Methodology to obtain long term needs of different actors in the railway sector

Christian Katschnig a*, Paul Melia b, Roberto Sañudo Ortega c, Manfred Ninaus a

ªInstitute for Innovation and Trend Research, Kalvariengürtel 67, 8020 Graz, Austria
ª Railistics GmbH, Bahnhofstrasse 36, 65185 Wiesbaden, GermanyCity
ᶜUniversidad de Cantabria, Av los Castros s/n, 39005 Santander, Spain

Abstract

This article tries shows the methodology used in the framework of the project NEAR2050 (Long term needs of different actors in the railway sector), a Shift2Rail-funded project, which aims to determine the long-term needs of different actors in the railway sector. In order to achieve this, and based on the Shift to Rail project brief, looks at several main topics. These include:
A determination of the long-term changes in future needs. The existing systems currently in use in the rail sector will be classified and based on the future trends and requirements of customers. This will look at the customer and stakeholder behavior before, during and after a journey or working routine.
The NEAR2050 project tries to determine and analyses mega-trends and scenarios for 2022, 2030 and 2050.This is to assess how the "landscape of mobility" will change for the mentioned years and result in recommendations for the Shift2Rail master plan.
Three partners from Austria, Germany and Spain are analyzing the current and the future situation of the European Rail sector.
Based on citizen participation techniques, trend and megatrends studies the main objective is to asses a future railway transport policy recommendations in terms of customer and railways sector demands.
All this work will serve to enhance the railways sector in Europe in the future. What is going to happen with the future of railways sector in Europe? What we all have to do to improve this important mean of transport in terms not only for passengers but freights?. NEAR2050 project thank to Shift to Rail support is analyzing the current and future EU rail S¡sector situation to answer all these questions.

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* Corresponding author. Tel.: +43 660 5161187;
E-mail address: christian.katschnig@iitf.at

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Nomenclature

FG   Focus groups. Citizen participation method
IDI   In depth interviews
MAAP Multi-annual action plan
SP   stated preference
IT   Innovation Technologies

1. Introduction

Over the next decades, population will increase, cities will become megacities and sprawl to unprecedented levels. The demographic changes that we are experiencing will continue and will influence heavily on people's mobility. In order to cope with these changes the current systems that are in place will have to be changed. People will require a different mentality and will have to choose different means of transport for their mobility. Passenger services will have to deal with increasing numbers of people with specific mobility needs. The question is what means of transport will they choose? What are the keys to attract more passengers to use the services?
In terms of freight; how will the needs of freight services change in the next decades? How can the existing freight services change to suit the demands that these new urban conglomerations will place on them?
Whatever systems are put in place will have to cover aspects such as, efficiency, affordability, quality, comfort, accessibility, punctuality and reliability, flexibility, information and value for money.

These long-term needs and expectations need to be analyzed in order to get a better understanding of them. However, it is equally important to analyze megatrends and future scenarios as in these, passenger and rail freight will form the backbone of the transport system, linking major urban hubs and feeding into multi-modal local transport networks.

This project uses trend analysis creating service blueprints, mini scenario creation and finally storytelling to predict in a long-term future rail sector perspectives. This methodology is well explained (Horx, 1996a; Horx, 1996b; Uebernickel et al. 2015).

On the other hand Citizen Participation through focus group (FG) and in depth interviews (IDI) have been done. This methodology based on FG is really known (Patton, 2005; Fern, 1982; Wilkinson, 1998; Rabiee, 2004) but it is the first time that it has been used to investigate the most important influencing factors and variables in the rail sector. This methodology help to identify the variables that have to be modified to get a great improvement in the rail sector.
Focus Groups based methodology has a lot of applications for a behavior research, for example for health research (Ausbury, 1995), for safety research in train during emergency situations (dell'Olio et al. 2013), in sustainable mobility through citizen participation and involvement (Ibeas et al. 2011). Here this has been combined with IDI. These IDIs are really important in citizen participation (Wang, 2001; MacDougall & Fudge, 2001).

