

Co-production of knowledge for designing inclusive digital mobility solutions – the methodological approach and process of the TRIPS project

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Abstract

We are still far from achieving the ambitions of ensuring independent living and providing equal opportunities to enjoy seamless, accessible, and independent travel for persons with special access needs. The goal of the project TRIPS (*TRansport Innovation for vulnerable-to-exclusion People needs Satisfaction*) is to empower people with different access needs to play a central role in the design of inclusive future mobility solutions. For this reason, a participatory approach is developed and applied to co-product knowledge on existing barriers, co-create solutions and co-evaluate the resulting prototypes and services. The project thereby engages seven European cities in the open innovation process. The paper introduces the first phase of the project, the user requirements analysis by illuminating the methodological approach and reflecting on first results of the co-production of knowledge. Special emphasis is placed on the building of the local working groups and their involvement in the research. The paper further demonstrates how participatory research in the context of inclusive mobility is enabled despite the current COVID-19 pandemic situation.

Introduction

According to the European Health and Social Integration Survey (EHSIS), in 2012 there were 42 million people aged 15–64 years who are considered having a disability. The definition of disability refers to people having a longstanding health problem and/or a basic activity difficulty that act as a barrier to participate in any of 10 life areas [1]. Meanwhile, today's transport systems remain inaccessible in considerable parts for people with disabilities, compromising their equal access to important services, job opportunities, education travel, overall lifestyle choices and capacity for independent living. By ratifying EU Treaties and the UN Convention on the Rights of Persons with Disabilities, EU member states have committed to respecting the rights of people with disabilities for independent living and to providing equal opportunities to enjoy seamless, accessible, and independent travel. This, however, has yet to materialize for people with access needs in the whole EU. As transport currently undergoes rapid transformation with new mobility models (e.g. vehicle sharing schemes) and transport-related digital solutions (e.g. Augmented Reality) coming into play all over the world, it is an opportune moment to design future mobility systems to be more inclusive from the very beginning. Participatory approaches are a promising way to engage users with access needs to become active participants in open innovation since they are experts of their own mobility and access needs. Engaging citizens through participation allows researchers to investigate user needs in complex systems, such as transportation [2]. Participatory approaches like *Action Research* [3], *Participatory Design* [4] and *Research through Design* [5] have been established in research and development, yet, there are only few attempts to adopt participatory and co-production to create inclusive mobility solutions [6-9]. To the best of our knowledge, there have not been participatory projects addressing transport systems in a comprehensive way, but only elements of it. The new European research

project TRIPS aims for adopting this comprehensive approach by addressing different access needs, various mobility systems in several European countries.

