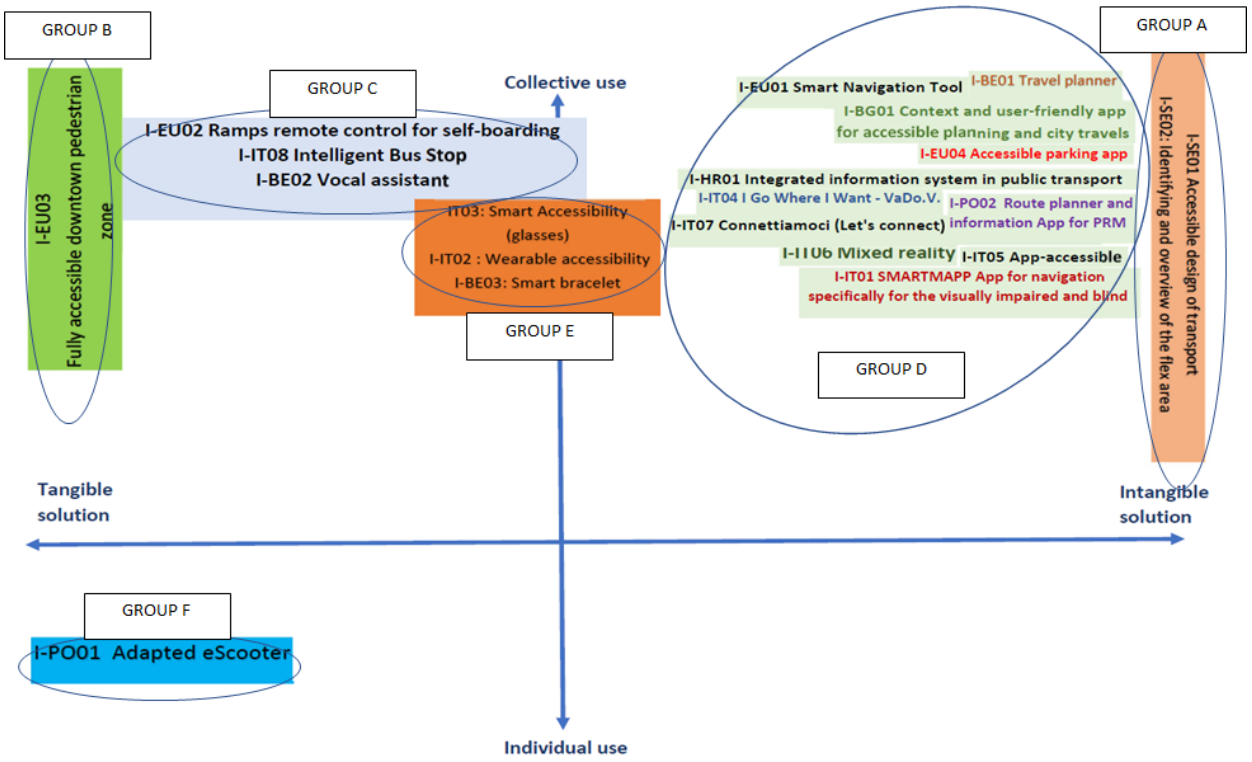

Figure 6 Classification scheme for all proposed incremental innovation mobility design concepts

- **Group A:** Clusters incremental ideas based on design (intangible solutions) with a collective use and impact (usable by all or most users):

I-SE01	Accessible design of transport
I-SE02	Identifying and overview of the flex area

- **Group B**: Clusters incremental ideas for solutions implying exclusively urban infrastructure adaptation/renovation (tangible solution) to benefit all/most citizens, such as:

I-EU03	A fully accessible downtown pedestrian zone

- **Group C**: Clusters incremental ideas considering mainly hardware-based solutions (tangible not excluding software sub-components) to improve the accessibility of transport equipment for all/most of the users, such as:

I-BE02	Vocal assistant
I-IT08	Intelligent Bus Stop
I-EU02	Ramps remote control for self-boarding

- **Group D**: Clusters incremental Ideas based only on software development (intangible) with services and accessibility for all/most users (collective benefit), which are:

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I-BE01	Travel planner
I-BG01	Context and user-friendly app for accessible planning and city travels
I-EU01	Smart Navigation Tool
I-EU04	Accessible parking app
I-HR01	Integrated information system in public transport
I-IT01	SMARTMAPP: App for navigation specifically for the visually impaired and blind
I-IT04	I Go Where I Want - VaDo.V.
I-IT05	App-accessible
I-IT06	Mixed reality
I-IT07	Connettiamoci (Let's connect)
I-PO02	Route planner and information App for PRM

- **Group E**: Clusters incremental Ideas based on IoT plus software application to realise services available for collective users, so including both tangible (i.e. wearables) and intangible components (apps and internet services), which are:

I-BE03	Smart bracelet
I-IT02	Wearable accessibility
I-IT03	Smart Glass Accessibility

- **Group F**: Clusters ideas foreseeing an assistive solution for transport of a specific user typology (individual users) mainly based on hardware development (including adaptation/modification) (tangible):

I-PO01	Adapted eScooter

The same clustering of design concepts has been adopted to interpret data from the PEST analysis.

3.5. The "desirability" of each solution

As explained in section 3.2, the light-MDI tool was chosen to capture the workshop participants' feedback regarding the design concepts' possible impact. Where possible, the design concepts matured in workshops were assessed with the tool that asks the participants to indicate whether the design concept, once implemented, will have a "very positive", "positive", "neutral", "negative" or "very negative" impact on each of the dimensions of the MDI considered. These dimensions are autonomy, travel time, comfort, safety, convenience, and affordability. As mentioned in section 3.2, the dimension of privacy was added as a possible area of concern.

To make the dimensions more understandable, they were represented as a question, leading to the compilation grid represented in Table 2.We employed the light-MDI tool in two different ways depending on the appetite of the participants. In most cases, the grids have been completed as a group exercise. In this case, the crosses represent in the templates are the outcome of moderated, group discussions mediated as a consensus-building process. Some people based their views on expected benefits from personal experience; others might have taken a more reflective stance, trying to empathise and imagine themselves in others' position or groups of people to represent a more holistic or

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abstract perspective. Like in most, group discussions some people also had more robust views than others, during this process. Nevertheless, a “group-view” was elaborated and represented in the grids.

In the case of the Belgium and pilot workshop the MDI-light grid was completed individually. This was originally decided due to time constraints as several design concepts needed to be assessed that would make the workshop tiring for participant and because the facilitator wanted to represent the variety of views. The calculation of consensus, in this case, can only be done by mathematics, calculating means. Nevertheless, this approach highlighted significant differences in individual perspectives on barriers, possible solutions, and their expected impact, and the importance of citizen deliberation sessions in search for consensus searching and prioritisation at a larger scale.

Which kind of impact do you expect for	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently					
Having a fast journey					
Having a comfortable journey					
Having a safe journey					
Having a convenient journey					
Having an affordable journey					
Travelling with no concern about the protection of your personal data					

Table 2 The light-MDI tool as used during the workshops

All the individual light-MDI assessments are represented in Annex 1.

The depth of impact of the different solutions

In this section, we calculate an overall MDI score for every single design concept. The following rules have been applied:

1. The ratings in the completed light-MDI analysis coming from the workshops (Annex 1) have been transformed into numeric values according to Table 3.

Very negative	Negative	Neutral	Positive	Very positive
-2	-1	0	1	2

Table 3 Numeric values for the light-MDI tool dimensions

2. In the case of individual completion (e.g., light-MDI scoring table showing the variety of opinions), a rounded medium score was calculated based on the distribution of the participants' opinions.
3. Dimensions in the light-MDI scoring tables coming from the workshops left in blank were considered neutral.
4. Each value obtained for each dimension was multiplied with a “weighted value” for the respective MDI dimension, as calculated in deliverable D4.2. See Table 4.

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				Multiplier factor				
MDI Dimension	Weighted values	Normalised values		Very negative	Negative	Neutral	Positive	Very positive
Independence	130,45	13		-26	-13	0	13	26
Comfortable	59,75	6		-12	-6	0	6	12
Safe	42,9	4		-8	-4	0	4	8
Time needed	34,2	3		-6	-3	0	3	6
Convenient	32,2	3		-6	-3	0	3	6
Affordable	9,75	1		-2	-1	0	1	2
Privacy	0	0		0	0	0	0	0

Table 4 "Weighted" dimension values

This resulted to the following prioritisations of design concepts based on the MDI (table 5)

Concept code	Ideas short description	MDI score
B-BG01	Adaptive jeep-transformer car	**51**
I-PO02	Route planner and information App for PRM	**49**
B-BG02	An autonomous car for individual rent and use	**43**
I-BE01	Travel planner	**42**
I-BE02	Vocal assistant	**42**
I-EU03	Fully accessible downtown pedestrian zone	36
I-IT05	App-accessible	36
I-BG01	Context and user-friendly app for accessible planning and city travels	33
I-HR01	Integrated information system in public transport	33
I-IT01	SMARTMAPP: App for navigation specifically for the visually impaired and blind	33
I-IT08	Intelligent Bus Stop	33
I-EU01	Smart Navigation Tool	30
B-BE01	Smart platform/robot/ramp	29
I-EU02	Ramps remote control for self-boarding	29
I-EU04	Accessible parking app	29
I-SE01	Accessible design of transport	29
I-BE03	Smart bracelet	26
B-EU02	Accessible cable car	25
B-IT01	Robo-Taxi with universal access and on-call service	25
I-IT07	Connettiamoci (Let's connect)	23
B-EU03	Mobile walkways city network	22
I-IT04	I Go Where I Want - VaDo.V.	20
B-IT02	LIDAR 3D Reconstruction of the Environment	19
I-IT03	Smart Glass Accessibility	19
I-IT02	Wearable accessibility	17
I-IT06	Mixed reality	17
I-SE02	Identifying and overview of the flex area	15
B-BG03	"Levitating" wheelchair	13
B-BG04	Socially interactive and inclusive public transport	13
B-EU04	Assistive buddy robot	13
B-EU01	Smart Mobility Cane	0
B-EU05	Autonomous motorcycle - wheelchair transporter	0
B-BG05	Assistive robot to facilitate the boarding of transportation means	//
I-PO01	Adapted eScooter	//

Table 5 Light-MDI scores for each design concept

Two main factors have influenced the scores: autonomy and comfort. The transformer jeep and the self-driving car, for example, suggest a means to overcome all physical barriers with high levels of comfort. They score higher than the levitating wheelchair, which was considered too futuristic. Among the incremental ideas, information providing solutions that help avoid or overcome barriers is popular. However, environmental interventions (such as

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accessible pedestrian zones) score also highly. Finally, concepts based on embedded information providing systems using multiple communication channels are desired, particularly verbal information.

The breadth of impact of the different solutions

To prioritise the broad list of mobility innovations, it is possible to utilise a refined version of the Social Impact Index (SII). SII was designed to measure the multiple factors of a social development programme that contribute to its ultimate impact. The tool can be refined to help measure a proposed initiative's social impact and prioritise potential investments. The tool is intended to be defensible, transparent, comprehensive, comparable, replicable, and maintainable. The social impact index tool is an index of indexes. The tool offers six components that are considered essential for a project to improve lives and communities. These components are:

- The degree to which the project will impact wellbeing and empowerment.
- The degree to which the project results in necessary paradigm change.
- The depth and breadth of the project (both how many people benefit from a project and the various ways in which they benefit).
- The effectiveness of the project's implementation.

These components are the basis upon which the social impact score is determined.

Within the context of proposed mobility innovations, we can identify a series of Social Impact Index Factors that can be used to prioritise. These could include:

- Breadth of Impact – A measurement of how many people the project impacts.
- Changing Paradigms – The degree to which the project encouraged mindset and behaviour changes.
- Wellbeing – The degree to which a person experiences improved quality of life.
- Empowerment – The degree to which a person or community is empowered to do what they wish to do.
- Depth of Impact – The degree to which a project provides lasting, positive changes in a person's life.
- Quality of Project Implementation – A measure of how well the project was implemented.

For the TRIPS project, the key factors to investigate are related to:

- **the breadth of impact**: numbers of people with a disability impacted by the proposed solution, and
- **the depth of impact**: the extent to which the proposed solution address intractable barriers to independent travel.

By undertaking such a review, the collected proposals can be visualised on a simple grid of breadth and depth of impact. The depth of impact can be retrieved from light-MDI scores. To determine the breadth of impact, the classification in table 6 has been applied.

