Ride2Rail

EVALUATION AND IMPACT ASSESSMENT

Deliverable D5.3

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 881825

Project Acronym	RIDE2RAIL
Starting date	01/12/2019
Duration (in months)	41
Deliverable number	D5.3
Call Identifier	S2R-OC-IP4-01-2019
GRANT Agreement no	881825
Due date of the Deliverable	30/04/2023
Actual submission date	04/07/2023
Responsible/Author	CERTH
Dissemination level	PU
Work package	WP5 “Evaluation and Impact assessment”
Main editor	Lambros Mitropoulos (CERTH)
Reviewer(s)	FSTECH, METROPOLIA
Status of document (draft/issued)	Issued

Reviewed: yes

Consortium of partners

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DOCUMENT HISTORY		
Revision	Date	Description
1	15/09/2022	Table of Contents
2	23/06/2023	First report draft
3	29/06/2023	Pre-final version addressing reviewers' comments.
4	30/06/2023	Final version
5	04/07/2023	Submission

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1. EXECUTIVE SUMMARY

The present report constitutes one of the last deliverables of Ride2Rail project and it is prepared in the framework of WP5 "Evaluation and Impact assessment". The RIDE2RAIL project aims to further enhance the notion of ride-sharing by developing, testing, and delivering a suite of as-a-service software components, proposing trips that will be covered partly by public transport modes and partly by private cars (ridesharing). The overall goal of WP5 was to define, develop and implement an evaluation framework to assess the impact of RIDE2RAIL (pre-and post-demo). In more detail, this document presents the results of Task 5.3 "Demo and overall evaluation" and Task 5.4 "Impact assessment".

This report aims to fulfil the following objectives:

1. To describe the methodology for the evaluation of the demo results (targets of KPIs set at global level but also at local).
2. To present the results (achieved KPIs) from each demonstration site.
3. To evaluate and interpret the impact of the demonstrations as well as prioritize impact areas when planning ride-sharing schemes.

In order to structure the methodology for the evaluation and impact assessment of the pilots a thorough literature review of related previous ride-sharing pilots was carried out and is presented in the beginning of this document. The four demonstration cities (*Athens, Helsinki, Brno and Padua*) and the KPIs (local and overall) are described for the reader to understand the performance and impact of each demonstration.

The impact evaluation process adopted by Ride2Rail project considers the four key impacts defined by topic S2R-OC-IP4-01-2019, which are: 1) the increase of passengers using public transport, 2) the improvement of rail connectivity with rural areas, 3) the minimization of environmental pollution while travelling, and 4) the proposal of additional criteria for informed decision making when planning a trip. In this context, the targets of KPIs are presented together with the achieved results following the demonstration in each city. Additionally, the Analytical Hierarchy Process (AHP) method is utilized to investigate the priorities, as perceived by partner stakeholders (i.e., transport providers, MaaS service providers, ICT providers, policy, and advisory bodies), that should be set when planning for such services. Finally, the lessons learned are described to contribute to future research.

2. ABBREVIATIONS AND ACRONYMS

AHP	Analytic Hierarchy Process
CFM	Calls for Members
DL	Dissemination and exploitation leader
DoA	Description of the Action
EL	Ethical leader
EU	European Union
FS	Financial Statement
GA	Grant Agreement
H2020	Horizon 2020
IP4	Innovation Programme 4
MaaS	Mobility as a Service
KPI	Key Performance Indicator
OC	Open Call
PC	Project coordinator
PM	Project manager
PMO	Project Management Office
PMT	Project Management Team
PO	Project Officer
PT	Public Transport
QAC	Quality Assurance Committee
S2R JU	Shift2Rail Joint Undertaking
TL	Technical leader
TSP	Travel Service Provider
WP	Work Package
WPL	Work package leader

3. BACKGROUND

The present document constitutes the Deliverable D5.3 “Evaluation and Impact assessment” in the framework of Tasks 5.3 “Demo and overall evaluation” and 5.4 “Impact assessment”, of WP5 “Evaluation and Impact assessment”.

It is one of the final deliverables of Ride2Rail project, following the scheduled demonstrations, and thus it concludes the RIDE2RAIL project (S2R-OC-IP4-01-2019).

4. OBJECTIVES/AIM

The overall goal of WP5 is to define, develop and implement an evaluation framework to assess the impact of RIDE2RAIL (pre-and post-demo).

Focusing on Task 5.3, a pre and post demonstration evaluation are carried out:

- **Pre-demonstration evaluation.** The baseline values of Key Performance Indicators (KPIs) identified in Task 5.1 and assessed in Task 4.1 will be used to perform a baseline appraisal of each demo site describing in this way their current qualitative and quantitative status (e.g., level of integration, services on offer, geo-spatial particularities).
- **Post-demonstration evaluation.** The actual values of KPIs, collected in Task 4.1 after the demo execution, will be compared to performance targets and KPIs of each site. The outcome of this comparison will be used to draw conclusions on the success achieved by each demo site in meeting the targets set prior to the demo. Mixed methods are used to collect the required data, including questionnaires, database interrogation, semi-structured interviews, direct observation, desk-based approaches.

The pre/post demonstration evaluation will include the overall travel experience of passengers and drivers offering the first/last mile ride. This comprises the usability of the apps (i.e., travel and driver companion) but also other aspects, such as:

- The attractiveness of the service;
- Possible effective incentives for behavioural change;
- Convenience and comfort;
- Perception of security and safety;
- Level of synchronisation with PT/Rail, the acceptability of the proposed terms and conditions.

The outcomes of the pre/post demonstration evaluation will be used to provide a descriptive and quantitative evaluation of the influence that RIDE2RAIL solutions in each of the demo sites. The Analytical Hierarchy Process (AHP) method will be used to obtain weights to allocate specific values to the different stakeholder priorities. For example, increase public transport patronage, depending on the site. In addition, these varied stakeholder priorities will be clustered around the four key impacts expected for topic S2R-OC-IP4-01-2019, namely:

- Increase the number of passengers using public transport;
- Improve rail connectivity with rural areas;
- Minimise environmental pollution while travelling;
- Propose additional criteria for informed decision making when planning a trip.

Where possible extrapolations will be made for larger scale assessment.

5. INTRODUCTION

The overall objective of the RIDE2RAIL Project is to develop an innovative framework for intelligent mobility, facilitating the efficient combination of flexible and scheduled transport services, thus enhancing the performance of the overall mobility system. This framework, consisting in a combined suite of travel offer classifications and software components, will natively be integrated into existing collective and on-demand transport services, connecting, and reinforcing the mobility offer especially in rural and low-demand areas, in order to foster the access to high-capacity services (rail, bus and other public transport services) thanks to easy-to-use multimodal and integrated travel planning, booking, ticketing and payment features.

More specifically, the Project aims to integrate multiple (public/private/social) data sets and existing transport platforms for promoting an effective ride-sharing practice to citizens, making it a complementary transport mode that extends public transport networks. The integration between the ride-sharing practice, along with a relevant critical mass of users, and the public transport network will deliver a crowd-based mobility network and will be achieved by the RIDE2RAIL framework for intelligent mobility. RIDE2RAIL will integrate and harmonize real-time and diverse information about public transport, ride-sharing, and crowdsourcing in a social ecosystem for facilitating the comparison between multiple options/services by using a set of criteria including environmental impact, travel time, comfort, and cost.

In brief, this document includes the description of the demonstration cities (Athens, Helsinki, Brno, and Padua) and the KPIs (overall and local) that were set. The KPIs results are presented as well as the findings from the AHP used to understand the perceived impacts of ride-sharing and priorities that should be set when planning such services. Finally, the lessons learned are described to contribute to further research.

5.1. Structure

Apart from the introductory sections, this report is structured around 6 main chapters. The current Chapter 5 includes introductory information aiming to familiarize the reader with the goals of the RIDE2RAIL Project in general and with the scope of this deliverable.

Chapter 6 records the literature regarding the framework and the impacts of ride-sharing demos/studies.

Chapter 7 presents the methodology of Ride2Rail demo cases.

Chapter 8 deals with pre city demonstration evaluation.

Chapter 9 deals with the post city demonstration evaluation.

Chapter 10 presents the overall impact assessment process including an extended description of the targeted impact areas and the specific KPIs that were set.

Chapter 11 reports the overall expected impacts as well as the lessons learned from the Ride2Rail demos. Finally, **Chapter 12** incorporates the conclusions of this Deliverable.

6. FRAMEWORK AND IMPACT-RELATED FINDINGS FROM PREVIOUS RIDE-SHARING PILOT STUDIES

Ride-sharing has been associated with several social, environmental, and behavioural effects; a growing body of empirical data validates these correlations. A non-exhaustive list of ride-sharing's benefits includes a) reduction in energy consumption and emissions, b) congestion mitigation, and c) reduced parking infrastructure demand. Individually, ride-sharing users may benefit from: a) shared travel costs, b) travel time savings by using high occupancy vehicle lanes (when avail; able), c) reduced commute stress, and d) preferential parking and other incentives (Shaheen, Cohen, & Bayen, 2018). One of the most widespread frameworks for assessing the impacts of ride-sharing is the measurements of specific indicators that fall under defined impact areas (e.g., economic, social etc.). However, several studies that did not have the opportunity to launch a ride-sharing pilot project, used statistical and survey data to model the effects of ride-sharing. The remainder of this section presents ride-sharing impacts and frameworks as recorded in the literature, while putting an emphasis on pilot projects' results.

The CIVITAS' "Cluster 1: Alternative car use" aimed at demonstrating a sustainable car use through the implementation sixteen measures, eight of which were related to ride-sharing while the rest were related to car sharing. The measures were deployed in 8 cities. In the framework of assessing the impacts of ride-sharing measures, three different impact areas were considered, 1) 'Economy, Energy, Environment', '2) Transport', and 3) 'Society' (McDonald, et al., 2005).

More specifically, it was reported that after the development of a ride-sharing system for students and staff at Krakow University of Technology, the operating cost were reduced by 27% and the fuel consumption reduced by 32% (caution advised) between 2007 and 2008. In the same report, it is claimed that the average car occupancy on workdays and ride-sharing trips increased by 7.2% and 18% respectively. Regarding societal impacts, awareness of ride-sharing raised from 34% to 66%. In Norwich, the existing ride-sharing service was established, and business and education organizations were recruited. Between September 2005 and May 2008 collective fuel and car running cost savings of £99,369 (approx. 12,000 euro) were reported. In addition, it was estimated that 304 tonnes of CO_2 were saved. Regarding impacts on transportation, it was reported that 1,646 single occupancy car trips were removed from the network during peak time. In the same context, similar impacts were observed in Toulouse between 2005 and 2007. Costs reduced by €321,880 and CO_2 emissions reduced by 0.338kg per km for a medium sized car (McDonald, et al., 2005).

For the evaluation of a ride-sharing service for students in Debrecen[1] in CIVITAS-MOBILIS project three different areas of impacts were defined: a) Transport system, b) Quality of service and c) Acceptance. Interviews conducted with participants and data recorded from the system (e.g., daily users) were utilized as a means of measuring the impacts in the above areas.

The impacts of the CHUMS project were assessed by using a set of indicators for which data were collected. These were divided into three main groups: 1) 'context information', 2) 'target group information' and 3) 'effects on mobility and environment'. The majority of these was assessed for before/after cases to measure the effect of implementation (CHUMS, 2016). CHUMS measures increased the awareness about ride-sharing significantly. Moreover, the attitude towards ride-sharing also changed in a positive way (awareness and attitude). As far as impact on travel behaviour is concerned, the number of registrations in the ride-sharing app increased in total by 2,397 new potential ride-sharing users spread over the five sites. The statistics regarding new registrations do not provide a comprehensive overview of the ride-sharing activity level since not all registered users participated in ride-sharing. For this reason, an estimate of 1,000 people was provided regarding the total increase of new ride-sharing users. As regards the total increase of actual trips, it was estimated that 55,000 new ride-sharing trips resulted in about 640,000 extra ride-sharing kilometres. The CHUMS measures realized an increase in ride-sharing mode share of 1.45% (between 0.01% and 36.17% for different target groups). There were also 0.18% less cars during the rush hour (between 0.01% and 3.86% for different target groups) and there was a decrease of single occupancy car trips by 0.19% (between 0.01% and 4.74% for different target groups). Regarding environmental impact, the implementation of the CHUMS measures directly saved 31,334 litters of fuel per annum, which is equivalent to 26 toe/annum in energy savings per annum, and indirectly saved 79 tons of CO_2 equivalent per year (CHUMS, 2016).

Within the framework of SocialCar[2] project, two different methodologies were adopted for evaluating the impact of ride-sharing. The first one refers to modelling city-wide impact assessment, while the second one is real life testing of the RideMyRoute App. In the context of modelling city/region wide impact assessment, SocialCar used percentage of individuals who have the inclination to utilize the SocialCar platform, as well as determining the anticipated alterations in travel patterns among various societal groups. This was accomplished by conducting a survey on technology acceptance and stated intentions. Next step was to create different "level-of-use" scenarios for each site. All scenarios led to a

[1] https://civitas.eu/sites/default/files/Evaluation%20Results%20%20F%20version%209.3%20D-1.pdf

[2] https://cordis.europa.eu/project/id/636427

decrease in car mode share and an increase in Public Transport mode share (Wright, Nelson, & Cottrill, 2018). A graphic representation of this approach is shown in Figure 1.

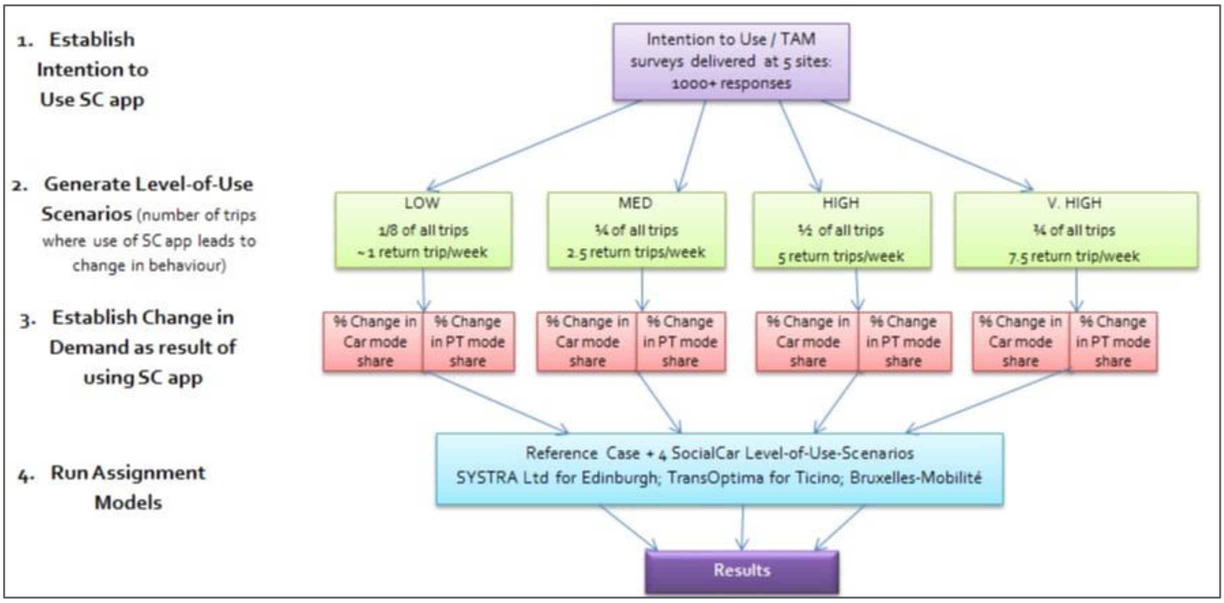

Figure 1: Summary of the modelling approach for the city-wide impact assessment in SocialCar project (Wright, Nelson, & Cottrill, 2018)

Regarding the impacts measured during the real-life testing of RideMyRoute App (Brussels, Edinburgh and Canton Ticino and Ljubljana) the impact assessment involved the evaluation of the smart app through a combination of:

- Monitoring and storing data on use of the App through the SocialCar back-end system during real life testing.
- Conducting user acceptance surveys with formal testers both before and after the real-life testing.
- Organizing focus groups after the testing to capture qualitative feedback and explore attitudes towards use in the future.

During the pilot, the use of the RideMyRoute App was automatically monitored and recorded by the SocialCar back-end software system. The information collected facilitated the evaluation of the App users, frequency of App usage for trip planning purposes, presence of ride-sharing alternatives in trip planning options, the degree of ride-sharing activity and availability from both drivers and passengers, and the feedback ratings received from both parties. As SocialCar aimed at increasing ride-sharing possibilities through the combination of ride-sharing with PT services, an important indicator called 'trip solutions with ride-sharing options' were measured which suggests a connection from ride-sharing to a public transport service compared to simply ride-sharing for the full length of the journey. Apart from the automated data collection, each site was required to enlist and involve 25 to 50 formal testers. These individuals were selected meticulously and agreed to partake in the testing of the RideMyRoute App, with the condition that they complete a Technology Acceptance Model (TAM) survey, to assess the system's usability, and provide comprehensive feedback on user acceptance through focus group meetings. In addition, a comparison of pre-trial (expectations) with post-trial (experience) surveys was conducted as part of the impact assessment process. It is worth mentioning that the greatest percentage of the total ride-sharing during the pilots were done in order to achieve connection with Public Transport (Brussels 97%, Canton Ticino 86%, Edinburgh 69% and Ljubljana 91%) (Wright, Nelson, & Cottrill, 2018).

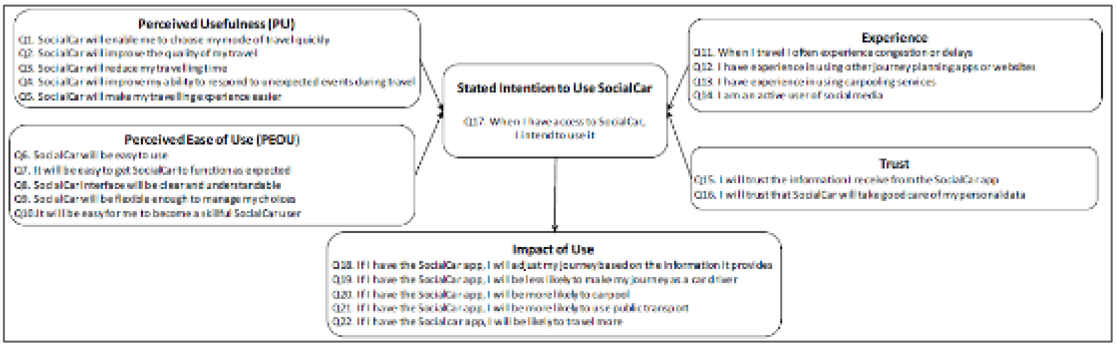

Figure 2: The TAM-based questions SocialCar team used to assess stated Intention to use the SocialCar App and the related Impact of use (Wright, Nelson, & Cottrill, 2018).

Nechita, Crișan, Obreja, & Damian (2016) utilized a modelling approach to calculate the total fuel consumption and CO_2 emissions for a specific route according to the number of persons per car using the Buddy application. The results are directly linked with the impact of ride-sharing. It is worth mentioning that for the time interval 06:00 – 10:00am, in which the maximum travel request is noted, a commuting driver consumes 28.25 liters of fuel and emits 64,561 g of CO_2 while with for one passenger the consumption of fuel is estimated to be 13,11 liters and the CO_2 emissions 20,174 g.

According to Bringme Srl Società Benefit (2020) the three areas of impact for the Jojob real-time ride-sharing application are: a) CO_2 reduction by cars, b) Reduction in the number of vehicles on the road, and c) Economic savings for commuters. In order to provide quantitative information regarding the environmental impact, a dedicated smart tool was developed to compare measurements of air pollutants in different timeframes. Additionally, data coming from the ride-sharing application (e.g., number of ride-sharing trips) was utilized to calculate impact. It is reported that almost 275 tons of CO_2 were not emitted into the air in 2020 corresponding to the annual absorption of a forest made up of over 13,500 tall trees. The number of journeys made by ride-sharing passengers who have given up on private means of transport in favour of shared transport on a single vehicle was estimated to be 66,702. In economic terms, individual users who have used ride-sharing saved a total of 462,550 euros.

The aim of Seyedabrishami, Mamdoohi, Barzegar, & Hassanpour (2012) was to explore the factors that influence travellers to ride-sharing and to assess its impact on energy. By utilizing the demand diversion model to determine the number of commuters who opt for ride-sharing they calculated the potential amount of fuel saved during the morning rush hour. In total, 470 survey responses were collected through interviews with travellers at fuel stations. According to the responses, 44% of the participants would choose ride-sharing independently of who the drivers is, 14% are willing to ride-share only if they had someone to share a ride with and 26% are willing to choose ride-share (no matter they know someone or not) because their current travel time is more than 35 minutes and desire a 20-40 % reduction in travel time. The annual fuel savings based on these three different scenarios are summarized in Table 1:

Table 1: Estimation of annual fuel savings in different scenarios in Tehran (Seyedabrishami, Mamdoohi, Barzegar, & Hassanpour, 2012)

Participants willing to ride-share (%)	Daily trip reduction (*morning peak hour*)	Daily fuel saving (*liters*)	Annual fuel saving for working days (*million liters*)
44	773,748	1,294,325	336.5
14	225,088	376,517	97.9
26	680,185	1,137,813	295.8

According to Noland, Cowart, & Fulton (2006) promoting ride-sharing is the most efficient means of reducing energy consumption, second only to banning driving altogether. Additionally, Jacobson & King (2009) estimated that adding one extra passenger per 100 vehicles could lead to 0.80 to 0.82 billion gallons of gasoline savings per year in the United States. Moreover, their research indicated that if one additional passenger was added to every 10 vehicles, it could result in potential annual fuel savings of 7.54 to 7.74 billion gallons in the U.S. Additionally, ride-sharing could save 33 million gallons of gasoline daily, if each average commuting vehicle carried one additional passenger (Shaheen, Cohen, & Bayen, 2018). Based on literature review findings ride-sharing impacts can be categorized as presented in Table 2.

Table 2: Categorization of ride-sharing's impacts and description of measuring methods

Category of impact	Specific impact	Data collection
Socio-economic	Reduction of travel costs due to shared travel costs	Questionnaires/Surveys combined with statistical analysis, Focus groups before and/or after the pilot, Recruitment and engagement of formal testers, Data recording through carpooling application
	Reduction of commuting stress	
	Awareness raising towards ride-sharing /sustainable mobility	
Environmental	Fuel saving/Reduction of CO_2 emissions	Simulation combined with survey and other data,

Category of impact	Specific impact	Data collection
	Reduction of vehicles on the road	Modelling combined with survey and other data
Transport	Congestion mitigation	Direct air pollution measurements, Simulation combined with survey and other data, Modelling combined with survey and other data
	Decrease of single occupancy car trips	
	Decrease in car mode share/Increase in PT mode share	
	Reduction of parking infrastructure demand	

In conclusion, the measured impacts are the result of a comparison between before/after cases, with the after cases to have in operation a ride-sharing service. To enable such evaluations, impact areas and key performance indicators (KPIs) are formulated to estimate differential effects.

