Valuing Customer Experience – How KPIs can distort investment decisions by focusing on economic aspects obscuring secondary benefits

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Abstract

The European Shift2Rail Initiative identified three high-level Key Performance Indicators (KPIs) "Life-Cycle-Costs", "Punctuality" and "Capacity" to which Shift2Rail projects contribute in the three passenger use cases (high-speed, regional, and metro) and a mixed freight use case reflecting the overall railway transport system. The KPI methodology is carried out within the framework of the IMPACT projects and it supports investment decisions in railway innovation. However, investment decisions can only reach optimal resource allocation when the KPIs communicated to policymakers encompass the whole range of economic benefits generated by projects. The high-level KPIs which were primarily identified focused on the supply side (i.e. economic benefits for providers of mobility), omitting economic benefits associated with the demand side (i.e. improved customer experience when traveling by train). In the absence of KPIs associated with the demand side, the metrics would lead to distortions in investment decisions.

A methodology integrating customer needs and customer behaviour has been developed within the framework of the IMPACT-2 project. The "Customer Experience Model" (initially presented at the 2019 WCRR in Tokyo) focuses on economic benefits associated with the demand-side of innovation projects, but does not take into account customer acquisition and increased modal share of train once these innovations have been deployed. The Customer Experience Model is based on multilevel weighting of data to bridge the gap between the availability of existing studies, and the need for a new methodology. This model feeds inputs for a modal shift calculation based on logit models whereby utility functions are set to include factors both known (e.g. travel time, travel cost, delay, customer experience factors, waiting time) and unknown. This paper highlights the importance of considering customer needs and to gain new perspectives when assessing investment decisions in innovative technologies for the railway system.

Keywords: Key performance indicators, Customer experience, Modal shift, Railway innovation benefits, Shift2Rail

1. Introduction

The Shift2Rail initiative has the goal to enhance the European railway system. While most of the projects in Shift2Rail target for the development of technological solutions that enable this goal, the IMPACT-2 project focuses inter alia, on the integrated assessment of the impact of the technologies developed in Shift2Rail (hereafter called Shift2Rail innovations) through the development of a KPI model and, on predicting the influence of the Shift2Rail innovations on the modal split for different use cases through the modal shift model. Hereby the KPI model is estimating the actual influence of the Shift2Rail innovations on Shift2Rail's key targets, which are a halving of Life-Cycle-Cost, a doubling of Capacity and an increase of Punctuality by 50% [1]. These are evaluated for four market segments: high-speed rail, regional rail, metro and freight rail [2]. The results are then feed into the modal shift model, which then predicts the change in the modal split based on these changed framework conditions. Nevertheless, early in the project it was identified that a significant number of Shift2Rail innovations cannot show positive influences through the defined KPIs. These innovations are not targeting an operational optimisation, which is measured with the described KPIs, but have an influence directly on the customer experience, i.e. how railway passengers perceive the whole railway journey including pre-steps such as booking, as well as information given during an eventual disruption. This issue was especially true for innovations in the passenger rail sector. This also showed a flaw in the classical way of evaluating railway innovations by not, or insufficiently, considering customer experience. This one-sided view on innovations can lead to a distorted impression on the advantages of implementing certain innovations. Thus, future investment decisions might be based on an inadequate information base. Therefore, the IMPACT-2 project developed the customer experience model to capture positive influences of technical solutions on customer experiences [3] and adapted the modal shift model to also take these aspects into account.

2. The Customer Experience model

To explain in a more understandable manner how the customer experience model is working, an example is given in this chapter. One of the Shift2Rail innovations, that could not sufficiently be evaluated through the use of KPIs, is the development of the technical demonstrator "Trip Tracker" (TD4.4) of Shift2Rail. In combination with other Shift2Rail innovations of the innovation programme 4 "IT Solutions for Attractive Railway Services", the Trip Tracker will be able to "monitor(s) relevant events available on the 'web of transportation things' that could affect the traveller's journey" and "provide the user with a shield against travel disruptions by enabling seamless re-arrangement" by offering to "display alerts, offer alternative routings and trigger re-accommodation where applicable or desired." [4].

To evaluate the influences of Shift2Rail innovations, it was necessary to first understand which factors influence the customer experience. Within the projects IMPACT-1 [5], NEAR2050 [6], GoF4R [7] over 200 factors were identified through different methods such as surveys and analysis of statistics of operators complain centres, which are influencing the customer satisfaction. Those factors are called "elementary barriers" within the customer experience model. In the different passenger market segments (high-speed, regional, metro) different elementary barriers have different influences on the customer satisfaction.

In order to better handle this number of elementary barriers, they were clusters into more than 20 so-called "Areas of Major Potential Improvement" (AMPI). These AMPIs were finally clustered into the three categories: AMPIs addressed by IP4, which are the AMPIs that include elementary barriers addressed by the innovation programme 4 of Shift2Rail, which is focussing on topics closely related to the customer experience; AMPIs addressed by other IPs (especially IP1 "Cost-efficient and reliable trains, including high-capacity trains and high-speed trains" and IP3 "Cost-Efficient and Reliable High-Capacity Infrastructure"), which include elementary barriers addressed through other Shift2Rail innovations such as those related to noise and train layout; and finally AMPIs not addressed by Shift2Rail, which include for example barriers related to weather or cleanness (see figure 1).