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Category	Specification	Examples	Value
All people	the entire population independently of their health condition.		(5)
Many people	people with some activity limitations due to mild disabilities of different nature and initial functional decline due to ageing	(Older) people with reduced mobility, vision and hearing	(4)
Some people	people with moderate activity limitations and participation restrictions due to rather frequent moderate functional limitations	Mild cognitive impairment, initial dementia, low vision, mild hearing impairments	(3)
Few people	people with significant activity limitations and participation restrictions due to specific but rather frequent severe functional limitations	Moderate to severe visual and hearing impairments. Wheelchair users	(2)
Very few people	people with severe activity limitations and participation restrictions due to specific severe or multiple functional limitations.	Severe motor restrictions, multiple disabilities	(1)

Table 6 Classification used to determine the breadth of impact of the design concepts

Attributing this value to each design concept, we enrich the table with the MDI scores with a value for the number of people to be positively affected by the solution (Table 7) with in red highlighting the highest values for depth and breadth of impact.

Table 7 Light-MDI scores and amount of positively affected people per concept

Concept code	Ideas short description	MDI score (Depth of impact)	Amount of people positively affected (Breath of impact)
B-BE01	Smart platform/robot/ramp	29	3
B-BG01	Adaptive jeep-transformer car	**51**	5
B-BG02	An autonomous car for individual rent and use	**43**	5
B-BG03	"Levitating" wheelchair	13	2
B-BG04	Socially interactive and inclusive public transport	13	5
B-BG05	Assistive robot to facilitate the boarding of transportation means	//	2
B-EU01	Smart Mobility Cane	0	2
B-EU02	Accessible cable car	25	5
B-EU03	Mobile walkways city network	22	5
B-EU04	Assistive buddy robot	13	5
B-EU05	Autonomous motorcycle - wheelchair transporter	0	2
B-IT01	Robo-Taxi with universal access and on-call service	25	5
B-IT02	LIDAR 3D Reconstruction of the Environment	19	3
I-BE01	Travel planner	**42**	5
I-BE02	Vocal assistant	**42**	4
I-BE03	Smart bracelet	26	5
I-BG01	Context and user-friendly app for accessible planning and city travels	33	5
I-EU01	Smart Navigation Tool	30	5
I-EU02	Ramps remote control for self-boarding	29	2
I-EU03	A fully accessible downtown pedestrian zone	36	5
I-EU04	Accessible parking app	29	2
I-HR01	Integrated information system in public transport	33	5
I-IT01	SMARTMAPP: App for navigation specifically for the visually impaired and blind	33	3
I-IT02	Wearable accessibility	17	4
I-IT03	Smart Glass Accessibility	19	4
I-IT04	I Go Where I Want - VaDo.V.	20	5

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I-IT05	App-accessible	36	3
I-IT06	Mixed reality	17	4
I-IT07	Connettiamoci (Let's connect)	23	5
I-IT08	Intelligent Bus Stop	33	5
I-PO01	Adapted eScooter	//	2
I-PO02	Route planner and information App for PRM	49	3
I-SE01	Accessible design of transport	29	5
I-SE02	Identifying and overview of the flex area	15	2

Mapping design concepts along their breadth of impact (y-axis) and depth of impact (x-axis), a clear picture of their distribution emerges.

For “Big Ideas” (disruptive innovations), the following figure (Figure 7) is obtained:

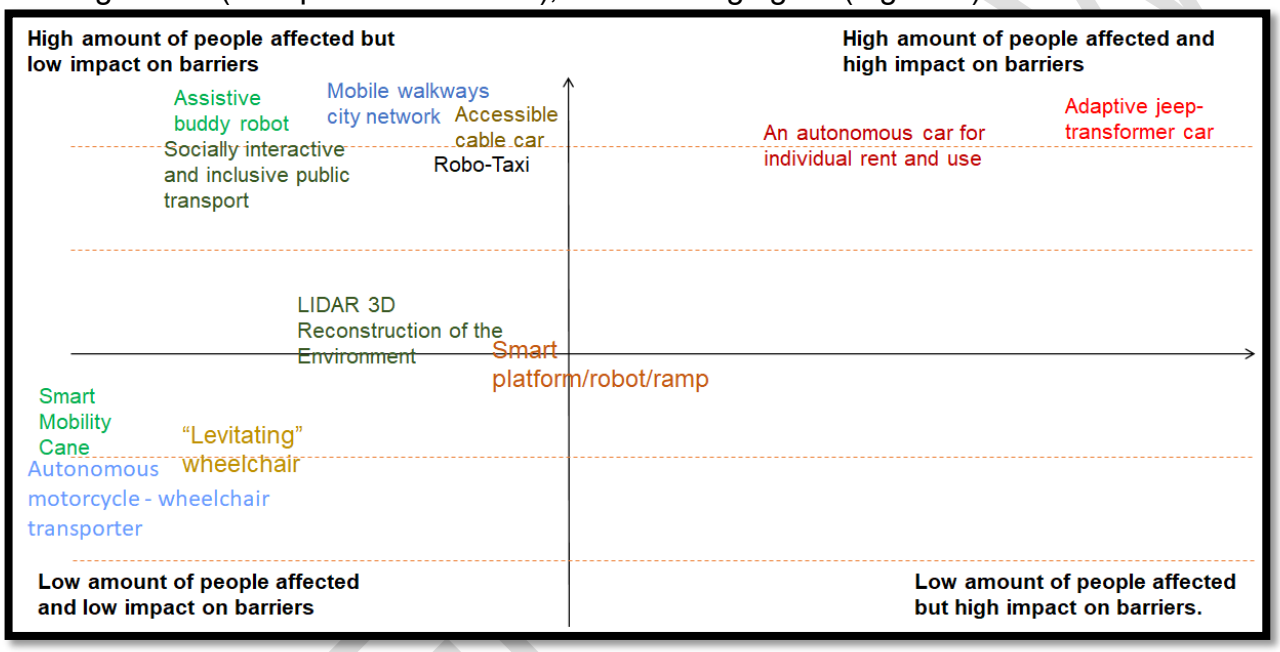

Figure 7 Visualisation for light-MDI and amount of positively affected people of Big Ideas

For incremental innovation, figure 8 is obtained:

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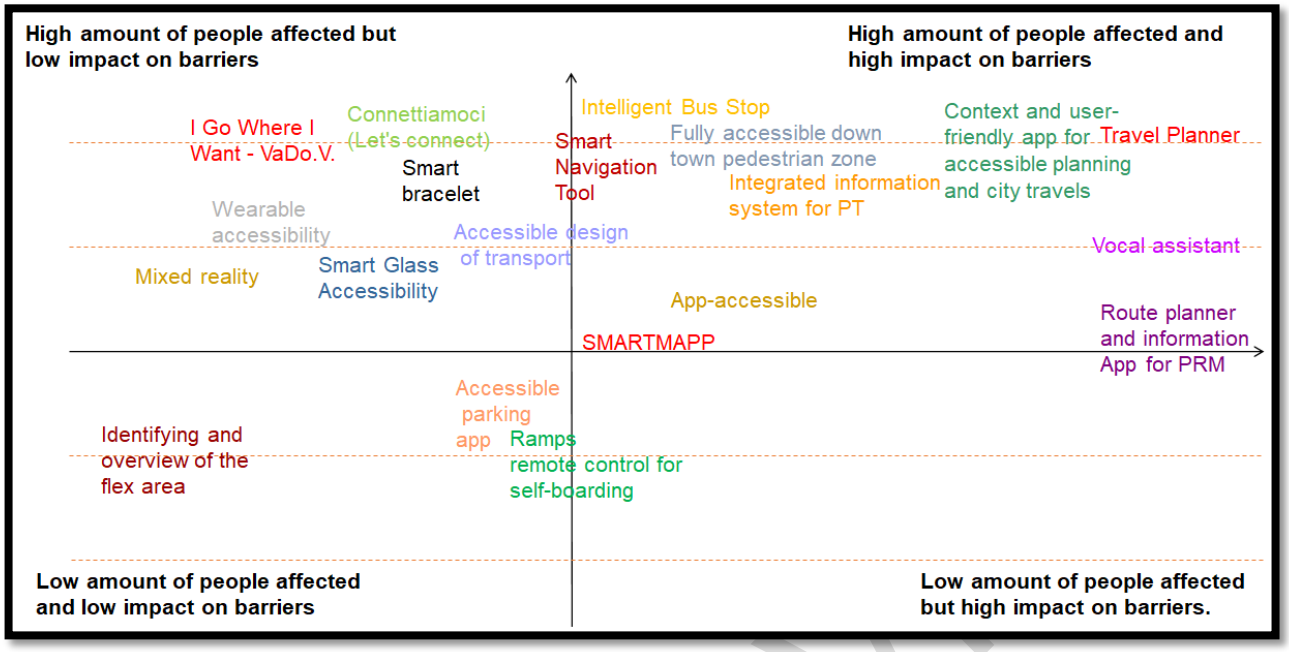

Figure 8 Visualisation for light-MDI and amount of positively affected people of all incremental innovation ideas

While such mapping can inform insights into the number of people that can be affected, we should avoid the pitfall directing public and private investments exclusively to those solutions, leaving solutions affecting minority groups and their specific conditions uncatered for. Instead, was to provide value for money solutions for these groups should be explored. The media can play an important role here, especially when they amplify an individual's difficulties or the stories of a small group of people, either because they are depicted as victims or heroes, impacting public opinion. Examples are Paralympic champions, children with rare diseases or the actors with disabilities. Although it is not for the authors of this deliverable to judge how people with disabilities are represented in the media, it is clear that starting from the stories of individuals, or of individual challenges, can lead to a more significant impact at a policy level. Transposing these to technological innovations, it should be noted that those initially designed to address a few persons' needs (touch paradigm, voice recognition, easy to read texts, eye gazing, text messaging) have led to innovations that affect larger groups. In contrast, solutions thought to be beneficial for large groups (mobile stairs, commercial websites) often have not resolved the core barriers experienced by people with disabilities.

3.6. The "feasibility" of each solution

TRL levels

The Technology Readiness Level (TRL) defines the level of maturity of a technological solution. The following levels are distinguished[3]:

TRL 1	basic **principles** observed
TRL 2	technology **concept** formulated

[3] https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-trl_en.pdf

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TRL 3	experimental **proof of concept**
TRL 4	technology **validated in lab**
TRL 5	technology **validated in a relevant environment**
TRL 6	technology **demonstrated** in a relevant environment
TRL 7	system **prototype demonstration** in an operational environment
TRL 8	system **complete** and **qualified**
TRL 9	actual system is **proven in an operational environment**

All concepts coming from the co-design workshop have been associated with a TRL of the entire solution (intending single technological components involved). For the sake of simplicity, the findings have been grouped/clustered to evidence similarities and common implications of technologies belonging to them.

For “Big Ideas” (Disruptive Innovations), the TRL evaluation's key drivers are the TRL values of technology components implied. Their availability constitutes the starting point for the solution itself.