7. METHODOLOGY

The purpose of this research is to integrate findings regarding KPIs and data that were presented in previous deliverables and tasks of the Ride2Rail project with additional data, when required, to assess the impact of the ride-sharing pilots in four EU cities. The steps of the assessment, which are also addressed in subsequent subsections, are depicted in Figure 3 below. The basic components of the impact evaluation process are:

- Demo cities. Four demonstrations deployed in diverse urban and rural context, all addressing cases of commuters and users which are attracted to public and shared transport services through the RIDE2RAIL crowd-based TSP and enhanced Travel Companion (see 7.1).
- KPIs. These refer to the set of KPIs defined for the R2R and for each demo city separately (see 7.2).
- Stakeholders. Demonstrations site are supported by major local stakeholders (see 10.5.3).
- Purpose. Each demo city expresses their specific purposes when implementing the R2R solution (see 10.1).
- Impact areas. Specifically for topic S2R-OC-IP4-01-2019 there are four key impacts: increase the number of passengers using public transport; improve rail connectivity with rural areas; minimise environmental pollution while travelling and propose additional criteria for informed decision making when planning a trip (see 10.3).

Firstly, a short description of the demo activities is provided (detailed description has been included in D4.4), providing the pilot description, which was not identical for all cities. Then, the defined Key Performance Indicators (KPIs) and their description follows; these KPIs are used for all demo cities to assess R2R demonstrations. When pilot-specific KPIs have been defined, these are also mentioned. The data sources and their estimation are outlined for demo KPIs. A pre-evaluation is performed (Task 5.3) to include the following:

- Pre-demonstration Evaluation. Baseline values of KPIs identified in Task 5.1 and assessed in Task 4.1 will allow a baseline appraisal of each demo site describing its current qualitative and quantitative status e.g., level of integration, services on offer, geo-spatial particularities.

- Post-demonstration evaluation. The actual values of KPIs, gathered in Task 4.1 after the demo execution, will be compared to performance targets and KPIs of each site to draw conclusions on the success achieved by the demo in meeting the targets set prior to the demo using a common mixed method such as questionnaires, database interrogation, semi-structured interviews, direct observation, desk-based approaches.

In addition, the above two activities will include the overall travel experience of passengers and driver offering the first/last mile ride. This comprises the usability of the apps but also other aspects such as:

- The attractiveness of the service;

- Possible effective incentives for behavioural change;

- Convenience and comfort;

- Perception of security and safety;
- Level of synchronisation with PT/Rail, the acceptability of the proposed terms and conditions.

This is followed by the quantification of defined KPIs and the estimation of priorities for demo cities when implementing a ride-sharing service. The impact evaluation integrates involved stakeholders, specific purposes, defined KPIs and collected data into meaningful cross-case comparison between demo cities. Weights per impact area are estimated by implementing the AHP method. Varied stakeholder priorities will be clustered around the four key impacts expected for topic S2R-OC-IP4-01-2019, namely:

- Public transport ridership;
- Rail connectivity;
- Environment;
- User satisfaction.

The combination of the aforementioned data will result in an interpretation and discussion regarding the impact of the R2R project and answer research questions regarding long term projections.

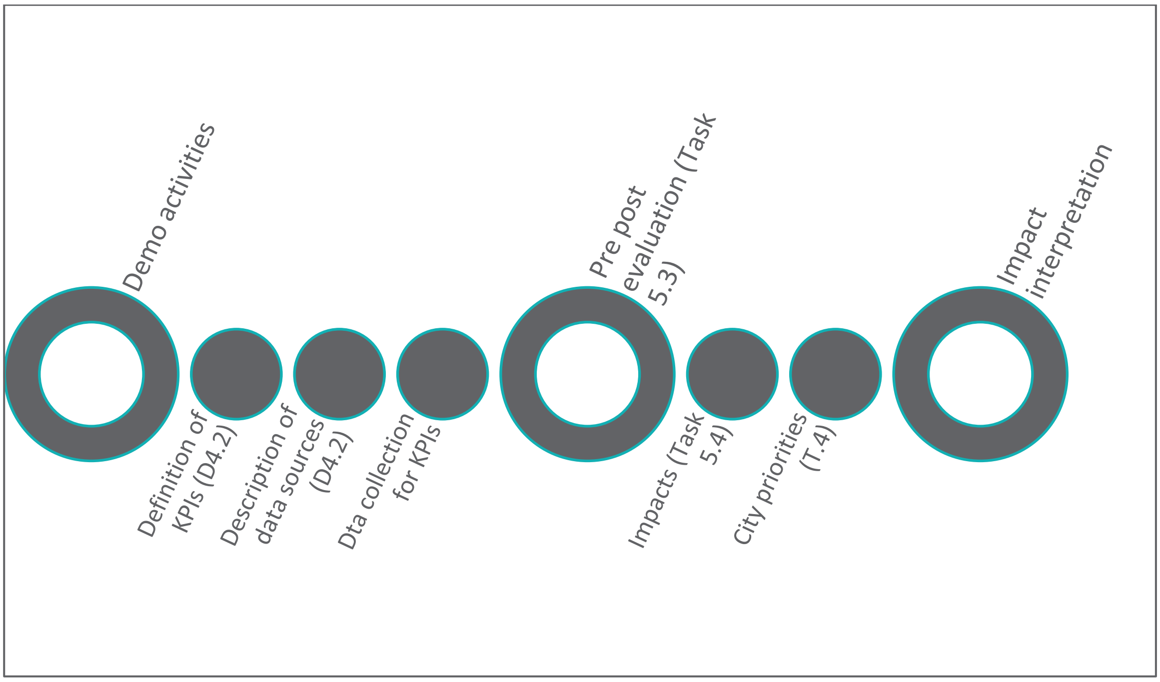

Figure 3. Steps towards impact interpretation

7.1. Demonstration Cities

The four demo sites were selected as ideal locations for testing the Ride2Rail services. These sites consisted of cities, or specific areas within cities, that were suitable for evaluating the project's outcomes. The target audience was commuters, including workers and students, who used various modes of transport in these different contexts. For instance, they would drive their own cars to the nearest train station and then continue their journey by train. The demo sites presented scenarios where Ride2Rail could assist commuters by providing options to share private cars with other commuters to travel together to a train station, or to identify the most efficient travel solution using public transport at the time of the request. The following sub-sections provide a brief description of each demo site, while more detailed descriptions can be found in D4.4.

7.1.1. Athens, Greece

The demo area in Athens consists of the 20-kilometer rail corridor stretching from Athens Airport to Doukissis Plakentias, along Attiki Odos toll road, which included three intermediate stations in Eastern Attica: Pallini, Kantza, and Koropi, all accessible via metro and suburban rail. This area comprises territories of five (5) municipalities with low population densities compared to the core centre of the Athens municipality. The objectives of the demo were to explore and provide feedback on smart multimodal solutions that integrated ride-sharing to increase car occupancy and rail ridership, establish demand-responsive ride-sharing connections with rural parts of Attica, integrate ride-sharing routes with the urban rail network, in combination with a network of peripheral urban rail hubs, and evaluate innovative concepts of multimodality as a test site for the assessment of IT services, taking into account new forms of shared mobility.

The stakeholders participating in the demo are categorized in project partners and external stakeholders. The project partners are:

- Centre for Research and Technology Hellas – Hellenic Institute of Transport (CERTH/HIT)
- ATTIKO METRO AE (AMETRO)[3]

The external partners mobilized through bilateral communications are:

- Municipalities of Koropi, AgiaParaskevi, Penteli, Vrilissia, Pallini, Paiania.

7.1.2.Helsinki, Finland

The Helsinki Demo was conducted in the Vuosaari district, which is the largest district in the city of Helsinki, covering a vast area of 17.1 square kilometres. The district comprises sparsely populated regions and it does not have any train stations. However, it is serviced by two metro stations, namely Rastila and Vuosaari, which catered to approximately 67.5 million passengers in 2017 for the entire Helsinki area. The metro stations are connected to at least

[3] ATTIKO Metro changed its name in ELLINIKO Metro S.A. in 2023.

five regular bus lines. The primary objective of the demo was to enhance access to rail and metro transportation for commuters during the first and last mile of their journeys. The demo focused on addressing the mobility requirements of residents in Helsinki's easternmost neighbourhood, Vuosaari, by providing on-demand services.

In the case of Helsinki, the demo included two parts, which both focus on reducing single-occupant private car trips:

Part 1: Testing the use of an automated shuttle bus in more rural areas, as part of a multi-modal last-mile journey, integrated in relevant travel planning applications. This part of the demo was carried out specifically in East of Helsinki in zone B in Vuosaari where the testing of an automated shuttle bus took place in the autumn 2021. The chosen route was recommended by the traffic planners of the City of Helsinki and was chosen for the demo based on this and while recognizing it to be suitable for the bus.

Part 2: Testing the RIDE2RAIL ridesharing platform, as much as possible integrated with existing mobility platforms (e.g. public transport routeplanner) and not limited to a certain specific zone of the Helsinki area.

7.1.3. Brno, Czech Republic

The Brno Demo Site encompassed the South Moravian region, which comprises several local hubs that daily commuters use to travel to work in the city of Brno. More specifically, the demo focused on commuters traveling from the Znojmo district to the city of Brno. According to statistics from the district, up to 4,000 commuters travel to Brno, with approximately half of them using public transport and the other half using their own cars. The primary objective of the demo was to promote the utilization of RIDE2RAIL services among commuters, such as single car drivers and to enhance car capacity sharing with other travellers. New transport terminals were constructed in easily accessible areas, complete with parking spaces, making it convenient for commuters to switch between private and public transport. The statistics revealed that most of these commuters travel alone in separate cars, making it a specific challenge to encourage them to share the capacity of their vehicles with other travellers.

Three groups of testers have been identified:

- Employees commuting to Brno regularly/several times per week.
- Students commuting to Brno regularly/several times per week.
- Other commuters travelling to Brno for other reasons (e.g., to Brno's hospitals).

7.1.4. Padua, Italy

The demo in Padua took place in a 40km radius surrounding the urban centre of Padua (Italy) involving urban and regional mobility service providers in Veneto and concerning rail, road and bus, and ridesharing as travelling modes. The demo has focused in urban and suburban area of Padua and surrounding areas, taking place from the 17/04/2023 to 21/04/2023 and focused on commuters belonging to the Padua province and travelling to/from the University of Ca' Foscari, with the main objective to encourage carpooling (and ride sharing acceptance) as complementary for public transport, to improve the efficiency of public transportation services, to encourage car drivers who travel alone to share the capacity of their car with other travellers and to reduce GHG emissions and traffic and parking congestions.

The Transport Service Providers (TSPs) involved in the project were BusItalia, which handles road transport, and Trenitalia, which deals with rail transport.

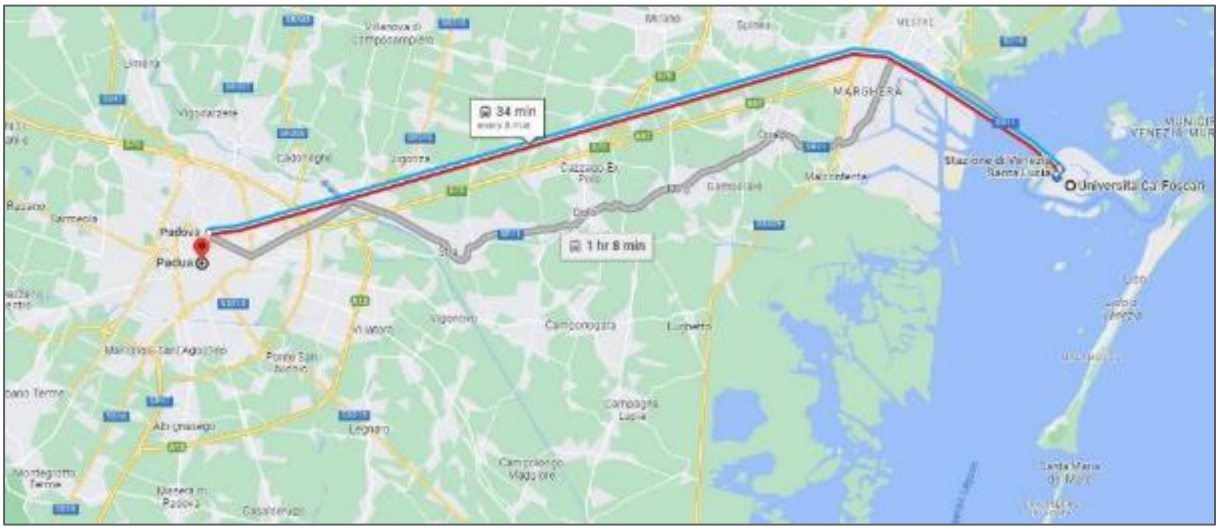

Figure 4: Padua demo site

During the demo, both the Driver and the Travel Companion apps were tested, while the specific functionalities put under the spotlight included Preference & Profile, Trip Planner, Trip Sharing, Navigation, Issuing, Booking, Traveller's Feedback, Guest User, Offering a Ride, View your Journey and Collaborative Space. In order to ensure the largest possible number of testers, a student engagement plan was structured through emails sent by university staff to students' mailboxes, including "Save the date" emails, reminders and an Engagement event on the Padua Demo and the TC and DC apps that took place on 14/04/2023. The goal was to train the Testers so that they could fruitfully tackle the demo. No incentives and/or gifts were provided to Testers so as to encourage participation in the demo. The demo included the testing of demonstration scenario with the support of project partners OLTIS, FIT CONSULTING and CEFRIEL.

7.2.Key Performance Indicators (KPIs)

The KPIs that are used to assess the performance of the ride-sharing demonstration were defined in D4.2. In total, seven KPIs were defined for all sites, as shown in Table 3.

Table 3: RIDE2RAIL KPI definitions

KPI	Definition
KPI#1 Number of RIDE2RAIL app* users	Demo site users who download the app and request at least one trip
KPI#2 Number of completed RIDE2RAIL app trips	A completed trip made by a demo site app user
KPI#3 Number of completed multi-occupancy vehicle trips with R2R app	A completed trip made by a demo site app user that involves either rideshare OR Robobus (Helsinki)
KPI#4 Number of completed trips involving public transit/rail with R2R app	A completed multi-modal trip
KPI#5 Number of completed commuter trips with R2R app	A completed trip that is a regular journey (work or education) conducted 4 (including outward or return) or more times a week
KPI#6 Number of completed rural trips with R2R app	A complete trip where one or both origin and destination is from a rural (or suburban) location
KPI#7 Number of Ride2Rail app downloads	Number of times app has been downloaded by unique users

(*): "R2R app" is the complete set of tools used in R2R: Driver Companion for drivers and enhanced Travel Companion for passengers/travellers.

Table 4 presents the cross-demo targets for each of the KPIs, as specified by demo sites. After discussion with demo sites, initial thresholds have all been set at 50% of target values.

Table 4: Cross-demo KPIs targets

KPI	Athens	Brno	Helsinki	Padua
KPI#1 Number of RIDE2RAIL app users	50	100	50	50
KPI#2 Number of completed RIDE2RAIL app trips	500	2,000	400	4,500
KPI#3 Number of completed multi- occupancy vehicle trips with R2R app	10	400	200	315
KPI#4 Number of completed trips involving public transit/rail with R2R app	2	50	200	4,050
KPI#5 Number of completed commuter trips with R2R app	187	20	240	3,150
KPI#6 Number of completed rural trips with R2R app	500	2,000	0	3,150

This leads to the following table which includes the KPIs for the whole project (Table 5):

Table 5: Whole project KPI targets

KPIs	Target
KPI#1 Number of RIDE2RAIL app users	250
KPI#2 Number of completed RIDE2RAIL app trips	7,400
KPI#3 Number of completed multi-occupancy vehicle trips with R2R app	925
KPI#4 Number of completed trips involving public transit/rail with R2R app	4,302
KPI#5 Number of completed commuter trips with R2R app	4,497
KPI#6 Number of completed rural trips with R2R app	5,650
KPI#7 Number of R2R app / service downloads	500

For Athens, targets for KPI #2, #5 and #6 represent 25 % (i.e., 90 days - the demo duration) of anticipated annual 2,000 projected trips with R2R, (all trips are rural or peri-urban) and trips with commuters (500).

In addition to general KPIs, demo-specific ones were identified for Athens (Table 6), Brno (Table 7) and Helsinki (Table 8). Padua did not include any local KPIs. Demo leaders were responsible for the data collection, which was necessary for the KPIs evaluation.

Table 6: Athens local KPIs

KPIs	Target
KPI#A1 Number of parking spaces at urban gate D. Plakentias	10
KPI#A2 Number of parking spaces at extra-urban Koropi station	5

Table 7: Brno local KPIs

KPIs	Target
KPI#B1 Reduction of need for parking spaces	10
KPI#B2 Number of surveyed users attracted to R2R app	30

Brno also proposed a target relating to CO_2 (a reduction of 3,400Kg CO_2).

Table 8: Helsinki local KPIs

KPI	Target
KPI#H1 Number of walk-in trips with the Robobus	200

Brno targeted users to include a public transit element to their journey, while additionally encouraging users to engage in ride share.

Due to geography, Helsinki did not anticipate any rural trips.

7.3.Data Collection

Data collection for each KPI was described in D4.2 and D5.1. Wherever possible, all data was collected through the app. All KPIs have focused on the operational aspects of RIDE2RAIL. This reflected both the nature of KPIs expressed in D4.1 by demo sites and the needs of the impact analysis. The KPI approach was streamlined as follows:

- KPIs 1-6 will be recorded through the survey.
- Where data may be available in the Ride2Rail ecosystem (e.g., count of users that have requested at least one trip [KPI#1]) this will be used to give additional validation of the recorded KPIs.

Table 9: KPI definition

KPIs	Definition
KPI#1 Number of RIDE2RAIL app users	Users who reside in and around demo site area who have downloaded or registered to service using R2R
KPI#2 Number of completed RIDE2RAIL app trips	Journey request for trip where geospatial data confirms arrival at destination; Captured in microsurvey - user indicates completed trip
KPI#3 Number of completed multi- occupancy vehicle trips with R2R app	Trip that has involved driver / passenger matching, and confirmed with arrival at destination through geospatial data
KPI#4 Number of completed trips involving public transit/rail with R2R app	Trip with origin or destination at PT hub; Captured in microsurvey - user indicates multi- modal trip
KPI#5 Number of completed commuter trips with R2R app	Analysis at end of demo period identifies repeat trips for a user profile; Captured in daily diary - identify commuter trips
KPI#6 Number of completed rural trips with R2R app	Origin or destination for trip is in area designated rural or peri-urban by demo site
KPI#7 Number of R2R app / service downloads	Registration to R2R app / service or to service that encompasses R2R functionality

- User experience KPIs is assessed by a set of metrics to measure usability performance and is described in section 7.3.
- Wherever possible, all data is collected through the app (see 8.3).
- Where 2 or more people share a vehicle, each of these is counted as a multiple occupancy vehicle trip (i.e., when a driver gives a passenger a lift, both will be counted as executing a multi-occupancy vehicle trip).

Trips can be attributed to a multiple category. In theory, a commuter journey that includes a rideshare, and public transit, would be included for all trip categories.

User data were collected after the execution of demos by deploying a questionnaire. These were translated to local languages and sent by email to demo participants. A copy of the survey is presented in the Annex.

7.3.1. Preparing for data collection

T4.2 involved a collaborative activity to capture and harmonise common KPIs that were based upon the aims of Ride2Rail, and were relevant to all demonstration sites. This led to seven KPIs as documented in D4.2.

T5.1 and 5.2 developed a robust methodology for the collection of this KPI data, and supporting data to capture user experience and usability. Furthermore, it was a requirement to capture basic demographic data such as age, gender and employment status. Finally, a decision was made to also capture the reason users wished to travel with Ride2Rail.

Therefore, a major part of the work was to take the KPI and user experience requirements and deliver a survey tool. While D5.1 and D5.2 outlined that survey tool, significant work was required in T5.3 to understand the practical implementation of the KPI methodology, while ensuring ease of implementation and consistency across demo sites. Several issues and modifications came to light during the preparation phase.

1. While trips requested could be captured from the data ecosystem of Ride2Rail, this data were limited in a number of ways. First, it was not possible to differentiate between a searched request, and one that was actually confirmed by the user (or users in the case of shared trips involving the driver companion). Second, it was not possible to confirm whether the trip had actually been taken or not. Primarily these issues where down to the technical challenge of capturing data that came out of the TSP aspect of the Shift2Rail travel companion. Therefore, the survey took on a significant role in determining actual trips that had been taken with Ride2Rail.
2. Linked to the above issues, it was not always possible to determine what type of trip had been taken. While it was theoretically possible to find Origin and Destination from the Ride2Rail ecosystem, again it was not always possible to assess whether a trip had actually been taken or not. Therefore, whether the trip was rural or suburban was captured via survey.

3. Three of the demo sites required specific confirmation that participants had completed the survey in order to assess whether they had completed their involvement in the demo and were therefore eligible for an incentive. While it was not possible to record a specific individual code for each participant, due to GDPR, a general code was set up for each site so that participants could email the demo organiser and receive an incentive.
4. An ethics and GDPR statement, along with a general introduction to the purpose of the survey, was prepared for the first page of the survey.
5. Multiple paths were required through the survey to accommodate
    a. Users who only used the Driver Companion
    b. Users who only used the Travel Companion
    c. Users who used both Driver and Travel Companion
6. A participant survey invitation email was required for each demo site.
7. As demos progressed it became apparent that it would be useful to capture data on how participants were currently travelling. Therefore, an additional question was added to capture how participants travelled before using Ride2Rail.

7.3.2. Implementation for each demo site

In the run up to each demonstration, the following steps were performed.

1. Demo partners confirmed whether they would need a translated version of data collection tools – this was the case for all demos except Helsinki
2. Where translation was required, demo site leaders were sent a spreadsheet with survey text, and participant email text. Demo site leaders returned completed translations.
3. Demo site partners set up a "general" contact email for inclusion on the ethics page, and should participants need to respond in order to receive an incentive.
4. A localised version of the survey was implemented, and sent to demo leaders along with the participant email, for confirmation
5. Participant email was sent by demo leaders to demo participants via the above "general" email
6. Participant response numbers were monitored by the survey administrator (UNew) and communicated to the demo leaders.
7. The survey remained open until several days after the demonstration period. When response numbers were no longer increasing, or demo leaders confirmed the number of survey responses matched the number of participants, the survey was closed.