2. Objectives of NEAR2050

The overall objective of NEAR2050 is to determine the long-term needs of different actors in the railway sector. In order to achieve this, and based on the project brief, NEAR2050 will look at five main topics, which will each include numerous sub-tasks. These include:

2.1. A determination of the long-term changes in future needs

The interaction of the stakeholders are analysed and modelled with the connections and dependencies of each stakeholder detailed. The existing systems currently in use in the rail sector will be classified and based on the future trends and requirements of passengers. These will be prioritised with regards to the effect that the expected Shift2Rail technical developments will have on them. This classification will be supplemented with information

obtained from external field studies and focus groups (FG) from outside the confines of Shift2Rail. As per the Shift2Rail MAAP, this will take into account high-speed traffic, regional passenger traffic, urban and suburban traffic, and freight traffic.

2.2. A determination of customer requirements

This topic focus on passenger traffic and looks at what current and potential passengers require that is missing at the moment. Investigations will be carried out into customer behaviour. This will look at behaviour before, during and after a journey. It is understood that a journey is not just limited to the time a passenger spends sitting on a train but will go further to look at the behaviour before and after a journey. This will include looking at passenger options for travelling to and from a station and how these can be improved.

These investigations will be based on the actual customer responses from (FG) and (IDI). As such a community platform will be established and maintained to gather actual information from passengers. Workers of rail sector and expert opinions from decision makers and those well established in the sector will be obtained by means of experts' FGs and IDIs. Some workshops have been organised and hosted with participants taken from the network of contacts each of the consortium members maintains. On the back of the community platform a project platform will be developed as a location where experts, external to the consortium, can share their ideas. Recommendations will be made as to how to improve customer requirements.

2.3. A determination and analysis of mega-trends and scenarios for 2022, 2030 and 2050

Under this topic, a study of mega-trends will be carried out. This is to assess how the "landscape of mobility" will change for the above-mentioned years. This study will need to consider the changes that will be seen in personal transport, information exchange, behavioural changes, and digitalisation to name a few. Assessments of these trends will consider the Shift2Rail objectives and the technological developments that are foreseen under Shift2Rail.
This topic will include a secondary study of mega-trends and the influence factors of future scenarios, while also carrying out a pre-evaluation and pre-prioritisation of these influence factors. This will initially be carried out by the consortium members however; the experience and expertise from external parties will then be sought via the project platform and expert interviews. This is to ensure that as many possible viewpoints are considered. The probabilities of these influence factors will need to be determined and will be based on the best-case, realistic, and worst-case scenarios for 2022, 2030, and 2050.
Mini-scenarios will be developed for each of the time-frames with each of the results verified by expert interviews and through a software based consistency matrix. Combinations of these mini-scenarios will then be brought together and fully modelled to show the perspectives and possibilities for each of the time scenarios. These will be put forward through a combination of storytelling and service design.
As a final element to this topic, the developed scenarios will be assessed regarding their relevance to Shift2Rail and how they can influence Shift2Rail policy, while also looking at how Shift2Rail can use these trends to influence policy for the railway sector.

2.4. Effects of 10% fewer cars

As part of this topic and relating to the mega-trends and future scenarios developed under the previous topic, an analysis will be made as to what social changes will occur if a 10% car reduction is achieved. This will be the product of a research analysis based on number of cars removed, modal shift, reduction in emissions, improvements in travel time, and improvement in overall health to name a few.
In order to establish user's behaviour regarding modal change, new several FG will be utilised and surveys will be made. The calculations of the expected social changes derived from a 10% or greater reduction on private car usage will be developed using Stated Preference Surveys were some plausible future scenarios will be made to de user. From these results, the expected modal change that each user will experience will be established. Once the expected modal share is determined, an analysis regarding railway sector will be developed.
This analysis will be carried out to investigate at what percentage modal share the rail sector is most suited and has optimum performance. This will further develop to investigate at what level of modal share are the benefits to the rail sector self-perpetuating.