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Disruptive Innovations			
Idea Title/code	**Emerging Technologies**	**TRL**	**Notes**
B-BE01: Smart platform/robot/ramp	Robots&Drones, AI	5	Robotic automation is an available technology in an industrial environment, such as dextrous arms and co-bot applications. The step is to allow its safe utilisation in an unstructured environment
B-BG01: Adaptive jeep-transformer car	Robots&Drones, AI, Morphing Robots	2/3	It is mainly related to the development of morphing robotic structure based on soft-robotics sensor-based components
B-BG02: Autonomous car which can be rented for individual use	AI, Autonomous Drive, Edge Computing	5/6	It comes as the direct implementation of the automation on driving control in the automotive sector: it is referred to as an ADAS level 5, whose tests are undergoing
B-BG03: "Levitating" wheelchair	Robots&Drones, AI, Autonomous Drive	2	It is a step forward moving from drones applied to the transportation of goods; transporting humans not only a matter of payload but also safety concerns
B-BG04 Socially interactive and inclusive public transport	AI, Social media, multimedia information systems	6/7	An integrated AI application inside a vehicle responsible for bringing together passengers with shared interests to talk. An information system to raise awareness of inclusion amongst people without disabilities: direct examples are social apps with geo-localization of contacts (as it was implemented in Google Latitude)
B-BG05: Assistive robots to facilitate getting on and off	Natural Interfaces, Social Robotics	5	Prototypes and scientific literature available (Dario et al., 1996) (Martini et al. 2015)
B-EU01 Smart Mobility Cane	AI, Sensor Fusion	5/6	Integration of a smart device onto technologies that are already tested and available. Examples are smart bracelets with finding functions (Bluetooth) and Sonar Glasses to help blind persons to detect obstacles[4] (Hussin & Lim, 2020)
B-EU02 Accessible cable car	Autonomous Drive	6	Based on a new urban infrastructure using existing technologies, the challenge is to consider coexistence with the urban built environment. Similar solutions are already in place for mountain ropeways
B-EU03 Mobile walkways city network	*Based on known solutions*	5	Based on a new urban infrastructure using existing technologies, the challenge is to consider coexistence with the urban built environment
B-EU04 Assistive buddy robot	Robots&Drones, Machine Learning, AI, Natural Interface	6	Application of social robotic in the urban environment. Several solutions could be adapted based on those already available on the market (Pepper, Nao Robot)
B-EU05 Autonomous motorcycle - wheelchair transporter	Autonomous Drive	4/5	This requires the direct implementation of automation upon driving control within vehicles. It refers to an ADAS level 5, whose tests are undergoing[5]
B-IT01 ROBO-TAXI with universal access and on-call service	AI, 5G, Robots and Drones (Automatic Drive System)	5	The solution can easily benefit from automotive applications both for ADAS and electric-powered vehicles
B-IT02: LIDAR Reconstruction of the environment	Laser scan, MEMS (Micro Electro Mechanical Systems)	6/7	This is a technology and not a mobility solution in itself

Table 8 TRL of Big Ideas – Disruptive Innovations

[4] https://www.closingthegap.com/sonar-glasses-mobility-aid-for-the-blind-and-visually-impaired/
[5] https://stiftung.adac.de/entwicklung-eines-e-trikes-fuer-rollstuhlfahrer/

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An additional assessment was carried out to classify the TRL of the proposed incremental Ideas. In addition to the readiness level of technological components (hardware and software), an evaluation of the TRL of the specific solution was added. The availability of certain technologies on the market (for example, those implied by Apps on a smartphone: GPS, 3-4-5G data communication, WiFi, web app, cloud services) is not equivalent to having the specific (accessible) solution ready-made. Additional engineering will be necessary with difficulties related to the solution's novelty and lack of equivalences already available. For this reason, two columns are provided (TRL Components and TRL Specific Solution), clarifying the differences.

Table 9 TRL of Incremental Innovation Ideas

Incremental Innovation Ideas				
Idea Title/code	**Technologies available**	**TRL components Components**	**TRL Specific solution**	**Notes**
I-BE01 Travel planner	App, 5G	9	6	An evolved version (accessible, integrated with other dbs) of the app already available (TripIt, Moovit)
I-BE02 Vocal assistant	App, RTLS, 5G, Low Power Data Transmission (LPDT)	8	6	Contextual vocal announces on board, as an evolved version (multilanguage) of what is already available on some vehicles
I-BE03 Smart bracelet	IoT, LPDT	8/9	6	Application of wearable with NFC already in use (NFC bracelets)
I-BG01 Context and user-friendly app for accessible planning and city travels	App, 5G	9	6	An evolved version (accessible, integrated with other dbs) of the app already available (TripIt, Moovit)
I-EU01 Smart Navigation Tool	App, 5G, RTLS	8/9	6	Evolution of GPS/beacon-based navigation apps (Google Maps, Waze, Path Guide)
I-EU02 Ramps remote control for self-boarding	Robotics, App, LPDT	7	5	Automation of platforms and ramps already available with the integration of sensors and remote control
I-EU03 Fully accessible downtown pedestrian zone	*Accessibility (UD) applied to the environment*	n.a.	n.a.	
I-EU04 Accessible parking app	App, 5G, RTLS	9	6	Purposely conceived version (accessible) of the app already available (POI for GPS)
I-HR01 Integrated information system in public transport	App, 5G, RTLS	9	6	An evolved version (accessible, integrated with other dbs) of the app already available (TripIt, Moovit)
I-IT01 SMARTMAPP: App for navigation specifically for the visually impaired and blind	App, 5G	8/9	6	An evolved version (accessible, integrated with other dbs) of the app already available (TripIt, Moovit)

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I-IT02 Wearable accessibility	App, IoT, LPDT. 5G	8	6	Smartwatch technology with integrated purposely developed services via app and cloud integration
I-IT03 Smart Glass Accessibility	App, IoT, LPDT, 5G	8	5	Smartglass (available on the market) integration with controlling app on a smartphone
I-IT04 I Go Where I Want - VaDo.V.	App, 5G, RTLS	8/9	6	An evolved version (accessible, integrated with other dbs) of the app already available (TripIt, Moovit)
I-IT05 App-accessible	App, 5G, RTLS	8/9	6	An evolved version (accessible, integrated with other dbs) of the app already available (TripIt, Moovit)
I-IT06 Mixed reality	App, AR-VR, 5G, RTLS	8/9	6	A specific version of the app already available adapted in terms of usability and accessibility options
I-IT07 Connettiamoci (Let's connect)	App, 5G, RTLS	8/9	6	An evolved version (accessible, integrated with other dbs) of the app already available (TripIt, Moovit)
I-IT08 Intelligent Bus Stop	RTLS, 5G, IOT	6/7	4	All the technologies are available and demonstrated in relevant environments. It could benefit from standards on vehicle-installation and installation-app for a regional/European development
I-PO01 Adapted eScooter	Electric cars	9	6	Inheriting technology solutions of electric vehicles (micro-mobility) in a purposely adapted design
I-SE01 Accessible design of transport	*Accessibility (UD) applied to transportation means*	n.a.	n.a.	
I-SE02 Identifying and overview the flex area	App, 5G	8/9	6	A new “app-based” service utilising concepts and technologies utilised in developing other similar services

Figure 9 demonstrates the impact on barriers vs the number of beneficiaries, where incremental ideas with a lower TRL are evidenced (ideas without TRL are not shown here):

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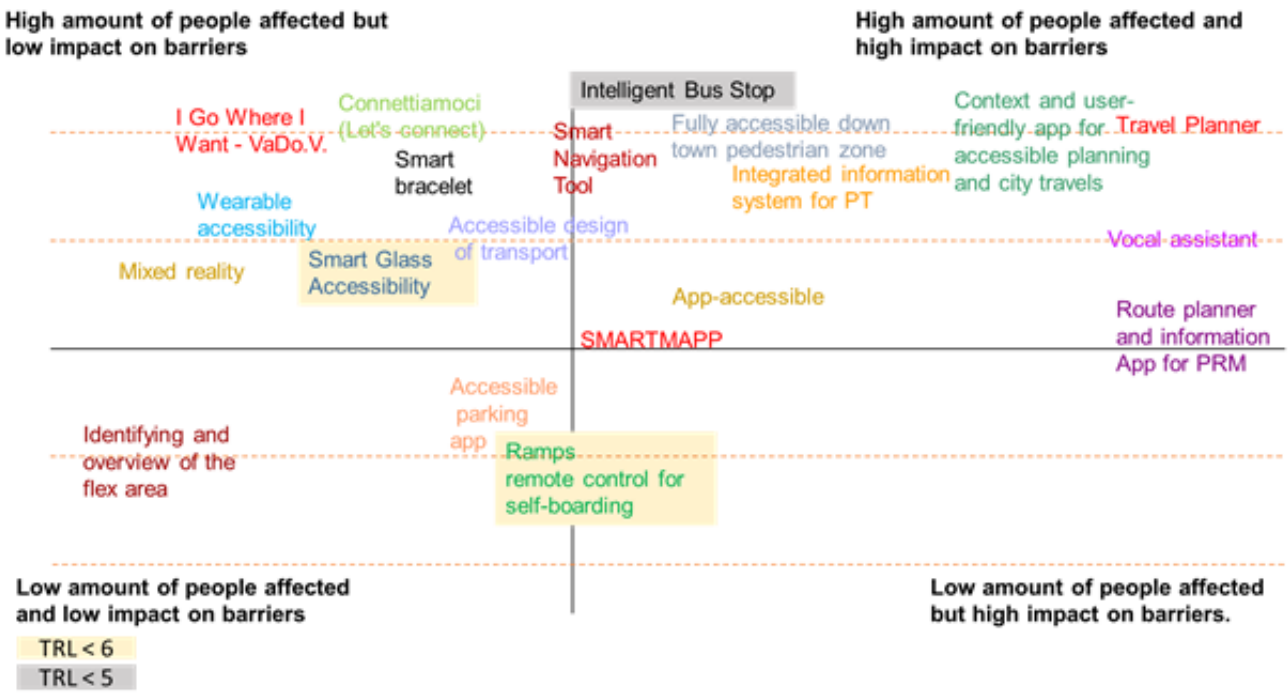

Figure 9 Visualization for light-MDI and amount of positively affected people of all incremental innovation ideas

As evidenced in the figure above, only a few solutions within the incremental ideas proposed are considered to have a TRL less than 6 (technology **demonstrated** in a relevant environment). This fact is encouraging the feasibility of the innovation proposed considering their impact and number of users: most of the ideas in the top-right quadrant (high impact and a high number of people affected) utilise knowledge, technology, solutions already available on the market, reducing costs, risks and timeframe for their development and release.

PEST analysis

A PEST analysis was performed by workshop participants (see section 2.2 for details on method). The analysis allowed the teams to identify opportunities to capitalise on, their enablers and constraints, as well mitigations to address constraints. This allowed the team to moving from what is possible to what is feasible. The PEST analysis of each team is represented in Annex 2. We aggregated the analysis for each of the design concept groups[6] to get a holistic, cross-country view of the political, economic, social, and technological factors affecting their implementation.

[6] Disruptive innovations and Groups A to Group F

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Disruptive innovations - big ideas			
Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political	Stimulate the economy Supports environmental policies Promotes technology transfer Offer an evident political leadership role	The impact on society can be hard to predict Some impact on cities and their actual "look". A degree of political risk as some people might not like it!	Consensus building Broad citizen involvement Impact studies needed
Economic	Stimulates the economy and companies.	Requires major investment. Associated Investment risks.	Cost-benefit studies Public-private financing
Social	Encourages inclusive solutions Supports people with major difficulties	Safety and perceptions of safety	
Technological	Fast developing technological progress	Security Robustness Challenge of a lack of standards Accessibility issues	Implementation of Universal design approaches

Table 10 PEST analysis for disruptive innovation idea cluster

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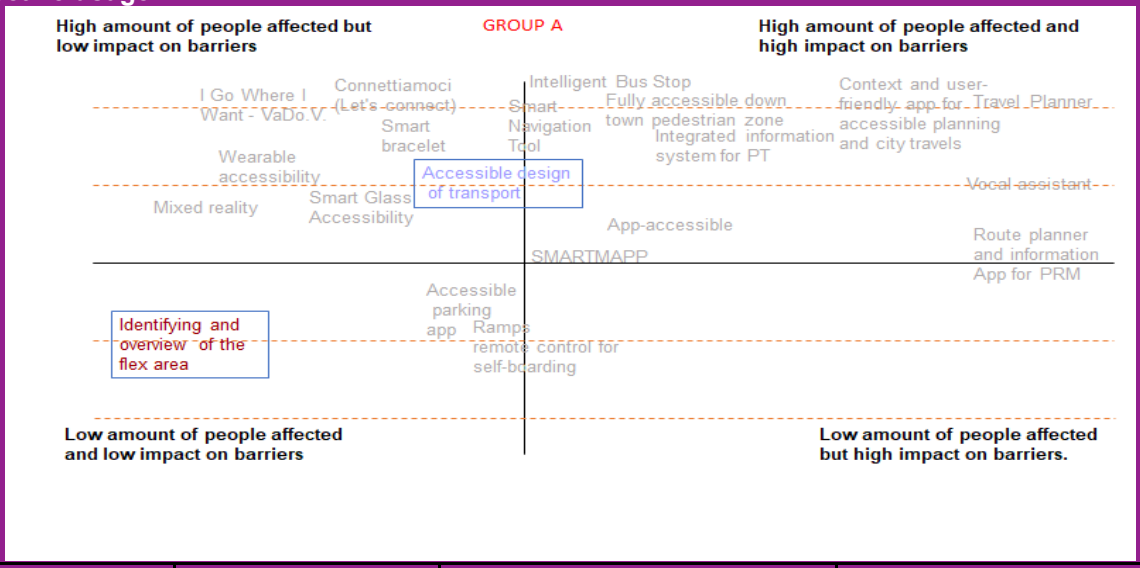
Incremental innovations of Group A: incremental ideas based on design (intangible solutions) with collective usage