7.3.3. Data analysis

When the demo concluded a number of steps were implemented to capture initial data. Then towards the end of the whole demo period UNew and FIT engaged in a process of data harmonisation to ensure accurate KPI data and best use of data emerging from the Ride2Rail ecosystem. Steps were as follows:

1. Data was extracted from the survey tool, and cleansed so that data specific to KPIs could be identified.

2. Survey data were merged from those who had used travel companion, driver companion or both.
3. System Usability Scale data was coded and calculated as a percentage score.
4. Demographic details were summarised.
5. A summary analysis was sent to demo leaders, along with text for free form questions (eg usability comments – where necessary, these were translated by demo sites)

Once all data for all demo sites had been collected, data from the survey and the ecosystem were cross checked and harmonised. Table 10 shows the final confirmed source of data for each KPIs.

Table 10: Final sources of data for KPIs

KPI	Description	Source
KPI#1 Number of RIDE2RAIL app users	Demo site users who download the app and request at least one trip	Ecosystem / Survey
KPI#2 Number of completed RIDE2RAIL app trips	A completed trip made by a demo site R2R user	Survey
NonKPI data – trips requested	Number of trips requested during the demo period – may not have been converted to actual journeys	Ecosystem
KPI#3 Number of completed multi-occupancy vehicle trips with R2R app	A completed trip made by a demo site app user that involves rideshare	Survey
KPI#4 Number of completed trips involving public transit/rail with R2R app	A completed multi-modal trip	Survey
KPI#5 Number of completed commuter trips with R2R app	A completed trip that is a regular journey (work or education) conducted 4 (including outward or return) or more times a week	Survey
KPI#6 Number of completed rural trips with R2R app	A complete trip where one or both origin and destination is from a rural (or suburban) location	Survey
KPI#7 Number of Ride2Rail app downloads	Number of times app has been downloaded by unique users. KPI 7 is (theoretically) non-dependent on any particular demo site. It was measured thanks to a specific functionality offered by the download site.	Ecosystem

8. PRE-POST CITY DEMONSTRATION EVALUATION

To understand the performance and success of RIDE2RAIL project, Task 5.1 set the Key Performance Indicators of referral and Task 4.1 appraised baseline values and measured, for each demo site. Together with quantitative indicators, qualitative criteria have been chosen to evaluate the usability of offered services.

KPIs belong to two sets: the first set regards general KPIs, those that are valid for all demo sites; the second set includes KPIs specific for each demo site.

Since the generic KPIs are related exclusively to the services offered by the R2R project, a term of comparison with any pre-existing or contingent situations is missing and consequently it is not possible to establish a baseline value. More specifically:

Table 11: KPIs baseline valuation

KPI	Baseline valuation
KPI#1 Number of RIDE2RAIL app users	As this KPI measures demo site users who download the app and request at least one trip it does not exist a referral with a similar app or service…
KPI#2 Number of completed RIDE2RAIL app trips	This KPI counts completed trip made by a demo site app user, this measure is specific to the project. No terms of comparison.
KPI#3 Number of completed multi-occupancy vehicle trips with R2R app	Completed trips made by a demo site app user that involves either rideshare OR Robobus (Helsinki), no terms of comparison here too.
KPI#4 Number of completed trips involving public transit/rail with R2R app	Number of completed multi-modal trip with R2R app, no terms of comparison too.
KPI#5 Number of completed commuter trips with R2R app	Number of completed trips of “commuter” kind, no terms of comparison with same kind of trips with another app.
KPI#6 Number of completed rural trips with R2R app	Number of complete trip where one or both origin and destination is from a rural (or suburban) location, no terms of comparison with completed trips with another app.
KPI#7 Number of Ride2Rail app downloads	Number of times app has been downloaded by unique users, specifically bound to the project.

Similarly, the demo-specific KPIs baseline are as follows:

Table 12: Athens local KPIs baseline valuation

KPI	Baseline valuation
KPI#A1 Number of parking spaces at urban gate D. Plakentias	To reserve specific parking spaces for this kind of activities is a news brought by Ride2Rail, no terms of comparison with previous experiences
KPI#A2 Number of parking spaces at extra-urban Koropi station	To reserve specific parking spaces for this kind of activities is a news brought by Ride2Rail, no terms of comparison with previous experiences

Table 13: Brno local KPIs baseline valuation

KPI	Baseline valuation
KPI#B1 Reduction of need for parking spaces	No terms of comparison with similar experiences
KPI#B2 Number of surveyed users attracted to R2R app	KPI specifically linked to the project, no terms of comparison

Table 14: Helsinki local KPIs baseline valuation

KPI	Baseline valuation
KPI#H1 Number of walk-in trips with the Robobus	First time ever

The Padua demo site did not have local KPIs.

For the sake of simplicity, we assumed that baseline values equal zero.

8.1.1. Rural trips definition

Counting rural trips makes it necessary to define a boundary between the urban area and the rural area for each demo site. For the definition of the border, the demo leaders were interviewed, as people informed about the situation, and the geographical points to refer to were then established (geo-fencing) except for the case of Brno where a different kind of criteria was adopted.

The definition of the urban perimeter through geographical coordinates has made it possible to calculate the number of rural journeys intended as journeys having origin or destination outside this perimeter.

Athens Rural Area
For Athens, it was decided that the best definition of urban area, from transportation point of view, was that of covering exactly the administrative area of the Province of Athens (Figure 5).

Figure 5: Athens urban area

Helsinki rural area

Helsinki rural area has been defined in accordance to the HSL (Helsinki Region Transport) area of operation for which the zones A, B and to some extent also C presents urban areas and D rural area. So a rough breakdown was:

- A/B: Urban
- C: Urban/Suburban/Rural
- D: Suburban/Rural

The defined perimeter is shown in Figure 6.

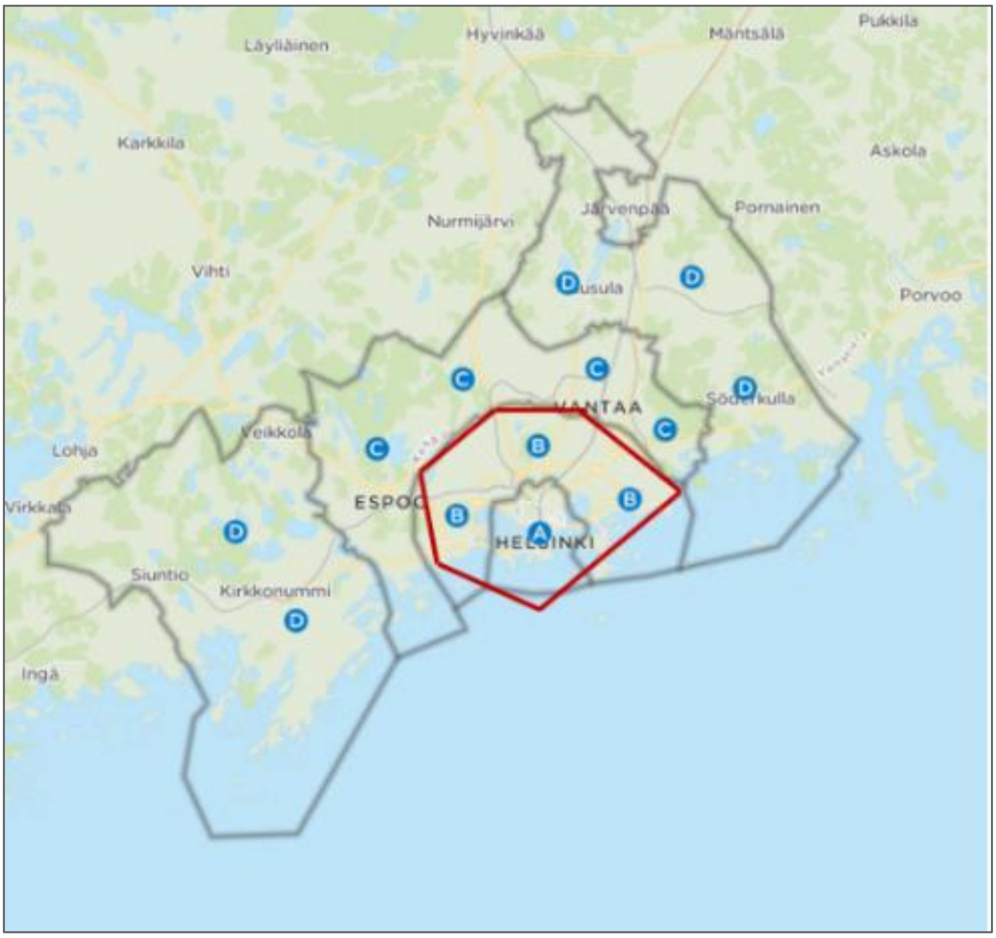

Figure 6: Helsinki urban area

Brno rural area

As aforementioned, for Brno demo site a different set of criteria for defining rural trips was used. Following the indication of the demo leader staff, all trips using a bus or a train were considered rural trips, those using just trams are instead urban trips.

Padua rural area

The urban area of Padua was easily defined thanks to its regular urban boundary as shown in Figure 7.

Figure 7: Padua urban area

9. POST CITY DEMONSTRATION EVALUATION

9.1. Target Values and Data Sources

The post demonstration evaluation bases its results on comparing performance targets and KPI values gathered in each demo city. Deliverable 4.2 "Monitoring indicators and targets" set values to reach for KPIs and it was the result of a process shared among Demo Leaders.

Table 15 gives the cross-demo targets for each of the KPIs, as specified by demo sites:

Table 15: Cross-demo KPIs

KPI	Athens	Brno	Helsinki	Padua
KPI#1 Number of RIDE2RAIL app users	50	100	50	50
KPI#2 Number of completed RIDE2RAIL app trips	500	2,000	400	4,500
KPI#3 Number of completed multi-occupancy vehicle trips with R2R app	10	400	200	315
KPI#4 Number of completed trips involving public transit/rail with R2R app	2	50	200	4,050
KPI#5 Number of completed commuter trips with R2R app	187	20	240	4,050
KPI#6 Number of completed rural trips with R2R app	500	2,000	0	3,150
KPI#7 Number of R2R App downloads	125	125	125	125

Regarding KPI#7, a single whole project target was set as the total number of users across the demo site plus an estimate of additional downloads through project dissemination. The app could be downloaded by one platform, namely the Bitly.com. This alternative solution permitted to count the downloads but at the price to make more difficult for the users the installation of the apps.

After this consideration, the total project KPIs are:

Table 16: Whole project KPI targets

KPIs	Target
KPI#1 Number of RIDE2RAIL app users	250
KPI#2 Number of completed RIDE2RAIL app trips	7,400
KPI#3 Number of completed multi-occupancy vehicle trips with R2R app	925
KPI#4 Number of completed trips involving public transit/rail with R2R app	4,302
KPI#5 Number of completed commuter trips with R2R app	4,497
KPI#6 Number of completed rural trips with R2R app	5,650
KPI#7 Number of R2R App downloads	500

Usability of apps and services was a field of investigation, too. To address this aspect, the approach was to deliver the System Usability Scale (SUS), adapted to Ride2Rail along with two open questions on perceptions of usability, and a best-worst scaling to confirm user preferences for trip criteria. These questions were delivered as a sub-section of the KPI survey that was submitted. The method for estimating SUS is described in detail in D5.2.

9.2. Results

With methods forementioned, the following results were drawn. About the general KPIs:

Table 17: General KPI values

KPI	Athens		Brno		Helsinki		Padua	
	Targ.	Res.	Targ.	Res.	Targ.	Res.	Targ.	Res.
KPI#1 Number of RIDE2RAIL app users	50	17	100	60	50	17	50	9
KPI#2 Number of completed RIDE2RAIL app trips	500	26	2000	1852	400	99	4500	387
KPI#3 Number of completed multi-occupancy vehicle trips with R2R app	10	15	400	87	200	68	315	9
KPI#4 Number of completed trips involving public transit/rail with R2R app	2	30	50	766	200	58	4050	10
KPI#5 Number of completed commuter trips with R2R app	187	39	20	1852	240	58	4050	10
KPI#6 Number of completed rural trips with R2R app	500	13	2000	1665	0	7	3150	10
KPI#7 Number of R2R App downloads (driver/traveler)	NA	12/27	NA	16/44	NA	7/22	NA	2/77

For the following totals:

Table 18: KPI Totals

KPI	Target	Result	Difference	Diff. %
KPI#1 Number of RIDE2RAIL app users (survey completed / ecosystem users)	250	101	-149	-60%
KPI#2 Number of completed RIDE2RAIL app trips	7,400	2,364	-5,036	-68%
KPI#3 Number of completed multi-occupancy vehicle trips with R2R app	925	181	-744	-80%
KPI#4 Number of completed trips involving public transit/rail with R2R app	4,302	864	-3,438	-80%
KPI#5 Number of completed commuter trips with R2R app	4,497	1,959	-2,538	-56%
KPI#6 Number of completed rural / suburban trips with R2R app	5,650	1,695	-3,955	-70%
KPI#7 Number of Ride2Rail app downloads (driver/traveller)	500	207	-293	-59%

Reasons for target missing in some occasions have been well delighted in the Demo Execution Report (D4.4). Additionally, targets were based on expectations of DoA that was signed prior to COVID-19 pandemic. When demos run, after lockdown periods, there was a different perception about mobility sharing schemes and the use of public transport. So, a combination of causes occurred and undoubtedly, they resulted to difficulties that affected the final outcome.

Regarding local KPIs, following values were collected:

Table 19: Local KPI values

KPI	Target	Result	Difference	Diff. %
KPI#A1 Number of parking spaces at urban gate D. Plakentias	10	10	0	0%
KPI#A2 Number of parking spaces at extra-urban Koropi station	5	5	0	0%
KPI#B1 Reduction of need for parking spaces	10	28	18	180%
KPI#B2 Number of surveyed users attracted to R2R app	30	60	0	100%
KPI#H1 Number of walk-in trips with the Robobus	200	1,112	912	456%

About usability, scores were computed on the base of surveys. The Driver Companion scored 58% and the travel companion scored 57%, both of which indicate good usability for a demonstration application (consider that the threeshold in this case is 50%). To note that usability feelings improved with each demo site deployment, suggesting iterative improvements in usability and functionality as the service was refined in response to user feedback.

Table 20: Usability

Demo Site	Travel Companion	Driver Companion
Athens	64%	58%
Helsinki	44%	37%
Brno	55%	59%
Padua	74%	85%
Overall	*59.25%*	*59.75%*

Lastly, the choice criteria preferred by users when they have to decide how to move was investigated. Through the survey, users were then asked to express their preference on 11 criteria using a value between 1=best and 11=worst. Following table presents overall ranking scores. Notably, these ranks are very similar to data collected in each demo site, so we didn't note particular variations by area or season.

Table 21: Offer criteria data

	Quick	*Reliable*	*Cheap*	*Comfortable*	*Environ-mental friendly*	*Door-to-door*	*Short*	*Healthy*	*Multi-tasking*	*Social*	*Pano-ramic*
Score	*2.4*	*2.6*	*3*	*3.6*	*4*	*4.1*	*4.1*	*6.5*	*7.1*	*7.4*	*8*

10. IMPACT EVALUATION AND INTERPRETATION

10.1. Objective and Scope

The impact of transport is multidimensional; it consumes energy, generates noise, pollutes the air, land, and water, and consumes materials as well as land. It consumes non-renewable energy sources like oil for manufacture, operations and maintenance, consumes large amounts of materials for infrastructure construction and vehicle manufacture; some of these processes are very energy intensive (e.g., production of cement.)

The problems that involve multiple criteria and alternatives (such as the ones associated with sustainable transportation) are defined as Multi-Criteria Decision-Making (MCDM) problems. In a MCDM problem, weights (w_1, w_2,..., w_n) are assigned to criteria to account for their relative importance. Weights can be assigned directly by the decision maker or can be determined by a methodology, such as cluster or factor analysis.

Several methodologies exist and have been adopted in the transport sector for assessing projects and plans. Selective MCDM techniques include:

- Bayesian decision making
- Entropy technique
- Expected value method
- Goals achievement method
- Utility function-based methods: Multi attribute utility theory (MAUT), Simple Multi Attribute Rated Technique (SMART), Analytical hierarchy process (AHP), Weighted Sum model (WSM), Weighted Product model (WPM)
- Outranking methods (ELECTRE, PROMETHEE I and II, REGIME analysis)

The most widely used methodologies are the AHP, the MAUT and the outranking method. Polatidis et al. (2006) recommend MCDM methods to be applied in renewable energy planning (sustainable development,) to avoid ending up an assessment of alternatives with an infeasible alternative.

The adoption of the AHP is based on the consideration that multiple stakeholders need to be involved to reach a decision which most likely will result to practical conflicts. To overcome this, the R2R engaged with stakeholders to reach a compromised and balanced solution meeting the needs of all parties. The steps that are followed in this section, include:

1. Quantification of KPIs (quantified data);
2. User survey after the demo completion (qualitative data);
3. Estimation of stakeholder priorities (weights);
4. Impact interpretation.

The total length of demo period was anticipated to reach 90 days; however, demo sites may utilise these 90 days in different ways. For example, Brno may have a subset of time (e.g., 2 weeks) with a concerted drive to meet demo targets. It should be, however, noted that the total demo duration of 90 days includes the preparation, planning, implementation, engagement process, training/internal testing, execution and evaluation phases.

10.1.1. Additional data requirements

As mentioned above, the principal data sources were identified in D4.2. Additional data sources are used to complete the impact assessment.

Data sources per demo city are also used to complete the assessment, as described below.

- Athens conducted a stated preference (SP). The SP survey was addressed to specific categories of trip makers and more specifically to those who commute from the eastern areas of Attica Region to Athens and vice versa using either the Metro and/or the Suburban rail system in the Attica Region. The main aim of the survey is to determine the willingness of these trip makers to use for their first/last mile of their trip a ridesharing/carpooling alternative either as drivers or as riders.

For all demo cities, stakeholder surveys were conducted to collect the necessary data to apply the AHP method and estimate priorities per demo city when implementing a ride-sharing service. Section 10.5 describes the full details on the data collection exercise, including method, participants, and results.

10.2. Demo Participants Survey

The results of the survey that was completed by the users upon completion of the demo, are summarized in Table 22.

Table 22: Characteristics of baseline service providers' data

	Value/Status	Total	Athens	Helsinki	Brno
Age	16-21	12	1	2	9
	22-35	27	2	5	20
	36-51	35	11	9	15
	52-65	11	3	1	7
	65+	9	-	-	9
Occupation	In work	53	15	15	36
	Student	20	2	1	13
	Unemployed	19	-	1	10
	Retired	2	-	-	1
Gender	Male	53	9	8	36
	Female	35	7	5	23
	Prefer not to say	6	1	4	1

According to Figure 22, in total 94 participants took part in the survey after the completion of the demonstrations in the cities. The majority of them (37.2%) belong to the age category 36-51. City-specific data showed the same from the city of Athens and Helsinki with 64.7% and 52.9% respectively. Only Brno differed among them, for which the majority of participants belong to the age category of 22-35. Regarding participants' occupation, the majority (56.4%) in total and per city belong to the workforce. In detail, 88.2% of the participants from Athens are working citizens. The same share applies to Helsinki's participants. Regarding the gender of the total participants, 56.4% were male. Males were also the majority of the participants in each city; 60% for Brno, 52.9% for Athens and 47% for Helsinki.

10.3. Impact Areas

The IP4 proposes the following KPIs to measure the influence of the IP4 TDs (Shift2Rail, Official website of the European Union, 2019):

- Increase the multimodal usage and the total number of passengers;
- Increase the usage of cross-border train services;
- Quality of services; facilitate the travel planning for users and reduce the time spent in planning travel; less time spent searching and booking tickets, less time and better user experience in waiting for the transport mode and rearranging the journey;
- Costs: increase the overall occupancy rate with limitation of peak and off-peak periods. Below are some first proposals to quantify these KPIs (to be refined and validated with the CCA activities in charge of the KPIs for S2R);
- Shopping: in case of multimodal journey, IP4 will reduce the look to book ratio by 60%, and increase the conversion rate by 200%;
- The number of international rail ticket sales is increased by 30%;
- The time to find an end-to-end journey;
- Abandonment by users, in the overall shopping effort for multimodal travels;
- Traveller satisfaction increased;
- Optimisation of the occupancy rate.

Specifically for topic S2R-OC-IP4-01-2019 there are four key impacts:

- Increase the number of passengers using public transport;
- Improve rail connectivity with rural areas;
- Minimise environmental pollution while travelling;
- Propose additional criteria for informed decision making when planning a trip.

Increase the number of passengers using public transport: As it is mentioned in the Shift2Rail's Multi-Annual Action Plan, the Key Performance Indicators (KPIs) for IP4 are dissimilar to those used in other IPs (capacity, reliability, LCC). The increase of passengers, resulting from IP4 activities improving the attractiveness of the rail sector, is a pre-requisite to the other IPs - we will only need additional capacity if we are able to attract more passengers. The Shift2Rail initiative seeks to increase the capacity for a given infrastructure, by increasing the number of trains (control command), while increasing the number of seats per train (rolling stock) and reducing the life cycle cost (of the rolling stock and infrastructure) all constitute major steps. It is also essential however to increase the number of passengers (occupied seats) by providing them with better reliability and quality of service - including one-stop shopping and seamless travel, and with better integration of the rail into the overall mobility ecosystem (Shift2Rail, Official website of the European Union, 2019).

Improve rail connectivity with rural areas: The target is to transform, the European citizen's global travel interactions into a fully integrated and customised experience, rendering the entire European transportation system a natural extension of citizens work and leisure environments, across all transport modes, local and long-distance (Shift2Rail, Official website of the European Union, 2015).

The influence in the environment is added as a core impact area in the list and the **user satisfaction** is also added to complete it. User satisfaction is related to traveller satisfaction and quality of services in the list above. User satisfaction is one of the core impacts in planning of public transport systems (European Institute of Innovation & Technology, 2023).

In order to estimate priorities for these impact areas when implementing a ride-sharing to rail service the AHP method is used. The participants should be from demo participants across the four demo sites. The method had to be practical, easily understood by participants, and the procedure needed to be completed within five minutes.

Therefore, the four key impacts areas, their abbreviations and the respective goals that will be used in next sections are:

- **Public transport ridership** (RS in red colour) - Increase the number of passengers using public transport;
- **Rail connectivity** (RC in blue colour) - Improve rail connectivity with rural areas;
- **Environment** (EN in green colour) - Minimise environmental pollution while travelling;
- **User satisfaction** (US in grey colour) - Improve user satisfaction.

10.4. KPIs Results

The reviewed literature in Chapter 6 records indications of the expected positive and/or negative of ride-sharing/carpooling across different impact areas (i.e., environment, economy, transport performance, etc.).

A qualitative assessment of identified KPIs in terms of used impact areas is shown in Table 23.