2.5. Correlation with the Shift2Rail Master Plan

The outcomes of these studies have to refer to and tie in with the objectives set out by the Shift2Rail Master Plan; namely by improving services and customer quality, reducing system costs, enhancing interoperability, and simplifying business processes. The influence factors, scenarios, megatrends, will all be assessed with regards to these objectives. If results from NEAR2050 show failings in the Shift2Rail Master Plan, then proposals will be put forward as to changes or additions that can be made in the Master Plan.

3. Concept and Methodology

3.1. Concept

The overall concept of this study deals with new methods of mobility in general, and in particular the railway sector. These will be expressed in scenarios for 2022, 2030 and 2050. Therefore, megatrends in mobility, social behavior, IT and many more must be identified to predict future scenarios.
In order to identify trends, it is necessary to classify different types of trends. When defining the trend types the following classification can be given:
Metatrends
• Combine or contradict megatrends
• They show directions in which a part of the world is moving in a long term perspective
• Same as the basic megatrends: half-value period of 20-50 years
Megatrends
• Deep impact and sustainable global trends, that influence the social and technological changes
• Considers all possible areas in life (consume, politics, values, etc.)
• half-value period of 20-50 years
Consumer trends and social-cultural trends
• Middle term changes, which are dominated by the attitude to life of people being in a social transformation process
• These trends are mainly in the consumer and product world representative
• Half-value period of 5 - 8 years
Product and fashion trends
• Ephemeral, incidental and marketing steered phenomena
• Half-value period of 0,-5 years

These trends need to be assessed based on the needs and requirements of the actual users of the rail services.
In the case passenger transport these are:
• Passengers: The opinions, perceptions and requirements of the users and potential users of the European railway network,
• Train crew: within this group the opinions and perceptions of drivers, train conductors, train inspectors, stewardesses, catering staff, station masters, and station staff (ticket office, office staff, and maintenance).
In the case of freight transport these are:
• Transport agencies: These agents intervene in the contracting and management of international transport services. They act as carriers for the import/export companies and loaders for the transport companies when their services are contracted.
• Multimodal Transport Operator: This figure can be a physical person or a legal body, a shipping company, a railway operator or a transit company specialized in acquiring the contract from the exporter or importer as the main shipper and they provide the unified documentation for all the means and modes of transport involved in the journey and they assume all responsibility for fulfilling the contract.
• Railway operators: Businesses providing the railway services and other commercial activities (companies which manage the track infrastructure and train operators).
• Warehouse staff: They provide goods storage services, using their own warehouses (staff, equipment, buildings, and services).
• Distributors: These could be retail or wholesale distributors of products.
• Charging companies: these companies contract the carrier of the goods. Charging companies can ask for the services of a terminal operating company, mainly related with the loading and unloading of goods.
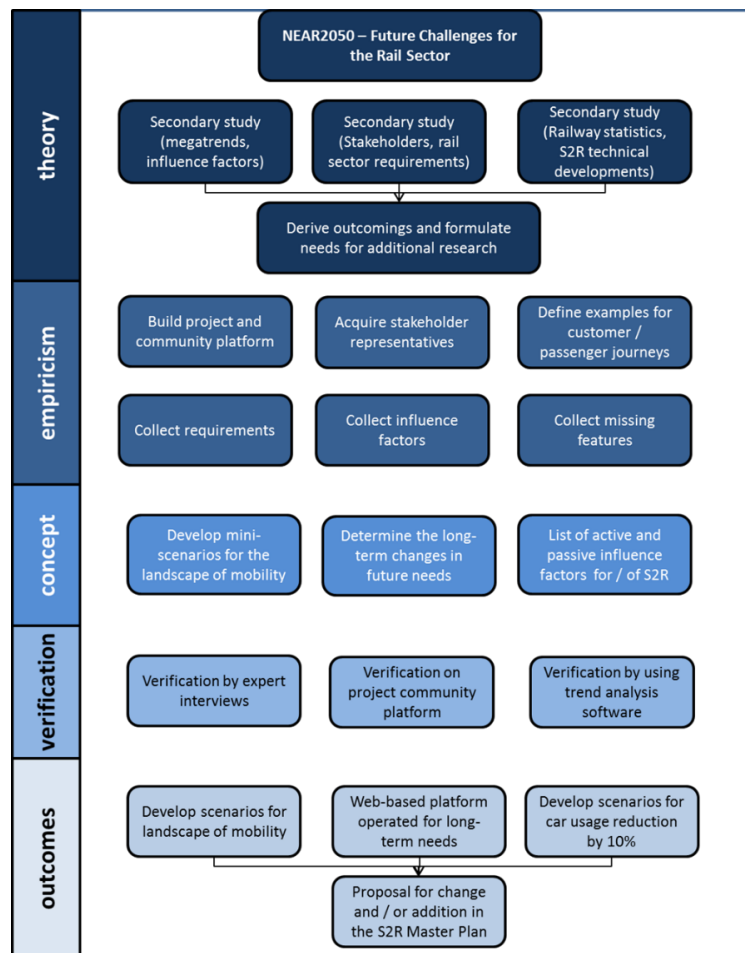• Administration staff: companies that administer the services surrounding the logistics of goods transport.