Area of analysis	Enabler	Constraints	Mitigation
Political	Application of legislation on individual protection, including GDPR and anti-discrimination. Unique travel pass/card	The lack of an integrated approach to protection in all occurrences. The lack of coordination between public sectors responsible for transport and social policies. Differences of policies on future public transport. Limited resources/income (due to COVID-19) could slow-down investment rates on innovation.	Limit the exposure of personal information/data Need for alternatives for accessible travel The application of Universal Design policies
Economic	Unique travel pass/card	Risk of rapid obsolescence of technological solutions, cost (public and individual) for continuous tech update. Maintenance costs. Reduced incomes (due to COVID-19) could reduce operative margins (increase in the cost of tickets) Delays and difficulties of reimbursement by the state.	Investment and support to develop new technical (accessible) solutions
Social	Flexible solutions for transport	Demographic differences within the country (rural vs urban areas) Set time tables Digital enabling competence needed Need to finance technical update Attitude towards new technologies: distrust on personal data integrity	3&5 Person-centred training and other services according to needs
Technological	A smartphone can access real-time information.	Robustness of solution: infrastructure protection against the environment Risk of rapid obsolescence of new technology Slow development of traditional AT	Test ISO standards with future travellers (with those who have the most hinders) Integration of innovation with available standard solutions Co-design process and universal design

Table 11 PEST analysis for incremental innovation Group A idea cluster

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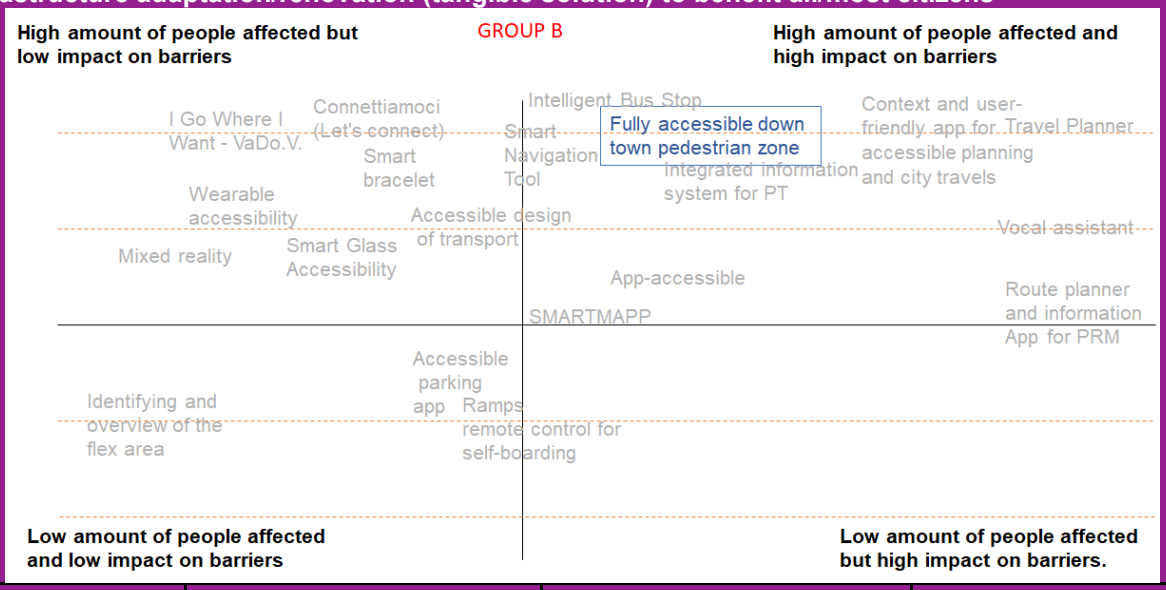
Incremental innovations of Group B: incremental ideas for solutions implying exclusively urban infrastructure adaptation/renovation (tangible solution) to benefit all/most citizens



Area of analysis	Enabler	Constraints	Mitigation
Political	City innovation Environmentally friendly Political wishes/view	Consuming trends of pedestrians Compatibility between commercial centres and large pedestrian zones	Integration with public transportation and micro-mobility solutions Wide public awareness and health benefits campaign Free parking zone around
Economic	Combination with new economic opportunities Public transport integration as facilitation to exploit areas	Resistance from stakeholder groups	Public transportation should be more accessible in smaller cities/improved Promoting commercial activities
Social	Opportunities for social innovation through architectural interventions Foster health and physical activities	Not all pedestrian zones are accessible for disabled people	Investment in new (accessible/inclusive) design Awareness raising Best practices examples from the cities/lessons learnt
Technological	Existing technical solutions available.	Paved surfaces may not be accessible	Use more accessible technology and building materials

Table 12 PEST analysis for incremental innovation Group B idea cluster

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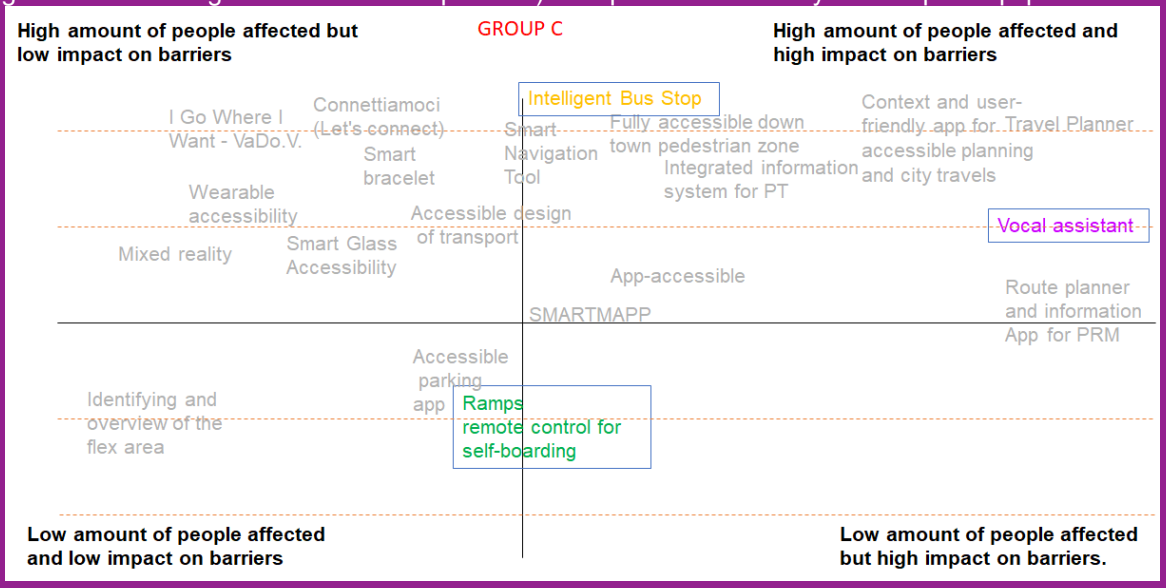
Incremental innovations of Group C: incremental ideas considering mainly hardware-based solutions (tangible not excluding software sub-components) to improve accessibility of transport equipment



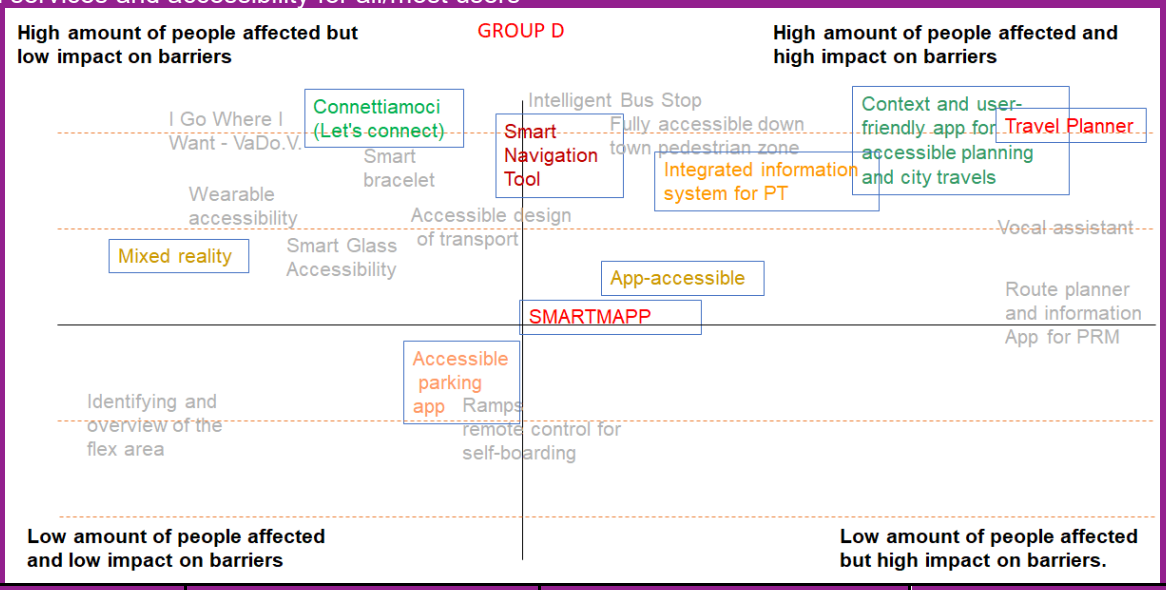
Area of analysis	Enabler	Constraints	Mitigation
Political	Development of a standard framework at the EU level	Innovation owned and managed by public services. The need for Public-Public and Public-Private agreements (i.e. Municipality vs Transport Service Providers. New urban infrastructure to fit into existing areas.	Integral re-design of all parts (standardized components)
Economic		Recurrent costs (Operation and Maintenance)	Integral re-design of all parts(standardized components)
Social	Well known technologies for all users (including PWD) Avoids the exclusion of an increasing % of elderly people		
Technological	Well known technologies for all users (including PWD)	Risk of Vandalism in unsupervised areas Outdoor environment exposure	Anti-vandalism by design Norms on pollution, climate protection

Table 13 PEST analysis for incremental innovation Group C idea cluster

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme Under Grant Agreement no. 875588

Table 14 PEST analysis for incremental innovation Group D idea cluster

Incremental innovations of Group D: incremental Ideas based only on software development (intangible) with services and accessibility for all/most users



Area of analysis	Enabler	Constraints	Mitigation
Political	SmartCity concepts New/emerging technologies applied in Universal Design of human-machine interfaces and accessibility Reduction of pollution and traffic problems Solution highly exportable/reusable	Public administrations (including Transport Service Providers) should develop the project for several years Standardization and norms at the EU level should be applied (old legal framework) Data should be updated regularly Against the risk of the opacity of private companies, such solutions should be owned and managed by public administrations Solutions should gather and present options, including options with private transportation Lack of sufficient "culture" about disability within public administration	A purposely created entity/consortium for project development could assure continuity against changes in political scenarios Certification could assure quality Regulations and norms could help to improve the quality of data Clear definition of ownership and source of data Citizens could contribute to data gathering evidencing mistakes and discrepancies (social approach to database feeding) Work in partnership with disabled user association
Economic	Low cost of maintenance of solutions Access assured by devices owned by most users Travel optimization (time management, costs) means savings for users and transport providers Reduced environmental impact means savings	Solution needs a significant initial cost to be developed: it comprises the cost related the access to data sources (if not available for free) and patent and trademarks utilised To assure continuity of service, a (public) regional authority must be provided, setting standards/contracts for data interoperability	Initial investments could be funded by a specific line of financing from EU funds (FESR-FSE) or the development of a new business model that includes private equity. Community-based (social model) data gathering could reduce come costs.

