

SMART MAINTENANCE AND THE RAIL TRAVELLER EXPERIENCE

Deliverable 3.2 - Experience Map in passenger journeys

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EXECUTIVE SUMMARY

The objective of this report is to provide a clear view of the outcomes of the qualitative research activities with railway sector key stakeholders and final users, held during the whole duration of the task 3.2 of the work package 3. These activities have been conducted in order to identify, code and evaluate passengers' experience of rail services through a Human Centred Design (HCD) approach for defining use context, users' characteristics and needs, possible usability issues and strong points of the travelling experience.

The considerations presented below have been used as a guide for creating a visual representation of the passengers' experience of rail services ("Experience Map"): the final outcome of the task 3.2 (i.e. Deliverable 3.2) (see attached documents linked to the report). According to that, the present document can be used to understand the rationale behind the map, which takes into account passengers' mental models, usability issues, positive outcomes and needs related to the possible interactions with rail services.

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TABLE LEGEND

Tables presented in the document are distinguished by size (i.e. number of columns and rows they are composed by) and color, depending respectively on the amount and on the typology of information reported in them. We make reference to the following colour-based code:

Light blue tables

Report information related to operative definitions, research procedures, methods and techniques applied.

Green tables

Report data gathered through qualitative research activities.

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1. SCOPE

Introduction

SMARTE project (Smart Maintenance and the Rail Traveller Experience) falls within the broader scope of research and innovation rail programme promoted by the EU Commission, “Shift2Rail”. It consists of two areas of intervention:

- **Smart Maintenance** – The challenge of the smart maintenance stream is to improve current railway train maintenance systems, through the integration of predictive data analysis algorithms and online optimization tools within an improved Condition Based Maintenance (onwards CBM) strategy;
- **Human Capital** – The challenge of the human capital stream is to understand the current and future needs of passengers from the railway sector as well as other transport systems characterised by rapid advances in technology and demographic change, and consider human centred design in identifying aspects of the customer experience which could be improved and simplified through information and mobility support.

SMARTE (Smart Maintenance and the Rail Traveller Experience) addresses the topic S2R-OC-CCA-01-2017: Smart Maintenance and Human Capital of the Shift2Rail Joint Undertaking Annual Work Plan 2017. The human factors work links to Work area 6 of the CCA-Cross Cutting Activities in the S2R MAAP, Human Capital, which aims to bridge the gap between changes in the railway and other sectors imposed by rapid technological advances and substantial demographic changes. Specifically within this work programme this call links to customer oriented design of mobility.

The smart maintenance work links to work area 3 of the CCA-Cross Cutting Activities, specifically sub-work area 3.3: Smart Maintenance. The plan identifies objectives from this area as the development of an overall maintenance concept taking into account all smart maintenance developments within Shift2Rail; R&D activities for CBM for passenger trains; and the integration of concepts for monitoring of infrastructure by vehicles and vice versa.

The present document refers only to the Human Capital stream of this work, which is addressed through Work Package 3 (“Human Factors: User Centred Planning and Mobility”).

Work Package 3 pursues several purposes within the SMARTE project, each of which addressing a specific task:

- Review demographic and societal factors affecting transport use, usability and attitudes towards transport (Task 3.1);
- Implement an “Experience Map”, a structured visual graphic representation of passengers’ experiences in dealing with travel organisation depicted in a typical journey experience. (Task 3.2);
- Perform surveys on a number of representative transport users, including non-rail users, to define the influence of key factors on the choice of a transport mode, including railway (Task 3.3);

- Integrate the outcomes of Task 3.1-3.3 to develop the “Smart Journey Vision”, a compendium of implementable recommendations and technical solutions for simplifying the end-user experience of planning and undertaking a trip that includes a rail journey (Task 3.4).

Task unit	Subtask
T3.1	<ul style="list-style-type: none"> • Review of demographic and societal factors affecting transport use at each step of journey, by modes of transport interconnected or alternative to train.
T3.2	<ul style="list-style-type: none"> • T3.2.1 – Plan: Creation of a research protocol starting by results of Task 3.1 review and recruitment of relevant stakeholders (representative passengers and rail sector stakeholders across Rome, Leeds and Brussels). • T3.2.2 – Investigate: Planning and scheduling of three workshops with key stakeholders for building the travel process and defining gaps existing between the offered service and passengers’ mental model will be organised. • T3.2.3 – Illustrate: Implementation of the “Experience Map”, which will simulate possible train trip experiences by taking into account the result from workshops with stakeholders and passengers groups.
T3.3	<ul style="list-style-type: none"> • T3.3.1 – Methodology definition: Definition of the methodological framework for the survey by identifying attrition factors for each activity in the journey. • T3.3.2 – Survey: Devise of the survey and translation of survey items in three local languages. Then, submission to the panel of 400 users/passengers via market research provider(s). • T3.3.3 – Analysis of survey results: Identification of the physical and planning factors and their relative importance in the journey to enlighten the resistance at each step of the journey, according to the quantitative results of the survey.
T3.4	<ul style="list-style-type: none"> • T3.4.1 – Scenario framing: Define scenarios of the Vision and revise the “Experience Map” preliminary version in the light of the survey’s quantitative outcome, in order to make it an element of the Vision. • T3.4.2 – Scenario scanning: Validation of scenarios of the Vision through a Delphi study. • T3.4.3 – Scenario forecasting and delivery of the Final Smart Journey Vision: Integration of findings of the previous subtasks to refine the scenario set, crafting and presentation of the “Smart Journey Vision” and of the ‘railmap’ in its final version.

Table 1 — Detail of WP3 task units

In particular, the T3.2, whose core objective is realising a diagram which could depict all the facets of the passengers’ rail journey experience, aims to code and evaluate passengers’ experience through a Human Centred Design (onwards HCD) approach for defining use context, users’ characteristics and needs, possible usability issues and strong points of the travelling experience.

According to that, this document represents a summary report of all the research activities held during T3.2 and of their results. It has been a guide for creating the “Experience Map” and it is meant to understand the rationale behind the map.

According to the HCD approach, passengers have always been at the centre of each mapping stage, with the direct involvement of representative passengers, who have been facilitated to uncover all the possible relationships and connections between the phases of the travel experience, in different contexts and user situations (interaction with services, spaces, products and people).

The “Experience Map” traces the passenger journey cycle from the moment when passengers want or need the service and continues when this is renewed or contested. Then the map is developed according to different behaviours, goals and jobs to be done (i.e. actions, thoughts, feelings, pain points). The “Experience Map” takes into account passengers’ mental models (how they expect the process should go), all possible interactions (e.g. at home, in station, at bus stop) and touch points (all moments when passengers interact with the service before, during, or after they purchase tickets), usability issues (pains, which could discourage passenger), positive outcomes (gains, which passengers desire) and needs (what passengers consider necessary in every stage to get the best from their experience).

In order to gain an industry perspective of the final users’ experience of rail services, key industry stakeholders have been included in the process through 3 operative workshops (Leeds, Milan, Dublin). These workshops have included passenger representation groups to facilitate a consensus on a process based on real customer needs/issues. As already anticipated in the introduction, these activities have been followed by qualitative in-depth semi-structured individual/group interviews with rail users/passengers in 3 different cities (Leeds, Rome, Brussels). The results of the activities with both stakeholders and final users have been used to shape the Experience map, which will be used as input in the next steps of the project (Task 3.3 and followings).

1.1 Stakeholders’ workshops

The stakeholders’ workshops are structured, facilitated discussions with selected key industry stakeholders (i.e. rail operators, journey planners and online ticketing services, international travel agencies, national and local associations of passengers) who are responsible for critical market functions and service provision. The workshops took place in three cities: Dublin, Leeds and Milan. The objectives of the workshops were to:

- understand and specify the characteristics and types of users and journeys which stakeholders regard as being of central importance for their interests or strategic objectives;
- select priority areas for investigation (e.g. through understanding how the industry perceives the passenger experience and how passenger associations represent their

experience) in order to plan and define further qualitative research activities with passengers.

1.2 Passengers' focus groups

The passengers' focus groups are a structured group interviews of final users of rail services who are asked to express opinions and share personal experiences on key aspects of rail journey. The aim is to elicit perceptions, feelings, attitudes and ideas of participants about this topic so as to better shape the following Pan-European survey as defined in SMARTE project-Task 3.3. The focus groups took place in three cities: Brussels, Leeds, Rome. The objectives of the focus groups were to:

- reveal passengers' behaviours, actions/attitudes (what passengers do or tend to do at each stage and what actions they take or tend to take to move to the next), questions (uncertainties, technical rigidities and other issues that prevent passengers from moving to next stage), interest, key expectations and barriers (structural, cost, implementation, process or other obstacles that hinder from moving to next stage) when selecting/using rail transport.
- according to the outcomes of the stakeholders' workshops, explore user perceptions (related to user experience) and different aspects of rail journey planning and undertaking, particularly pain points.
- according to the outcomes of the stakeholders' workshops, deepen the aspects mentioned above in order to understand how to represent them on the "Experience Map".

2. METHOD

2.1 Glossary

A glossary was developed in order to have a terminological alignment in respect to methods, techniques, tools and criteria of qualitative research activities and experience mapping activities (see Appendix A). During the whole duration of T3.2 the glossary has been intended as a point of reference and consultation by members of the consortium to avoid the use of terms and concepts whose meaning was not shared and acknowledged.

2.2 Stakeholders' workshops

Recruitment

Recruitment criteria have been defined according both to:

- the project proposal prescriptions (i.e. 36 stakeholders: 1 workshop for 12 people per country, covering a total of 9 stakeholders in each of 4 categories: rail operators, journey planners and online ticketing services, international travel agencies, national and local associations of passengers);
- the key characteristics of the networks of the partners leading each workshop;
- other linked activities that could attract and ensure the participation of the stakeholders.

Participants

City	Date	Participants	Countries represented	Membership categories
Dublin	11/04/2018	11 – 6 rail operators; 3 journey planners; 2 associations of passengers representatives	Europe – France, Ireland, Italy, Portugal, Switzerland, UK.	Desired participants according to the project proposal: <ul style="list-style-type: none"> • Rail operators (9) • Journey planners and online ticketing services (9) • International travel agencies (1) • National and local associations of passengers (6) Other participants attended: <ul style="list-style-type: none"> • Smart cities/mobility/rail transport experts (3) • Car sharing operator (1) • App-based taxi service operators (1)
Leeds	24/04/2018	7 – 1 rail operator; 2 journey planners; 4 associations of passengers representatives	Beyond Europe – EEUU, Israel, Hong Kong.	
Milan	24/09/2018	12 – 2 rail operators; 4 journey planners; 1 travel agency; 3 mobility experts; 1 car sharing operator; 1 app-based taxi service operators;		

Table 2 — Detail of stakeholders' workshops participants

Materials

- The **stakeholder profiling questionnaire** was created in order to identify, before the workshop, what factors influence rail passenger experience according to stakeholders' knowledge and understanding, so to better focus the discussion during the workshop;
- The **consent form** and **participant list** were created to inform participants about conditions of data use and processing and they were signed by each workshop attendees;
- The **workshop guide** was created in order to ensure the discussion about all the key topics to be focused without being too prescriptive, and to allow the moderator conveying spontaneity in the group, bringing out participants knowledge and perceptions. In it was also explained how to run the exercises and to use the canvases chosen to facilitate the group discussions;
- The **workshop reporting template** was created based on the structure of the workshop guide, to organise consistently the information gathered.