Table 23. KPIs and impact areas

	KPI	Definition
KPI#1	Number of RIDE2RAIL app users	Refers to the number of R2R demo site users who download the app and request at least one trip. It is assumed that the number of downloads increases as the user satisfaction increases.
KPI#2	KPI#2 Number of completed RIDE2RAIL app trips	Refers to the number of completed trips made by a demo site app. Given a well-designed application for ride-sharing the number of users is expected to increase which will be the outcome of satisfied users. R2R has specifically addressed this by developing an app that addresses users' preferences and providing the opportunity to customize trip conditions.
KPI#3	KPI#3 Number of completed multi-occupancy vehicle trips with R2R app	Refers to the number of completed trip made by a demo site app that involves either rideshare OR Robobus (Helsinki). Given a well-designed ride-sharing service the number of users is expected to increase which will be the outcome of satisfied users. In this way more multi-occupancy trips will be planned and completed.
KPI#4	KPI#4 Number of completed trips involving public transit/rail with R2R app	Refers to the number of completed multi-modal trips. Particularly, the R2R project aims to connect ride-sharing to rail and demo sites have focused on first/last mile trips to public transport. R2R through the personalized services is expected to contribute significantly to the number of passengers using public transport.
KPI#5	KPI#5 Number of completed commuter trips with R2R app	Refers to the number of completed trip that is a regular journey (work or education) conducted 4 (including outward or return) or more times a week. The R2R app gives the opportunity to plan shared trips in advance, so commuters that travel regularly, may pre plan their trips. Therefore, commuters will be able to plan trips with other commuters, and set up a travel schedule, thus, to contribute significantly to the number of passengers using public transport.
KPI#6	KPI#6 Number of completed rural trips with R2R app	Refers to the number of complete trips where one or both origin and destination is from a rural (or suburban) location. The R2R provided a driver and passenger app, to plan ride-sharing trips. It is expected in rural areas, where people use more

		often their private vehicles to be able to increase availability of shared vehicles (increase supply through the DC app) and increase rail connectivity with rural areas.
KPI#7	Number of Ride2Rail app downloads	Refers to the number of number of times app has been downloaded by unique users. Especially R2R, throughout is personalization app, which built in research on users' motives, constraints and reasons for ride-sharing, is expected to contribute significantly satisfied users
KPI#8	Usability rate	Refers to user satisfaction and is estimated based on survey results as indicated in section 9.1. The usability rate (KPI#8) is used among all demo cities.

Data was collected in the framework of Task 5.3 and is presented in the present document in order to contribute to and complete the impact assessment. Quantified KPIs per demo city are similar for KPI#1-7; additional ones complete each demo city.

KPI absolute values are provided for the demo period of each city and compared against the target that was set in D4.2. Therefore, target-actual values and percentage change are given to allow a before-after comparison and an interpretation of the KPI values given local conditions.

KPI 7 is (theoretically) non-dependent on any particular demo site, thus it is only considered aggregated for all cities.

It should also be noted that the travel restrictions imposed in EU countries, including the demo cities, resulted in significant lower level of travel demand across Europe. When demos run, after lockdown periods, there was a different perception about mobility sharing schemes and the use of public transport, combined with new mobility paths, increased teleworking/work from home, shifting of mobility peaks. So, a combination of causes occurred and undoubtedly, they resulted to difficulties that affected the final outcome. This fact contributed further to negative percentage change in terms of commuters.

10.4.1. Athens

Except aforementioned KPIs, demo specific KPIs are also assessed. Additionally, Athens assessed:

- The reduction in CO_2 emissions which refers to reduction in trips made by solo drivers, thus a reduction in vehicle kilometres travelled. A share of solo drivers is expected to leave their cars and join other solo drivers, thus create trips with 2 or more passengers. If ride-sharing results in multi-occupancy trips, this could result in a reduction of emissions. As it was indicated in D2.5 Recommendations and criteria for a successful ride-sharing in the IP4 ecosystem (Kortsari & Mitropoulos, 2020) environment and thus sustainability of the way respondents travel ranks high, as 48% of respondents would use ride-sharing and public transport services as a sustainable way to travel to reduce impact on the environment.

Table 24 summarises the quantified KPIs, i.e., either positive, negative impacts, the impact area they are classified within (colour indexed cells), and the target/actual values for Athens.

Table 24: Athens quantified KPIs

	KPIs		(+)/(-)	Target	Actual
KPI#1	Number of Ride2Rail app users	US	+	50	17
KPI#2	Number of completed Ride2Rail app trips	US	+	500	26
KPI#3	Number of completed multi-occupancy vehicle trips with R2R app	US	+	10	15
KPI#4	Number of completed trips involving public transit/rail with R2R app	RS	+	2	30
KPI#5	Number of completed commuter trips with R2R app	RS	+	187	39
KPI#6	Number of completed rural trips with R2R app	RC	+	500	13
KPI#7	Number of Ride2Rail app downloads*	US	+	125	39
KPI#8	Usability rate	US	+	50%	64% TC 58% DC
KPI#9	CO_2 reduction	EN	-	10%	18%

*Includes both drivers and passengers.

Table 25: Athens local KPIs

KPIs	Target
KPI#A1 Number of parking spaces at urban gate D. Plakentias	10
KPI#A2 Number of parking spaces at extra-urban Koropi station	5

The actual KPI values correspond to the Athens demo which lasted 1 week.

IA1: Increase the number of passengers using public transport
KPI#4, 5

- KPI 4 was calculated by recording through the after-demo survey the total completed trips involving public transit/rail with R2R app trips and comparing them to the set target.
- KPI 5 was calculated by recording through the after-demo survey the completed commuter trips with R2R app.

The KPI#4 change (+1400%) demonstrates the great potential of ride-sharing to be used as a first/last mile mode to public transport and increase PT ridership. It should be also reminded, that the Athens demo took place in a rural/interurban area, from which travellers are willing to travel to the closest sub-urban rail station to reach central areas of Athens (and vice versa). Consequently, this will result in less environmental impact. In parallel, KPI#5 (Number of completed commuter trips with R2R app) recorded a negative difference (-79%) of compared to the target that was set prior to demos.

IA2: Improve rail connectivity with rural areas
KPI#6

- The second impact area focuses on improving rail connectivity in rural areas. The KPI 6 was calculated by recording through the after-demo survey the number of completed rural trips with R2R app.

The KPI corresponds to -97% difference related to the set target. Similarly, to KPI#5, citizens of rural areas in Athens that are willing to use PT are people that would use PT to commute to their work. Consequently, since commuting trips were significantly reduced due to COVID restrictions, rural trips that would use ride-share with public transport affected negatively.

IA3: Minimise environmental pollution while travelling
KPI#9

- KPI 9 supports the impact area of environment, and it is estimated by using the travel behaviour data of users and the survey responses. Several assumptions are also made regarding the vehicle occupancy, fuel type and emission types. The impact that is estimated here refers to the reduction of CO_2 emissions by considering the demo users, thus at demo level, and it is not an extrapolation to the wider area of Athens.

In more detail the steps for calculating road transport emissions are:

The average trip distance by passenger car in Athens is estimated to be 11.3 km. The average emissions per passenger car for petrol vehicles is 122.4 grams/km. It is estimated that 100% of passenger cars in Athens for the demo are petrol cars (European Environment Agency, 2020).

Based on demo survey results 7 and 11 trips were completed by ride-sharing participants as drivers and passengers, respectively. Based on Athens demo data it is estimated an overall ride-sharing occupancy of 2.33 passengers per vehicle and 1.29 trips per person.

The percentage change of CO_2 emissions is expected to change based on assumptions. The basic assumption of CO_2 calculations is the modal share of travellers prior joining a ride-sharing service. It is assumed that the number of trips before and after joining ride-sharing remain the same.

Case A: It is assumed that all trips for travellers prior to joining ride-sharing were solo driving trips. After joining the ride-sharing demo, it is assumed that only those that participated as drivers (6 in total) maintain the role of a driver and share their vehicles to the ride-sharing program, whereas all others (participated as passengers-8 in total) are shared among previous solo-drivers.

Case B: It is assumed that all trips for those that participated as drivers to the ride-sharing demo prior to joining ride-sharing were solo driving trips. For travellers that participated as ride-sharing passengers it is assumed that 50% of them were solo drivers and 50% were public transport users prior joining ride-sharing.

After joining the ride-sharing demo, it is assumed that only those that participated as drivers (6 in total) maintain the role of a driver and share their vehicles to the ride-sharing demo, whereas PT users are shared among available ride-sharing cars.

Case C: It is assumed that all trips for those that participated as drivers to the ride-sharing demo prior to joining ride-sharing were solo driving trips. For travellers that participated as ride-sharing passengers it is assumed that 15% of them were solo drivers and 85% were public transport users prior joining ride-sharing.

After joining the ride-sharing demo, it is assumed that only those that participated as drivers (6 in total) maintain the role of a driver and share their vehicles to the ride-sharing demo, whereas PT users are shared among available ride-sharing cars.

It should be noted that PT users do not pose a CO_2 impact since an additional PT service is not considered in the after case (i.e., PT operation does not depend on ridership). Therefore, the before-after cases in terms of CO_2 are equal for PT (no side effect). Since available passenger cars in the network are sufficient to accommodate previously PT users, an impact is not introduced. If a sufficient number of PT travellers decide to share a new passenger car or cars, then the impact of the new introduction in the network should be considered. However, such a case is not examined here since the number of passengers is low and the number of drivers sufficient in the ride-sharing demo to assume that may these are accommodated to existing cars.

Table 26 presents the CO_2 emissions percentage changes for the three scenarios.

Table 26: Changes in CO_2 emissions according to the three scenarios

	Solo drivers		PT travellers		CO_2 change
	Before	After	Before	After	%
CASE A	All	none	0%	0%	61.1%
CASE B	Participants as drivers and 50% of participants as passengers	none	50% of participants as passengers	0%	44.0%
CASE C	Participants as drivers and 15% of participants as passengers	none	85% of participants as passengers	0%	19.1%

All shared among participants as drivers

IA4: Improve user satisfaction
KPI#1, 2, 3, 7, 8

The goal of improving user satisfaction is assessed through the five KPIs.

- KPI#1 was calculated by recording the app downloads through the after-demo survey.
- KPI#2 was calculated by recording the completed trip made by a demo site R2R user through the ecosystem.
- KPI#3 was calculated by recording the number of completed multi-occupancy vehicle trips with R2R app through the survey.
- KPI#7 was calculated by recording the Number of Ride2Rail app downloads, for both drivers and passengers, through the ecosystem.
- KPI#8 was represented by the usability rate as this was estimated in section 9.3

User satisfaction is assessed through both quantitative and qualitative means. KPI 1, 2, 3 and 7 are used to assess the satisfaction of users in terms of the ride-sharing app. The developed application is part of the R2R project and an essential component of the ride-sharing service. These KPIs show that the application, when extrapolated to the duration of the demos, achieved its targets (assumed that the rate would be the same for all days).

The usability rate for drivers and passengers were estimated to be 58% and 64%, respectively, showing that passengers were more satisfied than drivers. The ride-sharing application is composed of two components, which are offered to both drivers and passengers. The KPI8 values show that room for improvement exists for both components and especially for the driver companion (i.e., as the principal component is the one for passengers, it was expected that the driver companion would be rated lower).

The two additional KPIs for Athens (KPI#A1&A2) reflect the number of available parking spaces for users' fir ride-sharing users. As it was concluded in D2.5, one of the main reasons that drivers may not offer a ride with their car is the shortage of parking at their destination. In total 48% of respondents agreed to this statement. As it was concluded in D2.5: The two criteria related to parking (Parking offer and Lack of parking) are both rated with 5-stars by the majority of TSPs, showing that the provision of a parking place is important for the TSPs. Discounted parking seems to be a good incentive to convince drivers to join a ride-sharing application. In total 15 parking places were reserved for the needs of the demos and offered for free to ride-sharing users.

The after-demo survey indicated the pros and cons of the ride-sharing service (qualitative data) which are presented in Table 27.

Table 27: User comments based on after demo survey (Athens)

App component	Survey results
Driver companion pros	-Speed. -Pioneer. -Communication capability in regard to the use of the app. -Finding through an app other traveller to share a ride. -One app to cover all modes.
Driver companion cons	-Complicated. -Hard to use and impractical app. -The menu used to find the origin and destination of the trip is not easy to use due to the way roads are displayed. It is actually deterrent for use. -The app environment is complicated.
Travel companion pros	-If it worked properly, it would be a very useful app. -Cost reduction. -Display of available rides. -It is a very useful app. If it was optimized to become more trustworthy, I would certainly use it. -Useful app; it should work better. -Nice try, but it still needs work.
Travel companion cons	-I couldn't plan my trip easily. -Communication difficulties. -I didn't find the Koropi station listed. This was one of the target stations of the testing. -The app has a lot of problems in its use. -The trips I offered were not matched. -App crashes, app complexity.
Pros for both	-It would be a very nice idea in general if it was actually realized. I would like to be part of it. -Connecting app. -It is a well-organized app, quite simple in use. When the development has been finalized and is open for the users, I will certainly download it. The wider the use from the audience, the more I will be served in my rides, both as a user and as a driver.
Cons for both	-The RIDE2RAIL app didn't include all the functions, as those were described in the user guide. The other app didn't include Greece as a country, therefore i could not find the streets. In general, the use of the app was quite hard. -Application environment. -The app crashed many times, or just didn't work properly, which gave me a hard time. I would like to see it run properly, otherwise I cannot trust it for my rides, especially in the suburbs of Attica, that are not served by PT during all the hours of the day.

10.4.2. Brno

The Brno Demo Site focused on commuters traveling from the Znojmo district to the city of Brno. The primary objective of the demo was to promote the utilization of RIDE2RAIL services among commuters, such as solo car drivers and to enhance car capacity sharing with other travellers

Table 28 summarises the quantified KPIs, i.e., either positive, negative impacts, the impact area they are classified within (colour indexed cells), and the target/actual values for Brno.

Table 28: Brno quantified KPIs

	KPIs		(+)/(-)	Target	Actual
KPI#1	Number of Ride2Rail app users	US	+	100	60
KPI#2	Number of completed Ride2Rail app trips	US	+	2,000	1852
KPI#3	Number of completed multi-occupancy vehicle trips with R2R app	US	+	400	87
KPI#4	Number of completed trips involving public transit/rail with R2R app	RS	+	50	766
KPI#5	Number of completed commuter trips with R2R app	RS	+	20	1,852
KPI#6	Number of completed rural trips with R2R app	RC	+	2,000	1,665
KPI#7	Number of Ride2Rail app downloads*	US	+	125	60
KPI#8	Usability rate	US	+	50%	55% TC 59% DC

*Includes both drivers and passengers.

Table 29: Brno local KPIs

KPIs	Target
KPI#B1 Reduction of need for parking spaces	10
KPI#B2 Number of surveyed users attracted to R2R app	30

IA1: Increase the number of passengers using public transport
KPI#4, 5

- KPI#4 was calculated by recording through the after-demo survey the total completed trips involving public transit/rail with R2R app trips and comparing them to the set target.

- KPI#5 was calculated by recording through the after-demo survey the completed commuter trips with R2R app.

As Table 28 shows, target values for both KPI#4 and KPI#5 were exceeded. In more detail, the difference of the target and the actual values regarding KPI#4 is +1430% while for KPI#5 is +9160%. This result is encouraging as it reveals both the promotion of public transport through ride-sharing services (KPI#4) and the wide acceptance of ride-sharing concept from Brno's travellers (KPI#5) during the short period of demonstrating and post COVID-19 conditions.

IA2: Improve rail connectivity with rural areas
KPI#6

- The second impact area focuses on improving rail connectivity in rural areas. KPI#6 was calculated by recording through the after-demo survey the number of completed rural trips with R2R app.

Although the goal of 2,000 completed rural trips with R2R app was not reached, when considering the short period of the demonstration and post COVID-19 conditions in Czech Republic, it can be concluded that the demo achieved to record a significant number of trips, almost close to the target. The different definition of rural trips for Brno compared to other sites (all trips using a bus or a train were considered rural trips), contributes also to the achievement of KPI#6.

IA3: Minimise environmental pollution while travelling
KPI#9

The Czech Republic GDP per capita is 1.22 times higher than that of Greece, and vehicle kilometres travelled in the city are expected to be proportional to economic growth (Ecola & Wachs, 2012). Keeping all other assumptions, the same, based on the demo survey data for the city of Brno and the usage rate for drivers and passengers the CO_2 emissions impact is estimated.

	Before	After	Before	After	%
CASE A	All	none	0%	0%	42.9%
CASE B	Participants as drivers and 50% of participants as passengers	none	50% of participants as passengers	0%	27.3%
CASE C	Participants as drivers and 15% of participants as passengers	none	85% of participants as passengers	0%	10.1%

All shared among participants as drivers

Brno proposed a target for a reduction of 3,400 Kg of CO_2 over the whole duration of the pilot, however due to post COVID-19 travel restrictions the demo's duration was less than anticipated. The demo CO_2 reduction ranges between 116.8 and 17.5 kg just for the demo duration, or it may be claimed that the minimum carbon dioxide reduction was 10.1% based on Case C.

IA4: Improve user satisfaction
KPI#1, 2, 3, 7, 8

As previously mentioned, user satisfaction is assessed by both quantitative and qualitative data. KPI#1, KPI#2, KPI#3 and KPI#7 are utilized to estimate users' satisfaction regarding the ride-sharing application and are calculated directly from the app and surveys. Regarding the number of Ride2Rail app users (KPI#1) the target was not reached (-40%) while number of completed Ride2Rail app trips (KPI#2) differed from the target set by -7%. The target of completed multi-occupancy vehicle trips with R2R app (KPI#3) was set to 400 while the actual number was 87.

The KPI#8 (usability rate) for drivers and passengers were reported to be 59% and 55%, respectively, showing that drivers were more satisfied than passengers, the opposite from the Athens case. The target for both categories of users was set at 50% meaning that the actual values exceeded this threshold although there is room for enhancing both components.

Table 30: Brno local KPIs - actual values

Local KPIs (Brno)	Target	Result	Difference	Diff. %
KPI#B1 Reduction of need for parking spaces	10	28	8	180%
KPI#B2 Number of surveyed users attracted to R2R app	30	60	0	100%

As far as Brno's local KPIs are concerned, both were achieved. In more detail, the need for parking spaces (KPI#B1) reduced by 28 while the target was 10 resulting in a difference of +180%. According to surveys, the users that were attracted to the R2R application were 60 – two times the target value.

The after-demo survey recorded the pros and cons of the ride-sharing service (qualitative data) which are presented in Table 31.

Table 31: User comments based on after demo survey (Brno)

App component	Survey results
Driver companion pros	-Helped in searching for destinations -I found an interesting journey to home -Ecological passenger transport idea -Possibility of saving costs
Driver companion cons	-Once it took me a long time to find my journey when I received "backend issue", finally succeeded. -The application failed with an error; incorrect inputs of travel times; the application didn't find routes; it wasn't possible to show tickets (Android 12)

App component	Survey results
	-I wasn't always possible to set up a ride the first time. -The application showed the journey in a strange way and it wasn't possible to edit it. -I didn't have any passengers, DC didn't save searched locations.
Travel companion pros	– Introductory picture of monorail. – It didn't work properly just once. – Integration of all modes of transport into one travel solution. – Simplicity of application. – The possibility to use shared rides for shorter distances. – Visual aspect, simplicity. – Many interesting features. – User-friendly application, many functions, integration of shared rides with public transport. – Very easy to use, many functionalities. – Purchase of travel tickets. – Very easy to use app. – Very easy to use, simple application, integration of all modes of transport. – Nice application, simple, well arranged. – Idea is good, the application tried to be comprehensive when planning trips and choosing means of transport. – It brings multiple functionalities together. – Complexity, a wide range of transport options. – In some cases, an interesting trip suggestion. – The application knows the names of stops and streets well. – Incentive. – Design. – Design, functionalities. – It looks nice. – it is nicely done. – It remembers the stops.
Travel companion cons	-Long loading time and sometimes strange rides. -The application offered connections 4 hours later than I needed. -Frequent app crashes, strange travel connections. -Long loading time, nonsensical travel solution, long stretches of walking, one minute drive by public transport, few offers of travel solutions, there is no beginning and end of solution, the application didn't offer travel solutions at all one day, from Hustopeče journey to transfer 3.5 hours. -Incomplete travel solution. -Often a strange travel solution, also travel time 24 hours +, a lot of walking or walking in one place – in particular Zvonařka.

App component	Survey results
	-The translation wasn't correct, many typos. -On Wednesday the application didn't work at all, I had to look for a travel solution in another way. I couldn't rely on the app at all. -The travel solution was incomplete, there were no specific boarding points for shared rides, it was difficult to identify the driver. -Regular booking error, confusing organization of the trips in the My trips folder. -The application found a travel connection where I had to travel for 17 hours, strange arrangement of trips after search. -The application was sometimes unstable. longer current. -Slower to search, can't stay logged in. -The stability of the application: 1x the app crashed, often login: 2x-3x before the logging was successful, "My trips" – unsorted, unclear, after the validity of the trip, I would welcome a transfer to the archive or history. -A number of things are still not working, especially journey planning configuration. Chaotic Czech/English changes, issues with completing the purchase of a ticket, displaying never-made journeys, etc. -Long searching, complicated connection. -Instability, few connections, incorrect connections. -It isn't in Czech.
Pros for both	– Driver Companion worked properly and I had one passenger. – Driver Companion was easy to use, Travel Companion had nice design, great idea. – The application didn't work, frequent outages. – Great idea, easy to use. – Simplicity, all the necessary information is collected in one place. – Integration of all modes of transport, many tickets for a specific connection, simplicity of the application. -The idea is great; it just needs to be improved. – The possibility to share own ride with other users. – Easy to use, well arranged application. – Funny credentials. . – Effort to integrate all modes of transport, sharing own ride with other users. – Many functionalities. – The possibility to offer shared rides. – Driver Companion is quite simple.
Cons for both	– Travel Companion offered horrible travel solution which couldn't be used in practice and the total travel time by public transport was 1:20 more than by car. I

App component	Survey results
	used Travel Companion only once and then no more because I was disappointed. – Driver Companion had frequent outages. It was very difficult to identify passengers. In many cases, Travel Companion didn't find a travel solution on the first attempt, there are a lot of things that need to be fine-tuned so that it can actually be used in real traffic. – Frequent crashes of the application, unreliable, it was almost impossible to find passengers in the terrain, long loading time, very frequent booking error. – Many issues, incomplete travel solutions, there are still many things in the applications that need to be improved and fixed. – This is the research project, the applications are sufficient for testing, but it is not possible to use them in real operation. – Travel Companion didn't work properly; Driver Companion drew a different route by car than I'm used to driving and I didn't know how to edit it. – Travel Companion and Driver Companion should be one application; the driver has to switch from one app to the other. – The application didn't work for a day or more, there were unknown line and I had to travel by car. The travel solution contained absurdly many transfers with long travel time. Three passengers signed up for one shared ride (vehicle capacity was two seats). – Complicated setup of shared rides into the system. – It wasn't always possible to set up the ride, I received "backend issue". Travel Companion didn't work one day.

10.4.3. Helsinki

The Helsinki demo focused on the enhancement of the access to rail and metro transport for commuters during the first and last mile of their journeys. The demo focused on addressing the mobility requirements of residents in Helsinki's easternmost neighbourhood, Vuosaari, by providing on-demand services.