Figure 1: Overall interaction plan and outcomes

3.2. Methodology

3.2.1. Trend analysis

Starting with a secondary research of Mega-trends and trends relevant for the research issue by using enquiry of trend reports, trend conferences, all media channels, monitoring of relevant indicators, the non-directional search (scanning) for signs of influential developments, relevant influencing factors are identified by using this kind of trend scouting/monitoring. All these social-economic data are the basis to describe these influencing factors. The influencing factors are evaluated by context analysis, pointing out different perspectives (e.g. mobile phones can be investigated by the possibilities of technical factors and by the future usage). The other method is to evaluate the influencing factors were experts' FGs and IDIs, a structured survey of stakeholder groups getting a lot of expert opinions.
After this evaluation, the influencing factors are reduced and concentrated to the main influencing factors. It´s important to include all identified influencing factors for a first evaluation but also get a workable number of influencing factors for the detailed study and statistical analysis. The main influencing factors are not described in just one way but will be described in different characteristics (e.g. maximum expression – minimum expression) and every characteristic will be rated, how likely it is, that this characteristic will happen.

The development of mini-scenarios start by the definition of different "personas", types of customers and other stakeholders. These customers/stakeholders are confronted with selected specific influencing factors and their possible projections and a future perspective as an aggregation of these mini-scenarios will be "designed" by using the method of "service blueprint" to identify touchpoints customers and stakeholders have to face through their

rail system usage. These service blueprints are the guideline for developing visions of the future, the mini scenarios, an easy understanding story, that describes the customers`/stakeholders' way of life/travel/work.

The Verification of the future perspective, the hypothesis of the future, will be essential for acceptance by all stakeholders. In that care the verification will be done by further research using additional sources, like expert interviews and online surveys, confronting experts and survey participants with the developed future perspective and asking them if the deliverables are reasonable. On the other hand, trend analyses software will be used for statistical analyses of consistencies and dependencies of the influencing factors and mini-scenarios. Consistency in that case means that the scenario with the highest consistency is the most likely to happen but does not mean that the scenario will happen for sure. Because of these methods of verification, the scenarios will be revised.

Storytelling and visual recording will be deployed to address emotions, because only things that effect our emotions will lead to changes. Graphical recording is also perfect to show results because pictures are more understandable than a thousand words.