The TRIPS approach

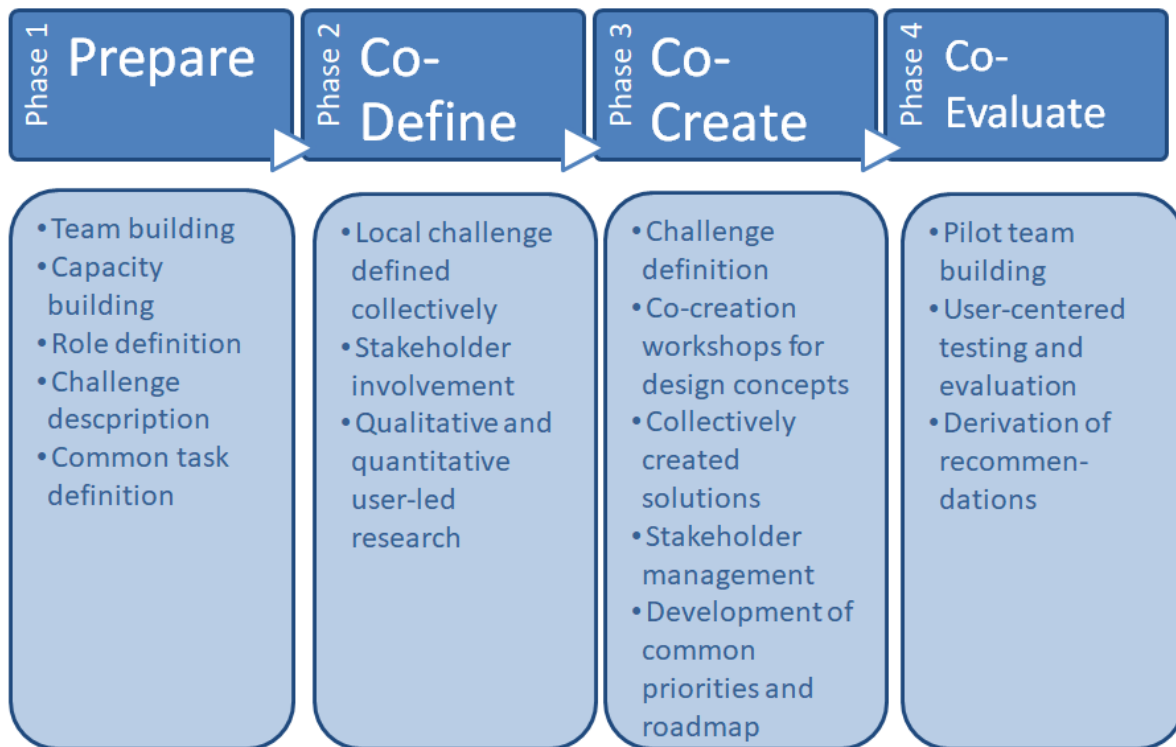
The goal of the *Horizon 2020* project TRIPS (*TRansport Innovation for vulnerable-to-exclusion People needs Satisfaction*, <https://trips-project.eu/>) is to design, describe and demonstrate in practice how to empower people with disabilities to play a central role in designing the inclusive digital mobility solutions. It puts forward a co-design approach that underpins Mandate 473: *Design for All* to eliminate discrimination and improve Access-for-All to mobility services [10]. This project seeks to understand important and often overlooked aspects of user impact and user's ability and readiness to take advantage of new mobility opportunities by undertaking in depth qualitative and extensive quantitative user research and targeted user involvement in the co-design of urban mobility solutions during the pilot studies.

The TRIPS consortium brings together pan-European networks of users with access needs, transport organisations, assistive technology experts and municipalities to engage in open innovation on mobility. Supported by design methodology experts, systems integration experts and privacy experts, the TRIPS project will deploy a *Co-design-for-All methodology* in seven European pilot cities – Bologna, Brussels, Cagliari, Lisbon, Sofia, Stockholm and Zagreb - to develop selected inclusive digital mobility solutions and their respective business cases to support their subsequent adoption. During the upcoming three years, TRIPS will conduct the research on user needs and attitudes towards future mobility solutions, review the state-of-the-art on accessibility, mobility and related digital and assistive technologies and policies and devise an index to measure mobility. The project will also bring users and transport experts together to discuss institutional barriers to adoption, agree innovation priorities and policy changes, co-develop an innovation roadmap and agree research priorities. In doing so, the project reaffirms the role of disabled users as drivers for change and active citizens alongside with regional authorities and businesses in designing digital transport solutions, and policy-makers in designing appropriate regulatory frameworks and social and educational strategies.

The co-production process in TRIPS is divided over four phases based on an iterative approach. In the *Prepare* phase, the working groups were formed that empower citizens of the seven mentioned cities to participate in the project. In the subsequent *Co-produce* phase, the barriers that were identified and the end-user perspective was examined based on the findings of social media content analysis and qualitative interviews as described below. The aim of the third phase - *Co-create*, is to together with the users to find possible solutions of the Technology Readiness Levels 3+ for the previously identified barriers and challenges. These solutions will help municipalities on their journey to accessible inclusive digital mobility. The methodology is described in the section concerning the planned activities. As the last step of the co-production process the created solutions are implemented and evaluated in the *Co-evaluate* phase. The created products will be tested by the users in a pilot study in the seven cities. Furthermore, the project aims for developing the *Mobility Divide Index* (MDI) as a set of comparable indicators for evaluating transport systems and creating new, user-centric standards for researchers, policy makers, transport and urban planners.