Table 32 summarises the quantified KPIs, i.e., either positive, negative impacts, the impact area they are classified within (colour indexed cells), and the target/actual values for Helsinki.

Table 32: Helsinki quantified KPIs

	KPIs		(+)/(-)	Target	Actual
KPI#1	Number of Ride2Rail app users	US	+	50	17
KPI#2	Number of completed Ride2Rail app trips	US	+	400	99
KPI#3	Number of completed multi-occupancy vehicle trips with R2R app	US	+	200	68
KPI#4	Number of completed trips involving public transit/rail with R2R app	RS	+	200	58
KPI#5	Number of completed commuter trips with R2R app	RS	+	240	58
KPI#6	Number of completed rural trips with R2R app	RC	+	0	7
KPI#7	Number of Ride2Rail app downloads*	US	+	125	29
KPI#8	Usability rate	US	+	50%	44% TC 37% DC

*Includes both drivers and passengers.

Table 33: Helsinki local KPIs

KPI	Target
KPI#H1 Number of walk-in trips with the Robobus	200

IA1: Increase the number of passengers using public transport
KPI#4, 5

As previously mentioned, KPI#4 and 5 are set to quantify the increase of passengers using public transport. Similarly, to Brno, the targets of Helsinki KPIs were exceeded. In more detail, the KPI#4 corresponds to +71% difference related to the set target and KPI#5 corresponds to 76%. Achieving both goals indicates the significant potential of ride-sharing to be employed as a first and last-mile solution to boost PT ridership.

IA2: Improve rail connectivity with rural areas
KPI#6

Regarding the goal of improving rail connectivity with rural areas, the target set for KPI#6 was over exceeded. No rural trips were expected using R2R application but actually 7 were completed. Based on the Helsinki rural area definition, rural trips were not expected. However, 7 trips were recorded showing the potential of ride-sharing services to both urban and rural areas.

IA3: Minimise environmental pollution while travelling

KPI#9

This impact area was not applicable for Helsinki.

IA4: Improve user satisfaction
KPI#1, 2, 3, 7, 8

User satisfaction in Helsinki, based on targets of KPI#1, 2, 3, 7, 8 was acceptable. More specifically, the number set as target for the Ride2Rail app users (KPI#1) was exceeded by 66%, while KPI#2 also shows a great difference which corresponds to +75% related to the set target. The latter indicates the great usage and potential of adoption of the ride-sharing app in the community of Helsinki. The target of completed multi-occupancy vehicle trips with R2R app (KPI#3) differentiated for +66% from the actual. Target of usability rate (KPI#8) of the R2R app was set to 50%, the same as in all other demo cities, and the achieved one according to Helsinki commuters was 37% for drivers and 44% for passengers. These rates did not reach the target of 50% and leave significant room for improvement for the application.

Table 34: Helsinki local KPIs - actual values

Local KPI (Helsinki)	Target	Result	Difference	Diff. %
KPI#H1 Number of walk-in trips with the Robobus	200	1,112	912	456%

Table 34 shows the results regarding the local KPI set by Helsinki. During the demonstration 1,112 walk-in trips with Robobus (KPI#H1) were carried out while the target was 200. This great success rate indicates the great potential of increasing trips with Robobus through R2R app and ride-sharing schemes in general.

The after-demo survey recorded the pros and cons of the ride-sharing service (qualitative data) which are presented in Table 35.

Table 35: User comments based on after demo survey (Helsinki)

App component	Survey results
Driver companion pros	-Graphics.
Driver companion cons	-Travel time calculations seem incorrect.
Travel companion pros	-Journey time estimate per leg. -It was easy to use. -The option to offer ride with one's own car and then get a lift as a passenger from someone. -Integration with HSL route planner. -The concept is great. I think there is potential to connect for example home-work-home trips. -Could not say. I tried to book two different car trips and there was an error and I couldn't get the trips. -The app was simple but I don't think I would benefit from the service it provided.

App component	Survey results
	-Quite conventional --> easy to learn how to use. -The concept. UI looked nice, but was confusing when used. -Functions like the HSL app.
Travel companion cons	-It does not seem to be better than existing route planners like google map or our existing local public transport route planner (which also includes city bikes, walking, trains, e.g.). Unclear why I should choose this particular alternative. - Landing page: train. Does not seem to refer to public transport or last-mile transport when a fast train is shown. - Too many categories on the left side column. Too many unclear terms. E.g., under "Experiences for me": what does "glasses" mean? Under "preferences", it's unclear what "tracking means" (message type, message content, etc.) and many more examples. - It did not always show the fastest route first. It shows the bus routes first, but they are twice as long as the tram or walking, in the case of one of my routes. - Too many features, a bit ambiguous what was the added value of e.g., glasses. -It was a bit slow and it gave unnecessarily many options of different walking routes. Why would I want to make a 15-minute walk if there is a 4 minute option available? - I found no added value for my daily mobility. The app felt complicated and it would be difficult to trust that the shared rides really happen as planned. -UI was poor. I think the app should focus only on providing shared rides. - Very hard to login. Tried numerous times and finally the app opened. Full of weird features. The start train screen does not say Welcome or anything and I thought the app is frozen. - Nice to see a public transport route planner app where it is integrated the possibility of ride sharing. However, the dominant route planner services in Helsinki currently are the public transport authority's Helsinki Region Transport (HSL) route planner "Reittiopas" as well as Google Maps. It is difficult to see that there would be actually need for a third route planner application (and with fewer functionalities, such as lack of possibility to purchase tickets). Though the ride sharing functionality is missing from these two route planners which would be a definite improvement in favour of Ride2Rail. Also the transnationality of the app is of great value if a single app could be used for travelling in different countries without the need for having to download and get familiar with local systems.
Pros for both	-It gave funny results. -Trip planner works mostly OK with public transport. -The idea is good, but the solution is still too early to launch. -The public transport timetable seemed to work ok.
Cons for both	-Lots of very strange features, very difficult to use. -No connection between driver and passenger, nearly impossible to meet each other.

App component	Survey results
	-The app did crash a few times. -No way to know who is your driver or your passenger. No location or way to send message. What happens if the driver or passenger cancels the trip? Too many weird and extra functions on the travel companion. -Main problem was the need for having two different apps for ride sharing functionality which degrades the user experience. Also missing functionalities such as: - -No list of offered rides (route, departure time, number of available seats etc.) - No possibility to cancel a booked ride - The app does not inform or make any changes if a ride is fully booked. - The drop of point can be on a place where it is not safe to stop (of course the driver should then look after for a safe place to stop near the calculated drop of point) - No possibility to conversate between driver and rider - No possibility to see the booked ride in real time. - Lack of clear visualization of the pickup and drop off point and the estimate of pick off and drop of time. - Lack of possibility to compensate the ride (e.g., automatic calculation of fuel consumption) and money transfer between the users. In case of the TC in general I actually do not see need for such app in Helsinki due to the competitive apps (HSL route planner and Google Maps). Maybe it would be more efficient to try to integrate ride sharing functionalities into the HSL app.

10.4.4. Padua

The demo in Padua focused on commuters belonging to the Padua province and travelling to/from the University of Ca' Foscari, with the main objective to encourage carpooling (and ride sharing acceptance) as complementary for public transport, to improve the efficiency of public transportation services, to encourage car drivers who travel alone to share the capacity of their car with other travellers and to reduce traffic and parking congestions.

Table 36Table 28 summarises the quantified KPIs, i.e., either positive, negative impacts, the impact area they are classified within (colour indexed cells), and the target/actual values for Padua.

Table 36: Padua quantified KPIs

	KPIs		(+)/(-)	Target	Actual
KPI#1	Number of Ride2Rail app users	US	+	50	9
KPI#2	Number of completed Ride2Rail app trips	US	+	4,500	387

KPI#3	Number of completed multi-occupancy vehicle trips with R2R app	US	+	315	9
KPI#4	Number of completed trips involving public transit/rail with R2R app	RS	+	4,050	10
KPI#5	Number of completed commuter trips with R2R app	RS	+	4,050	10
KPI#6	Number of completed rural trips with R2R app	RC	+	3,150	10
KPI#7	Number of Ride2Rail app downloads*	US	+	125	79
KPI#8	Usability rate	US	+	50%	74% TC 85% DC

*Includes both drivers and passengers.

IA1: Increase the number of passengers using public transport
KPI#4, 5

As it is shown in Table 36 the KPIs related to the increase of passengers using public transport was not reached. Similarly, to KPI#4, the same low rate applies to the number of completed commuter trips with R2R app (KPI#5). The short timeframe of the demonstration justifies to a great extent the difference between actual and target values. Increasing the number of passengers using PT implies the change in commuters' mindset and behaviour which is very difficult to be achieved in such a short period of time.

IA2: Improve rail connectivity with rural areas
KPI#6

Regarding the improvement of rail connectivity with rural areas, the number of completed rural trips with R2R app (KPI#6) present similar rate to KPI#4,5. In more detail, 10 rural trips were carried out during the actual demo duration (3,150/90 days, 245/7 days) which results in a difference of -96% from the set target. This low rate can also be related to the short duration of the demo and also its proximity to Easter holidays period (this is particularly true as Padua demo was focused on students).

IA3: Minimise environmental pollution while travelling
KPI#9

This impact area was not applicable for Padua.

IA4: Improve user satisfaction
KPI#1, 2, 3, 7, 8

As far as KPIs related to user satisfaction are concerned, the majority of them have been achieved in proportion to the time of the demonstration. The number of Ride2Rail app users (KPI#1) reached 9. The number of completed Ride2Rail app trips (KPI#2) was 387 while the target was 4,500. In total, 79 users, both drivers and riders, downloaded the R2R application

(KPI#7) resulting to a difference of -37% from the target. Last but not least, both drivers and passengers rated the usability of the R2R app higher that the target which was 50%. In more detail, Travel Companion was rated 74% while Driver Companion 85%. These high rates indicate the wide acceptance of R2R app as well as ride-sharing schemes in general.

10.4.5. Overall R2R project KPIs

When KPIs are aggregated for all demo sites, target and actual values in Table 37 may be compared to assess the overall project.

Table 37: Whole project KPIs

	KPIs		(+)/(-)	Target	Actual
KPI#1	Number of Ride2Rail app users	US	+	250	101
KPI#2	Number of completed Ride2Rail app trips	US	+	7,400	2,364
KPI#3	Number of completed multi-occupancy vehicle trips with R2R app	US	+	925	181
KPI#4	Number of completed trips involving public transit/rail with R2R app	RS	+	4,302	864
KPI#5	Number of completed commuter trips with R2R app	RS	+	4,497	1,959
KPI#6	Number of completed rural trips with R2R app	RC	+	5,650	1,695
KPI#7	Number of Ride2Rail app downloads*	US	+	500	207
KPI#8	Usability rate	US	+	50%	57% TC 58% DC

*Includes both drivers and passengers.

The limited period of the demonstrations did not provide the opportunity to regular commuters to plan and trust an innovative mobility solution to complete their trips. This is aligned with most studies that show that it is quite challenging to persuade solo car drivers to carpool. As van der Waerden, Lem, & Schaefer (2015) mention in their study, Wang & Chen (2012), investigated the transition from single occupancy vehicle (SOV) to carpooling using data from the Puget Sound Transportation Panel. They made a distinction between person-level psychosocial elements that captured one's cognitive judgment of a mode and structural factors that described the objective qualities of a decision scenario. Despite the modest number of switchers, they discovered a few factors, including commute length (a structural component) and respondents' affective bias in favour of carpooling (a psychosocial factor), that significantly affect the demand for moving from SOV to carpool.

It should also be noted that the travel restrictions imposed in EU countries, including the demo cities, resulted in significant lower level of travel demand across Europe. Although, travel restrictions were in some cases active during the demos, it should be further noted that travel protection measures against COVID-19 were active in Athens during the demo period, which posed major limitations to demo pilot partners to recruit travellers (i.e., convince travellers to participate to the trials and conduct trips and specially to persuade drivers to share their private vehicles with strangers). This fact contributed further to negative percentage change in terms of commuters. Additionally, some other considerations can be done in order to justify the reduced number (different mobility patterns after COVID, spread of teleworking/shifted mobility peaks, not ideal time of the year for a demo execution because of proximity of summer/Easter holidays, heatwave in the city affecting people's choice to move in urban and rural areas).

In their study of students and staff at the University of Milan, Bruglieri, Ciccarelli, Colorni, & Luè (2011) discovered that when the following conditions are met, students are interested in carpooling: allocated parking spaces, riding with known students, always the same crew, and reliable compatibility of departure and arrival times. The need for riding with known students and always the same crew implies that it is not easy for commuters to change their habits for the short term and start using an app to commute with strangers. According to Habib, Tian, & Zaman (2011) one of the main attributes that influence the consideration of carpooling in the traveller's choice of commuting mode is the frequency of carpooling in the last months. This further demonstrates the difficulty of commuters to switch to other modes of transport than their usual in a short period of time.

- Result/Feedback: in general, testers reported that they found the application easy to use and did not encounter any technical issue or particular problems when using it. Some people were very pleased with the application as it facilitated connections to the rural areas of the demo as well as the fact that several travel solutions were available. On the other hand, in some cases there was some redundancy in the questions or disappointment in not being able to purchase a ticket once it had been selected, leading to unnecessary additional steps.

The overall received feedback was quite positive. The Padua demo team, in its interaction with users, could also have the possibility to understand better their feeling about the application and the ecosystem, getting some recommendations for improvement (e.g., using a more easy and less technical vocabulary, make some improvements in the look and feel of the app to make them more appealing, extend the time frame/duration of the demo, improve the way to make the driver "visible" to the traveller using ride-sharing).

10.5. Impact Areas' Priorities

In addition to the KPI analysis, direct investigation was conducted at demo sites with partner stakeholders (i.e., transport providers, MaaS service providers, ICT providers, policy, and advisory bodies) based on the methodology that is outlined below to contribute towards understanding of perceived impacts of ride-sharing and priorities that should be set when planning for such services.

10.5.1. Analytical Hierarchy Method (AHP)

Analytical Hierarchy Process (AHP) is being applied for decision-making in various areas such as personal, social, political, governmental, education, manufacturing, and engineering as (Vaidya & Kumar, 2006) state in their review. In general, as regards decision making on sustainability, it involves intricate interactions between ecological, economic, and social factors, while it necessitates the active participation of stakeholders. Therefore, to facilitate decision-making for Sustainable Development (SD), various Multi-Criteria Decision-Making (MCDM) techniques, including the AHP, have been employed (Dos Santos, Neves, Sant'Anna, Oliveira, & Carvalho, 2019). AHP is also considered the most-widely used method for multi criteria analysis into the transportation and urban logistics fields. The results of a sample analysis confirm the frequent applicability of the method (Macharis & Bernardini, 2015). Compared to other methods, AHP offers the advantage of handling both intangible and tangible factors equally, and facilitating decisions that involve multiple objectives, criteria, and actors with relative ease (Saaty T. , 2005). This aforementioned ability in combination with other strengths of the AHP method such as (a) usage in a diverse range of fields, (b) easiness of comprehend its function, (c) flexibility and ease of application to a large number of criteria sets, (d) allowance for the interdependence of different criteria and (e) usage of both monetary and non-monetary scale, render the AHP a very flexible and robust method for evaluation (De Montis, De Toro, Droste-Franke, Omann, & Stagl, 2005). Additionally, the AHP can be adaptable and work jointly with a variety of methods, such as Linear Programming, Quality Function Deployment, Fuzzy Logic, and more. This allows users to leverage the advantages of these combined techniques, leading to improved outcomes and the attainment of desired objectives (Vaidya & Kumar, 2006).

Weighing by pairwise comparison is a method that stems out the AHP decision making framework and is performed in 3 steps (Saaty T. L., 1980):

- Step 1: Comparison of each element with the rest of the elements of the component and provision of a preferential level to the element for every comparison performed.
- Step 2: Calculation of elements' weights and normalization of their weights.
- Step 3: Statistical assessment of the consistency of the weights' matrix.

For the reader to understand the usage of AHP in the wider transportation field, below a brief (non-exhaustive) reference is made to such studies. AHP was used to evaluate various alternatives for light rail transit (LRT) corridors and routes. While the latter primarily concentrated on the current selection process for LRT corridors and routes in Memphis, Tennessee, the AHP-aided methodology was intended to facilitate public transportation decision-making more generally, while taking into account both federal New Starts guidelines and local priorities and preferences (Banai, 2006). Berrittella, Certa, Enea, & Zito (2007) utilized AHP in order to evaluate transport policies for reducing climate change impacts. AHP has also been deployed by a logistics company in selecting the optimal way of transportation between two specified locations in Turkey (Kumru & Kumru, 2014). As reported in (Duleba & Moslem, 2019), Ma, He, Ma, & Xia (2017) developed a variation of AHP called entropy-AHP to assess urban green transportation planning. Similarly, Pryn, Cornet, & Salling (2015) employed multiplicative AHP to make decisions regarding sustainable transport infrastructure development. Aiming to increase the effectiveness of travel demand management, Nosal & Solecka (2014) applied AHP for evaluating different variants of urban public transport integration, while Le Pira, Inturri, Ignaccolo, and Le Pira, Inturri, Ignaccolo, & Pluchino (2015) analysed different AHP models for collective preference rankings of sustainable mobility solutions. Recently, a modified version of the analytic hierarchy process (AHP) known as the extended AHP model, was applied to a case study in Budapest, in conjunction with grey theory to precisely calculate weight coefficients for commuting modes in a real-life transportation problem involving evaluators (Duleba, Çelikbilek, Moslem, & Esztergár-Kiss, 2022).

10.5.2. Stakeholder priorities

Participants of the demo site were asked to participate in a rating exercise to evaluate the four principal goals when planning a ride-sharing service. These goals represent the impact areas of the R2R project:

- Increase the number of passengers using public transport;
- Improve rail connectivity with rural areas;
- Minimise environmental pollution while travelling;
- Propose additional criteria for informed decision making when planning a trip.

Table 38: Rating elements

	Increase the number of passengers using public transport	Improve rail connectivity with rural areas	Improve environment while travelling	Improve user satisfaction
Increase the number of passengers using public transport	1			
Improve rail connectivity with rural areas		1		
Improve environment while travelling			1	
Improve user satisfaction				1

Note: PT= Public transport

The user is called to indicate the importance (or preference) of goal 1 compared to goal 2 by rating in a scale from 1 to 9 as shown in Table 39:

Table 39: Pairwise comparison scale for preferences

Numerical rating	Verbal judgements of preferences
5	Extremely important
4	Very strongly important
3	Very important
2	Moderately important
1	Equally important
1/2	Slightly important
1/3	Less important
1/4	Much less important
1/5	Not at all important

All intermediate integer ratings are possible. When goal 1 is less important than 2, then the respective reciprocal value is attributed (e.g., 1/5).

An online questionnaire was also created to facilitate demo participants to declare their goal rankings.

	Much more important	More important	Somewhat more important	Slightly more important	Equal	Slightly more important	Somewhat more important	More important	Much more important	
Increase the number of passengers using public transport	☐	☐	☐	☐	☐	☐	☐	☐	☐	Improve rail connectivity with rural areas
Increase the number of passengers using public transport	☐	☐	☐	☐	☐	☐	☐	☐	☐	Improve environment while travelling
Increase the number of passengers using public transport	☐	☐	☐	☐	☐	☐	☐	☐	☐	Improve user satisfaction
Improve rail connectivity with rural areas	☐	☐	☐	☐	☐	☐	☐	☐	☐	Improve environment while travelling
Improve rail connectivity with rural areas	☐	☐	☐	☐	☐	☐	☐	☐	☐	Improve user satisfaction
Improve environment while travelling	☐	☐	☐	☐	☐	☐	☐	☐	☐	Improve user satisfaction

Figure 8. Survey for estimating impact priorities

The given rating by the user, fills a column-stochastic matrix (comparison or reciprocal matrix) sized by the number of the compared goals (priority vectors). The cells over the diagonal unitary cells, are filled with the user's rating input value while the ones below them are equal with the reciprocal value of the input value.

$$A = \begin{bmatrix} 1 & a_{12} & a_{13} & a_{1n} \\ a_{21} & 1 & a_{23} & a_{2n} \\ a_{31} & a_{32} & 1 & a_{3n} \\ a_{n1} & a_{n2} & a_{n3} & 1 \end{bmatrix}$$

where:

$$\boldsymbol{a_{ij}} = \frac{1}{a_{ji}}, \qquad a_{ji} \neq 0$$

The Normalized Principal Eigen vector, which represents the weight w_i of the element in row i, is calculated based on Equation 4-2.

Consistency is examined by the Principal Eigen Value (λ_{max}), when summing up the product of each Eigen vector and the sum of the column of the reciprocal matrix and estimating consistency index (CI) through Equation 4-3 and consistency ratio (CR).

$$w_i = \frac{\sum_j \frac{a_{ij}}{\sum_i a_{ij}}}{n}$$

$$CI = \frac{\lambda_{max} - n}{n} - 1$$

$$CR = \frac{CI}{RI}$$

The Random Consistency Index (RI) depends on the number of elements n to be compared, as follows:

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

Usually, a CR of up to 10% is considered as good consistency however, higher values (e.g. up to 30%) may be also acceptable.

All weights of the goals sum up to 1, and their values indicate the trade-offs between the goals.

10.5.3. Stakeholders in demo cities

Involved stakeholders in demo cities vary based on the needs of the ride-sharing service that was tested. The stakeholders that were taken into consideration in the prioritization of impacts and their type is presented in the following tables. For a stakeholder group to be included in the priority-estimations, at least 5 participants per organization should have filled in the questionnaire, which are considered adequate since they hold knowledge and practical experience with the matter (Ozdemir & Saaty, 2015). The demo participants per city that have answered the questionnaire are presented in the following tables.

Table 40: Athens stakeholders

Stakeholder	Research	Operator	Public authority	Other
Stakeholder 1	√			
Stakeholder 2				Critical Infrastructure Provider
Stakeholder 3			Municipality	

Table 41: Brno stakeholders

Stakeholder	Research	Operator	Municipality	Other
Stakeholder 1	√			
Stakeholder 2				Software company
Stakeholder 3		PT operator		

Table 42: Helsinki stakeholders

Stakeholder	Research	Operator	Municipality	Other
Stakeholder 1	√			
Stakeholder 2			Local / regional government	

Table 43: Padua stakeholders

Stakeholder	Research	Operator	Municipality	Other
Stakeholder 1		PT operator		

The questionnaires were sent by emails to demo leaders, and they were forwarded to respective demo participants. The emails contained short directions and an example of how to rank priorities in each table. Participants' identity remained unknown since the only data that were required was the name of the organization they belong to.

10.5.4. Qualitative data

Participants were asked to rank four areas when planning for ride-sharing services to indicate how important these were for them. The following figures presents the scores for each demo city, and the average score across all demo cities for each criterion.

This analysis helps to understand the trade-offs between different stakeholders when planning for a ride-sharing service.