Procedure

The stakeholder workshop was configured as an active workshop which combined presentations and interactive activities. Both focused discussions and individual / group exercises were used.

Team

- One moderator – To conduct the whole workshop and facilitate the discussions and manage the participants during exercises;
- One/Two assistants – To take notes and support the moderator preparing settings and materials and managing participants during exercises.

Data gathering

Information related to perceptions and knowledge of the stakeholders about the rail journey and the services provided, the users and the rail sector were collected in two phases:

- Before the workshops, stakeholders were invited to fill in an online form proposed via email in which they were asked to express their opinion and understanding on the themes mentioned above;
- During the workshop the preliminary information gathered through the pre-workshop form was deepened in collaboration with participants through flipcharts and canvases (see Appendix B) specially created to facilitate discussion. With the help of stickers and post-it notes (if necessary), insights have been prioritised in relation to their importance according to stakeholders' perspective.

Data classification and coding

Considerations that emerged and were prioritised during the workshops were noted through reporting templates and then organised for analysis. An iterative approach to classification and coding of the data was followed. Items which were similar were grouped together, and matched to the three main topics (i.e. rail journey, passengers, rail sector). The factors identified in this manner were then used to select priority areas to be investigated through focus groups with passengers.

2.3 Passengers' focus groups

Recruitment

Recruitment criteria have been defined according to:

- the project proposal prescriptions (i.e. 45 passengers: 15 for each country - Belgium, Italy, United Kingdom; 20 adults from 18 to 65 years old, 16 seniors from 65 years old and up; men and women equally represented);
- the stakeholders' workshops outcomes (i.e. the passengers profiles identified as interesting from the stakeholders' perspective).

Participants

City	Date	Participants	Sampling criteria
Rome	12/07/2018	<ul style="list-style-type: none"> • 9 adults – from 18 to 65 years old; 5 men, 4 women; • 6 seniors – from 65 years old and up; 2 men, 4 women; 	According to the project proposal: <ul style="list-style-type: none"> • age; • gender;
Leeds	20/07/2018	<ul style="list-style-type: none"> • 17 adults¹ – from 18 to 65 years old; 8 men, 9 women; • 6 seniors – from 65 years old and up; 3 men, 3 women; 	According to stakeholders' workshops outcomes: <ul style="list-style-type: none"> • Frequency of rail use, including regional rail, metro and tram (very often/regular, punctually, rarely)
Brussels	14/09/2018	<ul style="list-style-type: none"> • 11 adults – from 18 to 65 years old; 7 men, 4 women; • 4 seniors – from 65 years old and up; 1 man, 3 women; 	<ul style="list-style-type: none"> • Regularity of travels (commuter/non commuter)

Table 3 — Detail of passengers' focus groups participants

Materials

- The **recruitment form** was created in order to identify properly the participants whose profiles are key according to research objectives;
- The **consent form** and **participant list** were created to inform participants about conditions of data use and processing and they were signed by each interview and focus group participant;
- The **focus group guide** was created to ensure the discussion about all the key topics was to be focused without being too prescriptive, and to allow the moderator to convey flexibility in the group, in order to bring out participants' spontaneous reactions and ideas. It also contains indications on how to use the set of images / illustrations chosen as *stimuli* in order to facilitate starting the discussion;

¹Although not specifically requested by the project proposal, some travelers with mobility limitations/impairments have been involved in the research activities with passengers held in Leeds. Their contributions and their perspective on the theme of the rail journey, together with that of the other participants, are reported and discussed at Section 5

- The **focus group reporting template** was created based on the structure of the focus group guide, to organise consistently the information gathered.

Procedure

- Homogeneity within and heterogeneity between the groups have been reached, in order to both:
 - facilitate a rich communication flow avoiding conformism;
 - multiply the points of view avoiding conflicts or blocking discussions.
- Topics were presented from the most general ones to the most specific ones, with each question narrowing the discussion and concentrating on a subset of what previously discussed;
- A moderator led the discussion, while an assistant took notes on contents of the discussion. After the discussion, both drew up a report of the content that emerged accompanied by quotes.
- The focus group took place according to the following phases:
 - Warm-up;
 - Activities framework and project presentation;
 - General introduction of each participant;
 - *Stimuli* presentation;
 - Discussion;
 - Conclusion;
 - Incentives distribution.

Team

- One moderator – To conduct the whole focus group and facilitate the discussions and manage the participants during exercises;
- One/Two assistants – To take notes and support the moderator preparing settings and materials and managing participants during exercises.

Data gathering

Information related to perceptions and experiences of the passengers about the rail journey and the rail service were collected during the focus groups. Notes and verbatim quotes were taken through a wall chart or mind-map completed in collaboration with participants. Participants were invited to use paper copies of journey phases (see Appendix C) and topic guides to collate their thoughts whilst participating. With the help of stickers and post-it notes (where necessary), insights have been prioritised in relation to their importance according to passengers' perspective.

Data classification and coding

Considerations that emerged and were prioritised during the focus groups were noted through reporting templates and then organised in order to be analysed. An iterative approach to classification and coding of the data was followed. Items which were similar were grouped together, and matched to the three priority topics (i.e. rail journey phases, peak hours, mobility at first/last mile). The factors identified in this manner were scanned for differences and similarities between different passenger groups according to the typology. Items identified by more people as

of particular importance and as significantly affecting the journey experience, were considered of high priority.

3. DIAGRAMS AND EXPERIENCE MAPPING PROCESSES REVIEW

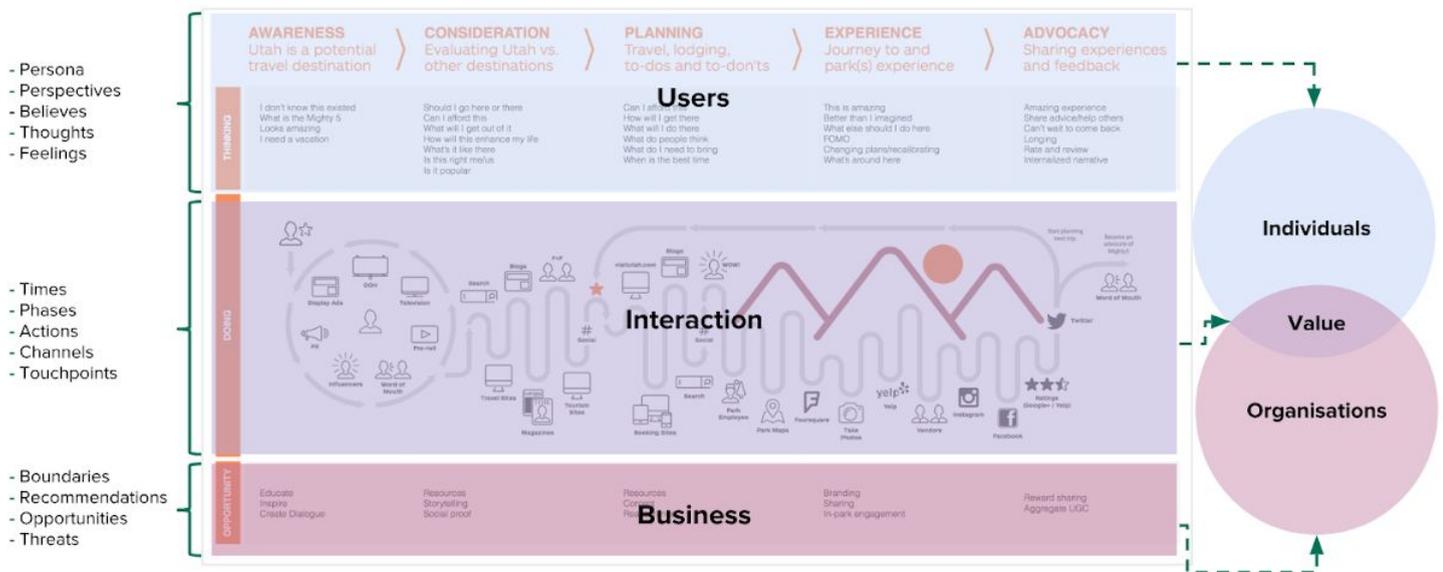
The phase of definition of the information needed to reconstruct the passenger experience with the rail services and of the methods to collect and analyse them was followed by the phase of review of the literature and of market cases / studies concerning the user/customer experience mapping. This phase consisted of the following steps:

- search for an operational definition of the concept of map / diagram that could adapt to the research needs of the project;
- identification of the main map / diagram typologies;
- comparison and choice between the map / diagram typologies;
- crafting of the map.

For the purpose of defining how to manage the diagrams and maps review process and, more specifically the steps indicated above, Kalbach's methodological framework was used as the main approach, as outlined in "Mapping experiences: A complete guide to creating value through journeys, blueprints, and diagrams" (Kalbach, 2016).

Search for an operational definition of map

The creation of the "Experience Map" arose from the need to simplify and represent the complex system of interactions between users and rail services, providing at the same time useful insights for the rail sector to understand the quality of the passenger experience. As such, the "Experience map" conforms to the concept of alignment diagram: "*The term alignment diagram refers to any map, diagram, or visualization that reveals both sides of value creation in a single*



overview. It is a category of diagram that illustrates the interaction between people and organizations.”²

Image 1 — Example of alignment diagram and of its logic

This concept enables the development of a map by which conceptually and visually expresses the experience of the rail services from the point of view of individuals (i.e. the passengers), organisations (i.e. the railway industry stakeholders) and of the interaction between these two worlds (i.e. the rail journey).

Identification of the different diagram typologies

According to this definition of alignment diagram, different diagram typologies have been identified among which choosing the proper experience mapping solution:

- customer journey map;
- experience map;
- service blueprint;
- mental model diagrams;
- touchpoint inventory;
- isometric map;
- ecosystem models;

There have been considered different framework requirements to compare the diagram typologies mentioned above. Here are some:

Frame the diagram

² Kalbach, J. (2016). *Mapping experiences: A complete guide to creating value through journeys, blueprints, and diagrams*. O'Reilly Media, Inc., 4

- Point of view (how does a rail journey fit into users' daily actions? Where do they come in contact with the railway services? When?);
- Scope (determine the boundaries of the experience and the granularity needed to tell a complete story);
- Focus (which aspect will describe the individual's experience and the organization?);
- Structure (chronological, hierarchical, spatial or network?);
- Use (who will use the information displayed in the map?).

Identify touchpoints

- Type of touchpoint to consider (static, interactive, human);
- Moment of truth (emotionally charged and critical moment of the interaction between individuals and services).

Focus on creating value

- Determine the perceived benefit (the interaction represents a functional, social, emotional, epistemic or conditional value for users?);
- Job to be done (what kind of advantage individuals look for when they use railway services?).