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Social	Horizontal coverage of implemented services: the majority of the population own devices able to run the solution Sufficient level of digital literacy The attitude to favour of portable digital solutions/service to improve the quality of life	Digital divide risk should be still considered: the case of language minorities (Roma, Euskadi) Accessibility constraints in future solutions Privacy of data should be assured by design Quality of information (reliability, updating) qualifies the solution assuring its success	Training as part of the development of each project: "packages" tailored to the elderly or other users Accessibility awareness should increase in a community of developers Limited personal data requested to service access (excluding any commercial re-use of personal contact/data) Community-based approach to use real-time data from users comprising a user interface for transferring complaints, problems, or wrong information to authorities and service provider
Technological	Solutions based on already available technologies High performance vs cost of devices and networking	Accessibility should be assured for all the functionalities provided by each solution User Interface should consider lack of digital literacy of part of people with disabilities Constant privacy control and policy update Data should be timely updated Internet service coverage could be a problem for app functions	Application of UD principles Simplified approach to the user interface to be usable by the majority (considering different interfaces to communicate data) Centralised responsibility for personal data treatment (update, storage, usage) Users able to submit information, alerts from other users, community support Transport service providers could help to have complete coverage of internet services (free wifi access points)

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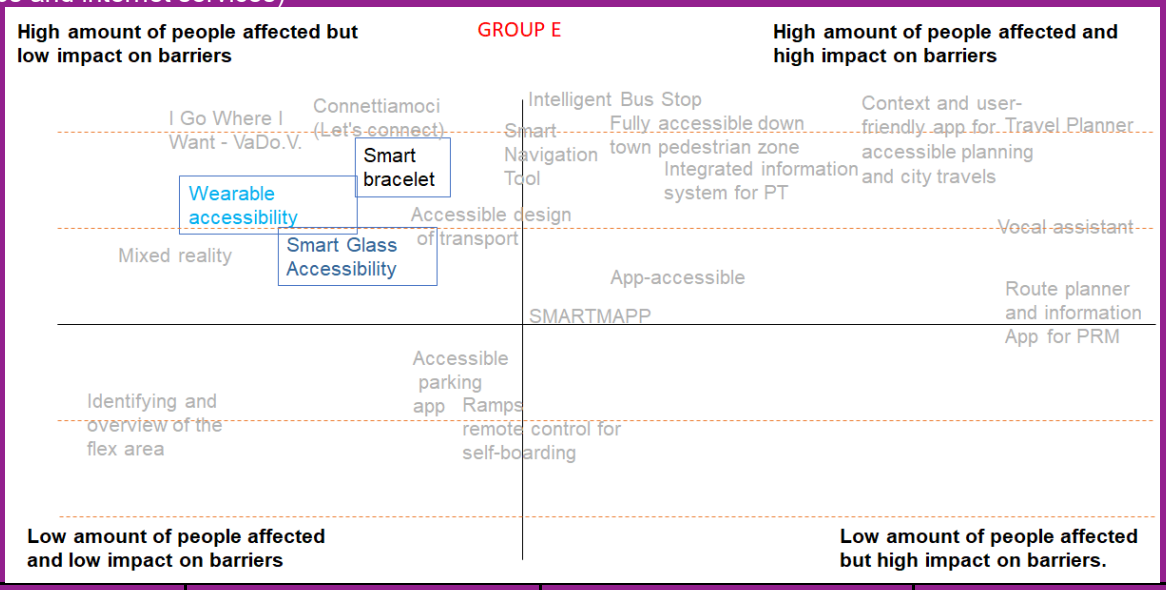
Incremental innovations of Group E: incremental Ideas based on IoT plus software application to realise services available for collective users, so including both tangible (i.e. wearables) and intangible components (apps and internet services)



Area of analysis	Enabler	Constraints	Mitigation
Political	Access and utilisation of dispersed information already available by accessing different databases	Public administrations (including Transport Service Providers) should develop the project for several years, assuring the quality of data and refinement of approach (accessibility). Recognition of diversity, giving equal access to all should be considered a constraint	A purposely created entity/consortium for project development could assure continuity against changes in political scenarios Guidelines or norms could help development in recognizing diverse needs
Economic	Hardware already available Costs of wearables in general, is low and compatible with personal finance capabilities	Solutions should take care of compatibility with external hardware, giving the chance to use available and low-cost wearable	Discounts and incentives could help the diffusion of extra-hardware utilized for these solutions
Social	The solution is not based on stigmatizing devices Highly acceptable, assuring a horizontal coverage employing accessible design	The effectiveness of solutions mainly depends on the quality of information gathered by databases. They should be qualified and controlled with a continuous process.	Public-private agreements to enhance the quality of information supplied.
Technological	Multiple-use of the same hardware device is key for high reusability of technologies	Data should be updated in real-time assuring quality As there is a need for additional hardware, training should be provided to assure reliable use.	Attention to data structure and user design (accessibility) can mitigate the problem Easy to read instruction manuals and tutorial could help to address the majority of the population

Table 15 PEST analysis for incremental innovation Group E idea cluster

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Incremental innovations of Group F: ideas foreseeing an assistive solution for transport of a specific user typology (individual users) mainly based on hardware development (including adaptation/modification) (tangible)			
Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political	Inclusion	Legislation	Precedents
Economic		Costs	Subsidized by state and reduced cost to use
Social	Mainstream vehicle	May reduce space available on streets Consumer preference to own a car instead of an e- scooter Over use of Individual vehicles	These can be a shared service
Technological	Electric vehicle Navigation system	Batteries production and recycling	Same potential solutions as suggested for electric cars

Table 16 PEST analysis for incremental innovation Group F idea cluster

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4. Recommendations

Following are recommendations based on the lessons learned during the cycle of workshops that have seen a wide range of stakeholders in different European countries discussing barriers to mobility with public means, possible innovation concepts to overcome these difficulties, and the potential impact and feasibility of those concepts.

The recommendations are based not only on the workshops' formal outcomes but also on the broader discussions that were triggered by the workshops' participatory design.

1. Permanent innovation is needed in the transport sector, and most transport providers are fully aware of that. In alignment with technological development, the transport sector should **mainstream accessibility requirements and increasingly adopt a Design-for-all perspective** so that the largest possible number of citizens can use services without additional accommodations or retrofitting in the future.

2. A significant need in **future transportation design is to consider diversity in society**, including but not limited to minority ethnic groups, migrants, or visitors. By starting the design from a universal design principle, solutions can accommodate a diversity of needs and backgrounds. As such, the transportation sector should reflect society. Accommodations such as symbols for directions and labels support both those with a print impairment and those who find the local language challenging.

3. Investments in the transport sector are needed, recognising the number of barriers that people with disabilities still meet in using public transportation. Infrastructural barriers are the most limiting barriers as they often prevent travelling at all. In case barriers are related to inaccessible design, assistive equipment as accommodation could be used, but operational costs should not be neglected. **The long-term removal of structural barriers** might be the better option.

4. In planning to prioritise investment in accommodations, the research undertaken highlights **the importance of evaluating durability as one element of decision making**. This is driven by the specific barriers to be addressed and the context. In some situations, a low-tech solution to a particular barrier (such as steps) may be the most appropriate (a ramp rather than a chair lift) as it is unlikely to breakdown. However, at other times a high-tech solution such as a payment wristband or wearable will be more effective as it is both reliable and highly inclusive.

5. The ongoing “technological revolution” is an opportunity for fostering inclusive societies where all people with disabilities can participate on an equal footing (Hoogerwerf et al., 2016). Technological innovations that do not take into account accessibility requirements from an early stage should be avoided. **Public funding for designs that do not address the needs of people with disabilities should be treated with great caution, and public procurement must take accessibility requirements into account.**

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6. Disruptive innovations overall have a more extended timeframe for realisation than incremental solutions. Nevertheless, some of them are based on technologies close to maturity, such as self-driving cars or buddy robots. Although they provide essential opportunities for inclusion, urban innovation, or stimulation of the economy, **assessing implications and barriers should be undertaken as early as possible**. This assessment should be based not only on cost-benefit criteria, safety and infrastructural adaptations but also on psychological barriers, such as citizens' acceptance.

7. **Prioritisation needs to pay due regard to multiple dimensions**, to achieve a balanced scorecard before making decisions. The co-design process lends itself to such a scorecard approach that blends environmental, economic, social, technological and impact factors within local contexts. Such an approach will vary over time as new external influences are brought to bear. For instance, social desire not to travel on crowded buses and trains may become more widespread due to social distancing introduced during the Covid-19 crisis.

8. Investment in an accessible transportation sector can offer **a "triple win" scenario where environmental sustainability, inclusive society and economic development are all addressed simultaneously**. To reach that goal, different stakeholders have to be included in an early stage in developing future mobility solutions.

9. We note the tension between implementing solutions for broad groups of the population and addressing individuals' needs. In seeking to promote access for all, it is essential to address those substantive barriers that have been identified as preventing travel altogether. Such barriers may impact small numbers within the population, but **denial of access to transport is an infringement of human rights**. The allocation of resources to address such substantive barriers is essential in ensuring those rights are fulfilled.

10. Understanding that transport barriers' impact is far more significant than merely an incapacity to move from "A to B" is crucial. It impacts life possibilities such as education, employment, or social and political participation. **A lack of mobility reduces opportunities throughout life.**

11. People with disabilities state a clear preference for opportunities to travel in social groups. This includes the chance to meet and engage with new people when travelling and the need to travel with others, including workmates, fellow students, family, and friends. **This social dimension of travelling has to be considered in designing future transportation scenarios and solutions**.

12. Transport providers and planners should recognise that seeking to resolve current accessibility issues allows them to anticipate future demographic challenges, notably those arising from an ageing population. **Innovations originated by the need to improve accessibility for persons with specific functional profiles**

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could be adapted and exploited by a more significant part (or even the majority) of the population.

13. Co-Designed solutions that seek to address barriers to access for people with a disability need to be understood within a broader context. Some of the solutions that would impact mobility access have equal value in other fields related to employment, education and independent living. **Understanding the potential of a concept to meet needs in a breadth of settings will help promote and prioritise some implementation concepts**. For instance, the wearable band for payment of tickets and access to platforms may apply beyond mobility. A further iteration of these workshops might seek to apply a concept beyond mobility to suggest the scale of use cases.

14. Technologies that address specific barriers experienced by those with a disability may benefit those experiencing situational disability due to short-term issues. Recognising those innovations that will have the most significant impact beyond users with a disability might influence scalability and cost of implementation. **Linking designs to ease travel for all as an additional analysis can build upon the research that focuses on disability**.

15. The model of co-design workshops has been seen to have many benefits. However, **the mixture of large groups working virtually may not easily meet the needs of persons with cognitive or intellectual impairments**. Alternate approaches to consultation and co-design may require engagement with this part of the disabled community who face specific challenges in planning journeys and assimilating information. For those on the neurodiversity spectrum, the co-design model and open-ended nature of discussion may also present particular barriers to involvement.

16. The city workshops model that evolved due to the Covid limitations offers an opportunity for much more significant work to be done at the city level. The city projects developed in WP6 must be **networked within TRIPS to ensure transferability of learning**. Such projects should seek to consider a common project planning methodology to aid comparisons between locations and refine the criteria for prioritising products for local pilots and implementation. It should be recognised that **perspectives on barriers, possible solutions, and their expected impact are highly individual perspectives and probably only by collaboration and co-production approaches can we find a consensus**.

17. A shortcoming of the TRL approach is its focus on development. However, the context dimension should not be disregarded. The Social Readiness Level measures would bring additional benefit to the project and have been added to the approach described above. Considering long implementation timeframes for solution developments, **structural funds (FSE, FESR), as an "external" incentive factor, could be crucial in the decision-making process**.

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5. Conclusions

This deliverable, together with deliverable 4.2., has reported on work undertaken during the pandemic with relevant stakeholders using co-design and co-production research methodologies. Fifteen workshop sessions have been held involving more than 100 experts.

The participants in those workshops have looked into barriers that persons with disabilities encounter while travelling. They have also brainstormed on a wide variety of disruptive and incremental innovative design concepts to overcome many of those barriers. Each of those design concepts has been assessed on their possible impact on the various dimensions of travelling and their feasibility. This has led to the validation and finetuning of tools for co-design and co-production processes in this realm and comprehensive information regarding the different solutions as imagined by the participants.

The researchers found that many technologies that formed the basis of the participants' solutions are available and mature, but that their combination into practical prototypes still requires significant innovation. In some cases, this innovation is related to engineering. In other cases, more or less critical infrastructural adaptations are needed. Also, cultural barriers need to be addressed, especially in rethinking design solutions from a more inclusive perspective. Finally, investments in making transportation increasingly accessible is an urgent need, if only because mobility is a human right.

Regarding the viability of solutions, it should be noted that in investing in transportation systems and infrastructure, priority should be given to those solutions with an extended high return in actual and social costs. Short term financial pain in making systems more inclusive will be compensated by long term savings. Policymakers should adopt the view that investing in accessibility is investing in lower demand for special services and a shared sustainable future.

To take this forward, we recommend that efforts to prioritise design concepts do so by applying multiple tools as a methodology. These should include

- PEST analysis
- Environmental scanning
- MDI
- Technology readiness
- Social impact analysis

Any balanced scorecard based on these will need to be adapted to reflect local contexts. However, some key themes have emerged in the design process as areas of priority across cities.