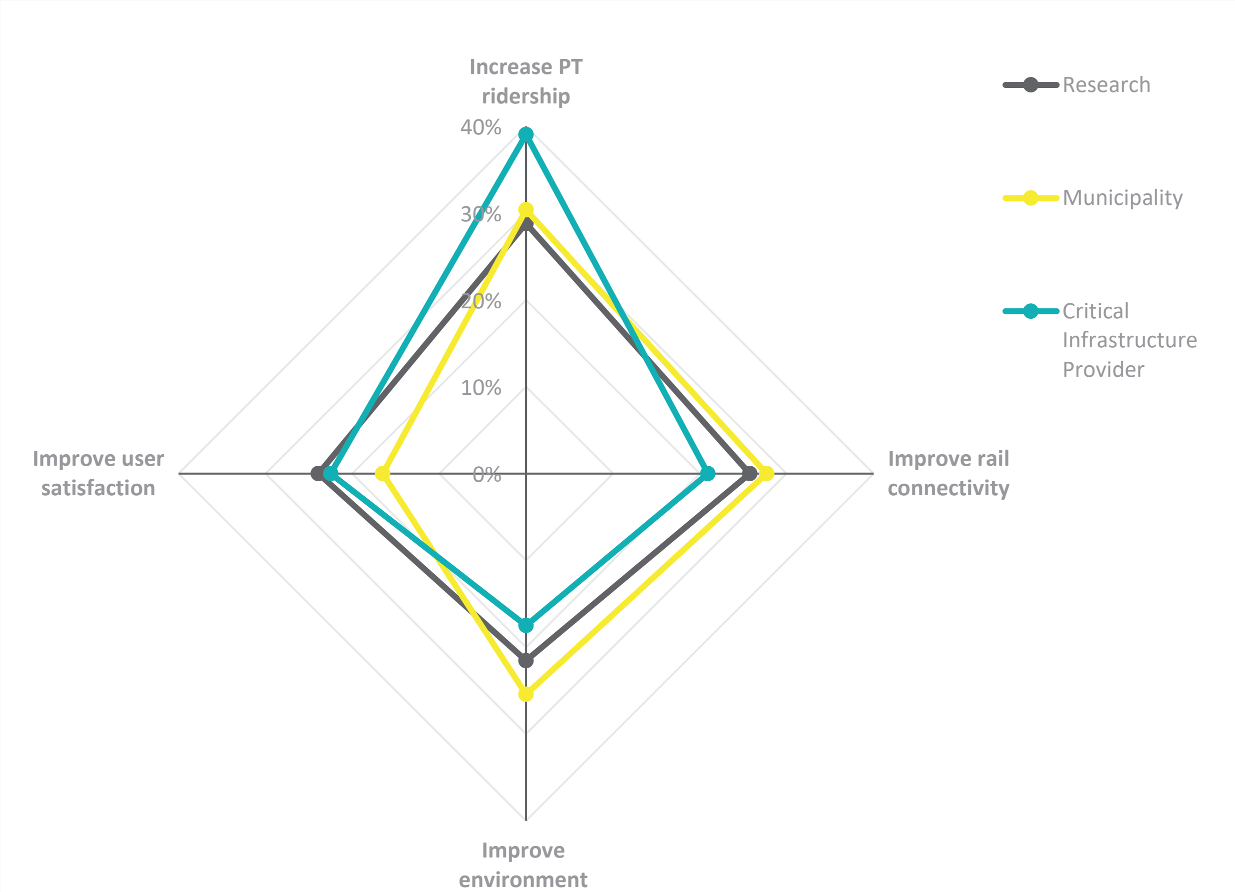

Figure 9. Athens stakeholders' priorities

Carefully examining Figure 9, it becomes apparent that Athens' stakeholders from the community of Research prioritise the four areas in a similar way (values range between 20% and 30%). In more detail, number one priority when planning for ride-sharing services is considered to be the increase of PT ridership (29%) while improving environment is ranked in the last position (22%). On the other hand, stakeholders from Municipalities consider a low priority to improve user satisfaction (16%) while increasing PT ridership is the number one priority for them also (30%). The improvement of rail connectivity and the environment are ranked equally, 28% and 25% respectively. Participants from the critical infrastructure provider give more importance in increasing the ridership of Public Transport (39%) when planning for ride-sharing services. The lowest priority by them is given to the improvement of the environment (18%). Improvement of user satisfactions is given 22% while improvement of rail connectivity is given 21%.

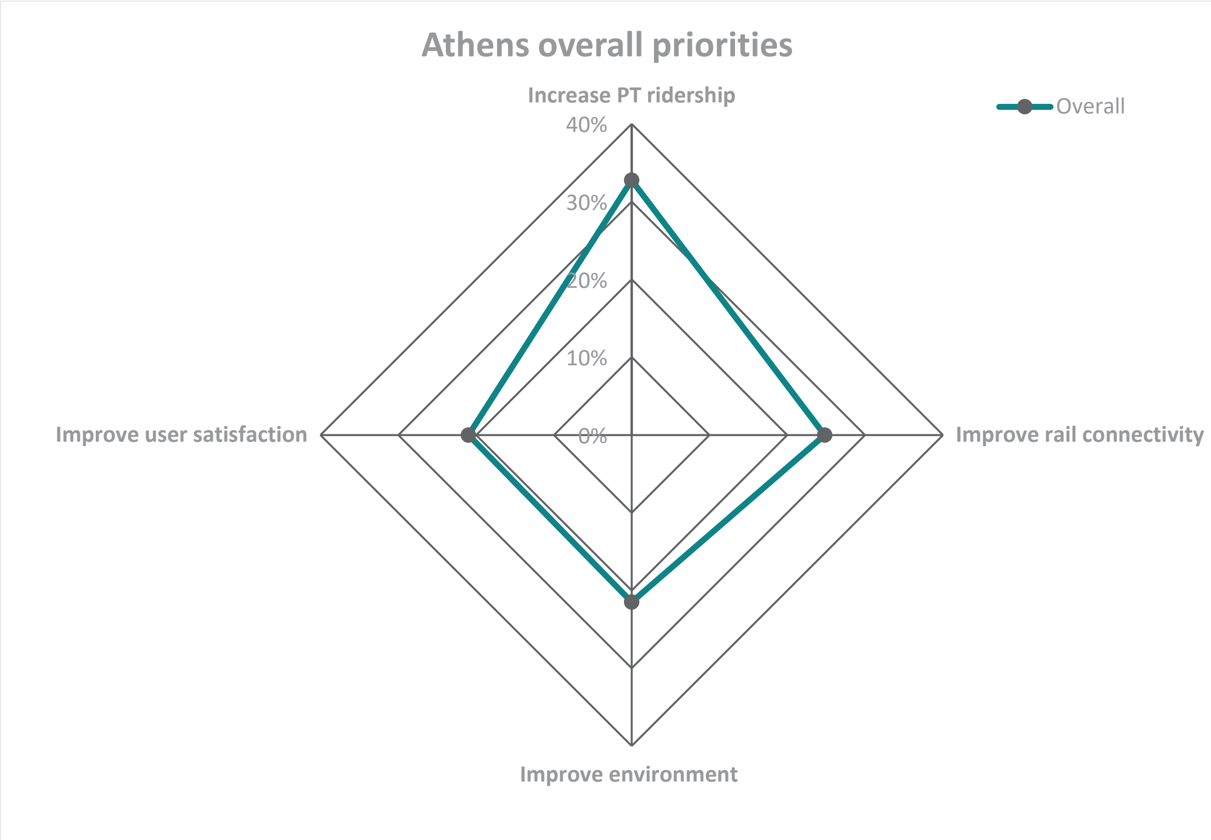

Figure 10. Athens overall priorities

As it can be seen in Figure 10, the first priority according to all stakeholders is the increase of PT ridership (33%) which is followed by the "improvement of rail connectivity" to rural areas (25%). The third place is attributed to both "improvement of user satisfaction" and "improvement of the environment" with 21% each.

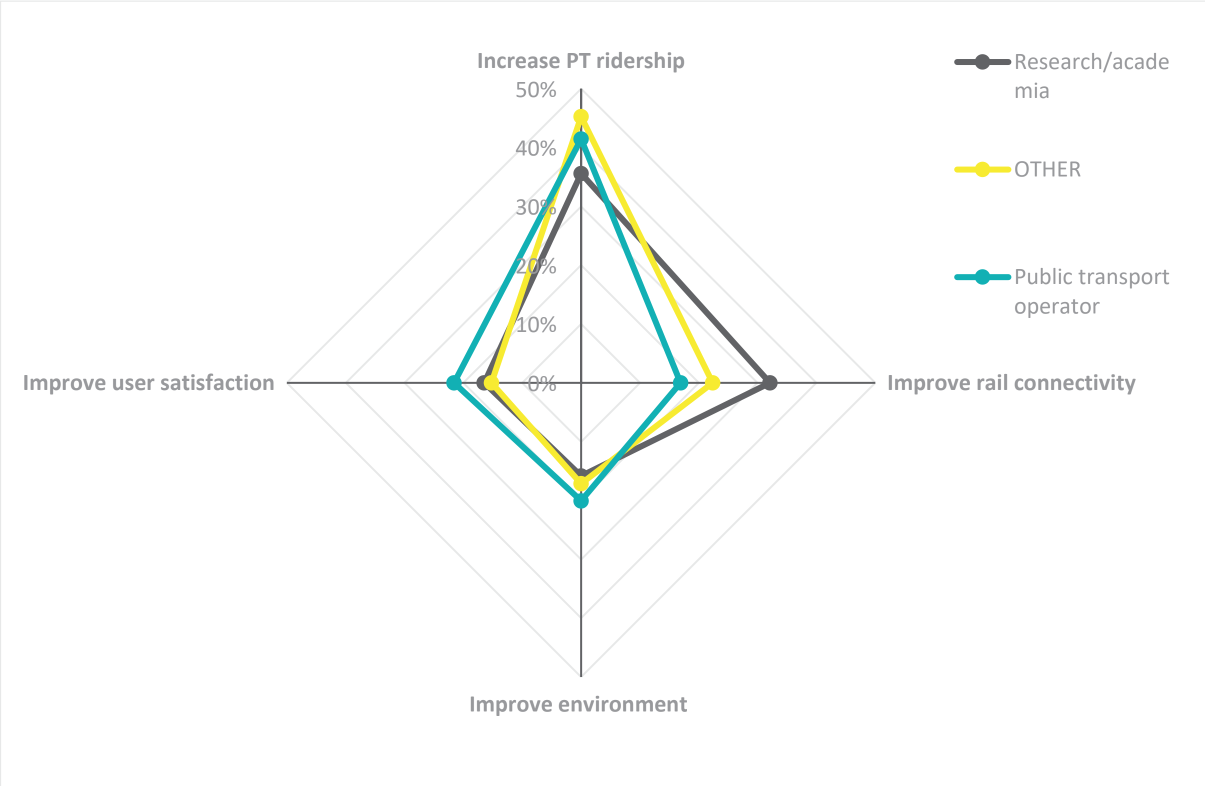

Figure 11. Brno stakeholders' priorities

Regarding priorities for Brno's stakeholders, all of them (Figure 11), ranked as the top priority the "increase of PT ridership" (values range between 36%-45%). Stakeholders from the Research/Academia ranked high enough the "improvement of rail connectivity to rural areas" (32%) while the "improvement of the environment" (16%) and the "user satisfaction" are given lower priorities (16%). Stakeholders that belong to other category (software company) ranked as their second priority the "improvement of rail connectivity to rural areas" (22%) after the "increase of PT ridership". The "improvement of user satisfaction" was prioritised by them in the lowest position (15%) and the "improvement of the environment" is ranked slightly higher than the latter (17%). The Public transport operator considers the "improvement of rail connectivity to rural areas" as the lowest priority (17%) while "improving user satisfaction" is ranked after the increase of PT ridership (22%) and is followed by "improving the environment" (20%).

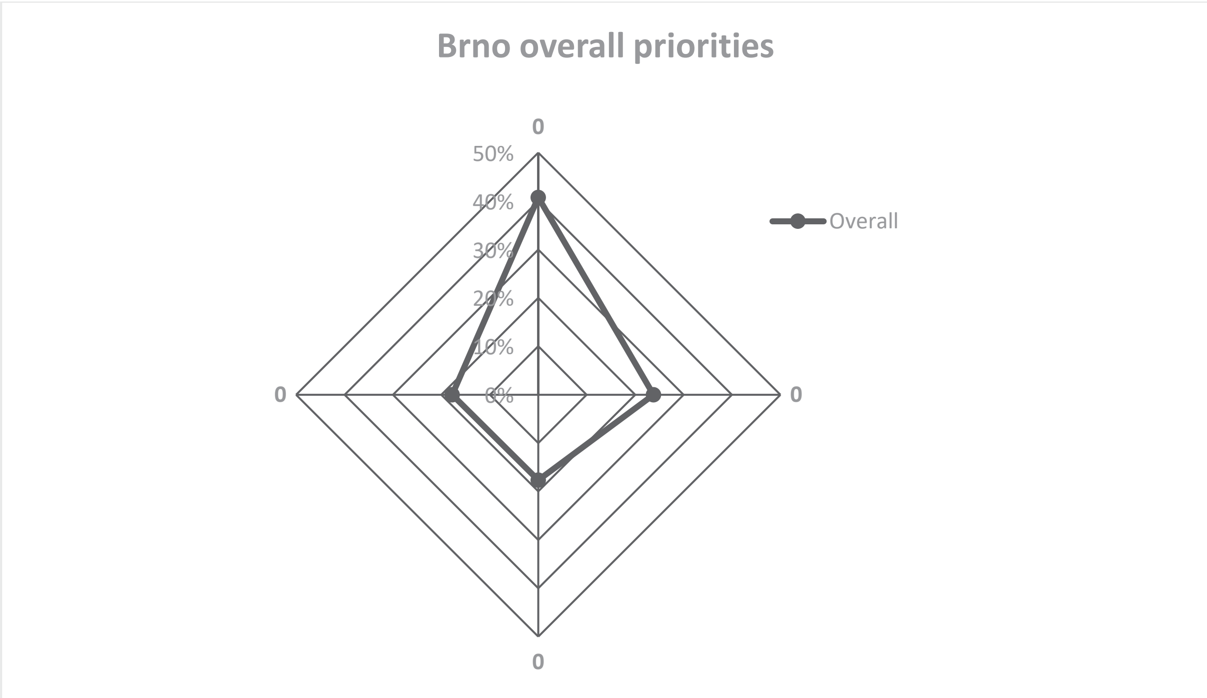

Figure 12. Brno overall priorities

Regarding the overall priorities for Brno' (Figure 12), the top priority is considered to be the "increase of PT ridership" (41%) as previously mentioned. It is followed by the "improvement of rail connectivity to rural areas" (24%) while the last position is equally distributed among the "improvement of the environment" (18%) and "improvement of user satisfaction" (18%).

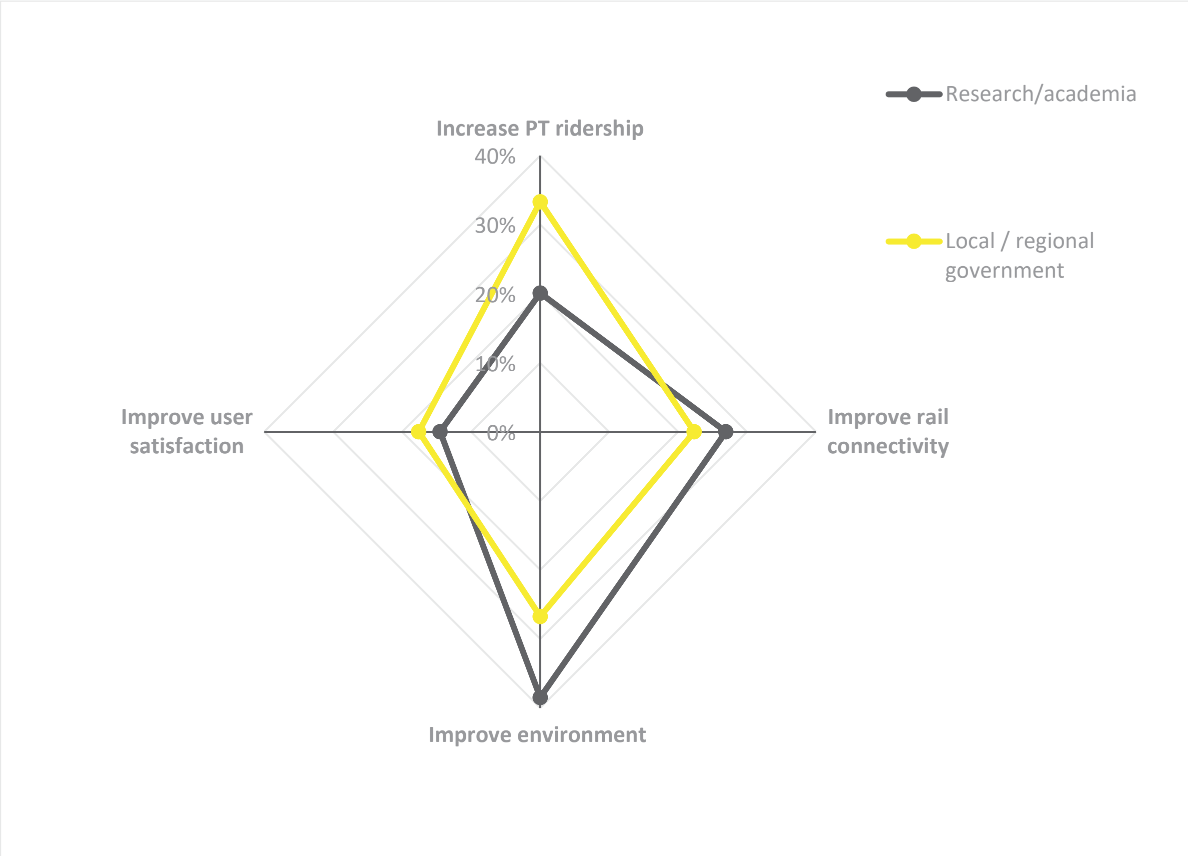

Figure 13: Helsinki stakeholders' priorities

Stakeholders from the Research/Academia community in Helsinki consider improving environment as the ultimate goal when planning for ride-sharing services (38%) followed by the "improve rail connectivity" goal (27%). "Increase PT ridership" owns the third place (20%) and as last priority is considered the improvement of user satisfaction (14%).

On the other hand, stakeholders coming from local/regional government set as top priority to increase PT ridership (33%) followed by the improvement of the environment (27%). Improving rail connectivity is ranked in the third place of priorities (22%) while the improvement of user satisfaction is considered last (18%) similarly to stakeholders' opinion from Research/Academia.

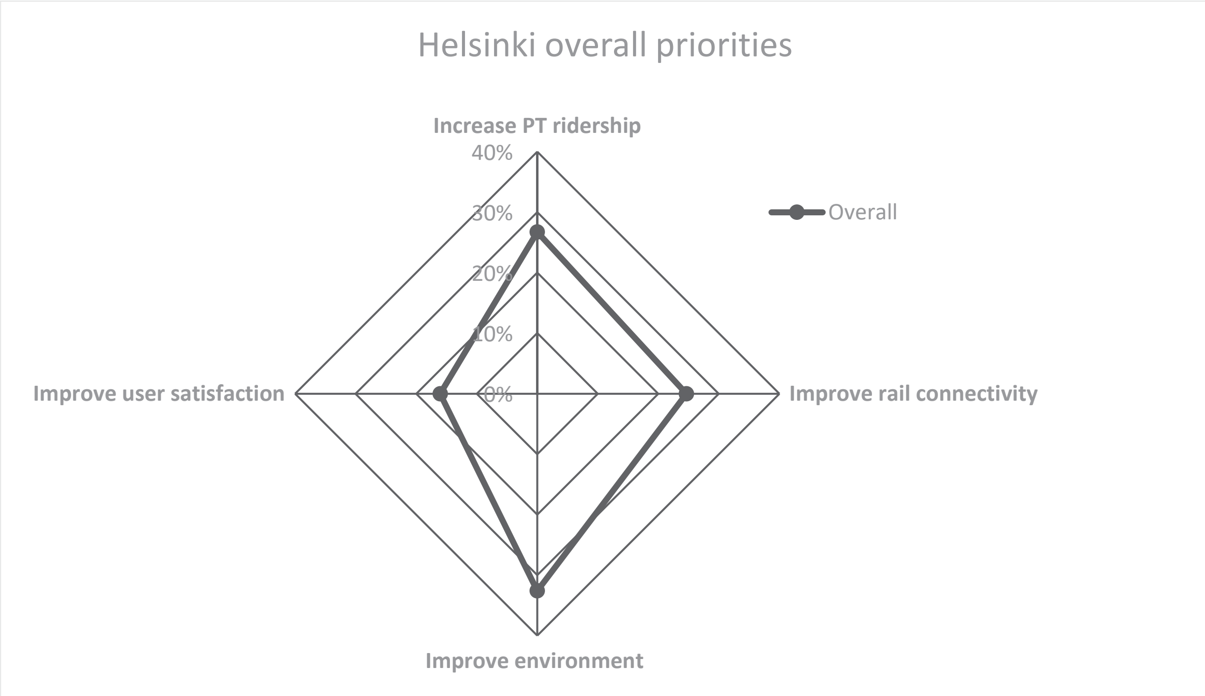

Figure 14. Helsinki overall priorities

Based on the feedback from all Helsinki's stakeholders, Figure 14 shows that as first priority is reported the improvement of the environment (33%). As second priority with similar percentage (27%) emerged the increase of PT ridership which is followed by improving rail connectivity (25%). The improvement of user satisfaction was ranked in the last position (16%).