Comparison and choice between diagram typologies

Type	Point of view	Scope	Focus	Structure	Uses
Service blueprint	Individual as the recipient of the service	Concentrated on service encounters and ecosystems often in real-time	Real-time actions, physical evidence across channels. Emphasis on service provision, including roles, backstage actors, processes, workflow	Chronological	Improve an existing service or brainstorm new ones
Customer journey map	Individual as a loyal customer, often making purchase decision	Usually from becoming aware, through purchasing, to leaving a company and returning	Emphasis on cognitive and emotional states of the individual, including moments of truth and satisfaction	Chronological	Optimizing sales, customer relations, and brand equity
Experience map	Individual as an actor behaving in a context of a broader activity	Beginning and end by definition, given by the specific experience or context	Emphasis on behaviors, goals, and jobs to be done. Typically includes actions, thoughts, feelings, pain points	Chronological	Used for product and service design improvements, innovation
Mental model diagram	Individual as a thinking and feeling human within a given domain	Breadth of experience by definition, emerges from the data	Emphasis on fundamental motivations, feelings and philosophies	Hierarchical	Used to gain empathy for individuals; inform product and service strategy and innovation
Spatial map	Individual as a part of a multifaceted system of interaction	Given by the size, capabilities, and constituents of an organization	Highlights the flow of information and relations between various aspects and components of a system	Spatial	Understand the flow of information for optimization and process innovation

Table 4 — Comparison between diagram typologies

According to the research objectives of this task, it was required a visual representation which could put at its center the traveler as individual (with his/her complex universe of actions, background experiences, responses, emotions, difficulties, needs) and depict his/her interactions with multiple touchpoints (static, interactive and human) and the quality of the experience with them in a chronological sequence. For these reasons, the experience map has been considered as the proper mapping solution.

Crafting of the “Experience Map”

Once the experience map was confirmed as the proper mapping solution, a three steps process for the map crafting was defined:

1. Definition of the informative elements to be reported and represented on the map and of the general layout (see Image 2);
2. Identification of a common working space (i.e. RealtimeBoard) in which to test different layout solutions, in order to allow each partner to share contributions with the others and update the drafts (see Image 3);
3. Refining of the visual and graphical aspects of the map also through the support of a graphic design team (see Image 4).

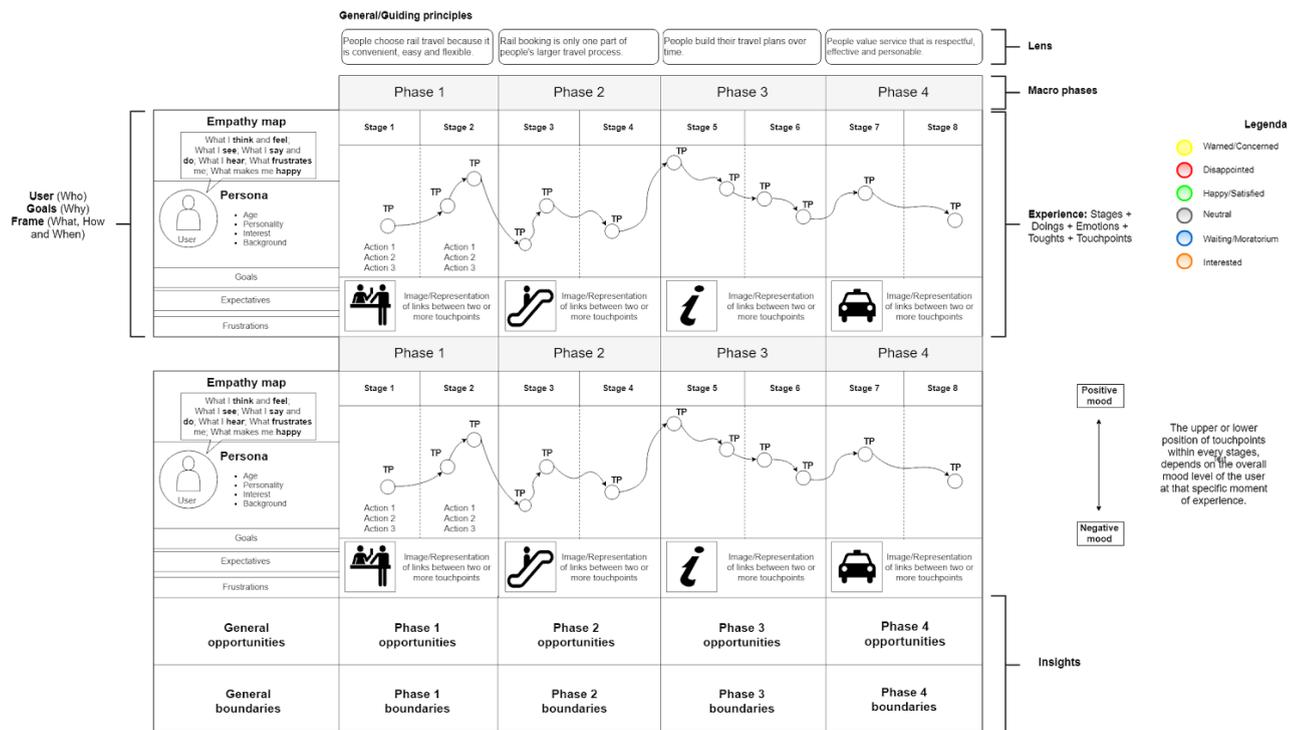


Image 2 — “Experience Map” draft (March 2018)

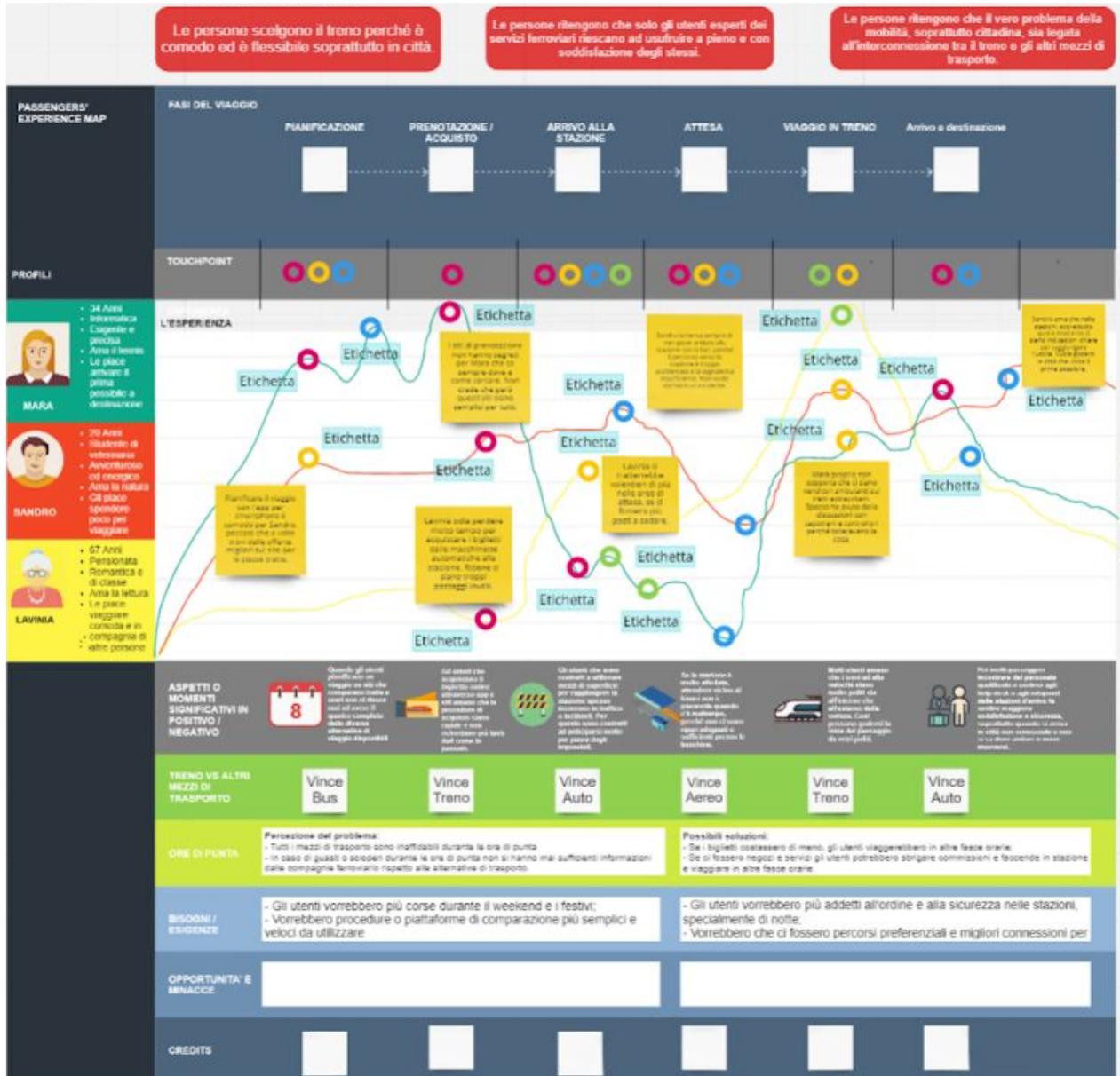


Image 3 — "Experience Map" draft (September 2018)

- **Top** – Description of the overriding filters through which view the journey, such as user group profiles and more general experience principles;
- **Middle** – Depiction of the range of interactions passengers have across channels, touchpoints, time, and space in pursuit of satisfying one or more travel needs;
- **Bottom** – Description of the takeaways emerged from the experience mapping process (e.g. strategic insights, recommendations, technical advices).

The final version of the “Experience Map” (see the list of related documents) depicts the following elements:

- **Passenger perspectives** – General beliefs and perceptions about the rail journey commonly shared by passengers;
- **Rail journey phases** – Main phases that characterise a rail journey;
- **Touchpoints** – Points of the journey experience where passengers meet / use the different rail services provided;
- **Passengers groups profiles** – Descriptions of groups of passengers with the same characteristics and rail travel habits;
- **Comparison between train and other means** – Comparison between the rail sector and other means of transport on different aspects of a journey;
- **Peak hours** – Deepening on the needs/pains of the passengers during peak hours;
- **Needs** – Conditions that have to be met in order to ensure a good passenger experience with rail services;
- **Opportunity / Threats** – Advantages for the rail sector if passengers’ needs will be met and negative consequences for the rail sector if passengers’ needs are not met.

4. STAKEHOLDERS' WORKSHOPS OUTCOMES

4.1 Introduction

Below are reported the summarised results of the qualitative research activities with key stakeholders of the rail industry held in Dublin, Leeds and Milan. These results identify how stakeholders perceive the passenger experience and which of its aspects have strategic importance for their objectives. Furthermore, these results were functional to select areas and themes to be investigated through qualitative research activities with passengers. The following data have been gathered through questionnaires and workshops. Section 4.2 provides an operative definition of each of the four categories of stakeholders considered key rail industry representatives according to the project proposal. Section 4.3 presents stakeholders' perspective about the rail sector, the final users and the rail journey. Section 4.4 presents stakeholders' considerations on specific phases of the rail journey. Section 4.5 deepens stakeholders' perception of the trends (e.g. economic, demographic, technological, etc.) affecting passenger experience, focusing both on the trends impacting on the offer and on the demand of rail services.

4.2 Profiles

Below, operative definitions of each of the four categories of stakeholders considered key rail industry representatives according to the project proposal are provided.