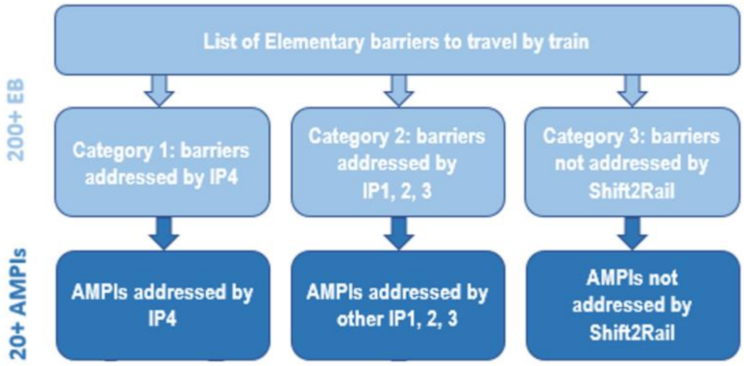

Figure 1: Data integration within the Customer Experience model

In terms of the Trip Tracker this means that eight elementary barriers were identified, that are addressed by the innovations developed in the Trip Tracker in combination with other IP4 developments. Those elementary barriers were clustered into two AMPIs, which are both included in the AMPIs addressed by IP4 (see figure 2).

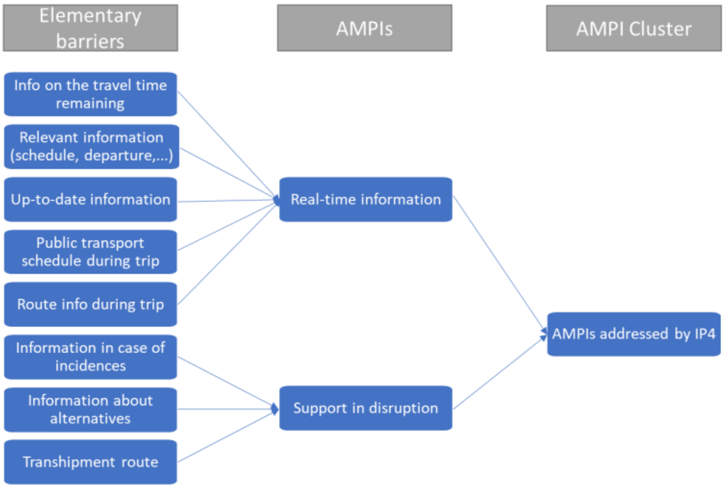

Figure 2: Data integration for the example Trip Tracker

Finally, the progress on removing the identified barriers through the Shift2Rail innovations are monitored. The AMPIs are so defined that in case the Shift2Rail innovations are successfully implemented, the elementary barriers included should no longer exist. So, in our example, if the Trip Tracker and the related necessary other innovations of IP4 are successfully implemented, the factors of having no information about the travel time or no information in case of a disruption, should no longer be a part of a traveller's journey and thus do not have a negative effect on the customer experience. Until this final state is reached and the AMPI can be set to 0% negative influence on the customer experience, experts are estimating intermediate steps of barrier removal based on the grade of development and implementation of the innovations.

The customer experience model calculations need to be fed into the modal shift model to show the significance of the developed innovations and the customer experience. This is done by clustering the identified AMPIs once again into the categories *Booking & Ticketing, Information* and *Comfort & Services*. Hereby, the AMPIs addressed by other IPs are transferred into *Comfort & Services* and the AMPIs addressed by IP4 are sorted into *Booking & Ticketing* and *Information*. In case of our example, this means that both AMPIs "Real-time information" and "Support in disruption" are sorted into the category Information.

3. The modal shift model

The aim of the IMPACT-2 passenger modal shift model is to assess the potential of Shift2Rail innovations to increase the rail modal share for the three use cases high-speed, regional, and metro. To reach this aim the modal shares in different use cases are modelled by Multinomial Logit model and Nested Logit model. In the logit models, a utility function is set up for each mode in each use case, which includes both factors known to the modeller, such as travel time, travel cost, delay, customer experience factors, waiting time and factors unknown to the modeller, which are included in the model as an error term and an alternative specific constant for each mode. Figure 3 shows an overview of the IMPACT-2 modal shift model with input data, the logit models and output data. The figure also shows that the results of IMPACT-2's KPI model regarding capacity and LCC improvements, are not directly included in the modal shift model. Rather, they indirectly affect the ticket prices and frequencies determined within the optimisation, which is conducted using profit maximising in the case of high-speed and welfare maximisation in the cases of regional and metro.