This paper aims to describe the methodological approach used in the first two phases in more detail – see *Prepare* and *Co-define* (see figure 1 below). In the following sections, the co-production of knowledge is introduced and the performed activities are presented: 1) forming of working groups, 2) implementing social media content analysis and 3) conducting qualitative peer-interviews. Furthermore, the planned activities, especially the quantitative survey and the co-creation, are

presented.



Picture 1: Four phases of the co-production process of the TRIPS project

Co-production of knowledge

The TRIPS methodology promotes close collaboration between transport users and stakeholders through Participatory Research and Design processes [11, 12]. Adopting the lens of participatory change, the project aims to facilitate interactions between different stakeholders to develop mutual understanding and alignment of interests. The participatory character is also emphasized in co-production that aims for improving public involvement in research as active collaborators [13]. The project thereby builds on participatory design approaches in the context of transportation like the living lab approach of the project *Reallabor Schorndorf* [14]. TRIPS aims to adopt Wright et al. [15] notions of participatory design that postulates that ‘knowing the users’ in their lives, requires both an understanding what it feels like to be that person (empathy) and what their situation is like from their own perspective (perspective sharing). Thus, the goal of the user research and needs identification in TRIPS is to understand disabled citizens’ divergent needs and attitudes towards future mobility as a means for designing inclusive mobility solutions for all. A mixed methodical approach [16], combining qualitative and quantitative methods, is applied to study the user needs.

Originally, the consortium planned to engage disabled users through face-to-face interviews and conduct a shadowing study to observe users taking public transport during their trips in the various partner cities, to understand the challenges they face during their end-to-end journeys and explore the criteria affecting their transport-related decisions. The current COVID-19 pandemic situation, however, demanded a rethinking of the original plan. Instead, a social media content analysis was performed to identify barriers of public transport use in the cities under consideration. Furthermore, the face-to-face interviews were replaced by phone/online interviews. During the qualitative research, the data was analyzed to create user profiles and inform the development of questionnaire for validation with the wider disability community and other vulnerable-to-exclusion groups. For this part,

the project will develop an accessible online questionnaire and engage members of the European Network on Independent Living (ENIL) in various European cities as respondents. The online survey will remain open until the end of the project, by when we aim to reach a minimum of 500 disabled and other vulnerable-to-exclusion citizens (such as senior citizens, immigrants) across EU member states to allow for cross country comparisons.

Forming of local working groups

Co-production is a new way of working which empowers all the actors in the process to participate fully on the basis of shared knowledge and equal partnership [18]. As the first step of the co-production process, working groups were established in each of the seven cities. The working groups consist of about 10-15 people, including persons with different access needs (wheelchair users, visually impaired individuals, hearing impaired individuals, persons of short stature, etc.), transport providers, representatives of city municipality and specialist of assistive technologies.

The most important elements of the co-production process can be summarized in two points: 1) the working group must work in the co-productive way from the very beginning to enable users to exert influence decisions at an early stage of the project, by defining the list of strategic priorities and key challenges worth considering for execution; 2) partners (transport partners, city officials, and users) agree on a common goal or outcome they want to achieve from the beginning. To ensure all actors across the cities have the same understanding of co-production, the TRIPS consortium made a concrete summary document on how to put co-production into practice. This document highlighted the essential principles of successful co-production, such as sharing of knowledge and power, finding time and space to develop and discover skills, providing guidance around the time and work commitment and compensation for the members of the group.