Desired stakeholders' profiles

Profile	Description
Rail operators	Public or private organisations whose main activity is represented by the provision of rail transport services for people. These representatives of the rail industry, besides transportation, have logistics and infrastructural responsibilities towards the context they operate in.
Journey planners and online ticketing services	Public or private organisations whose main activity is represented by the provision of information and/or technologies for people in order to allow them to plan, book and purchase journeys. These representatives of the rail industry, often use specialised search engines to support customers finding an optimal travel solution (in terms of time, cost, transport mode, etc.) to travel between two or more given locations. Within these organisations are also included public entities responsible for public transport planning and monitoring.
International travel agencies	Public or private organisations whose main activity is represented by the provision of travel and tourism related services to the public on behalf of suppliers such as railways, car rentals, hotels, travel insurance, package tours, etc.
National and local associations of passengers	Advocacy organisations whose main activity is to represent and promote the interest of travelers both as rail passengers and customers. These representatives of rail industry work to ensure passengers' rights are respected at local and national level.

Table 5 — Operative definition of stakeholders’ categories to consider according to the project proposal

Furthermore, it is appropriate to report that, in addition to the stakeholder categories listed above, other types of representatives of the mobility and transport sector have been involved in the activities (i.e. Smart cities/mobility/rail transport experts, local authorities, car sharing operators, taxi service operators).



Image 5 — Dublin stakeholders’ workshop

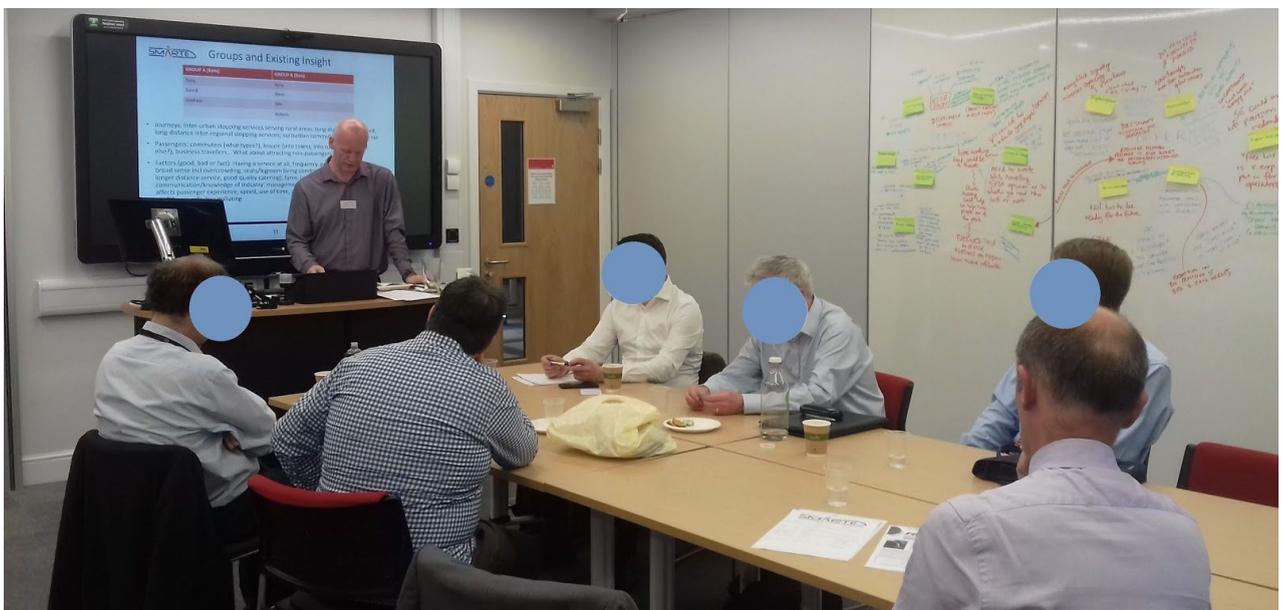


Image 6 — Leeds stakeholders' workshop

4.3 Stakeholders' perceptions and aspects to deepen

Below stakeholders' considerations on the main topics discussed during workshops (i.e. the rail sector, the final users and the rail journey) are reported.

Topic	General perceptions
Rail sector	<ul style="list-style-type: none"> ● Rail sector is conceived as part of the mobility system, in which other transport modes are perceived as allies (not just opposite options that could undermine the rail sector). The interest is more on creating a better integrated offer than attracting people from other transport means.
Final users	<ul style="list-style-type: none"> ● Travelers are perceived as dynamic and not linked to a single transport mode but linked to the whole urban transport system; ● A big interest was registered in attracting to rail: <ul style="list-style-type: none"> ○ non-captive travellers, specially outside the peak hours; ○ commuters whose travels are usually multimodal.
Rail journey	<ul style="list-style-type: none"> ● Stakeholders tend to think and talk not in terms of rail transport but in terms of mobility. That testifies how some sector representatives are moving toward a vision according to which the full integration of all transport modes is key: other transport modes are perceived as part of the system, not opposing options that could undermine the rail sector. This approach is partially shared by the stakeholders - but not always.
Topic	Aspects to deepen
Rail sector	<ul style="list-style-type: none"> ● Connections with other modes of transport (especially for non-commuters); ● Competition with low cost bus services (e.g. Flixbus); ● Characteristics of rail operators offer of ticketing solutions (e.g. pricing, degree of ticket dematerialisation, possibilities of booking/purchasing); ● Rail operators information provision (e.g. on delays, disruptions); ● Rail operators connectivity offer.
Final users	<ul style="list-style-type: none"> ● Social inclusion (e.g. possibility to ensure smart mobility to the widest public, not only through smartphones); ● Sustainability of mobility services (not only rail services) for travelers (e.g. car sharing is not sustainable for commuters); ● Integration of other mobility services in rail tickets (e.g. integration of car sharing services in the monthly tickets for commuters); ● Off-peak commuters behavior; ● Youth mobility behavior; ● Cultural barriers which could lead specific population groups (e.g. ethnic minorities) to not use rail services.
Rail journey	<ul style="list-style-type: none"> ● Service contracts between Public Administrations and rail operators; ● Possibility of provision of multimodal services; ● Connection with airports.

Table 6 — Stakeholders' general considerations on the rail sector, the final users and the rail journey

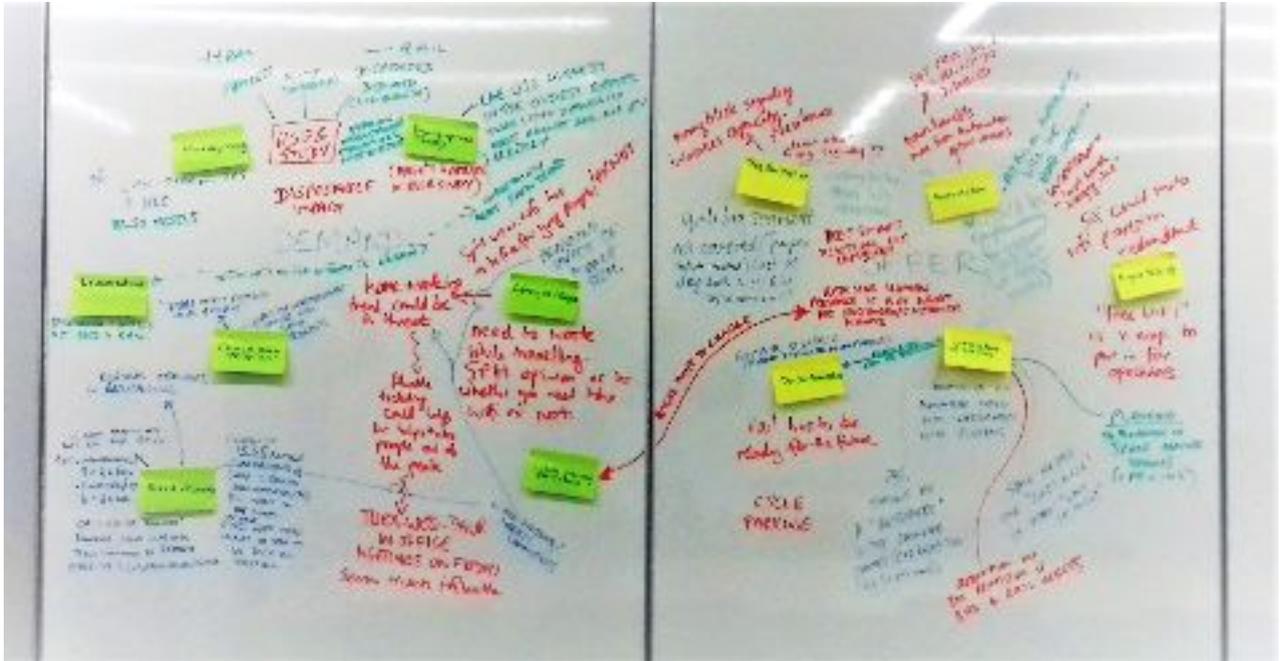


Image 7 — Stakeholders' workshop - Example of outcomes

4.4 Considerations on rail journey phases

Below stakeholders' considerations on specific aspects related to the phases of the rail journey are reported.

Phases	
Planning the journey	<ul style="list-style-type: none"> ● Apps have to provide potential users with specific and not generic information, otherwise they risk being useless; ● Some apps are perceived as non-neutral (e.g. stakeholders reported cases of apps for travel planning, which drive the user to non-rail interconnected services managed by the holding which the incumbent RU belongs to); ● Rail journey times are considered more reliable and consistent than the ones of other modes of transport; ● Weekend and night travel solutions are still inadequate to meet demand.
Booking/Purchasing the ticket	<ul style="list-style-type: none"> ● Fares are considered as not advantageous for frequent travelers, while ticketing solutions and offers are considered not flexible for non frequent travelers; ● The user experience policy is fundamental when implementing an app or a device for ticketing. Ticket purchase has to be easy, possible with credit cards. Barriers issued against the use of debit cards by the payment service provider or by the bank of the merchant may be a barrier to online purchase of integrated tickets; ● Some apps are perceived as non-neutral.
Accessing the station	<ul style="list-style-type: none"> ● Connections and accessibility to the station are two of the most important factors to attract travellers to rail; ● The possibility to depart/arrive in the city center is one of the most important competitive advantages for rail, but it could be undermined if: <ul style="list-style-type: none"> ○ Information on delays, disruptions, etc. is not accurate; ○ Pathways and signs towards other mobility services are not evident and clear to the public. ● Some stakeholders retain that the improvement of information and communication at stations has to be realised by RUs and infrastructure managers, who often play too much a simple role of “people transporter”. ● Some stakeholders retain that rail operators have to play a big role in ensuring opportunities for: <ul style="list-style-type: none"> ○ e-mobility (e.g. installing public recharging stations); ○ bike sharing (e.g. every station has to have a secure bike-station with a sufficient number of racks).
Waiting at the station	<ul style="list-style-type: none"> ● Some stakeholders refer that manned ticket offices are still perceived by the public as a security factor, and still help in keeping sufficient security levels, especially in less crowded stations and at evening time (i.e. after 8PM); ● Station managers should invest more resources on security services..
Travel by train	<ul style="list-style-type: none"> ● Stakeholders indicated the following aspects of the travel phase of the journey as key: <ul style="list-style-type: none"> ○ punctuality; ○ comfort on the vehicle; ○ cleanness of vehicles; ○ security.