3.2.2. Customer and stakeholder requirements

A purpose-built methodology has been developed for identifying and developing the demands and offers for passengers and freight service clients. This has been designed in order to obtain a full account of what users currently need and expect from the rail sector.
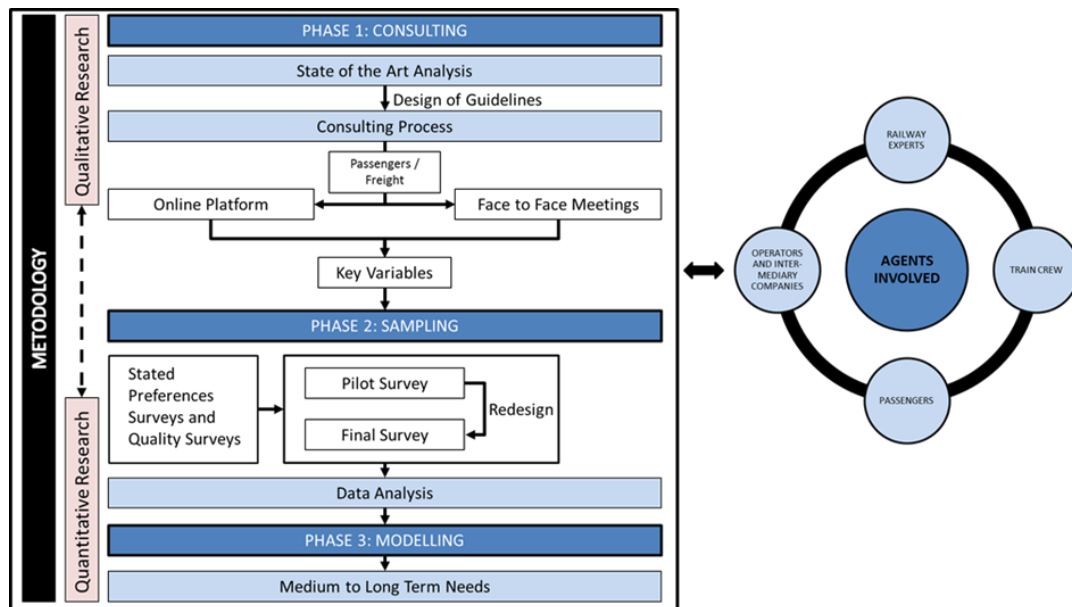

Figure 2: Proposed methodology

This project is based on using qualitative techniques for the initial data collection through the use of (FG) and (IDIs) with the agents involved. As the project develops, further quantitative measures will be introduced during which Stated Preferences Surveys (SP) will be designed. These will be based on the variables established during the qualitative phase of the process and these will be used to quantify the different objectives set out in this proposal.

3.2.3. Qualitative Research

This consulting process begins with a thorough review of the state of the art, followed by an initial identification of the determinant variables in the behavior of the agents involved in the European railway field (both passenger and goods transport).
This initial identification of the variables will assist in the design of the various scientific guidelines for organizing the FGs and IDIs representing the consulting process. This consulting and later analysis of the data collected will be made over three levels of railway transport: urban, regional and long distance (conventional and high speed),

and in two analytical spheres (passengers and goods). FGs, as qualitative tools, are well tested for use in social investigations and for encouraging public involvement.

In order to bring together the opinions and perceptions of all the different agents involved on a European scale, the consulting process will be carried out in two different ways:

1. Investigations in three European countries: FG and in-depth interviews will be held in each country with all the agents involved in the study. This process will serve as the basis for extracting all the determinant variables to be used in the later design of the SP asked to a representative sample of users.

2. The development of an Online Platform: This will be used to collect data through online FG, and will provide a debating area for each of the agents involved can take part in online focus groups, online debates, and where on line IDs etc. can be held.

3.2.4. Quantitative Research

Once the various FG and in-depth interviews have been held, the next stage is to extract the determinant variables for the different analytical scales and for each type of agent involved. These are required for the later design of a Pilot SP. This pilot survey will be asked to a representative sample in each of the cases and after any modifications that are thought necessary the final SP survey will be designed.