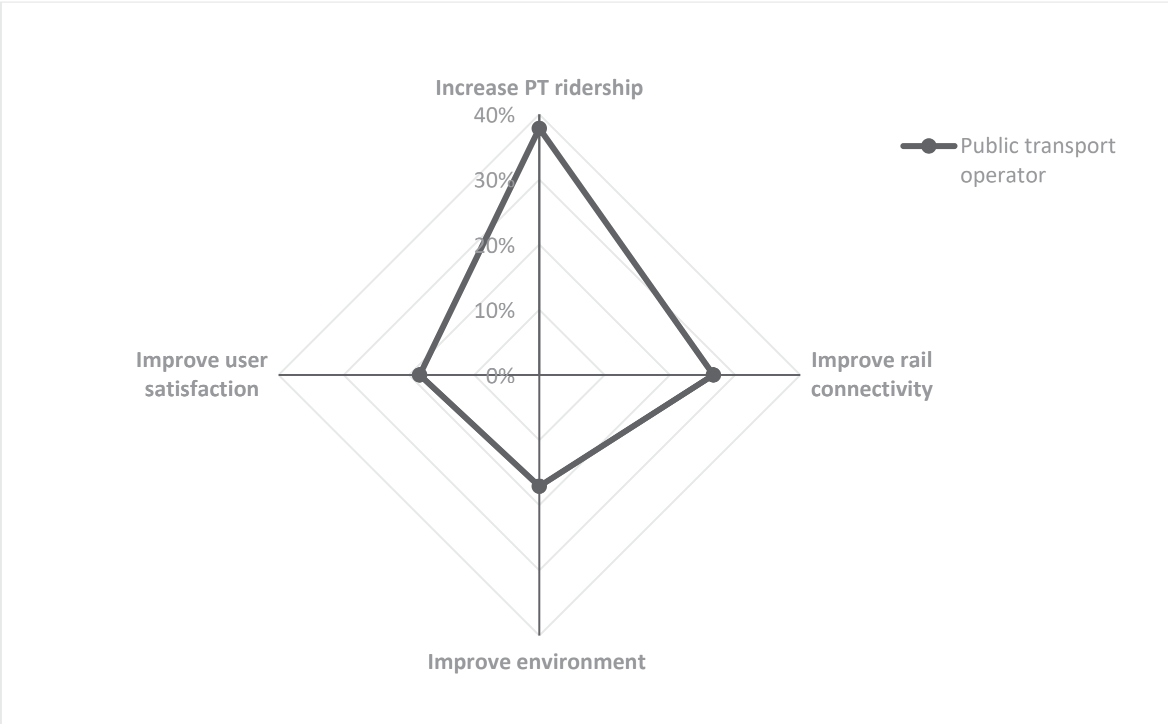

Figure 15. Padua stakeholder/overall priorities

In Padua, as presented also in Figure 15, stakeholders are coming from only one category which is PT operator. According to them, “increase PT ridership” is ranked in the first place of priorities (38%) followed by “improve rail connectivity”. The third place is taken by “improve user satisfaction” (18%) goal while the last one by “improve environment” (17%).

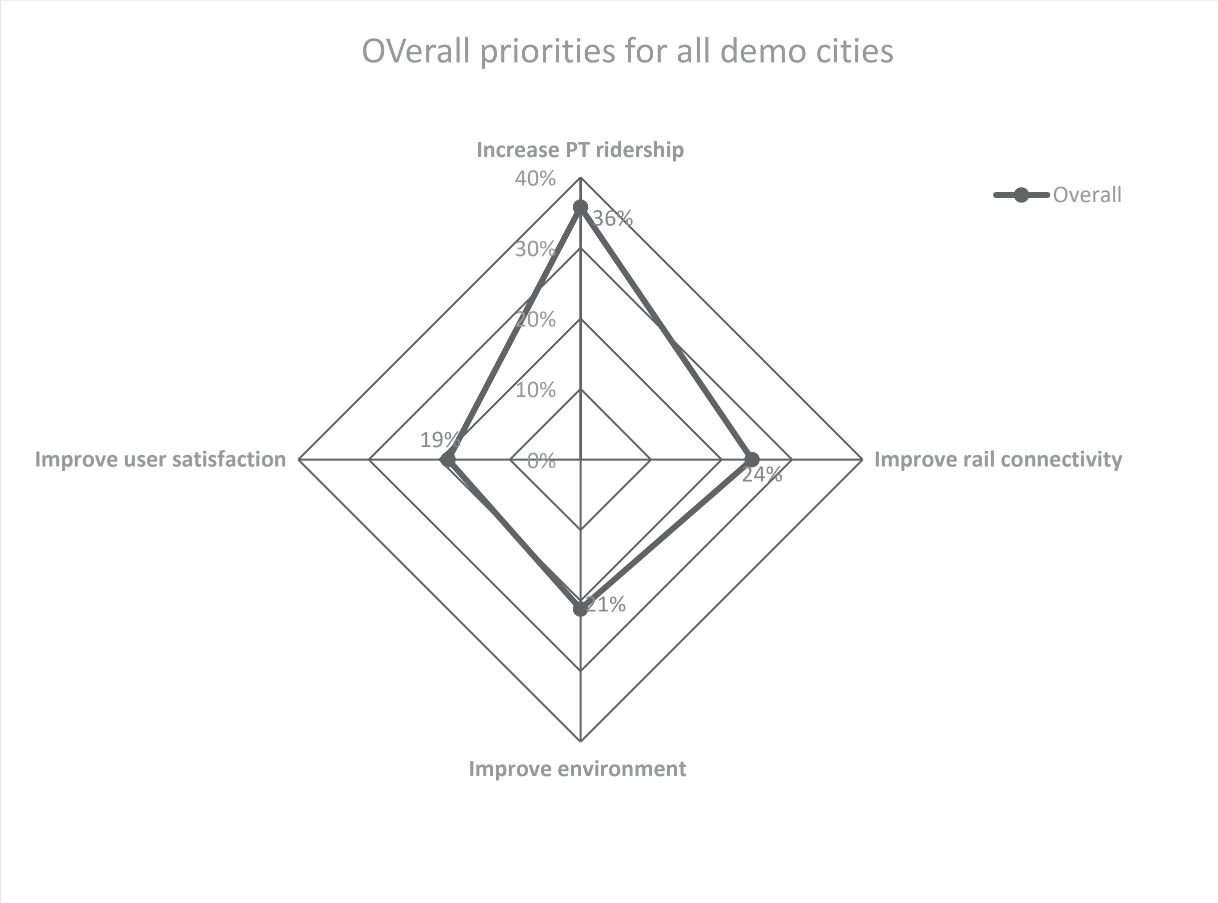

Figure 16: Priorities among all demo cities

Figure 16 depicts the aggregated priorities of stakeholders from all demo cities. As it can be seen, the increase of PT ridership emerged as the most important goal among the four scoring 36%. This is followed by the improvement of rail connectivity (24%) and finally the improvement of the environment (21%) and user satisfaction (19%).

10.5.1. Cross impact evaluation

The priority ranking of each goal regarding the planning of ride-sharing services per demo city is illustrated comparatively in Figure 17. The goal "increase public transportation ridership" is ranked as the highest priority by all cities (41-32%), with Brno ranking it with the highest share (41%) and Helsinki with the lowest (32%) resulting to an overall 36%.

Regarding the "improvement of rail connectivity to rural areas", the way the cities have ranked this goal does not show significant variations (27-22%). Padua ranked it higher than the others (27%) while Helsinki lower (20%). Athens and Brno considered this goal as their second priority, scoring 25% and 24% respectively. According to the overall result score (24%) for this priority area, it is considered by stakeholders the second most important after increasing PT ridership.

The "improvement of the environment" is the area that presents the higher variation among cities. In more detail, the highest ranking is given by Helsinki (28%) while the lowest by Padua (17%) and this results in an overall 21%. In between, Athens and Brno give a score of 21% and 18% respectively.

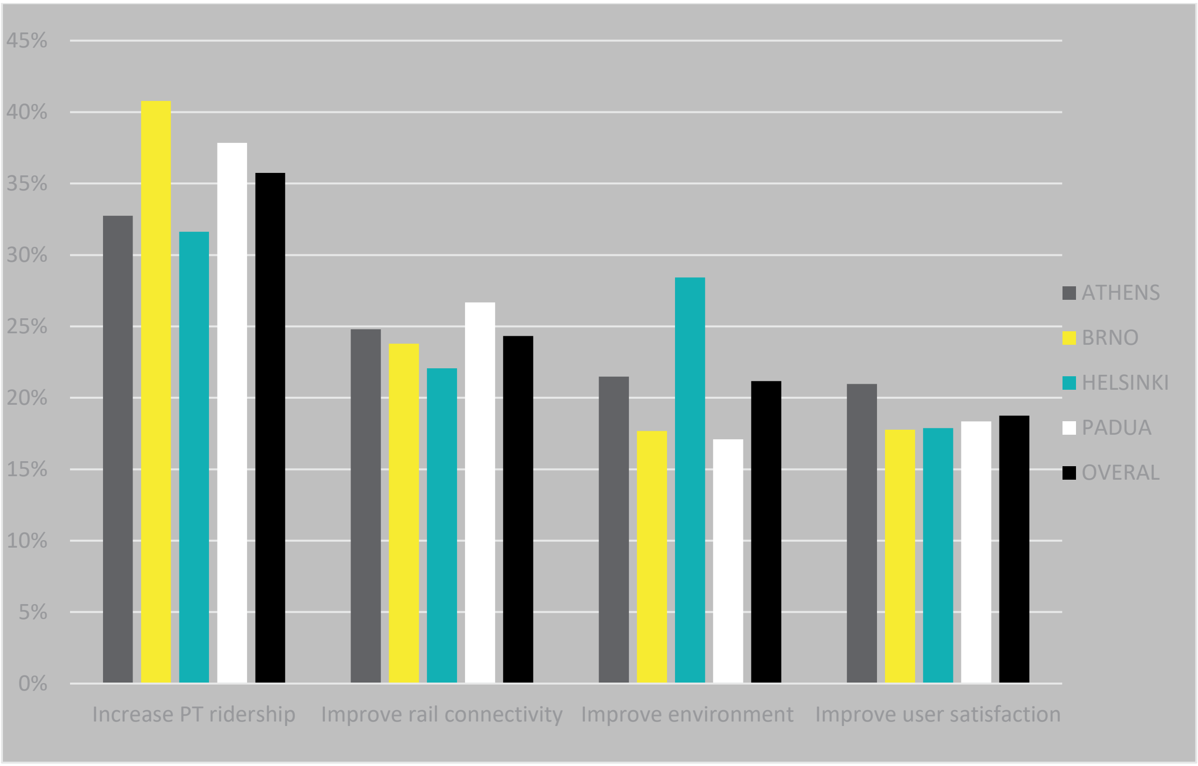

Figure 17: Priorities per priority area among demo cities

Regarding the goal of improving user satisfaction, Athens ranks it higher than the other cities (21%) while Brno gives the lowest score (17.8%). This impact area is ranked as the lowest one among cities with an overall 17%.

According to the aforementioned, the increase of PT ridership is agreed among all demo cities as the number one priority when planning ride-sharing services. On the other hand, the improvement of the environment and user satisfaction are ranked as the lowest, but it is worth mentioning that these areas present also the highest variation showing that cities share different opinions on this issue. In this context, while Helsinki rates the improvement of the environment as second, Athens ranked as the third.

11. OVERALL EXPECTED IMPACT AND LESSONS LEARNED

Ride2Rail permitted a live demonstration of a functional, end to end, journey tool with shared travel functionality with the aim to facilitate the use of public transit and rural trips. The users of this experience shared their main perceptions and they can now be considered, as pillars for future developments, the importance of utility when choosing trip criteria as the ridership and connectivity. Theme for reflection is the fact that users expressed as of lower importance the environment aspects, compared to more immediate characteristics as quickness or cheapness, a sign that day-to-day commuting needs trump system considerations.

The data reported shows that general targets set at the beginning of the project have not been achieved fully. The results of the local KPIs are an exception, where instead the objectives have been achieved and in a couple of cases the estimates have even been surpassed.

Reasons for that target missing have been well highlighted in the Demo Execution Report (D4.4). There was a combination of causes which undoubtedly made things more difficult and delayed the achievement of the objectives set.

Nevertheless, participation was sufficient to permit and collect the data necessary to build evaluations on the services being tested. So, we can score something as 20 trips per demo user of which 2 are of shared kind. The apps have demonstrated a good level of usability despite the fact that they are an outcome of a RIA project so, by definition, they were not yet ready for a mass market.

The conclusions drawn from the users' feedback received from the surveys carried out after the demonstration in the cities show that although a ride-sharing service is expected to be by city travellers as an asset in daily transport, the technological constraints burden at the moment its usage. Regarding the advantages of the Driver Companion (DC) most of the users applaud the concept of the app and mention that it helps reducing travel costs, however as cons they also report complexity of the interface and unresponsiveness in some occasions.

In parallel, users of the Travel Companion (TC) agree that the application is very useful and it helps reduce travel costs. In addition, a lot of participants find the user interface quite simple and easy-to-use and consider practical the ability to get/issue tickets through the app. The integration of PT with ridesharing and other shared mobility modes was also considered an asset. Participants of the Helsinki demo rated the integration of HSL route planner positively. On the other hand, some users report they found difficult to navigate in the application and also that it often crashes. Many users mention that the travel planning provided was not the optimal. Delays in finding the route planning were also reported. An interesting proposal was the integration of the two different applications in one for the sake of simplicity.

Regarding the environmental impact, ride-sharing has demonstrated in the literature a significant potential to reduce road-based CO_2 emissions. The impact depends on the transport mode that travellers used to use before joining a ride-sharing program. The stated preference survey that was conducted in Athens, Greece within the framework of Ride2Rail revealed the existing transport mode per respondent and the willingness to join a ride-sharing scheme. Regarding the transport mode used during the first mile of their trips, almost 62% were made with a private vehicle, 45.4% from which as driver with no passengers (SOV) and 16.3% as a driver with passengers onboard (HOV). Bus used as a mode of transport by 29.3% of the sample and 9.1% of respondents used a taxi during the first mile of their trips (Figure 18). Regarding the transport mode used during the last segment of their trips, almost 47% of the sample used their car with no passengers, 11.8% used their car with at least one passenger onboard and 20.1% travelled by bus (Figure 19).

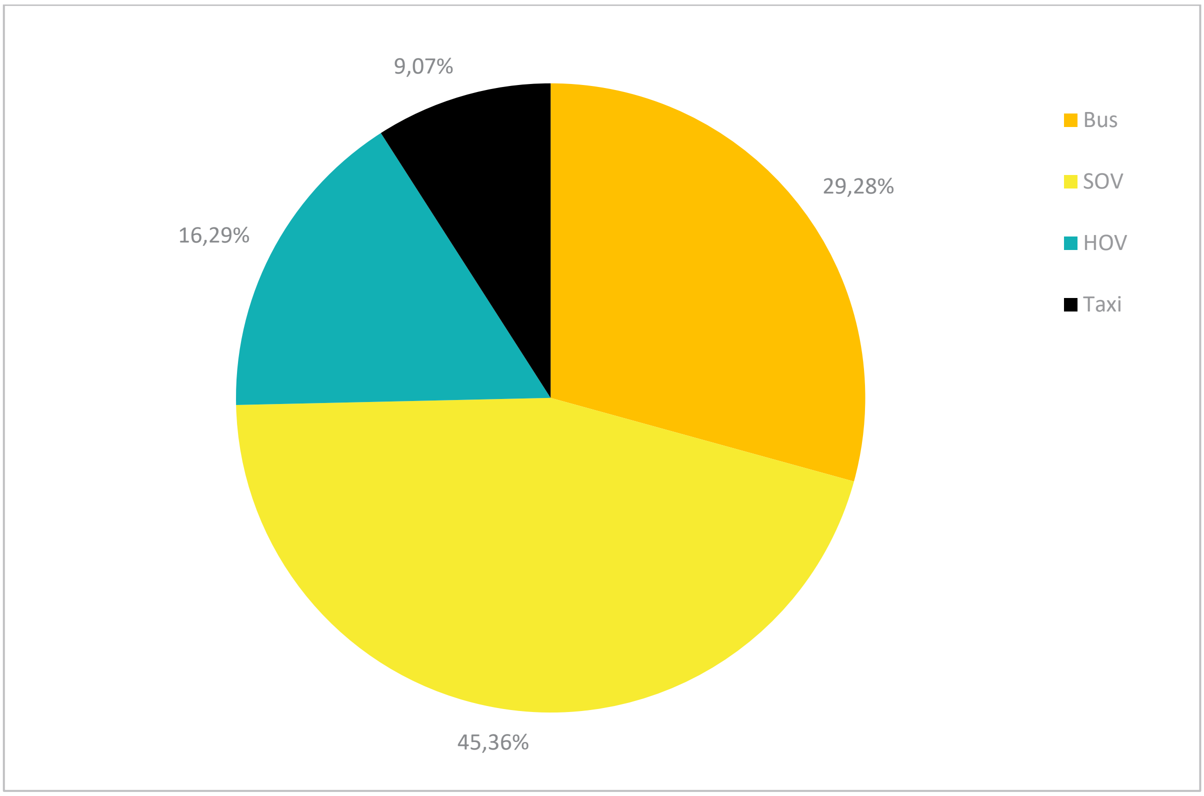

Figure 18. Transport Mode First Mile trips

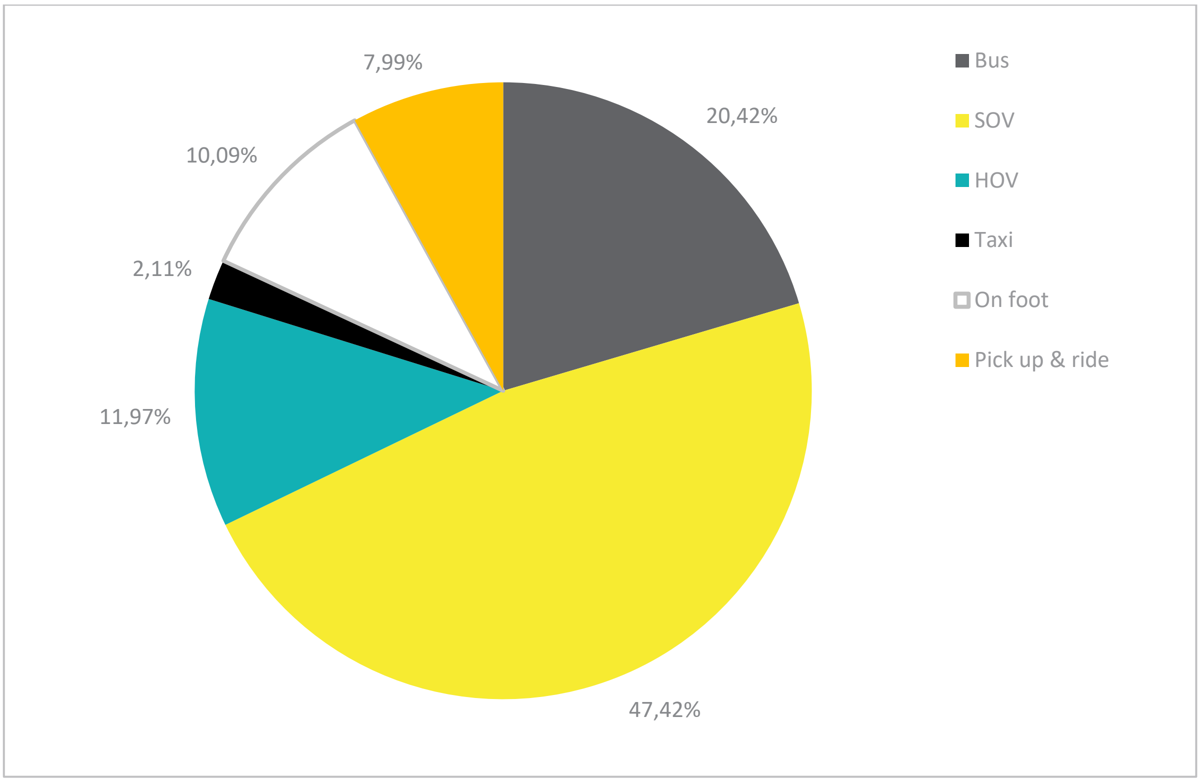

Figure 19. Transport Mode Last Mile trips

Based on SP findings, it was estimated that the average trip length for Athens is 11.3 km. The average emissions per passenger car for petrol vehicles is 122.4 grams/km (European Environment Agency, 2020). and it is assumed that 100% of passenger cars in Athens for the demo are petrol cars

Based on SP responses, in total 57% of respondents would be willing to join a ride-sharing program either as a driver (29%) or a passenger (28%). Table 44 provides CO_2 emissions reduction estimations when the share of travellers that are willing to join a ride-sharing program ranges between 10% and 57%, and the vehicle occupancy is 2 or 3 passengers.

As a result, it can be seen that in terms of environmental impact there is great potential of CO_2 reduction ranging between 5%-38.3%.

Table 44. CO_2 emissions reduction for different ridesharing penetration and vehicle occupancy for Athens

	10%	20%	30%	40%	50%	57%
Rideshare pass. x2	5.0%	10.0%	15.0%	20.0%	25.0%	28.8%
Rideshare pass. x3	6.7%	13.3%	20.0%	26.7%	33.3%	38.3%

It should be noted that since emissions are proportional to the number of vehicles (as all passenger vehicles are assumed to be gasoline fuelled), traffic conditions are expected to be improved as well due to less vehicles on the road. Moreover, whilst vehicle fuel efficiency gains are not reflected in this assessment, given the low electric vehicle penetration in Athens, it can be argued that when gasoline vehicles will be substituted by electric vehicles, the CO_2 reduction will be even higher than the estimated in Table 44. For example, for maximum ride-sharing participation of 57% and electric vehicle usage of 50%, the CO_2 emission will be reduced by 43%. Therefore, a well-structured ride-sharing service that is supported by a technologically advanced application to capture users' preferences as these were presented in WP2 and incorporated in the app (WP3), and is completed by the provision of incentives to travellers, has the potential to improve traffic conditions, the environment and the travellers' satisfaction.

11.1. Further Exploration of Ride2Rail

While the four demo sties have explored the application of Ride2Rail, there was also interest in assessing the Ride2Rail concept at other locations. Furthermore, there is a need to understand how Ride2Rail, as a shared travel concept, compares with other forms of shared travel.

Finally, it is important to understand the wider relevance and appeal of the Ride2Rail, beyond the demo sites. To assess this, a survey of 400 residents of the Newcastle-upon-Tyne, UK area was organized. This survey presented participants with a textual description of one of four shared travel concepts – the Ride2Rail concept, describing the potential to request and pay for shared lifts to a local railway / metro station for onward travel to Newcastle city centre; a traditional taxi; paying a friend to give a lift to the station (i.e., non-ticketing, informal lift share) and an autonomous taxi. All participants lived within 10 miles of the current rail / metro service, or within 10 miles of a new rail service opening in 2024. Participants were also asked about their current mode of travel.

Combined with the local urban area (Tyne and Wear), this local population approaches 2 million people. However, it is also an area of significant urban deprivation and levels of car ownership are low and therefore the need for mobility alternatives is high. The area is served by significant rail services, in the form of:

- The main East Coast Mainline route – serving Newcastle Central;
- Suburban and rural mainline rail;
- An extensive metro system;
- A new rail line in development.

The wider North East area also covers some of the most rural parts of the United Kingdom with limited access to public transport.

Therefore, Newcastle and the North East fits the profile for Ride2Rail in a number of ways:

- Urban, suburban and rural population;
- Theoretical strong connections to mainline and metro rail, but barriers in terms of first and last mile travel;
- Diverse travel needs for students, commuting and leisure, particularly for those without a car.

11.1.1. Method

A survey was developed using the GDPR compliant Online Survey tool. Questions were asked in four parts

- Part 1 asked for participants general use of transportation – current modes and current trip purpose.
- Part 2 asked for participants trip preferences, in terms of different reasons for choosing either public transit or private car. These reasons were derived from the choice criteria used in WP2 and the survey in WP4.
- Part 3 gave participants one of four scenarios – a 100-word textual description of:
  - Travelling to a station using Ride2Rail;
  - Travelling to a station using an autonomous shuttle;
  - Travelling to a station using a taxi;
  - Travelling to a station by sharing a lift with a fried;
- Participants were asked for their ranking of how likely they were to use the mode, and what trip criteria were important to them (matching Part 2).
- Part 4 asked basic demographic information.