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- Stakeholders maintain delays and disruptions are still prevented by “good relations” with labour unions, since train drivers are still one of the most unionised category of workers;
 - The possibility for passengers to use travel time in different ways is considered a competitive advantage over other means of transport.
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Table 7 — Stakeholders’ considerations on specific aspects related to the phases of the rail journey

4.5 Trends affecting the rail journey experience

With the contribution of the stakeholders, we have identified the ongoing main trends interesting the railway sector which have an impact on the whole experience of the rail journey. Namely, we have distinguished between trends affecting the offer and trends affecting the demand for rail services.

Trends affecting the offer	
Services integration and Mobility-as-a-Service (onwards MaaS)	<ul style="list-style-type: none"> • The integration of services is considered one of the most relevant trends affecting rail mobility. The spread of integrated services (e.g. smart ticketing and booking) is possible thanks to the increasing availability of new technologies within the reach of large groups of users (e.g. smartphones apps development); • MaaS is perceived both as an opportunity and a concern. It could complete the rail journeys, covering the first and last miles, but it could also offer more attractive mobility solutions excluding rail.
Digitalization	<p>Passengers' rail journey experience is perceived to start always more often with ICT devices, so that it is strategically unsuitable and no longer possible, to consider "physical trip" separated from "virtual trip". Therefore, since information will accompany travelers through the whole journey in the future, information about public and private transportation, also thanks to the new digital technologies (e.g. Wifi/5G/IoT/ Big data, Open data), will be integrated, always available and accessible to a wide range of users. In particular:</p> <ul style="list-style-type: none"> • Digitalisation and, more specifically big data, are perceived as ways to optimise costs and monitor the demand; • Ticketing also likely to be more digital based going forward; • Question whether 5G will replace wireless in future; <p>Moving block signalling will open up more capacity.</p>
Automation/ Artificial Intelligence	<ul style="list-style-type: none"> • Homeworking/auto-controlled vehicles are the easiest form of automation/red herring – people want humans. • Automatic vehicles open up more capacity through higher service levels and resilience (e.g. Thameslink); • Automated cars (Shared Automated Vehicles) could be a feeder service to rail in the future. However, they could become a competitor of rail transport too, especially if they would reach the same level of safety and security which are mandatory for rail vehicles; • MaaS diffusion is perceived as dependent also from the evolution of automated cars.
Renewable energies and need for decarbonisation	<ul style="list-style-type: none"> • Reduction in the use of vehicle with high level of carbon emission is perceived both as having a positive impact on environment and on economical aspects related to greener modes of travelling. The rail mobility offer is perceived to change according to the introduction of new policies for decarbonisation, to the introduction of new pro-environmental vehicles (e.g. E-trains) and to the raising awareness of people about decarbonisation implication on health; • This trend is perceived as a key factor to attract travellers to rail since it enables the widespread of bans and limitations for the more pollutant cars

	towards carbon-free areas and corridors, both at urban level and for long distance travels (e.g. bans to diesel cars).
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Table 8 — Trends affecting the offer

Trends affecting the demand	
Personalisation of the offer	The future travel experience (not only rail experience) will be tailored to everyone's needs and wants. Transport offers/services will be defined in a one-by-one approach.
Growing urbanisation	<ul style="list-style-type: none"> • Peak hours are problematic: the 'travel demand management' goal is to remove people from peak hours to other time-slots. Home working might help balance peak but will hit revenues too. • Travellers with irregular patterns (e.g. those working away during the week) need more flexible ticketing. • Travellers are perceived as dynamic - not linked to a single transport mode (but linked to the urban transport system). • More concentrated populations help rail, more dispersion hinders it. • New generations are more and more willing to place themselves near stations and to buy houses near stations and public transport. This is particularly evident when checking real estate prices between areas near and far public transport facilities (e.g. metro stations). • New lifestyles include less educated youngsters, more vandalism, which leads to the need for new legal and insurance conditions for rail operators.
Social and demographic changes	<ul style="list-style-type: none"> • More than in the past people want high-quality mobility services, which means they are looking for a travel chain which has to be reliable, flexible, safe, accessible, comfortable and non-discriminatory. In particular, accessibility and safety objectives are key in consequence of the ageing society and also because rail sector aims to be able to meet mobility needs of people with disabilities (e.g. through integrated and automated mobility solutions). • Living without owned cars is more possible in cities, less frequent in peri-urban and rural areas. • Sharing is inversely proportional to income and directly to Value of Time. • Sharing economy as a societal trend is particularly evident in Northern Europe more than in Mediterranean countries.
Pollution perception and increasing awareness on health	The interest in climate change and air pollution has never been so strongly perceived by people, and, also in consideration of the increasing awareness on health, their impact on individuals' everyday life in urban centres is becoming more evident. Therefore, rail stakeholders expect people's interest moving toward eco-friendly and sustainable modes of transport. Nevertheless, for some stakeholders, climate change and health awareness could be considered as the trend of lowest importance if compared to the others surveyed. From their perspective, in fact, these trends may influence the choice of fuelling (e.g. electric cars) rather than the use of the train as a substitute for other means of transport.
Sharing economy	Shared economy and shared mobility could solve the first/last mile problem, allowing people to get to their destination avoiding the use of their private car;

<p>Whole journey perception</p>	<p>People are more likely to see their travel experience as more than the simple sum of the journeys with different means of transport. It's experienced as an A to B issue (e.g. door-2-door perception, comfort perception).</p>
<p>Brexit</p>	<p>From the UK group, Brexit also emerged as a key issue, from possible negative impacts on rail demand from re-structuring of economy back to manufacturing away from services and from a reduction in overall scale of economic activity. Possible resultant reduction in overseas commuting and travel. Also in UK the changing status of workers (through the IR35 tax law) flagged as an issue for rail demand, as fewer will be able to claim back travel expenses.</p>

Table 9 — Trends affecting the demand

5. PASSENGERS' FOCUS GROUPS OUTCOMES

5.1 Introduction

Below are reported the summarised results of the qualitative research activities with final users of the rail services held in Brussels, Leeds and Rome. The following data have been gathered using methods and techniques belonging to Psychosocial Research, such as questionnaires, interviews and focus groups. Section 5.2 describes the user group profiles. Section 5.3 describes the main phases that characterise a journey and we present the main insights coming from their discussion. Section 5.4 deepens the theme of peak hours. Section 5.5 presents the main insights coming from the comparison between rail and other journey modes for both urban routes and extra-urban routes.

5.2 Profiles

Several user group profiles have been identified. Before describing each user group profile, it is appropriate to provide the rationale of the factors considered and those excluded. In defining the discrete user categories, more relevance was given to individual factors, such as habits, expectations and perceptions (related to the rail journey), rather than demographic factors (e.g. age, gender, occupation, etc.). In fact, the former allowed proved easier than the latter to detect and understand the differences between the needs, the frequency and the modes of use of different typologies of real users. Therefore, each user group profile is composed of travelers that are similar to each other, but different from those of other groups according to the characteristics reported above. Below a brief description of each of the four profiles identified is presented.

Profile	Description
Commuter traveller non frequent rail user	People who travel the most for work and/or for study but do not use the train as their main mean of transport. They want the transportation system to be flexible and customisable to their needs. They do not have preferences for any mean of transport or company of services, because their main objective is to arrive as quickly as possible to their destination spending as little as possible.
Commuter traveler frequent rail user	People who travel the most for work and/or for study and use the train as their main mean of transport. Like "Commuter traveller non frequent rail user" people, they want the transportation system to be flexible and customizable to their needs. They do have preferences between transportation companies and feel disappointed when the services offered don't meet their needs, not repaying their fidelity. Some of them: <ul style="list-style-type: none"> - have a proven travel routine and they tend to take always the same means of transport at the same time slots in order to not incur in unexpected contingencies; - have a proven travel routine too, but they are more likely to try different/new combinations of means of transport to travel from A to B. They are also interested in the transportation news in their cities.
Non-commuter traveler non frequent rail user	People who travel the most for leisure during their free time (e.g. sightseeing, visit museums and exhibitions, visit the family) but do not use the train as their main mean of transport. They prefer using other means of transport instead of the train especially when they travel within the city they live in or they are visiting, but they would use the train more if some aspects of the rail journey improve. Some of them:

- have a quite consolidated negative perception of the rail journey and in general of the transportation system. They are more likely to confirm their negative expectations about travelling by train than to change their mind about rail services;
- neither have a positive or a negative perception of the rail journey, but they are more likely to find/focus on its positive aspects and on the pleasure of travelling.

Non-commuter traveler frequent rail user	People who travel the most for study and/or leisure during their free time (e.g. sightseeing, visit museums and exhibitions, visit the family) and use the train as their main mean of transport. They share with “Commuter traveler frequent rail user” people the disappointment when the rail services offered don’t meet their expectations/needs, especially because they want to have a good rail journey experience during their free time.
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Table 10 — Passenger group profiles

In these research activities, as will be shown through the results presented below, it is notable that there is a certain heterogeneity in the outcomes. This heterogeneity, however, didn’t prevent the identification of discrete passenger profiles and cross-cutting trends which interest all the categories described above. Among these common trends, some could be interesting to deepen with further analysis, namely the general tendency people increasingly have to avoid traveling by private car unless it is strictly necessary. In fact, especially for urban travel, public transport is preferred to the private car, except in cases where many different places must be reached in a limited time, multiple chores must be done or the public means lack of reserved spaces / systems to get on/off for people with mobility limitations/impairments. On the other hand, when planning non-urban trips, people consider their availability of time and budget to decide whether to use the car or other means of transport. As well as for the other results, needs, habits, beliefs and experiences which stands behind these trends will be clarified through T3.3 survey.



Image 8 — Rome passengers' focus group



Image 9 — Passengers' focus group - Example of outcome

5.3 Passenger experience

Here are presented the main insights collected through the discussions focused on specific topics related to the travel experience. The focus groups started from the discussion of the main phases that characterise a journey. These phases were identified through literature review and stakeholders' workshop outcomes. In order to facilitate the interpretation of the following outcomes, here are provided below the descriptions of these phases.

Phase	Description
Planning the journey	The phase when people plan and choose how to go from A to B, what means of transport they have to take, how much time the journey will take and how much it will cost.
Booking / Purchasing the ticket	The phase when people book or purchase the ticket/s for one or more means of transport they will need for the journey.
Arrive at the departure station	The phase when people leave their houses and take one or more means of transport to reach the departure station.
Waiting at the departure station	The phase when people wait at the station for the arrival of the rail vehicle to travel in.
Rail journey	The phase when people are physically on the vehicle.
Arrive at the destination	The phase when people get off the vehicle to reach their final destination (through one or more means of transport, where needed).

Table 11 — Rail journey phases

Each phase identifies a precise moment of the journey that, depending on the type of passenger, can be experienced in a different way. However, net of the differences between groups of users with similar characteristics and needs, it is possible to find a general agreement around the following points.