To stimulate equal partnership and a change of power dynamic towards user-centricity, we ensured that disabled users take the coordinating role in the working groups. For this reason, ENIL members and other activists, experienced in working with people with disabilities, were recruited for the roles of the Local User Lead. Starting from March 2020, the Local User Leads were introduced to the representatives from the city and the local transport providers. An essential step towards the joint work in the project was the definition of roles of the working groups and to establish communication channels for continuous exchange. The working groups leaders and at least one more member of the CUT were trained as co-design facilitators in order to plan and guide the co-design sessions with transport providers, representatives of city municipality and specialist of assistive technologies. This resembles the high rung of *partnership* on Arnstein's *ladder of citizen participation* [19], which describes different levels of participation similar to a ladder.

One of the first tasks for the Local User Lead was to bring people with disabilities in the city together around the topic of accessible transport and so form a User Group of people with different access needs as part of the working group. This will be done by first defining the barriers to accessibility at the start of the project with the goal to develop pilot solutions to remove (some of the) barriers at the end. Due to the COVID-19 situation the start of the (physical) meetings of the working groups have been postponed. Instead of this, the Local User Lead will start connecting disabled people in the city to TRIPS through the sharing of recourses for the media content analysis and by asking them which transport barriers they face by implementing the qualitative interview. This will ensure the groups can start from a strong position and have the first physical meeting of the working group towards the end of August, 2020. Later on, they will work on the quantitative survey.

Social media content analysis

Social media content analysis uses user-generated social media data that serve as a barometer for monitoring changing attitudes toward newsworthy or controversial issues [20]. Media content analysis has been used for studying public opinion on a topic like concerns and challenges related to the introduction of a e-scooter system [23]. In TRIPS project, this method of data collection was used to identify barriers that people with access needs face before, during and after their travelling with public

transport (by bus, metro, subway, taxi, ridesharing, bikesharing, micro-mobility etc.). The social media content analysis provides insights into the topics people discuss about at platforms, in social media channels and as comments to online newspaper articles. The entries were analyzed thematically according to the following research questions:

1. Which topics do the different web entries focus on?
2. Which barriers of public transport and its related features (access/booking) are addressed?
3. What similarities and differences in content exist between the different cities?

At least 30 media entries concerning accessibility of public transport, barriers, assistance services etc. were researched in each of the project cities. For the analysis, social media platforms, such as Twitter, Facebook and Instagram were scanned based on appropriate search terms like *Disabled/mobility-impaired / wheelchair /visually impaired / blind / deaf, hearing impairment / Public transport / bus /metro/ subway / transit / mobility / taxi*. In contrast to other approaches like reported by Gössling [23], only social media entries by private persons were selected for analysis but no official journalistic reports or articles. Both, selection and analysis has been conducted by working groups who are familiar with the specific characteristics of the local transport systems and the media channels. Entries and related information were collected in a table that comprises information concerning the nature of the disability referred to, the described barrier and possible solutions named. Content was analyzed in detail regarding their informative and affective reactions to public transport-related issues and systematically coded and clustered with the software MAXQDA based on grounded theory [21,22].

Our primary results of social media content analysis highlighted the relevance of existing barriers, especially the recurrent complaint about missing or broken ramps which is the most frequent topic addressed in social media related to accessibility of public transport. The social media analysis revealed that some groups of public transport users with special access needs, like persons with sensory impairments and mental impairments are rather underrepresented in online discussions about existing barriers while others, especially wheelchair users, use this medium more frequently. The results of the social media content analysis also revealed several solutions proposed by the social media users that are mostly related to the provision of real-time information. One of the analysed Facebook entries suggested more regular checks: *“What we want is to demand rigor and transparency. Perhaps considering regular visits by NGOs-PDO¹, who can have access, without pre-schedule, to garages, who can request fault reports, request the total number of complaints in the last three years, be aware of the number of stops that do not allow people to pull over and use the ramp...”* (Content on Facebook from Lisbon). Another social media entry summarized the underlying demand that the TRIPS project is aiming to serve with its open innovation approach, *“It is best to construct public transport in such a way that it works for everyone from the beginning”* (Content on Facebook from Stockholm).