In order to address alternative transport modes to the car (such as the railway) the information that is collected using traditional mobility surveys is not enough and more suitable methods like stated preference surveys need to be used. The information provided by these will be fundamental in supplying the Discrete Choice Models. After the models have been estimated and the results obtained the indicators can be found which allow overall planning measures to be taken for the railway transport systems.

SP surveys provide an approximation of user preferences and are a kind of quasi-experiment based on hypothetical situations established by the researcher and therefore, represent an approximation to a controlled experiment.

On the one hand these questionnaires will affect a representative sample of the target population and this will guarantee the possible quantification of the parameters that need to be measured and the fulfilment of the objectives through a pilot experience taking place in each of the three participating countries. On the other hand, these surveys will be simultaneously launched via an online platform in order to obtain greater heterogeneity in the results and have available a much larger sample on an overall European level which will allow transversal analyses of the information obtained.

4. Initial findings

4.1. Initial findings trend analysis

The secondary research of Mega-trends and trends relevant for the research in phase 1, using enquiry of trend reports, trend conferences, all media channels, monitoring of relevant indicators, the non-directional search (scanning) for signs of influential developments posted around 400 influencing factors and were organized in different criteria like "social-economic", "ICT", "Technical", etc.

In order to get a workable number of influencing factors and trends all content of the secondary research, the focus groups, expert interviews and online survey was summarized to 24 mega-influencing factors and mega trends.

(1) Passenger comfort / needs, (2) Development of EU / government, (3) Environmental awareness, (4) Energy transformation, (5) Aging world, (6) Changing workforce / changing society, (7) The female century, (8) Smart everything, (9) Intermodality / synchro-mobility, (10) Urbanization, (11) Postindustrial service society, (12) Supply chain integration, (13) Liberalization of transport sector, (14) Standardization of transport sector, (15) Last mile, (16) Services for users / stakeholders, (17) Automation, (18) Cargo mobility, (19) Service integration by extensive collaborative models, (20) Infrastructure, (21) Rising traffic demand / cost / productivity, (22) Future technologies / modularization, (23) Data transfer / security, (24) Game changers,

All influencing factors and trends that were analyzed in an earlier stage are assigned to the upper level mega influencing factors and mega trends.

Due to the proposed goal of NEAR2050 to create a representative group of actors of the rail sector and to observe the future perspectives and future needs of different actors of the rail sector 16 "personas" had been created. These

"personas" differ from age, sex, etc. and pass different customer journeys as passenger as well as "working journeys" as actors in the rail system. The conclusion of the "persona" creation are "persona" maps that show the story of the customer's experience. It not only identifies key interactions that the customer has with the organization, but it also brings user's feelings, motivations and questions for each of the touchpoints.
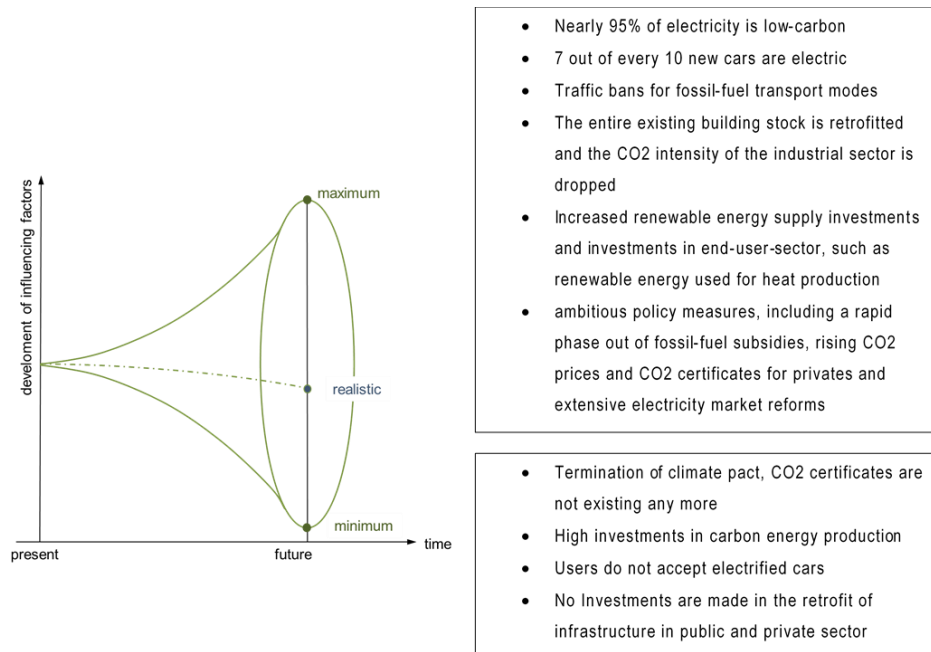