First, innovations that address access to information and communication in the form of ease of access to planning a journey, navigating, wayfinding and responding to unanticipated change are highly valued and have a high score for readiness to innovate. Second, approaches to reduce or mitigate the impact of widespread physical barriers, both

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permanent and temporary, have a high social acceptance level amongst stakeholders. Some of these approaches may require more significant investment or take longer to implement.

Several additional factors need to be considered as the project is taken forward. The cost and cost-benefits need to be factored into decision making carefully. A key finding of the workshops was that the PEST model for interpreting perceived barriers was a constructive way of establishing dialogue. During the workshops' discussions, barriers impacting the implementation of accessible solutions could be openly addressed and mitigations considered. This process was critical in determining which innovations would impact the lives of people with a disability and have a high chance of success in implementation. This combination of factors might serve as a basis for successful future planning.

Further consideration of the business model that can support accessible innovation would be beneficial. The examples of emerging technologies have been introduced by a range of organisations funded in diverse ways. Analysis of the most appropriate business model to support specific innovation is an essential aspect of co-design that will vary from location to location. The extent to which the private or public sectors operate public transport may create limitations to specific innovations. This has been evidenced by the debate over the UBER business model, which may contravene licensing or employment regulations and laws in some locations but not others. The more such inconsistencies can be reduced in Europe or national districts, the greater the market opportunity for innovation. Hence, the greater the likelihood of rapid implementation.

This report's value lies not in a predetermined set of innovation designs or concepts but in creating an integrated framework by which such priorities can be established. The need to determine the extent to which substantive barriers to mobility for some and ease of travel for all forms a basis for investment may vary from location to location. However, the needs of the “outlier” groups facing the greatest barriers should not be ignored. Addressing such needs may offer key indicators for further development that can benefit all travellers.

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Annex 1 – Individual light-MDI list for every design concept

B-BE01: Smart platform/robot/ramp					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently				X	
Having a fast journey				X	
Having a comfortable journey				X	
Having a safe journey				X	
Having a convenient journey				X	
Having an affordable journey			X		
Travelling with no concern about the protection of your personal data			X		

B-BG01: Adaptive jeep-transformer car					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently				3	6
Having a fast journey				5	4
Having a comfortable journey				1	8
Having a safe journey			2	4	2
Having a convenient journey					8
Having an affordable journey			4	2	1
Travelling with no concern about the protection of your personal data			1	3	4

B-BG02: An autonomous car for individual rent and use					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently				1	2
Having a fast journey			1	1	1
Having a comfortable journey		1		2	
Having a safe journey		1		1	1

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Having a convenient journey				2	1
Having an affordable journey			1	2	
Travelling with no concern about the protection of your personal data	1		1	1	

B-BG03: "Levitating" wheelchair					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently			1	2	
Having a fast journey			2	1	
Having a comfortable journey			2	1	
Having a safe journey		1	2		1
Having a convenient journey			2		
Having an affordable journey			2		1
Travelling with no concern about the protection of your personal data			2		1

B-BG04: Socially interactive and inclusive public transport					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently			2	1	
Having a fast journey			1	1	1
Having a comfortable journey				2	1
Having a safe journey			2	1	
Having a convenient journey			1	1	1
Having an affordable journey				2	1
Travelling with no concern about the protection of your personal data			2	1	

B-EU01: Smart Mobility Cane					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently	2	2	2 (X)	3	1

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Having a fast journey	3	1	4 (X)	1	1
Having a comfortable journey	2		4 (X)	3	1
Having a safe journey	2	1	4 (X)	1	1
Having a convenient journey	2	1	6 (X)		1
Having an affordable journey					
Travelling with no concern about the protection of your personal data					

B-EU02: Accessible cable car					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently	1		1	6 (X)	2
Having a fast journey	1		1	2 (X)	7
Having a comfortable journey	1		2	4 (X)	4
Having a safe journey	1	2	1 (X)	5	2
Having a convenient journey	1	0	3	3 (X)	3
Having an affordable journey					
Travelling with no concern about the protection of your personal data					

B-EU03: Mobile walkways city network					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently		2	3 (X)	3 (X)	2
Having a fast journey		2		7 (X)	2
Having a comfortable journey		1	2	6 (X)	1
Having a safe journey	1	1	2 (X)	6	
Having a convenient journey		2	3 (X)	4	1
Having an affordable journey					
Travelling with no concern about the protection of your personal data					

B-EU04: Assistive buddy robot

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Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently	2	1	1 (X)	2 (X)	4
Having a fast journey	2	2	2 (X)	2	3
Having a comfortable journey	2		3 (X)	3	3
Having a safe journey	2	1	2 (X)	5	1
Having a convenient journey	3		2 (X)	3	3
Having an affordable journey					
Travelling with no concern about the protection of your personal data					

B-EU05: Autonomous motorcycle - wheelchair transporter					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently	1	1	4 (X)	2	3
Having a fast journey	1	1	3 (X)	4	2
Having a comfortable journey	1	1	5 (X)	1	2
Having a safe journey	1	2	5 (X)	1	1
Having a convenient journey	1	1	4 (X)	3	2
Having an affordable journey					
Travelling with no concern about the protection of your personal data					

B-IT01: Robo-Taxi with universal access and on-call service					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently				X	
Having a fast journey				X	
Having a comfortable journey				X	
Having a safe journey			X		
Having a convenient journey				X	
Having an affordable journey			X		

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Travelling with no concern about the protection of your personal data			X		

B-IT02: LIDAR 3D RECONSTRUCTION OF THE ENVIRONMENT					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently				X	
Having a fast journey				X	
Having a comfortable journey			X		
Having a safe journey				X	
Having a convenient journey			X		
Having an affordable journey		X			
Travelling with no concern about the protection of your personal data			X		

I-BE01: Travel planner					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently					X
Having a fast journey				X	
Having a comfortable journey				X	
Having a safe journey				X	
Having a convenient journey				X	
Having an affordable journey			X		
Travelling with no concern about the protection of your personal data			X		

I-BE02: Vocal assistant					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive

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Your ability to travel independently					X
Having a fast journey				X	
Having a comfortable journey				X	
Having a safe journey				X	
Having a convenient journey				X	
Having an affordable journey			X		
Travelling with no concern about the protection of your personal data				X	

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I-BE03: Smart bracelet					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently				X	
Having a fast journey			X		
Having a comfortable journey				X	
Having a safe journey				X	
Having a convenient journey				X	
Having an affordable journey			X		
Travelling with no concern about the protection of your personal data	X				

I-BG01: Context and user-friendly app for accessible planning and city travels					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently			1		2
Having a fast journey			1		2
Having a comfortable journey			1		2
Having a safe journey			1		2
Having a convenient journey				1	2
Having an affordable journey			1	1	1
Travelling with no concern about the protection of your personal data			2		1

I-EU01: Smart Navigation Tool					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently		3		4 (X)	4
Having a fast journey	1	1	1	4 (X)	4
Having a comfortable journey		2	2	3 (X)	4
Having a safe journey		1	3	5 (X)	2

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Having a convenient journey		1	2	4 (X)	4
Having an affordable journey					
Travelling with no concern about the protection of your personal data					

I-EU02: Ramps remote control for self-boarding					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently		2	1	3 (X)	5
Having a fast journey		1	3	3 (X)	4
Having a comfortable journey		2	1	4 (X)	4
Having a safe journey		1	3	5 (X)	2
Having a convenient journey	1		2	4 (X)	4
Having an affordable journey					
Travelling with no concern about the protection of your personal data					

I-EU03: Fully accessible downtown pedestrian zone					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently			1	4 (X)	6
Having a fast journey			3	3 (X)	4
Having a comfortable journey			1	4 (X)	6
Having a safe journey				5 (X)	5 (X)
Having a convenient journey				5	6 (X)
Having an affordable journey					
Travelling with no concern about the protection of your personal data					

I-EU04: Accessible parking app					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently			1	6 (X)	4

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Having a fast journey		1	1	5 (X)	4
Having a comfortable journey			1	4 (X)	5
Having a safe journey			3	4 (X)	3
Having a convenient journey			1	6 (X)	3
Having an affordable journey					
Travelling with no concern about the protection of your personal data					

I-HR01: Integrated information system in public transport					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently				X	
Having a fast journey				X	
Having a comfortable journey				X	
Having a safe journey					X
Having a convenient journey				X	
Having an affordable journey			X		
Travelling with no concern about the protection of your personal data				X	

I-IT01: SMARTMAPP: App for navigation specifically for the visually impaired and blind					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently					X
Having a fast journey				X	
Having a comfortable journey			X		
Having a safe journey				X	
Having a convenient journey			X		
Having an affordable journey			X		
Travelling with no concern about the protection of your personal data		X			

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I-IT02: Wearable accessibility					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently				x	
Having a fast journey			x		
Having a comfortable journey			x		
Having a safe journey				x	
Having a convenient journey			x		
Having an affordable journey			x		
Travelling with no concern about the protection of your personal data			x		

I-IT03: Smart Glass Accessibility					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently				x	
Having a fast journey			x		
Having a comfortable journey			x		
Having a safe journey				x	
Having a convenient journey				x	
Having an affordable journey		x			
Travelling with no concern about the protection of your personal data			x		

I-IT04: I Go Where I Want - VaDo.V.					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently				x	
Having a fast journey				x	
Having a comfortable journey			x		
Having a safe journey				x	

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Having a convenient journey			x		
Having an affordable journey			x		
Travelling with no concern about the protection of your personal data		x			

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I-IT05: App-accessible					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently					x
Having a fast journey				x	
Having a comfortable journey			x		
Having a safe journey				x	
Having a convenient journey				x	
Having an affordable journey			x		
Travelling with no concern about the protection of your personal data		x			

I-IT06: Mixed reality					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently				x	
Having a fast journey			x		
Having a comfortable journey			x		
Having a safe journey				x	
Having a convenient journey		x			
Having an affordable journey		x			
Travelling with no concern about the protection of your personal data		x			

I-IT07: Let's connect					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently				x	
Having a fast journey				x	
Having a comfortable journey			x		
Having a safe journey				x	
Having a convenient journey				x	

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Having an affordable journey			x		
Travelling with no concern about the protection of your personal data		x			

I-IT08: Intelligent Bus Stop					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently					x
Having a fast journey				x	
Having a comfortable journey			x		
Having a safe journey				x	
Having a convenient journey			x		
Having an affordable journey			x		
Travelling with no concern about the protection of your personal data			x		

I-P02: Route planner and information App for PRM					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently					X
Having a fast journey					X
Having a comfortable journey				X	
Having a safe journey					X
Having a convenient journey				X	
Having an affordable journey			X		
Travelling with no concern about the protection of your personal data		X			

I-SE01: Accessible design of transport					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently				X	
Having a fast journey				X	
Having a comfortable journey				X	

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Having a safe journey				X	
Having a convenient journey				X	
Having an affordable journey			X		
Travelling with no concern about the protection of your personal data			X		

I-SE02: Identifying and overview of the flex area					
Which kind of impact do you expect for…	Very negative	Negative	Neutral	Positive	Very positive
Your ability to travel independently					
Having a fast journey				X	
Having a comfortable journey					X
Having a safe journey			X		
Having a convenient journey					
Having an affordable journey					
Travelling with no concern about the protection of your personal data		X			

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Annex 2 – Individual PEST analysis list for design concepts

B-BE01: Smart platform/robot/ramp			
Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political		Question of the final responsibility for the project.	
Economic		Development and maintenance costs (more than 2000 transports stops in Brussels).	Studies on the cost, performance and use.
Social		Bad use of the platforms	Possible link with smartphones for disabled persons.
		Deterioration	Awareness campaign
			Limit access to specific users.
Technological		Many technological constraints in the creation and implementation of these assistance platforms.	Grow awareness around the use of new technologies.
		Ensure the security of the platforms.	