Interviews

Interviews with people with access needs were conducted to acquire in-depth information and insights concerning the knowledge and opinions of the interviewees. Interview guidelines were prepared in advance but were regarded as a loose framework based on open semi-structured questions. The questions were clustered to four topics: 1) choice behavior (e.g. *“Are there any transport means that you do not use or avoid? For what reason?”*), 2) barriers (e.g. *“Which are the main barriers you face when using public transport?”*), 3) assistance (e.g. *“What technology do you use and would like to use to help at each stage of your journey with different means of transport, both for booking and traveling?”*) and 4) participation (e.g. *“Are there other possibilities to get involved in transport design in the city? Do you feel they are meaningful?”*). The interviews were conducted via phone or video

¹ NGO-PD stands Non-governmental organisation and disabled people organisation

chat by the local users leads. Each local user lead interviewed 7 persons with access needs in each of the seven cities.

The primary results of the interviews revealed that the public transport systems in the cities under consideration are far from being accessible for everyone. It was expressed by the interviewees that there are solutions that would make transportation more accessible but they are not implemented, not used in the right way. A lot of accessibility equipment are broken, such as elevators, escalators or audio announcements in busses. The interviews contributed to the findings of the social media content analysis by enriching the results and providing more insights into the thoughts, attitudes and intentions of persons with sensory impairments that were rather underrepresented in the social media analysis. The interviews revealed that persons with visual impairments often face barriers like inaccessible ticket machines or missing audio announcements in busses.

Planned activities

The qualitative studies represent a cornerstone for the proceeding survey study. The accessible online questionnaire aims for minimum 500 respondents from various European cities. Members of disability organizations (such as *European Disability Forum*) and members of other organizations representing other vulnerable-to-exclusion citizens, such as senior citizens (*AGE Platform Europe*), migrants (*European Movement International*), people of lower economic status (*The European Anti-Poverty Network*) will be invited to participate in the survey study starting in autumn 2020.

Cross-country comparison of the results will provide further insights into commonalities and differences in the requirements of disabled individuals concerning their mobility needs and inform prioritization of research and investment agendas to maximize the impact of transport accessibility efforts. These mobility needs and requirements will be further accounted for making strategic decisions on the challenges to focus on in the co-design process that starts from the notion that all participants are equal partners with equal power of decision making [18].

The co-design-for-all methodology of phase 3 (*Co-create*, see Figure 1) will engage citizens of the project cities for creating accessible solutions. The working groups will help to prioritize ideas and define the focus of the co-design workshops. They will be peer trained in the method and take part in the co-creation workshops together with representatives of the municipality and transport operators to develop prototypes. These prototypes and demonstrators will be further tested and evaluated for usability and user acceptance by different users in the pilot phase in the seven project cities (phase co-evaluate, Figure 1).

Expected impacts and conclusions

The research contributes to enable safer and more comfortable travel to all passengers with and without access needs. As a first result, the project will provide a review of the accessibility of current and future mobility systems, assistive systems and ICT technologies related to transport to identify gaps. Based on the analysis of existing barriers, the Co-design-for-All methodology of TRIPS project will create the conditions for the equal participation of all citizens in open innovation and for the development of inclusive mobility designs from their inception. Thus, the identification of barriers while using the public transport is just the first step that will be followed by a comprehensive *Co-creation* phase to identify, discuss and test accessibility solutions for the specific conditions in the seven cities.

An expected impact of the project is to help policy-makers design appropriate regulatory frameworks by creating a comprehensive roadmap that distils the project's findings into recommendations for policy-makers, transport authorities, regional authorities and operators. The TRIPS consortium thereby engages users with access needs and institutional actors in the development of policy recommendations, an industry roadmap and research priorities. Furthermore, the development of the *Mobility Divide Index* (MDI) based on the findings, will contribute to form a set of comparable indicators and proposing a new, user-centric standard available for researchers, policy makers,

transport and urban planners, operators and stakeholders' representatives. To conclude, the project will empower people with disabilities to play a central role in the design of inclusive digital mobility solutions.

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