- Nearly 95% of electricity is low-carbon
- 7 out of every 10 new cars are electric
- Traffic bans for fossil-fuel transport modes
- The entire existing building stock is retrofitted and the CO2 intensity of the industrial sector is dropped
- Increased renewable energy supply investments and investments in end-user-sector, such as renewable energy used for heat production
- ambitious policy measures, including a rapid phase out of fossil-fuel subsidies, rising CO2 prices and CO2 certificates for privates and extensive electricity market reforms

- Termination of climate pact, CO2 certificates are not existing any more
- High investments in carbon energy production
- Users do not accept electrified cars
- No Investments are made in the retrofit of infrastructure in public and private sector

Figure 3: Trend projection funnel "energy transformation"

By conducting trend research in combination with expert interviews, the influencing factors defined in phase 1 were analyzed in the team of experts with regard to future development possibilities.
It is obvious that a differentiation of the influencing factors can occur in a future projection until 2050. According to the scenario funnel, the different future projections (expressions) were identified for each influencing factor. This creates a funnel within whose borders future developments will take place with a high probability. This is exemplarily shown in the graphic below for the influencing factor "energy transformation".

All these findings are now combined to service blueprints for all personas to have a guideline for the creation of mini-scenarios, describing the future customer and stakeholder journeys until 2050.

4.2. Initial findings customer and stakeholder requirements

In order to reach the goals proposed, 4 FGs, several internal expert workshops and 18 in-depth interviews were held, involving, due to the pilot nature of the experience, agents and users from the railway sector (passengers, crew and station staff, customers and experts). The IDIs were held only with experts from the railway sector (retired people form rail sector, University Professors, Railway Engineers). As the perception of railway users and social groups is different from that of operators, administration and workers, it was decided to hold separate FGs for workers and users. These expert IDIs, workshops and FGs occurred divided up in Spain, Germany and Austria, to have regional differences considered.

The goal was to cover all point of views and perspectives of different stakeholders in the sector. The expert-interviews were carried out among universities, government institutions, public transit authorities, transport associations, railway undertakings, shippers, passenger associations and regulator/regulatory authorities.
Covered are local traffic, long-distance traffic and freight traffic for Spain, Germany and Austria.
The interviewed experts were selected by our methodology and asked if they would take part in the study. The 100% positive response rate to our requests for interviews shows, that the market is moving and committed to the future of rail.

The online survey achieved 336 full answers from a total of 549 in the first stage all over Europe which leads to representative results regarding customer requirements. The online survey tool is ongoing used for several surveys verify the projects 'results. This survey does not only ask for current rail sector situation and customer demand but future rail scenarios and evolution (2030, 2050).

The most important variables for people extracted from on line survey were: number of daily and hourly trains, fares (Fare policy, discounts, low cost services…), connections with urban transport at the station (both for access and arrival), travel time by train (duration of the trip), on board information (connections and transfers, stops, incidents…), information about urban Transport connections at the station, ease of ticket purchase (more sale points, vending machines, online purchase…), location of the station near city centre, between others. These were ordered by using Best-Worst models.