B-BG01: Adaptive jeep-transformer car			
Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political	Need for such cars also in health care – for emergencies and rescue missions.	Lack of political will and policies to develop such a car.	Progress in modern technologies

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	Such vehicles guarantee higher security for the traveller compared to the other proposed design concepts.	The streets and the city infrastructure are not adapted to benefit from such a car fully.	This car can be used by everybody – with or without a disability.
Economic	Although potentially expensive, such a project would save money in the long run for users and manufacturers.	Sometimes individual needs are difficult to assess and account for as they are diverse, which will slow the process of creating transportation means adapted for most people.	In a sustainable economic environment, the state can plan to invest in such cars' design and production and create financial mechanisms for their manufacturing funding.
Social	Such cars can give drivers with disabilities the same possibilities that are available for drivers without disabilities.	People without disabilities would not trust drivers with disabilities with such special cars.	If these vehicles are small in size and for single person use, they will better integrate into the usual traffic following the same traffic rules valid for everybody.
Technological	Similar technologies exist, and this specific project demands their appropriate combination to realise this car's scope.	How to assess who is entitled to such a vehicle and who can drive it is a difficult task that will hinder and slow down the production process.	There exist alternative technologies which could provide similar conveniences.

B-BG02 - An autonomous car which can be rented for individual use			
Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political	In line with effective ecology policies, the environment will be preserved if some	Lack of state regulation and legislation to guarantee the protection of the clients of autonomous cars.	Big companies are interested in the development of vehicles using modern technologies.

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	economy car regimes are available.		
	No need to change the existing traffic rules.		
Economic	Investment in the car industry	Tax policies	
		The level of unemployment will go up, especially for professional drivers	Autonomous cars will make some professions like drivers disappear, but new professions will appear or employment options requiring different competencies.
			The decrease of people needed in the transport sector will allow reallocation of funds in road infrastructure, design of new transportation means and investment in innovative projects
			The number of assistants of persons with disabilities helping mobility in cities will decrease
Social	This would help to the independence and autonomy of persons with disabilities	The ageing population will not accept and adopt autonomous cars. Persons with disabilities will be afraid to hire such a fully automatic car	The use of public or personal transport in major cities is imperative. People get easily accustomed and used to technological innovations
Technological	New technologies are constantly improving for the benefit of many towards more comfortable and easier use.	Adapting of older people to new, different technologies	

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	Autonomous cars have already been developed worldwide, and trials show that they fit fully in an environment of compliance.	All participants do not follow road traffic rules	Autonomous cars would teach other drivers to drive more carefully

B-BG03: "Levitating" wheelchair			
Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political	The search for solutions to alleviate the problems of people with special needs.	Business priorities	The search for solutions to address the planet's environmental problems.
	There is no need to adapt public transport when the wheelchair can make its transitions.	Disability organisations would find it challenging to promote such a tool and discuss whether a person can utilise it successfully.	It is possible to find a way to develop such an environment preserving a wheelchair.
Economic	The autonomy of the person with a disability with mobility difficulties and no personal assistants or other attendants is needed.	The high costs and investments for the development of such projects.	Tax benefits for companies investing in such projects.
	The idea will attract investment interest from businesses.	These vehicles are likely to be expensive, and reducing their price is only a matter of years away from developing the most appropriate vehicle.	National programs could be set up to finance this development.

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Social	Easy movement enables people with disabilities to be in many places and fully involved in public life.	The maintenance of such a wheelchair may not be affordable for social services as a cost if it is not approved and mentioned in the legislation.	Having such a wheelchair would limit the role of assistants in public transport.
	Persons with disabilities are of different age and have various needs in an active social life – they need independent mobility to school, work, hospital, the pharmacy, the store, to meet friends, etc.	High cost	Targeted funding for low-income people
Technological	The development of modern technologies and easy access to the Internet.	Getting to the desired place after travelling to your final destination.	Design tailored to the needs of the traveller.
	The development would not be complex. Engineering achievements are getting closer to such a project.	So far, no society or group of people has approved such a means for transportation which can deter producers.	

B-BG04: Socially interactive and inclusive public transport			
Area of analysis	**Enabler**	**Constraints**	**Mitigation**

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Political	It is aimed at everybody, not a small group of people.	No political will and stability in policymaking.	There are more and more examples from the world that are approaching this mode of transport.
Economic	It would save the cost of specialised transport and be cheaper for consumers.	It would be costly to introduce the technology into all more extensive transportation means such as buses and metro.	It would persuade employers to hire people with disabilities, making it easier to move to work.
Social	People with disabilities will be able to communicate with others more frequently.	People without disabilities do not know how to communicate with people with disabilities. Raising awareness is required.	Public attitudes are not against the presence of people with disabilities in transport.
Technological	The technologies will apply to all.	Development may take time as it also requires adaptation of the entire transport network.	Organisations of and for people with disabilities could make proposals to improve transport services.

B-EU01: Smart Mobility Cane			
Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political	Can contribute to more independent lifestyles Encourage independence of persons with disabilities Promote a healthy lifestyle (more walking) Crucial for citizens (both disabled people and pedestrians)	Risk of relying too much on not yet sufficiently mature technology Safety for citizens Might increase social inequalities It might not comply with safety rules	

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Economic	Integrated notification and advertisement services Financial incentives or subsidy In line with consumer trends such as advertisement services integrated into tourist attractions or shopping choices	More expensive, at least at the beginning More expensive (initial stages) The trade-off with other AT technologies	
Social	Supports the independence of people with visual impairments	It does not support social equity Not supported by health policy due to expensive rates.	
Technological			

B-EU02: Accessible cable car			
Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political	Civil society involvement	automobile lobby logistical issues (not all cities, environments are adapted for cable car infrastructure) political consensus for long-term implementation / continuity long-term project and slow implementation	limit permissible lobbying stop government support to the auto industry involve other stakeholders, diversify the involved lobbies analysis of city setup (street system, building substance, available space) replacement/superimposing of infrastructure infrastructure and living space arrangement and integration in inner-city vs peripheral areas

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			popular support (bottom-up) integration in a common vision for the city and accessible transport building the case around additional benefits (such as getting drunk tourists out of the city centre etc.)
Economic	Private investors Company ownership Appropriate timing for introduction	introduction and set-up of the necessary infrastructure competitors	impact analysis & market assessment introduction in individual phases pilot projects to solidify the argument tax income for the city analysis of additional benefits (e.g. pollution reduction => health benefits) multi-layered cost-benefit analysis quality of life measures economies of scale for accessibility - diversification of talent pool for companies attracting investments
Social	social acceptance	Readiness/acceptance of new transport concepts long-term fluctuations in societal acceptance (over ten years or more) long-term return on investment time to market aesthetics: intrusion / eye-sore local disturbance during construction	opinion polls among citizens public consultations perception of safety (concerning co-travellers) support personnel

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Technological	existing technology incremental innovation/improvements seamlessly integrated accessibility integration of personalised solutions analogies/lessons learned from other technologies	lacking interoperability ensuring necessary frequency	

B-EU03: Mobile walkways city network			
Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political	Policies and regulations need to be adapted New image for cities: dealing with curbs As part of city modernisation projects	Existing infrastructure: Different territorial authorities are responsible for the area Costs: Redesign of cities Cultural factors: effect on “atmosphere” or character of a city -> change of the cityscape Perceived safety: inferences from outside at some moments of the day (e.g. evening, rush hours), especially in problematic cities	
Economic	Potential for new jobs: e.g. facilitators Cooperation between public and private stakeholders	Costs Local variance: not one concept for all	
Social	Communication: the feeling of safety	Safety: people might overlook each other and use more smartphones or leave luggage on the walkway	

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	Opens discussion/conversation regarding city planning and walkable city centres Accessible for everyone no separate solution: accessible from the beginning Substitute for private cars may boost environmentally friendly modes	Contradicts the goal for more active mobility: substitute walking	
Technological	Adapt velocity: implement different walkways for different speeds. Scaling: the technology already exists (e.g. airport)	Maintenance Safety	

B-EU05: Autonomous motorcycle - wheelchair transporter			
Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political	an incentive to remove physical barriers in the environment	homologation requirements / safety requirements traffic regulations (e.g. e-scooters driving on walkways) traffic controls of new forms of transport lacking license of users (lack of knowledge/awareness) unsafe image of this mode of transport	

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Economic	privately run improvement of existing modes of transport universally designed modes of transport and services mainstream accessibility	uncertain demand introduction of yet another new mode of transport affordability	
Social	revive public discussion around universally accessible transport influence public attitudes toward accessible public transport	safety lack of appropriate infrastructure (as opposed to e-scooters that can use cycle-lines) environmental impact of new infrastructure	
Technological	building on existing technology	reliability robustness	

I-BE01: Travel planner			
Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political	Political interest in improving accessibility to public transport	Political coordination between regions in Brussels and Belgium	Public Transport actors (STIB) could launch projects independently
	“Universal Design”: this concept is beneficial for ALL the users	Difficulties in defining all types of disabilities	Qualification and quantification of disabilities at the federal level
		Many nuances among people with reduced mobility: challenging to satisfy everyone	Work with the associative sector to create user profiles that make sense

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Economic	The application is universal, and the foundation already exists	Development and improvement costs of the application	
Social	The app and the website enable to touch easily and significantly the daily life of many people	'Digital fracture.'	Training and information to raise awareness
Technological	The growing use of digital technologies	Potentially too much information and lack of accessibility of applications/websites	Include the app in already existing applications

I-BG01 - Context and user-friendly app for accessible planning and city travels			
Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political	Political will, legal provisions incentivising the development of such applications	Politically regulated access to databases, timetables, adaptation to etc., regulated access. The data shall be up-to-date and correct.	Provision of regulatory solutions that regulate it
		Development of such an application by large companies	
		Opacity and prioritisation of certain companies that do not wish to develop such applications	Lobbying, public procurement, projects
		Lack of expertise and sufficient consideration and examination of consumer needs and preferences	EU membership, lobbies, NGO activity
	National policies are becoming more open to new technologies	There is no political will to create a single system that maintains up-to-date data on the transport situation in the city and which	Citizens could help by voluntarily introducing changes to the situation affecting people with disabilities

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		would provide information to the application	
Economic	Advantageous activity related to government procurement		
		The high price of the application or its usage	Targeted funding for low-income people
	No major investments required	Cost of maintenance	State funding, European projects
	Job creation		
	Saving transport costs due to travel optimisation		
	Saving users time		
		Further adaptation of road notification systems to make the application work well requires significant and permanent funding	This app will save users many costs for taxis and other private transport
Social		Languages of the Annex include Roma, Turkish, etc.	
		Lack of access methods tailored to the capabilities of all users	Different access methods tailored to the needs and capabilities of all groups. Covering all users groups.
	Popularity and positive public attitudes towards internet applications		
	Most people have phones and can install the app		

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	Easy and free internet access for all citizens - via computer, telephone, etc.	Possibility of access to personal data by institutions, outsiders, etc.	
		Adults and people with lower education will have difficulty using it	Providing training and promotion, design tailored to the elderly or other users
	There is a public consensus on the importance of people with disabilities being informed about access to the environment	The situation in the big city changes daily and often without planning	There are no cultural or other specifics that lead to the negative use of such an application
Technological	The app will be usable and require little preliminary knowledge and skills		
	The technology already exists		
	Easy update of the information	Problems with the Internet connection	Free Internet and coverage of stops and metro stations, vehicles, elevators
		Availability of a smartphone or a tablet	Installed at stops, metro stations, means of transport, via QR code
			Ability to save the information and use it offline.
		Adequate and timely information update	The ability for users to submit information alerts from other users, community support

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	The development would be most straightforward among all other concepts	Not all people with disabilities are technically literate to make full use of such an application	If the application is filled with many possibilities for use, particular needs can be covered

I-EU01 - Smart Navigation Tool			
Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political	Publicly owned tool: integrate public services and favour public solutions	inclusion of every offered service, not only public ones but private ones, like Uber Challenge of selection: always recommend public service as the best alternative? A public rather than a private solution Privacy issues: where is data stored? Standardisation: European wide standards as requirements	Clear separation between the contribution of partners Define ownership of community solutions PPP should be balanced for benefits and constraints Duration of partnership: what happens after the end? Have in mind legal constraints and regulations Difficulties in procurement procedures should be managed early, •certification to assure quality and reliability of providers
Economic	Networks already exist Use advertisement as a business model	Availability of data/maps Interoperability of data types -> costs The requirement for one central provider, specific, regional services can be added Need for a relapse system	Take in mind different business models Sustainability depends on the service provider: public v private and should be assessed beforehand Allowing for advertisements for providing service free of costs for end-users Linking app to smart city approaches and open datasets Community-based approaches for data collection

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Social	Positive impacts on personal mobility: Flexibility, freedom of choice, personalisation etc. Create a community to collect and share real-time information from citizens, e.g. construction work	Reliability Trust: e.g. data storage Structural problems	A community-based approach to use real-time data from users Use interface for transferring complaints/problems/wrong information to authorities and service provider The synchronisation of data from different sources Fall-back system Use other data sources, like on-road cameras and sensors, for confirmation or verification of data Contact persons in unplanned situations, like incidents
Technological	Smartphones, GPS and internet, are available Integration of weather data	Big amount of data Standardisation Integrate community-use data Different interfaces for providing feedback/interaction for other requirements	Universal design Interoperability of interface and data Relatively easy add-on for existing systems (upscaling)

I-EU03 - Fully accessible downtown pedestrian zone			
Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political	Environmentally friendly Political wishes/view Reduction of Pollution	Strong opposition from drivers size Risk of divided/polarised society Raising consumption trends from pedestrians Merchants oppose large pedestrian zones (the difference between small and large cities)	Integration with public transportation Wide public awareness Parking spaces available/free – not for pay – parking space Allowance to bring personal individual micro-mobility devices (scooters, etc.)