General perceptions

Expertise	Passengers consider that the transport system seems to be understandable only for experienced users, who have learned how to manage it. On the contrary, those who do not fully understand or know how each means of transport behaves and connects to other means, incur unforeseen effects or inconveniences.
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Value for money	<p>The cost of tickets and season ticket is considered too high compared to the quality of the services offered. However, some passengers would be willing to pay more for the rail services offered, if the overall quality of the travel experience was higher. However senior travellers seem to agree with their monthly/year subscription price. Price system was also pointed out as “improvable”, e.g. pricing the stations travelled, not the entrance into the network, having the possibility of buying a ticket by using all the transport means (e.g. cash, credit card) and at the same price everywhere (on the vehicle and at all the stations), or validating the ticket once on the vehicle and not in the station, in case there is a delay in the rail network and so a need to change the transport mean.</p>
Ordinary train Vs High speed train	<p>Passengers perceive a deep difference in the quality of the services provided (and thus the journey experience), between rail journeys with ordinary trains and with high speed trains. It makes them strongly prefer the latter type. Due to this difference, passengers are likely to be more demanding when they travel by high speed train. In fact, if during the high-speed train journey something doesn't work according to their quality expectation, they tend to be very disappointed.</p>
Peak hours	<p>Passengers report that when the rail vehicle/platform/system is overcrowded, it is more likely to result in missing/poor services (i.e lack of seats, unfriendly or non-professional behaviour from rail companies personnel). People refer to overcrowding as making the rail journey stressful and harder to use the time in personally valuable ways (e.g. eating, studying, working), which reduces key advantages for rail travel over other means travel (i.e. flying, driving).</p>
Communications	<p>Passengers consider communications from rail companies as unreliable, in particular when related to unexpected delays. It has been pointed out as one of the main concerns in both urban and inter-urban travels. However communication does not only affect unexpected events (e.g. delays, disruptions, strikes): regular communication is also considered misleading, like the waiting time in the panels at the stations.</p>
Travel time	<p>Different passengers typologies attribute a different value to travel time.</p> <ul style="list-style-type: none"> ● Urban passengers: <ul style="list-style-type: none"> ○ Non regular passengers (especially retired people) do not consider time as a key criteria when they plan their journeys (e.g. if walking to their destination means 20-25 extra minutes, they'll probably consider this option); ○ Frequent passengers (especially commuters) do consider it highly relevant when they plan their journeys and it mainly affects the choice of the mean of transport they take (e.g. metro is normally selected to avoid traffic jumps). ● Non urban passengers: <ul style="list-style-type: none"> ○ Frequent passengers' (especially intercity commuters whose travel time - one way- usually takes more than 1 hour) travel time means losing the opportunity to do other activities.

Environment

Liveability of the station	Passengers would like to be encouraged by service providers to have a fuller experience whilst at the station, and not to see it only as the place where to wait to take the train. In this regard, people stated they would gladly spend their time in stations if their infrastructural conditions and the way they are maintained were better (e.g. inadequate cleaning and maintenance of the stations, poor control and security, waiting areas not available or not equipped). Moreover, what discourages the most passengers to 'live' at the station instead of passing through it, is the lack of shops, markets, gyms, equipped places where to study and / or work: namely places where to continue their lives rather than an uncomfortable time between journeys. It has also been registered that passengers are more likely to perceive big and central stations (e.g. stations equipped with shops and cafes) as designed for tourists rather for citizens.
Accessibility	Passengers with disabilities or with reduced mobility report more difficulties with using rail for first mile, waiting at station, as well as boarding/using/leaving the vehicle (e.g. need for more space for wheelchair/walking aid users, their equipment and their carers) and the destination station (e.g. no or broken elevators). Accessibility issues also extend to the staff at stations and on trains who need to be more trained to better welcome and assist passengers with mobility limitations.
Connection	
Eco-friendly vocation	Some passengers would like their city to provide them with eco-friendly travel solutions. However, although bicycles and electric or hybrid vehicles are perceived as effective alternative to the common means of transport, at the same time they are seen as inconvenient travel solutions due to poor or inadequate cities infrastructures (e.g. lack of direct connection to reach the stations, of road signs, of reserved parking for "eco-means of transport");
Connections to the station	Passengers believe that connections between transport means at the stations/hubs (i.e. metro and tram, but also taxis, buses, cars) are insufficient and inadequate. In particular, the existing ones are unreliable due to the frequent delays and disruptions that force them to move well in advance to reach the station in time. Those who mainly use surface means of transport to reach the rail stations (i.e. tram, taxis, buses, cars), report that traffic extends travel time and increases health risks (i.e. pollution, accidents), and also complain of the difficulty of parking near the station. Broadly speaking, people do not like traveling on public transport when they have to go to the station if they have luggage, because they are crowded and they don't want to be forced to take the car for this reason;
Interconnection	Passengers perceive the connections between the different means of urban transport and the dialogue between the railway companies and those of the public transport of the cities as the most critical aspects of the journey experience. This aspects increase a general perception of unreliability of all the means of transport and, more specifically, of the means of the public transport.
Catchment	Wider regions and suburbs are poorly served in terms of rail service frequency, and this is a key reason why people living in these areas avoid selecting rail transports to travel.

Table 12 — Considerations emerged from the discussion on the journey phases

5.4 Peak hours

Peak hours have been addressed and analysed as a specific topic during the research activities with passengers, as they were identified as particularly problematic from the point of view of the stakeholders of the railway sector. In the main, passengers feel captive to peak hours and they are perceived as “impossible to avoid”. It marks a very negative and powerless feeling towards this issue. Peak hours indeed are definitely a source of discomfort for passengers, who, in many cases, see the very minimum conditions for a pleasant travel experience fail. Therefore, during peak hours, the perception that passengers have of all the means of transport (especially public transport), including the rail sector, is completely negative. Although they consider that the main problem is related to the insufficient number of train rides compared to the number of users traveling in those time slots, they also focus on many other aspects of the situation and of the rail journey experience. In particular:

Considerations on peak hours	
Reliability	<ul style="list-style-type: none"> • During peak hours, every means of transport is perceived as unreliable; • During peak hours people would like to have more rides guarantee (especially in case of strikes).
Order and security	<ul style="list-style-type: none"> • During peak hours, people would like more operators to be involved in order service, in informing and managing people in order to avoid overcrowding on platforms; • During peak hours people would like to have more room in both the platforms and the vehicles; • People are worried about waiting at the platform when it is overcrowded, they feel insecure and unsafe (e.g. they are afraid of pickpocketing, they are afraid that someone could faint or fall on the tracks, etc...).
Need for information	<p>During peak hours, especially in the case of overcrowding, people would like to receive more reliable and timely information from the rail companies about:</p> <ul style="list-style-type: none"> • What are the causes of eventual delays / disruptions; • When the next trains are scheduled; • What is the level of overcrowding on the next trains; • If there are alternative means that can be taken to reach certain destinations. <p>In these situations, the lack of information is experienced with discomfort by users, who remain uncertain about what to do. They perceive that they are not put in the condition to make appropriate decisions for themselves.</p>
Live the station	<p>People would be willing to travel in different time slots from peak hours if they had services, shops and spaces to carry out activities and / or run errands (e.g. a supermarket for shopping, and workstations to continue working). Other aspects such as the starting time in the offices, if flexible, or even the teleworking, could help passengers to avoid peak hours.</p>
Ticket cost	<p>Although the majority of passengers believe that in many cases those traveling at peak hours cannot do otherwise, some of them believe that economic discounts, offers and lower fees on time slots with lower people concentration could lead many people to prefer not traveling during peak hours.</p>

Table 13 — Considerations emerged from the discussion on the peak hours

5.5 Train compared to other means of transport

Here are presented the main insights that are common across the identified passenger groups. There have been reported the elements/perceptions with respect to which there has been a convergence of opinions between participants of the different focus groups.

Urban rail journey

Comparison between city rail services with the taxi, the bus and the car. Here below the main considerations gathered:

Urban journey	
Strengths	Weaknesses
Cost (Vs. Taxi, Car)	Mechanical breakdown (Vs Taxi, Bus, Car)
Traffic (Vs. Taxi, Bus, Car)	Territorial coverage (Vs. Taxi, Bus, Car) (in particular in particular door-to-door experience)
Speed (Vs. Taxi, Car)	Obsolete vehicles (Vs. Taxi, Bus, Car)
Reliability (Vs. Taxi, Bus, Car)	Number of rides (Vs. Taxi, Car)
Crowding (Vs. Bus)	Safety on night times (Vs. Taxi, Bus, Car)
Safety (Vs. Bus, Car) (referred to accidents)	Flexibility (Vs. Car)
No parking needed (Vs. Car)	Cost (Vs. Bus)
Possibility to socialise (Vs. Car)	Speed (Vs. Bus)
Time control (Vs. Taxi, Bus, Car)	
Stress (Vs. Car)	

Table 14 — Detail of the comparison between city rail services and other means of transport

Extra-urban journey

Comparison between regional and inter-country rail services with the airplane, the bus and the car. Here below the main considerations gathered:

Extra-urban journey	
Strengths	Weaknesses
Cost (Vs. Airplane, Car)	Last minutes travel solutions / offers to book / purchase (Vs. Airplane)
Travel time (Vs. Airplane, Coach, Car)	Safety (Vs. Airplane) (both referred to the access to the mean of transport and to accidents)
Flexibility (Vs. Airplane)	Probability of inconveniences and unforeseen (Vs. Airplane)
Sustainability (Vs. Airplane, Coach, Car)	Infrastructure (Vs. Airplane)
Comfort (Vs. Airplane, Coach, Car)	Accessibility (Vs. Airplane)
Romantic dimension (Vs. Airplane, Coach, Car)	Noise (Vs. Airplane) (onboard)
Scenery (Vs Bus, Car)	Possibility to buy tickets on the vehicle (Vs. Coach)
Easy-to-check information about travel solutions, schedules and routes (Vs. Coach)	Cost (Vs. Coach)
Reliability (Vs.Coach)	Territorial coverage (Vs. Coach, Car)
Fidelity cards (Vs. coach)	Luggage limits (Vs. Car)
Number of rides (Vs. Coach)	Adjustability of the air-conditioning system (Vs. Car)
No parking needed (Vs. Car)	Flexibility (Vs. Car)

Table 14 — Detail of the comparison between regional and inter-country rail services and other means of transport

5.3 Passengers groups profiles' needs

After processing data coming from the qualitative research activities with passengers, in addition

to the identification of behavior and opinion trends common to all categories of passengers considered, specific needs for each user group profile presented above have been identified. Below a detail of these needs is reported in Table 15:

Passengers group profile	Needs
Commuter traveller non frequent rail user	Passengers would need: <ul style="list-style-type: none"> ● planning tools (both digital and non digital) to be more easy-to-use ● more equal fares ● more rides to be available both on weekdays and on holidays ● their city to provide eco-friendly travel solutions to reach the stations ● larger, cleaner and more equipped waiting rooms, both in smaller / peripherals and bigger / central stations ● the stations, even peripheral ones, to be equipped with bars, bathrooms, bookshops, stations to charge the devices (e.g. PC, mobile phones) to better live the waiting experience ● more facilities and offers for those who frequently travel on high-speed trains ● cheaper travel solutions if they are forced to book last-minute
Commuter traveler frequent rail user	Passengers would need: <ul style="list-style-type: none"> ● more rides to be available both on weekdays and on holidays ● their city to provide eco-friendly travel solutions to reach the stations ● more equal fares ● larger, cleaner and more equipped waiting rooms, both in smaller / peripherals and bigger / central stations ● the stations, even peripheral ones, to be equipped with bars, bathrooms, bookshops, stations to charge the devices (e.g. PC, mobile phones) to better live the waiting experience ● more facilities and offers for those who frequently travel on high-speed trains ● cheaper travel solutions if they are forced to book last-minute ● on-vehicle systems of ticket validation/check ● better and more connections to stations, between stations and between stations and airports ● small cities to be more and better served
Non-commuter traveler non frequent rail user	Passengers would need: <ul style="list-style-type: none"> ● more (reliable) information provided by railway companies in case of delays / breakdowns / disruptions ● online booking / purchase procedures to be simpler and faster ● more offline planning and booking/purchasing procedures ● on-vehicle systems of ticket validation/check ● higher rail frequency, in particular inside the city center
Non-commuter traveler frequent rail user	Passengers would need: <ul style="list-style-type: none"> ● more and better connections to stations, between stations and between stations and airports ● more (reliable) information provided by railway companies (especially in case of delays / breakdowns / disruptions) ● rail and non rail services to be better integrated ● better signaling and connectivity

Cross-cutting needs

Passengers would need:

- more surveillance personnel to be present in the stations:
 - in case of delays / breakdowns / disruptions to guarantee order and to inform travelers on the situation
 - at night time to guarantee surveillance and security
- more reserved places for people with limitations/impairments on urban or local trains
- reserved places for people with mobility limitations/impairments on urban or local trains to be always be booked in advance.
- public means of transport to be equipped with proper systems to support people with mobility limitations/impairments get on/off the vehicles
- more reserved parkings for people with mobility limitations/impairments
- more trained and qualified station personnel who can properly assist passengers with mobility limitations/impairments accessing the platform and getting on the train
- seats reserved to people with mobility limitations/impairments to not be isolated
- the stations, even the small and peripheral ones, to be designed and equipped to guarantee accessibility to people with mobility limitations/impairments (e.g. elevators, escalators, ramps).
- station lighting system to be improved

Table 15 — Detail of the needs of passenger groups profiles

6. ASPECTS TO DEEPEN THROUGH THE SURVEY

The present report and the Passenger Experience Map want to be a link between T3.2 and T3.3 activities. The goal of T3.3 is to perform surveys on a number of representative transport users, including non-rail users, to define the influence of key factors on the choice of a transport mode, including railway. Inputs to the survey design will be taken from Tasks 3.1 and 3.2.

The survey will include questions about day-to-day-operations (e.g. buying tickets, finding the way to the station, having to achieve other daily goals) to investigate multiple factors affecting passengers perceived satisfaction, and shortcomings, which impair their comfort. In particular there will be integrated in the survey questions about the process usability (e.g. the amount and comprehensibility of the information provided by travel companies, managing of delays, use of customer support). In addition the survey will help the researchers to collect data that could verify and/or implement the hypothesis build on the result of the tasks 3.1 and 3.2.

The survey will investigate the perceived usability of each activity (i.e. the cognitive and physical effort) associated with pre-during-post travel phases, for both rail and the relevant competing transport modes (covering at least airlines, long distance buses and cars), and non-rail users will be included, in order to understand why they do not use rail.

Journey phases	Factors
Planning the journey	<ul style="list-style-type: none"> ● Possibility to use one or different tools to plan the journey (online and offline) ● Usability of (online and offline) planning tools ● Information provision
Booking / Purchasing the ticket	<ul style="list-style-type: none"> ● Possibility to use one or different booking / purchasing method (online and offline) ● Ticket / season ticket cost ● Ticket / season ticket integrations ● Information provision
Arrival at the station	<ul style="list-style-type: none"> ● Time spent to arrive to the departure station ● Access to the station with different means of transport ● Accessibility (e.g. stairs, elevators, escalators etc...) ● Interchange experience ● Presence of infopoint
Waiting at the station	<ul style="list-style-type: none"> ● Facilities in waiting areas in the stations ● Connectivity in the station (wifi and similar) ● Control, security and safety (real and perceived) ● Cleaning and maintenance of the stations ● Illumination and non-aggressive screens ● Accessibility (e.g. stairs, elevators, escalators etc...)

The rail journey	<ul style="list-style-type: none"> ● Connectivity on the vehicles (wifi and similar) ● Cleaning and maintenance of the vehicles ● Control, security and safety (real and perceived) ● Facilities on the vehicles ● Comfort (e.g. ergonomic seats, illumination, gastronomic offer, etc.) ● In-time information (e.g. panels in vehicles about the next station, etc.)
Arrival at destination	<ul style="list-style-type: none"> ● Time spent to arrive at the destination from the arrival station ● Presence of infopoint at the arrival station ● Interchange experience
Whole journey	<ul style="list-style-type: none"> ● Rides availability and frequency on night times, on weekends, on holidays ● Interconnection between rail vehicles and other means of transport ● Eco-friendly travel solutions ● Connections: <ul style="list-style-type: none"> ○ to stations ○ between stations ○ between stations and airports ○ to small cities

Table 16 — Factors to deepen through the survey

7. CONCLUSIONS

The conclusion of the analysis reported in this document is conveyed in the “Experience Map” (D3.2) which aims to summarize the results of the T3.2 qualitative research activities presented here. The “Experience Map”, therefore, provides a detailed representation of cross-cutting trends and specific differences emerged between the travelers profiles in terms of needs, perceptions, pain points, etc. We can, however, use this section to report some considerations of a more general and high level.

According to the outcomes of the T3.2 qualitative research activities, both for stakeholders and passengers the role of mobility and, more specifically, of rail mobility, have changed compared to the past: journeys are no longer seen as “moving from station A to station B” and are more likely to be seen as part of an individual’s life and identity. Economical, social, environmental and climatic factors contributed to this change of perspective and consequently to the renovation and complexification of individuals needs as passengers. Among these new needs it’s placed passengers’ desire to live a satisfying and fulfilling rail journey experience from the very moment of the planning to the moment of the arrival.

Workshops, focus groups and interviews conducted for this task have deepened the understanding of stakeholders’ and passengers’ knowledge and perceptions across a broad spectrum of rail journeys, in order to better frame these needs and expectations. The main considerations with respect to passenger experience of rail journey are reported as follows:

- Rail sector is conceived as part of the mobility system, in which other transport modes are perceived as allies (not just opposing options that could undermine the rail sector). The interest is more on creating a better integrated offer than attracting people from other transport modes;
- Travelers describe themselves and are perceived from the rail industry representatives as dynamic and not linked to a single transport mode but linked to the whole urban transport system.
- People are assuming an holistic perspective with respect to their travel experience and are more likely to see it as more than the simple sum of the journeys with different means of transport.
- The quality of passengers’ rail experience seems to depend not only from the factors historically identified by the rail sector as key (e.g. price, punctuality, comfort, security, etc.) but also from other factors such as quality and quantity of information provided, ease of use of the planning tools, accessibility, customisable tickets, etc.
- Compared to the past there seems to be greater convergence and alignment between trends influencing the offer (e.g. services integration, digitalisation, automation, renewable energies) and the demand (e.g. personalisation of the offer, social and demographic changes, increasing awareness on health) for rail services.
- Since passengers’ travel experience is getting more complex, also as result of the increase in the number of services connected to the rail journey, there’s a growing need to find solutions that will allow people to manage it in a simple way.

Although, stakeholders' and passengers' ideas in reference to rail mobility are clear, the railway sector does not seem to be able to actually fully meet the needs of final users. In accordance with the qualitative research activities findings, in fact:

- Rail means of transport coexist with a wide range of different modes of transport on the mobility network, in the same way several types of journeys coexist and quickly succeed each other even in a single day. However the way these means of transport dialogue and interconnect each other is still rudimentary, creating inconveniences and making it difficult for people to manage a journey which requires taking different means of transport;
- Digitalisation is a process that proceeds rapidly, but at the moment it is not homogeneous and some sections of the population feel like they are undergoing it passively. In particular, the migration to the web of a large part of the planning, booking and purchasing of a journey processes has created a gap between those who are able to master these processes and those who can not. The latter category aspires to be autonomous like those who manage their train travel experiences digitally;
- Although the rail industry trend which goes toward the personalisation of the services is well perceived by final users, it is believed that the services actually provided are not up to these goals, that the costs of customisation are too high and that the number of possible travel solutions is increasing while there are no tools capable of simplifying the choice of the travelers among them;

Traditional aspects such as the security feeling, cleanliness of the stations/vehicles and comfort while travelling are still key criteria to choose rail transport as the preferred transport mean.

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9. ACRONYMS

- CBM: Condition Based Maintenance
- CCA: Cross-Cutting Activity
- EU: European Union
- HCD: Human Centred Design
- ICT: Information and Communications Technologies
- MAAP: Multi-Annual Action Plan
- MaaS: Mobility as a Service
- R&D: Research & Innovation
- RU: Railway Undertaking
- S2R: Shift2Rail Joint Undertaking
- SMARTE: Smart Maintenance and the Rail Traveller Experience
- T: Task
- UK: United Kingdom
- Vs: Versus

10. APPENDIX

Appendix A – Glossary of terms used during T3.2 activities

Term / Concept	Definition	Notes / Examples	Sources
Accessibility	<Interactive systems> usability of a product, service, environment or facility by people with the widest range of Capabilities.	The attributes and characteristics of an interactive system that allow people with limited vision, hearing, dexterity, cognition or physical mobility to interact effectively and efficiently with the interactive system.	ISO 9241-11:2018(en) UXQB CPUX-F Curriculum and Glossary
Comfort	Degree to which the user is satisfied with physical comfort.		ISO/IEC 25010:2011(en)
Context of use	Users, tasks, resources, and the physical and social environments in which an interactive system is used.	A context of use description describes a. User groups and user group profiles, b. Tasks, c. Environments, d. Equipment, e. Scenarios illustrating what happens in the context of use.	ISO 9241-11:2018(en) ISO 9241-210:2010
Customer journey map	A visual or graphic interpretation of the interaction experience history with a company, a service, a product or a brand, from the point of view of the customer, over time and through the channels. It focuses the stages and touchpoints between the user and his/her characteristics and business needs.	Key elements: - Actions - Goals - Emotions - Pain points - Moment of truth - Satisfaction - Touchpoints - Channels: where the interaction takes place (e.g. website, app, call center, in-store) - Company insights (e.g. boundaries, opportunities, technical recommendations)	Kalbach, J. (2016)
Ecosystem model	A specific type of spatial map that allows to visualize the user experience with a product / service / brand / company holistically, by considering the interconnections between each involved element and its centrality / proximity with respect to the others elements.	Key elements: - Users; - Practices performed; - Information used and shared; - People user interact with; - Services available; - Devices; - Channels.	Kalbach, J. (2016)
Effectiveness	Extent to which correct and complete goals are achieved.	1. Effectiveness is one of the three measurable attributes for usability. The others are efficiency and satisfaction. 2. Effectiveness is the attribute of usability that focuses on being able to accomplish tasks.	ISO 9241-11:2018(en) UXQB CPUX-F Curriculum and Glossary
Efficiency	Resources expended to achieve specified goals.	1. Resources include time, human effort, financial and material resources.	ISO 9241-11:2018(en)