Variables and their importance were extracted, also a SWOT analysis was made for each participant group. The novelty also has been to create a combined SWOT analysis where it can be seen share common aspects and individual aspects (for each group) concerning railways sector.
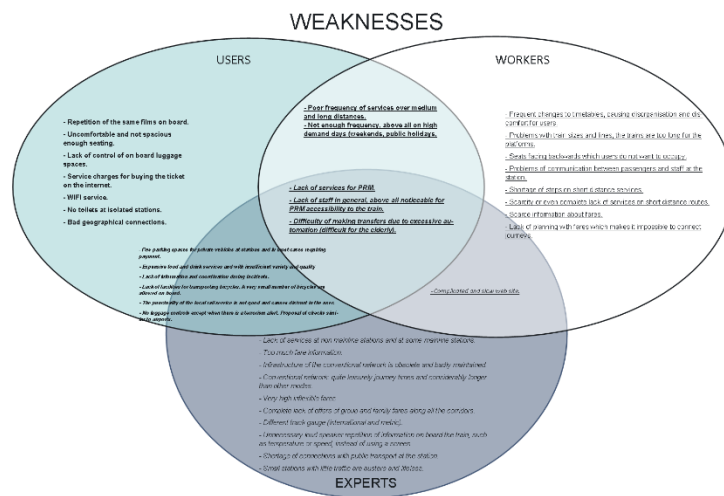

Figure 4: Example of combined SWOT Analysis for all customers. This case shows common and individual weaknesses for each participant.

We have to make railways more efficient and reliable when interacting with the following points:
•Adaptable timetables. More frequencies. More trains. This means less track maintenances and track disruptions which can affect traffic.
•We have to differentiate between long distance trains, local trains, passenger and freight, conventional and high speeds. This means we have to differentiate between different types of traffic in railway's networks.
•Increase comfortability and safety without increasing service cost. Make more comfortable (more space, wifi, passenger services on board, etc.)
•Automation is increasing but passengers still need human staff for assistance. Special to attract the elderly, PRM and disabled people.
•Less energy consuming, special in freight. More CO2 reduction in rail transport.
•Rail fare flexibility. Taking into account transport intermodality and interoperability.
The study is ongoing and now project partners have to focus on future projections and prediction of future rail demand.

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6. Acknowledgements

7. References

Horx, M. (1996a). Ist Trendforschung eine Wissenschaft? In: Horx, M. / Wippermann, P. (1996) Was ist Trendforschung, Düsseldorf

Horx, M. (1996b). Die Methoden der Trendforschung. In: Horx, M. / Wippermann, P. (1996) Was ist Trendforschung, Düsseldorf

Uebernickel, F., Brenner, W., Pukall, B., Naef, T., & Schindlholzer, B. (2015). Design Thinking – Das Handbuch, 171ff

Patton, M. Q. (2005). Qualitative research. John Wiley & Sons, Ltd.

Fern, E. F. (1982). The use of focus groups for idea generation: the effects of group size, acquaintanceship, and moderator on response quantity and quality. Journal of marketing Research, 1-13.

Wilkinson, S. (1998). Focus group methodology: A review. International Journal of Social Research Methodology, 1(3), 181-203.

Rabiee, F. (2004). Focus-group interview and data analysis. Proceedings of the nutrition society, 63(4), 655-660.

Asbury, J. E. (1995). Overview of focus group research. Qualitative health research, 5(4), 414-420.

dell'Olio, L., Ibeas, A., Barreda, R., & Sañudo, R. (2013). Passenger behavior in trains during emergency situations. Journal of safety research, 46, 157-166.

Ibeas, A., dell'Olio, L., & Montequín, R. B. (2011). Citizen involvement in promoting sustainable mobility. Journal of Transport Geography, 19(4), 475-487.

Wang, X. (2001). Assessing public participation in US cities. Public Performance & Management Review, 322-336.

MacDougall, C., & Fudge, E. (2001). Planning and recruiting the sample for focus groups and in-depth interviews. Qualitative health research, 11(1), 117-126.