The survey was distributed using the prolific survey recruitment service and completed by 400 participants across the North East area.

11.1.2. Results

This analysis covers results specific to the Ride2Rail scenario. Responding participants were aged between 16 and over 65 – median age 22 – 35, and included 45 females and 55 males. Employment status is presented in Figure 20

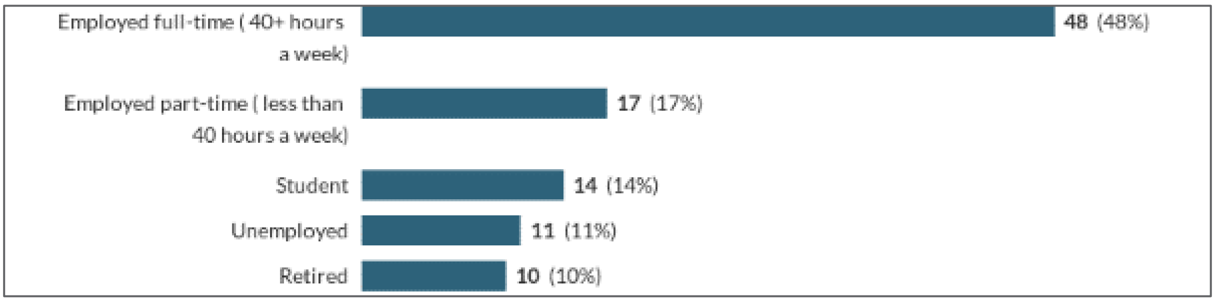

Figure 20: Employment status

All participants lived within a maximum of 10 miles of either an existing train / metro line, or the planned Ashington-Blyth line.

After the scenario description, participants were asked how often they would use the service. Figure 21 shows the response distribution for Ride2Rail, along with reported current use of organised lift sharing, and other shared options – scores are as percentages of overall responses.

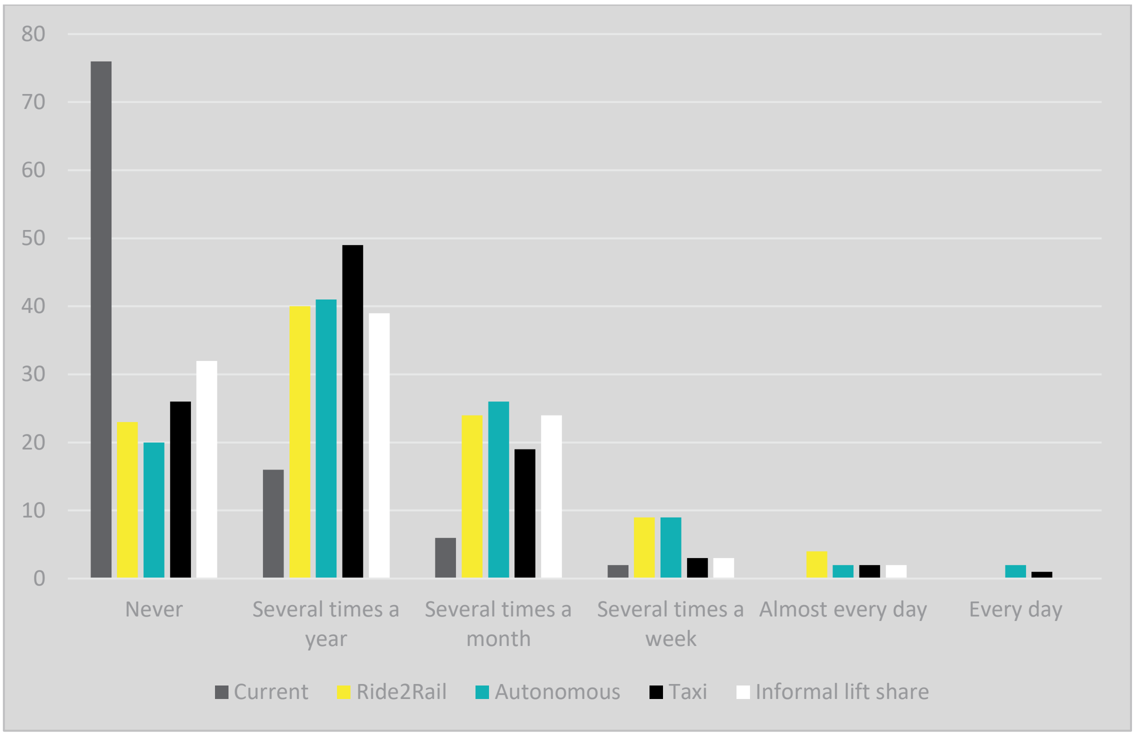

Figure 21 Distribution of responses to shared travel concepts

Participants were asked with what frequency they would use Ride2Rail as a service for different trip purposes. Responses are presented in Figure 22. Choice criteria for using the Ride2Rail system were compared to current choice reasons criteria for private car and public transport (1 indicates a Higher preference), and presented in Figure 23.

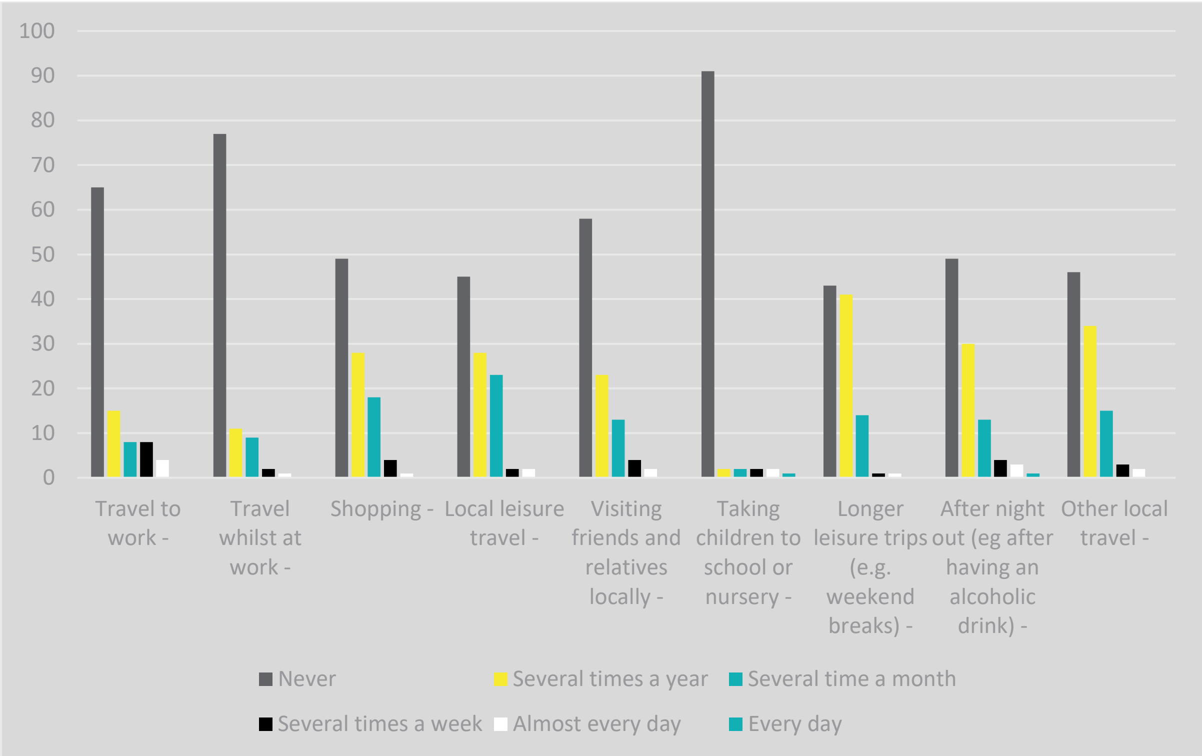

Figure 22: Ride2Rail trip purpose

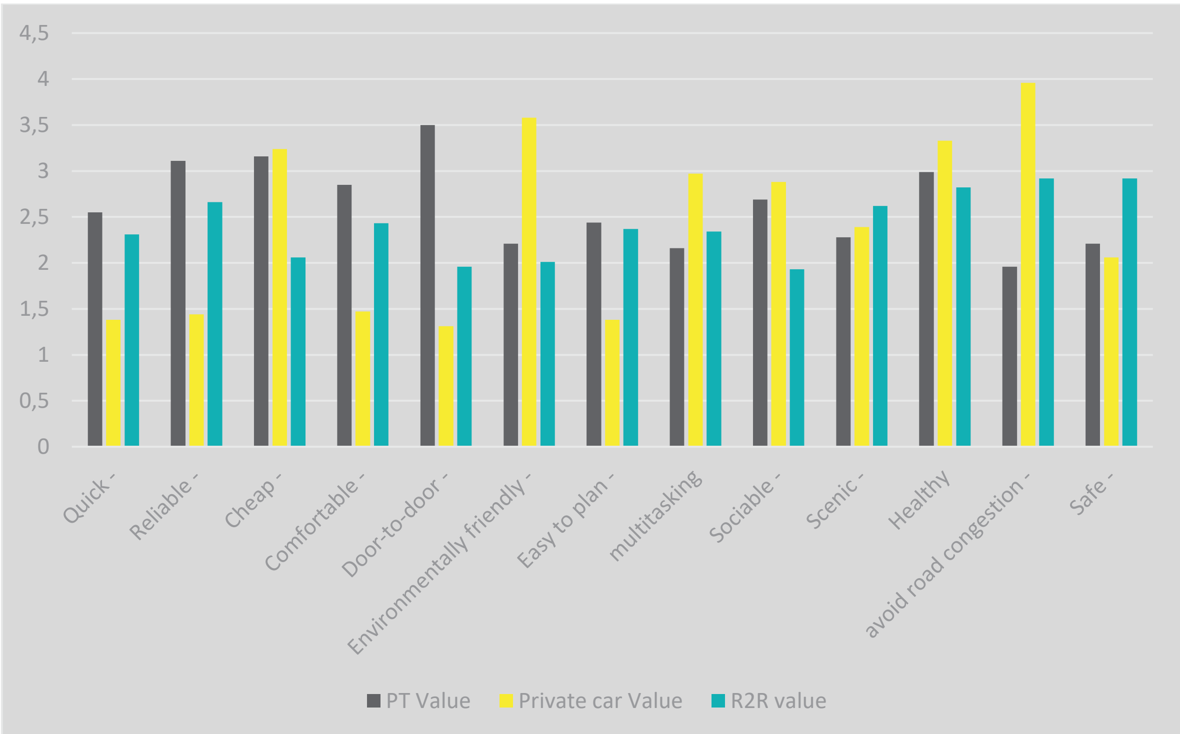

Figure 23: Choice criteria for Ride2Rail in comparison with car and public transit

11.1.3. Discussion of Newcastle survey

These results indicate the strong general appeal of the Ride2Rail concept. First, it is clear that the Ride2Rail concept compares favourably with current concepts of ride-sharing. Participants were more willing to use Ride2Rail, and to use it more regularly, in comparison to current levels of organised lift sharing.

Second, Ride2Rail compares favourably with other forms of potential sharing to connect with rail services. While conventional taxi is preferred for occasional trips, Ride2Rail compares as well or better for more regular uses, up to several times a week. While scores are similar for autonomous shared trip, we note that this is fundamentally unproven technology, whereas Ride2Rail is a solution that can be deployed now.

The trip purpose analysis provides interesting information as to why people would use the Ride2Rail service. It is notable that while there is some interest in using trips for functional purposes such as work, the major interest is using Ride2Rail for leisure purposes, such as visiting friends, making longer leisure trips, or other local travel.

Finally, the choice criteria comparison indicates some of the reasons why travellers would use Ride2Rail. Against the private car, Ride2Rail is particularly valued in terms of being cheap, environmentally friendly, supporting multitasking on a trip, being sociable and avoiding road congestion. In terms of comparison with public transit, Ride2Rail compares favourably in terms of being cheap, providing door-to-door travel, and being sociable. Both demos, impact analysis and the original choice criteria work in WP2 have highlighted the importance of cost and cheapness of travel as a choice criteria. Therefore these survey results confirm that not only is cost a vital criteria, Ride2Rail is perceived as having the potential for delivering a cost effective alternative to public transit and car travel.

12.CONCLUSIONS

Ride2Rail (R2R) project aims to integrate multiple (public/private/social) data sets and existing transport platforms for promoting an effective ride-sharing practice to citizens, making it a complementary transport mode that extends public transport networks. Within the framework of R2R, ride-sharing pilots were implemented in four European cities as previously described. In order to assess the impacts of these demos an evaluation framework was developed and implemented. In brief, a pre and post demonstration evaluation were carried out. Pre-demo evaluation used the baseline values of Key Performance Indicators to perform a baseline appraisal of each demo site while in post-demo calculated the actual values of KPIs after the demo execution were compared to performance targets and KPIs of each site. In addition, the Analytical Hierarchicy Process (AHP) method was used to obtain weights to allocate specific values to the different stakeholder priorities. The stakeholders' priorities were clustered around the four key impacts expected for topic S2R-OC-IP4-01-2019.

It should be mentioned that there were several challenges in implementing the demos as the COVID-19 pandemic had broken out and travel restrictions were in place. In this sense, citizens were generally reluctant to use public transport and/or they changed their mobility behaviours with spread of working from home, new mobility peak hours shifted compared to the pre-pandemic world. Another important consideration linked to COVID-19 is the reluctancy to share vehicles with strangers. This was particularly true after the first two big "waves" of pandemics, but the concern about crowded spaces, cleanness of vehicles and social interaction has been still something relevant during most of the demos. As confirmed by the literature, the limited period of the demonstrations does not always provide the opportunity to regular commuters to plan and trust an innovative mobility solution to complete their trips. This is particularly true in a post-COVID environment with the above-mentioned new mobility patterns widespread in Europe and beyond. Other factors affecting the overall numbers are included in this document. Despite this, the project reached a huge number of testers, and those who accepted to be involved, enthusiastically participated to the project activities, providing valuable feedback that can be very useful for improving the IP4 ecosystem and its tools, in order to increase their quality and the overall user experience.

Regarding choice criteria preferred by users when they travel, the criterion "quickness" is considered the most important criterion (score 2.4) for commuters to choose their mode of transportation. "Reliability" follows in the ranking (score 2.6), showing that passengers place a high value on schedule accuracy. "Price" comes third (score 3) indicating that passengers are willing to pay a bit more if the transport is fast and reliable. "Comfortability" owns the fourth place (score 3.6) and is followed by the criterion of environmentally friendly transport (score 4). Having door-to-door and short transport are ranked in the middle of the choice criteria (score 4.1). The last positions are attributed to the following criteria respectively: health (score 6.5), multi-tasking (score 7.1), social (score 7.4) and panoramic (score 8).

Having in mind all challenges described above, through the evaluation of the demo's impacts it came out that there is great potential to adopt ride-sharing and increase PT ridership. Despite the shorter duration of the demo, in Athens and Brno targets of several KPIs were exceeded such as KPI#3 (completed multi-occupancy vehicle trips with R2R app), KPI#4 (completed trips involving public transit/rail with R2R app) and KPI#5 (completed commuter trips with R2R app). The overall usability rate of TC and DC was around 59%, exceeding the target of 50%, and indicating that participants applaud the ride-sharing concept, even at low TRL.

The estimated priorities when designing a ride-sharing service across demo cities represented the Research community, Public Authorities, Critical Infrastructure Providers, PT Operators and Software company. The aggregated results showed that the top priority is considered the increase of public transport ridership which is followed by the improvement of rail connectivity. Following the COVID-19 pandemic, a lot of effort is placed at EU level to recover and even increase PT ridership and this is reflected also by the estimated priorities per city and in overall.

Ride-sharing has demonstrated a great potential for feeding PT and increasing its ridership, yet the technological barriers and provision of incentives should be well integrated to gain new customers that trust and feel confident to use this innovative mobility solution.

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14. ANNEX

Introduction page

Dear participant,

We thank you for your participation in the Ride2Rail demonstration https://ride2rail.eu/, and we cordially invite you to participate in this survey.

This page gives you information on the survey and your rights as a participant. The survey takes around 5 minutes to complete.

Context

Mobility as a Service (MaaS) is a new paradigm to combine public and private transportation services within a unified and digital service to enable users to plan, book, and pay quickly and seamlessly for their mobility needs. In the MaaS context, a *travel experience* is a user experience during travel associated with specific functionality (e.g., journey planning or booking).

Ride2Rail, part of the **Shift2Rail Joint Undertaking** (https://rail-research.europa.eu), investigates and evaluates the acceptance of digital technologies to support ride sharing and shared journeys within MaaS.

Survey objective

We designed this survey, available in multiple languages, to collect the satisfaction from **Travelers'** with respect to new MaaS travel experiences. We are interested in the urban areas of Athens, Brno, Helsinki and Padua (the Ride2Rail demonstration sites).

The simple questions aim to gather your experiences using Ride2Rail. The functions or utilities presented in each demo site will be evaluated by your responses and it will help us make a better assessment to improve mobility services.

Your participation

Your participation in this survey **is entirely voluntary**.

You do not need to have any specific knowledge or competence regarding mobility to answer the questions: you can simply refer to your direct experience with mobility services. You can stop or resume the survey at any time. After accepting the terms of this message, you will directly enter the survey page.

Data processing

The survey will be done and completed anonymously, and no personal data will be collected (as defined in the European General Data Protection Regulation). We are not able to identify you in any way. We will ask you a set of questions (with respect to the function or utility you may face) and collect your answers for statistical purposes only.

Newcastle University and **FIT Consulting** are responsible for data collection and processing according to the GDPR. You can find all the Privacy details, and Personal Data Processing applied by **Newcastle University** https://www.ncl.ac.uk/data.protection/ and by **FIT Consulting** at https://www.fitconsulting.it/privacy-cookies/

This data collected will be only stored the time required to achieve the objectives of the Ride2Rail project.

Data removal

If in any time you decide to remove your data from this study, please send an email with this request to:

r2rbrnodemo@gmail.com

By proceeding, you confirm and accept that you have read and understood all the above.

Thanks for your participation in our survey!

Next >

How did you use Ride2Rail?

Which did you use during the demo period? * *Required*

- ○ Just the driver companion (I only tried to be a driver)
- ○ Just the travel companion (I only tried to be a passenger)
- ○ Both a passenger and a driver

‹ Previous

Next ›

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Usage page - driver and passenger

How many times have you used the Ride2Rail Travel Companion as a **passenger** of a shared trip? * *Required*

How many times have you used the Ride2Rail Driver Companion as a **driver** of a shared trip? * *Required*

For all of your Ride2Rail journeys, how many connected to public transit (bus, tram, train, metro) either at the beginning or the end of the trip? * *Required*

For all of your Ride2Rail journeys, how many were a commute FROM home TO work / education etc? * *Required*

For all of your Ride2Rail journeys, how many were a commute FROM work / education etc TO home? * *Required*

For all of your Ride2Rail journeys, how many either started or ended at a rural or suburban location? * *Required*

‹ Previous

Next ›

Driver and passenger usability page

This part of the survey uses a table of questions, view as separate questions instead?

How would you rate **organising trips A S A DRIVER U SING THE DRIVER COMPANION?** *
Required

Please don't select more than 1 answer(s) per row.

Please select at least 10 answer(s).

	Strongly agree	Slightly agree	Neither agree nor disagree	Slightly disagree	Strongly disagree
I think that I would like to use the Driver Companion frequently.	☐	☐	☐	☐	☐
I found the Driver Companion unnecessarily complex.	☐	☐	☐	☐	☐
I thought the Driver CompanionI was easy to use.	☐	☐	☐	☐	☐
I think that I would need the support of a technical person to be able to use the Driver Companion.	☐	☐	☐	☐	☐
I found the various functions in the Driver Companion were well integrated.	☐	☐	☐	☐	☐
I thought there was too much inconsistency in the Driver Companion.	☐	☐	☐	☐	☐
I would imagine that most people would learn to use the Driver Companion very quickly.	☐	☐	☐	☐	☐
I found the Driver Companion very cumbersome to use.	☐	☐	☐	☐	☐
I felt very confident using the Driver Companion.	☐	☐	☐	☐	☐
I needed to learn a lot of things before I could get going with the Driver Companion.	☐	☐	☐	☐	☐

This part of the survey uses a table of questions, view as separate questions instead?

How would you rate **organising trips as a PASSENGER USING THE TRAVEL COMPANION?** *
Required

Please don't select more than 1 answer(s) per row.

Please select at least 10 answer(s).

	Strongly agree	Slightly agree	Neither agree nor disagree	Slightly disagree	Strongly disagree
I think that I would like to use the Travel Companion frequently.	☐	☐	☐	☐	☐
I found the Travel Companion unnecessarily complex.	☐	☐	☐	☐	☐
I thought the Travel Companion was easy to use.	☐	☐	☐	☐	☐
I think that I would need the support of a technical person to be able to use the Travel Companion.	☐	☐	☐	☐	☐
I found the various functions in the Travel Companion were well integrated.	☐	☐	☐	☐	☐
I thought there was too much inconsistency in the Travel Companion.	☐	☐	☐	☐	☐
I would imagine that most people would learn to use the Travel Companion very quickly.	☐	☐	☐	☐	☐
I found the Travel Companion very cumbersome to use.	☐	☐	☐	☐	☐
I felt very confident using the Travel Companion.	☐	☐	☐	☐	☐
I needed to learn a lot of things before I could get going with the Travel Companion.	☐	☐	☐	☐	☐

This part of the survey uses a table of questions, view as separate questions instead?

Which of these options are most useful when organising a trip (1 is MOST useful, 11 is LEAST useful) ✱ *Required*

Please don't select more than 1 answer(s) per row.

Please select exactly 11 answer(s).

	1	2	3	4	5	6	7	8	9	10	11
Quick	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Reliable	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Cheap	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Comfortable	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Door-to-door	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Environmentally friendly	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Short	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Multitasking	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Social	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Panoramic	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Healthy	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Are there any other ways to choose your journey?

What is the best thing about Ride2Rail? What did you like about it? ✱ *Required*

What problems did you face with Ride2Rail? What did you dislike about it? ✱ *Required*

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About you

How old are you? *Optional*

- ○ 16 -21
- ○ 22 - 35
- ○ 36 - 51
- ○ 52 - 65
- ○ 65+

What do you do? *Optional*

- ○ Student
- ○ In work
- ○ Unemployed
- ○ Retired
- ○ Other

What gender do you identify as? *Optional*

- ○ Female
- ○ Male
- ○ Other
- ○ Prefer not to say

‹ Previous

Finish ✔

Final page

Thank you for taking part to the Brno Ride2Rail survey.

This is the code that you need to send to receive a special gift for your participation:

Brno_Survey_R2R.

Please send this code to r2rbrnodemo@gmail.com

If you have any further questions, please send these to r2rbrnodemo@gmail.com

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