		<p>2. Efficiency is one of the three measurable attributes for usability. The others are effectiveness and satisfaction.</p> <p>3. Efficiency is the attribute of usability that focuses on being able to accomplish a task using acceptable amounts of resources.</p>	<p>UXQB CPUX-F Curriculum and Glossary</p>
Empathy map	<p>A tool used to represent a group of users, such as a customer segment. It allows to "empathize" with individuals, framing the profile through six sections.</p>	<p>Key elements:</p> <ul style="list-style-type: none"> - think and feel (what matters to users) - listen (what users say are meaningful to them) - see (what do users see in the product/service, what affects it, what value does it give them) - says and does (users' phrases and distinctive actions) - pains (what frustrates users) - values/rewards (what makes users happy and satisfied) 	<p>Kalbach, J. (2016)</p>
Experience map	<p>A strategic tool to understand and visually represent individuals' interactions with a product, service, or ecosystem. At its center there is the experience, meant as a complex universe of actions, responses, emotions, difficulties and an individual who wants to satisfy a need.</p>	<p>Key elements:</p> <ul style="list-style-type: none"> - Phases of behaviour - Actions and steps taken - Jobs to be done, goals, or needs <p>Thoughts and questions</p> <ul style="list-style-type: none"> - Emotions and state of mind - Pain points - Touchpoints - Physical artifacts and devices - Opportunities 	<p>Kalbach, J. (2016).</p>
Focus group	<p>A focused discussion where a moderator leads a group of participants through a set of questions on a particular topic.</p>		<p>UXQB CPUX-F Curriculum and Glossary</p>
Human-centred design	<p>An approach to design that aims to make interactive systems more usable by focusing on the use of the interactive system and applying human factors, ergonomics and usability knowledge and techniques.</p>	<p>The term "human-centred design" is used rather than "user-centred design" in order to emphasize that this part of ISO 9241 also addresses impacts on a number of stakeholders, not just those typically considered as users. However, in practice, these terms are often used synonymously.</p>	<p>ISO 9241-210:2010</p>
Interactive system	<p>Combination of hardware, software and/or services that receives input from, and communicates output to, users.</p>	<p>This includes, where appropriate, packaging, branding, user documentation, on-line help, support and training</p>	<p>ISO 9241-210:2010</p>
ISO 9241	<p>A family of standards covering human-centred design.</p>	<p>ISO 9241 includes standards related to:</p> <ol style="list-style-type: none"> a. Software ergonomics, b. The human-centred design process c. Displays and display related hardware d. Physical input devices e. Workplace ergonomics f. Environment ergonomics g. Control centres h. Tactile and haptic interactions. 	<p>UXQB CPUX-F Curriculum and Glossary</p>
Isometric map	<p>A specific type of spatial map that allows to illustrate three-dimensional elements of an experience in two-dimension.</p>	<p>Key elements:</p> <ul style="list-style-type: none"> - Relationship; - Channels; - Touchpoints; - Interactions between channels and touchpoints; - Stage directions; 	<p>Kalbach, J. (2016)</p>

		<p>- Isometry is achieved with colors, rotated angles of the object on the diagram and shadows. This effect gives dynamism to the map and conveys an idea of a stronger interaction between the different elements involved in the user experience.</p>	
Mental model	<p>A simply <i>affinity diagram</i> of behaviors made from ethnographic data gathered from audience representatives.</p>	<ol style="list-style-type: none"> 1. Affinity diagrams, in the simplest interpretation, show groups of related things. [...] A mental model for a particular topic is, in essence, an affinity diagram of user behaviors. 2. The perception people have of themselves, others, the environment, and the things with which they interact. 3. Alternative, popular definition: A person's thought process about how something works in the real world. 4. People form mental models through experience, training, and instruction. The mental model of an interactive system is formed largely by interpreting its perceived actions and its visible structure. Expectations resulting from the use of other or similar systems are also of importance. 5. If a user's mental model of an interactive system is incomplete or contradictory, then the user cannot easily use the interactive system. 	<p>Young, I. (2008 a)</p> <p>UXQB CPUX-F Curriculum and Glossary</p>
Mental model diagram	<p>A method to collect and display information related to the way users think a product/service works. It focuses on beliefs, assumptions and representations of users and does not report personal preferences or opinions or tastes.</p>	<p>- Mental model diagrams are typically very long documents in which the top half describes the mental model patterns across a set of people, while the bottom half describes all provisions that address thought processes within the top half:</p> <p>Top half</p> <ul style="list-style-type: none"> • Boxes: thoughts, reactions, operating principles; • Towers: sets of similar boxes • Mental spaces: sets of similar towers. <p>Bottom half</p> <p>A set of products and services that support / satisfy the thoughts contained in the boxes of the top half.</p>	<p>Young, I. (2008 a)</p> <p>Kalbach, J. (2016)</p>
Persona	<p>A hypothetical archetype of actual user.</p>	<ol style="list-style-type: none"> 1. A persona is a description of a user and what he or she intends to do when using an interactive system. 2. Personas are not real; rather they are imaginary but realistic examples of the real users they represent based on empirically determined data (e.g. observations, interviews). 3. Personas typically have a name, age, some background, goals and aspirations. A persona description should include information about the persona's knowledge about and interest in the subject matter of the interactive system. 4. Personas are defined by individuals' goals. 	<p>Cooper, A. (2004)</p> <p>UXQB CPUX-F Curriculum and Glossary</p>

Pleasure	Degree to which a user obtains pleasure from fulfilling their personal needs	Personal needs can include needs to acquire new knowledge and skills, to communicate personal identity and to provoke pleasant memories.	ISO/IEC 25010:2011(en)
Qualitative user requirement	A statement of what users must be able to locate, recognize, understand, select or input as part of conducting a task with the interactive system.	<p>1. Qualitative user requirements are the basis for efficient use of the interactive system. In contrast, quantitative user requirements can enforce measures on the efficiency of the interactive system – that is, whether users can solve particular tasks with the interactive system, e.g. in an acceptable time or with a specified maximum number of use errors.</p> <p>2. Qualitative user requirements are not features. They provide the basis for features.</p>	ISO 9000:2015(en)
Quality	The degree to which the interactive system fulfils requirements.	Examples of quality characteristics other than usability are correctness, reliability and security.	ISO 9000:2015(en)
Quantitative user requirement	Required level of usability to meet identified user needs expressed in terms of measures of effectiveness, efficiency and satisfaction in a specified context of use.	Quantitative user requirements are acceptance criteria for the effectiveness, efficiency and satisfaction of the interactive system, for example whether users can solve particular tasks with the system in an acceptable time or with a specified maximum number of use errors.	ISO 9000:2015(en)
Requirement	A condition or capability that must be met or possessed by an interactive system to satisfy an agreement, standard, specification or other formally imposed documents.	This glossary further distinguishes between Qualitative user requirement, and Quantitative user requirement.	ISO/IEC 25000:2005
Resources	All means required to use an interactive system.	Typical examples of resources are time, financial cost, physical and mental effort, hardware, software and materials.	UXQB CPUX-F Curriculum and Glossary
Satisfaction	Freedom from discomfort, and positive attitudes towards the use of the product.	<p>1. Attitudes related to the use of an interactive system, and the emotional and physical outcomes arising from use.</p> <p>2. Satisfaction is one of the three measurable attributes for usability. The others are effectiveness and efficiency.</p>	ISO 9241-11:2018(en)
Service blueprint	A technique of designing and visualizing the service delivery process from the point of view of the customer and the organization. Although easy to read, it does not explicitly include information about the individual's emotional state.	<p>Key elements:</p> <ul style="list-style-type: none"> - Physical evidence: the manifestation of the touchpoints that customers interact with are physical evidence (e.g. physical devices, electronic software, face-to-face interactions). - Customer actions: the main steps a customer takes to interact with an organization's service. - Onstage touchpoints: the actions of the provider that are visible to the customer. The line of visibility separates onstage touchpoints with backstage actions. - Backstage actions: the internal service provision mechanism of the organization that are not visible to the customer, but directly impact to the customer experience. - Support process: internal processes that indirectly impact the customer experience. Support processes can include interactions between the organizations and partners or third-party suppliers. 	Kalbach, J. (2016)

SQuaRE	<p>A series of International Standards which consists of the following divisions:</p> <ul style="list-style-type: none"> - Quality Management Division (ISO/IEC 2500n), - Quality Model Division (ISO/IEC 2501n), - Quality Measurement Division (ISO/IEC 2502n), - Quality Requirements Division (ISO/IEC 2503n), - Quality Evaluation Division (ISO/IEC 2504n), - SQuaRE Extension Division (ISO/IEC 25050 – ISO/IEC 25099) 		ISO/IEC 25000:2005
Touchpoint	<p>A touchpoint is a point of interaction involving a specific human need in a specific time and place.</p>	<ol style="list-style-type: none"> 1. Identifying the touchpoints means consider every level at which the relationship between individuals and an organization takes place. 2. Typically, touchpoints include a range of elements, such as: <ul style="list-style-type: none"> - TV ads, print ads, brochures - Marketing emails, newsletters - Website, apps, software program - Phone calls, service hotline, online chat - Service counter, checkout register, consulting - Physical, shipping materials - Bills, invoices, payment systems 3. There are three primary types of touchpoints: <ul style="list-style-type: none"> - Static: don't allow users to interact with them (e.g.: email newsletter, ads) - Interactive: (e.g. website, apps) - Human: involve human-to-human interaction (e.g.: sales representative, support agent) 	<p>Risdon, C. (2013)</p> <p>Kalbach, J. (2016)</p>
Usability	<p>Extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.</p>		ISO 9241-11:2018(en)
User	<p>Person who interacts with the product / service.</p>		ISO 9241-11:2018(en)
User experience	<p>Person's perceptions and responses resulting from the use and/or anticipated use of a product, system or service.</p>	<ol style="list-style-type: none"> 1. User experience includes all the users' emotions, beliefs, preferences, perceptions, physical and psychological responses, behaviours and accomplishments that occur before, during and after use. 2. User experience is a consequence of brand image, presentation, functionality, system performance, 	ISO 9241-210:2010

interactive behaviour and assistive capabilities of the interactive system, the user's internal and physical state resulting from prior experiences, attitudes, skills and personality, and the context of use.

3. Usability, when interpreted from the perspective of the users' personal goals, can include the kind of perceptual and emotional aspects typically associated with user experience. Usability criteria can be used to assess aspects of user experience.

Appendix B – Stakeholders’ workshop canvas

Journeys

Journey categories relevant for our businesses or missions

- ...
- ...
- ...

Passengers

Passenger categories relevant for our businesses or missions

- ...
- ...
- ...

Aspects of the travel experience that we wish to investigate deeper

- ...
- ...
- ...

Positive aspects of travel by rail, as perceived by (our) passengers

- ...
- ...
- ...

Negative aspects of travel by rail, as perceived by (our) passengers

- ...
- ...
- ...

Appendix C – Passengers’ focus group rail journey phases chart