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		Risk avoided by politicians	Broad public awareness, the problem of smaller cities is less developed public transportation systemImprove public transport, promoting everyday activities and Broad public awareness, medical insurance Pedestrian areas usually don't work without public transport support; integration of public transport is necessary. Integrate into urban planning through political will (parking spaces are expensive), public awareness campaign is recommended Offering incentives for the people using bikes etc
Economic	Suitable for shopping / real estate/services Public transport generally facilitates by combining with it Offer parking spots for free Hard to have a pedestrian centre Public transport planning prevents pedestrian planning	Opposition in the smaller historical cities Taxi driver might have losses Raising consumption trends from pedestrians Merchants oppose large pedestrian zones (the difference between small and large cities)	Difference small/larger cities Less developed public transport in small cities Public transportation should be more accessible in smaller cities/improved Promoting commercial activities, offering free space for a terrace in front of stores
Social	Perfect for socialising Perfect for physical exercises Accessible and user-friendly Perfect for socialising	Smaller cities and some regions are still not accessible enough Corona risk or more viruses Not all pedestrian zones are accessible for disabled people	Investment in a new design Social distancing, Good promotion of going out, and not staying on the bus or home Awareness-raising Best practices examples from the cities/lessons learnt

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	Physical exercise User friendly for disabled persons		Planning new design for pedestrian zones inclusive design Technical constraint due to construction material (cobbled stone in pedestrian zones) Air spaces are convenient for social distancing despite confinement, still too crowded Low-risk areas restraining infection rates Promotion of the policy of pedestrian zones and awareness-raising Promote best practices (e.g. Brussels, Vienna) Access to pedestrian zones through inclusive mobility innovation technology is the main priority
Technological	Existing technical solutions for integration	Stones are not very accessible	Use more accessible technology

I-EU04, Accessible parking app			
Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political	Decreased pollution Relocation of parking Do we need traffic in city centres? Safety and reducing pollution of the environment Supporting people with disabilities in inclusive mobility	Social inequality as a barrier (not affordable for everyone)	

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Economic	Managing people traffic for easier parking		
Social		Manipulate people's patterns on managing the way they chose destination (e.g. Google navigation) •Social inequality	
Technological			

I-HR01 - Integrated information system in public transport			
Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political	Membership in the EU	old legal framework	global trends of increasing demand for inclusive transport
	Cooperation with foreign stakeholders	reluctance to change and innovate	development of a strategic city project management system
	"Smart city" strategic documents	constant changes in laws, policies, strategic documents	plans for the development of integrated public transport of the City of Zagreb and surrounding counties
		the disinterest of political structures and public transport operators	sustainable urban mobility plans
Economic	a unique product on the market	the emergence of competition with a better product	directing business to higher value-added products
	there is a real demand	the untapped potential of City infrastructure/technology and other resources	Integrative Territorial Investment Program for Better Connectivity and Cooperation

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		insufficient investment for equipping, expanding and modernising the system	financing from EU funds
		underdeveloped modern business infrastructure (business incubators, technology parks)	
		insufficient cooperation with other counties in the preparation of joint economic development projects	
Social		customer dissatisfaction	
	cooperation with other cities	insufficient communication and stakeholder networking	growing awareness of the rights and needs of people with disabilities
	Increase of PWD in the general population	part of the population will not be able to use it	
	growth of technological literacy		
Technological	development of new technologies	Product sustainability	development of a strategic city project management system
	Experience with IT innovations	Experts with experience in developing accessible system/apps	improving energy efficiency
	there is already usable infrastructure to build on		

Similar ideas have been grouped in applying the PEST analysis.

Incremental Innovation Ideas: I-IT01/ I-IT04/ I-IT05/ I-IT07: SmartMAPP + Va.Do.V + App-accessible + Connettiamoci (Let's connect)

Area of analysis	Enabler	Constraints	Mitigation

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Political	The interest of mobility suppliers		
	A large number of possible users		
			The lobby of disability user associations to push political decisions
		Public administration should be able to develop projects with a long/mid-term duration (3-5 years)	Agency for development of the project
	Easily to export in different municipalities	To provide and include the interaction also with private transport means (taxi, bicycles) and traffic condition (traffic jams)	Links, sponsorships with the public (museums) and private initiatives to cover some of the costs
	It could be a unique platform to supply other information on health, culture and events, and municipal services.		
Economic	Low costs for service management		
	App available free from stores		
		Costs to build up app and service Patent and trademark costs?	Public incentives Sponsors Media campaign to push the project and the service Public-Private partnerships

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Social	A large number of possible users: also the elderly could benefit from the same innovation		
		Possible overlap with similar ongoing projects	Benchmark on existing proposals?
		Limited digital literacy in some regions?	Design for accessibility simplifying interface and interactions
		Quality and homogeneity of information It should offer barrier-free (for all) solutions	Active involvement of the association of disabled persons to evaluate barriers, solutions, an itinerary of interest, including their advice in data update.
	The utilisation of hardware already in use (no stigma, acceptability)		
		Privacy concerns	Anonymous access? – Minimising personal data for access and utilisation of the service
	Foster social inclusion increasing participation in cultural life of the community		
Technological	Multiple-use of same hardware already owned and utilised (diffusion of devices)		
	Technology well known and available		

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	(incremental innovation)		
		Accessibility issues (blind, low-vision)	Attention to UX in interface design (guidelines and norms)
		Quality of data: continuous database update and reliability of data (info filtering and control)	Sponsorship to cover costs (against the promotion of events and initiatives)
		Possible obsolescence of app – rapid technological evolution	
		Constant privacy control and policy update (evolution of related rules)	The formal definition of responsibility in a unique centre?

Incremental Innovation Idea I-IT02: Wearable accessibility

Area of analysis	Enabler	Constraints	Mitigation
Political	Possible improvement by the integration with existing services and databases		
		To consider equally different needs	Guidelines to develop participatory involvement of the disabled user community
Economic	Hardware already available on the market with reasonable cost		
		In the case of wearable still limited diffusion (compared with smartphones)	Public incentives
Social	Acceptability of solution (including wearable hardware if needed)		

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	Quality and homogeneity of information (potentially available)		
		Scarce quality in the information available	Public-private agreements to enhance the quality of information supplied
Technological	Multiple-use of same hardware already owned and utilised		
		Education/Training for the optimal use	Instruction manual
			Attention to UX in interface design (guidelines and norms)

Big Idea B-IT01: ROBO-TAXI

Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political	Green battery-powered transport		
	Accessibility vs demographic change		
		Scarce regulatory norms	Push for new rules and recommendations
Economic		Cost	Scale economies, technology standardisation
	Incentives to cover not recurring costs		
Social	Universal solution for all users		
	Pollution reduction		

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	Traffic reduction		
	Solution nearer to user needs		
		Employment reduction	Re-qualification and new careers
		User Diffidence against Autonomous Drive System	Reduced max speed
Technological	Electric propulsion technology already on the market		
		Autonomous Drive to be fully validated	

Big idea B-IT02: LIDAR 3D Reconstruction of Environment

Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political			
Economic		Concerns about the high cost of the solution	Large scale economies could prevail
Social		This can produce stigma on users showing this device	Embedded on mobile phones will be a commonly available technology gadget

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Technological		Concerns about the availability (TRL) of small embeddable devices	
		Is this embeddable on a mobile device? (miniaturisation, power consumption, robustness)	

Incremental Innovation Idea I-IT08: Intelligent Bus Stop

Area of analysis	Enabler	Constraints	Mitigation
Political	Development of a standard framework at the EU level		
		Bus Stop under public service responsibility	Integral design of all that is around the bus stop
		Relationship between municipality and transport providers	
		Reduction of parking spaces in consequence of bus stop re-design (possible conflict)	
Economic		Costs of each intelligent bus stop	Integral design of all that is around the bus stop
Social	Well known technologies by many users (including PWD)	Older people (increasing % of the population) could be still excluded	
Technological	Well known technologies by part of all users (including PWD)	Vandals	Anti-vandalism design
		Outdoor environment exposure	To apply norms to protect these systems against pollution, climate and human-related damages

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Incremental Innovation Ideas I-IT03/ I-IT06: Smart Accessibility (glasses) + Mixed Reality_(AR+VR on smartphone screen)

Area of analysis	Enabler	Constraints	Mitigation
Political	Synergies between databases and services already in place – integration could improve the services		
		Public administration able to develop projects with long-mid term duration (3-5 years)	Agency for development of the project
		Equity of access for all needs	Norms to assure the widest accessibility
Economic	Limited costs: no additional cost in case of smartphone base solution (no extra hardware)		
	Reward-based on usage		
		Hw related costs if needed (external hardware)	Discount and incentives
Social	Horizontal coverage of the solution		
	Providing cultural awareness about diversity through the accessible design of the solution		
		Scarce and low-quality information	Social attention to the project and its outcome

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Technological		In the case of wearable: another item to be managed (donned/doffed, recharged)	
		Training	
		Data: quality and usefulness	Attention to data structure and user design
	In the case of wearable: it can be used in other contexts for different objectives		

Incremental Innovation Ideas I-PO01 - Adapted e-scooter

Area of analysis	**Enabler**	**Constraints**	**Mitigation**
Political		Legislation	Precedents
	Inclusion		
Economic		Costs	Subsidised by state and reduced cost to use
Social	Mainstream vehicle		
		Reduce the spaces available on streets	It can be a shared service
		Preference to own a car instead of an e-scooter	
		Is an individual vehicle	The possibility of carrying up to two persons
Technological	Electric vehicle	Batteries production and recycling	The same problem as electric cars
	Has a navigation system		

Incremental Innovation Ideas I-P02 Route planner and information App for PRM

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Area of analysis	Enabler	Constraints	Mitigation
Political			This does not imply institutional engagement
		Requires data from different transport operators.	
		Requires collaboration between entities and users	
Economic		Reduced target public	Use of existing technologies
		Free to use	Use of existing technologies
	Use of existing technologies		
	Crowdsourcing		
Social	User participation		
Technological	5G		
		Users have to have a smartphone	

Incremental Innovation ideas I-SE01/02 Combined

Area of analysis	Enabler	Constraints	Mitigation
Political	To care about the individual/the individual's protection and needs; the need for policy, legislation for GDPR	Difficult to protect integrity in all situations.	Limits the number of times someone has to tell about personal needs.

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	The division between the public transport and disability system	The division between the public transport and disability system	
		No politics yet for universal design	
	One travel card for the whole of Sweden	Different political views on public transport development	How many alternatives are to be offered?
		Less income due to the pandemic, risk there will be less development and will to develop	
Economic		Technic gets old quick, cost to update, not everyone has the means to buy smartphones and other technologies,	
	One ticket/one system for the individual and the government	Secondary costs for equipment, maintenance and subscriptions etc	Investment and support to develop new technology
		Less income due to the pandemic or more expensive tickets	
		Access to a bank account (refugees) and to Bank ID due to different social factors	
	Subventioned tickets and tickets paid by the government;	Challenging to get reimbursed when receiving social benefits;	

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Social		Demographics – long-distance, densely populated areas and areas with few; cultural differences between the city and the rural areas, for example, on waiting time etc	Person-centred training and other services according to needs
	Flexible solutions for transport	Set time tables	
		Digital competence	
		No money to buy the technic	
		Attitude towards new technology – fear for integrity, don't want to have it;	
Technological	Smartphones can pick up API real-time information;	Sensitive technology, batteries that die; humidity, the sensitivity of the infrastructure	To test ISO standards with future travellers (with those who have the most hinders)
		Updating technology – risk to be too old;	
		Requires bank ID and must be updated	
			To be based on co-production and universal design;
		Slow development of traditional technical equipment (electric wheelchairs)	Integration of new technology with older technical equipment

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