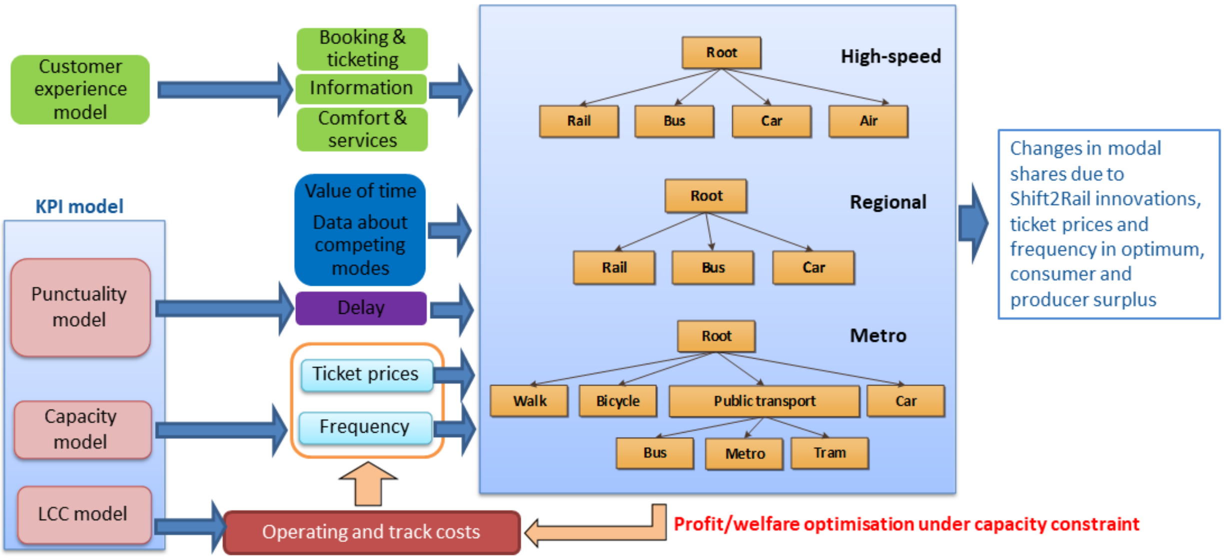

Figure 3: Overview of the IMPACT-2 modal shift model for passenger transport use cases.

As described in the previous chapter, the AMPIs from the customer experience model are aggregated into the three categories *Booking & ticketing, Information* and *Comfort & services*. These are included in the modal shift model as nominal variables, which are 1 in the baseline situation and 2 in the Shift2Rail future scenario when all Shift2Rail innovations in the customer experience area are assumed to have been implemented. The effect of the customer experience improvements in the modal shift model are to a large extent determined by the parameters in front of the customer experience variables, i.e. how rail passengers value customer experience improvements in relation to other improvements, such as decreased waiting times and ticket prices. An expert workshop was arranged to determine these relative valuations and they were also compared to relevant literature in the area (e.g. [8], [9], [10]). It should be noted that the valuations differ depending on use case. The details of the expert workshop as well as the comparison to relevant literature can be found in Deliverable D3.2 [11] of the IMPACT-2 project.

To evaluate the potential of Shift2Rail innovations on modal shift, the effect of different categories of innovations is examined separately in the modal shift model. These effects from different innovation categories are presented in Figure 4 for each use case. The results show that the customer experience variables have an important effect in the high-speed, regional, as well as the metro use case when compared to other Shift2Rail innovation categories. In the specific high-speed use case analysed, track capacity is constrained already in the baseline scenario and Shift2Rail innovations that allow for an increase in track capacity, such as innovations concerning Moving Block and Automatic Train Operation, are obviously very important to make it possible to suit a resulting demand when increasing the rail modal share. Therefore, an increase in track capacity will enable a corresponding increase in frequency, which in turn has a substantial effect on the rail modal share due to reduced waiting times for passengers. However, as long as an increase in rail demand can be met by available capacity, the customer experience variables play a significant role in increasing rail demand. Shift2Rail innovations on *Booking&Ticketing* and *Comfort&Services* would increase high-speed rail demand by around 20% given that there is enough rail capacity. Shift2Rail innovations on *Information* would increase the high-speed rail demand by about 25%. Looking at the example of the Shift2Rail Trip Tracker innovation that we have used throughout the paper, this is included in the customer experience variable *Information* in the modal shift model, and thus its effect on modal shift is reflected in the effect of *Information*. For the specific regional use case analysed, track capacity is not an issue, but reduction of delay and waiting times are important drivers for increased passenger rail demand. Thus, an increase in frequency that reduces the waiting time, and a reduction of delay has the strongest effect on rail modal share. After reduction in delay and waiting time, customer experience variables are the most important drivers for the regional use case. The specific metro case analysed in this paper is already optimised track capacity wise in baseline, and it is therefore not possible to run more trains per hour, only to increase the number of seats per train somewhat. Therefore, an increase in frequency is not possible and thus has no effect. Also, punctuality in the metro use case is already optimised and no further improvement of punctuality is considered for this use case (thus delay has no effect for metro case in Figure 4). All in all, the possibilities for increased metro demand are very limited for this specific metro use case. The rail demand increases that do happen, are mainly due to improvements of customer experience variables.

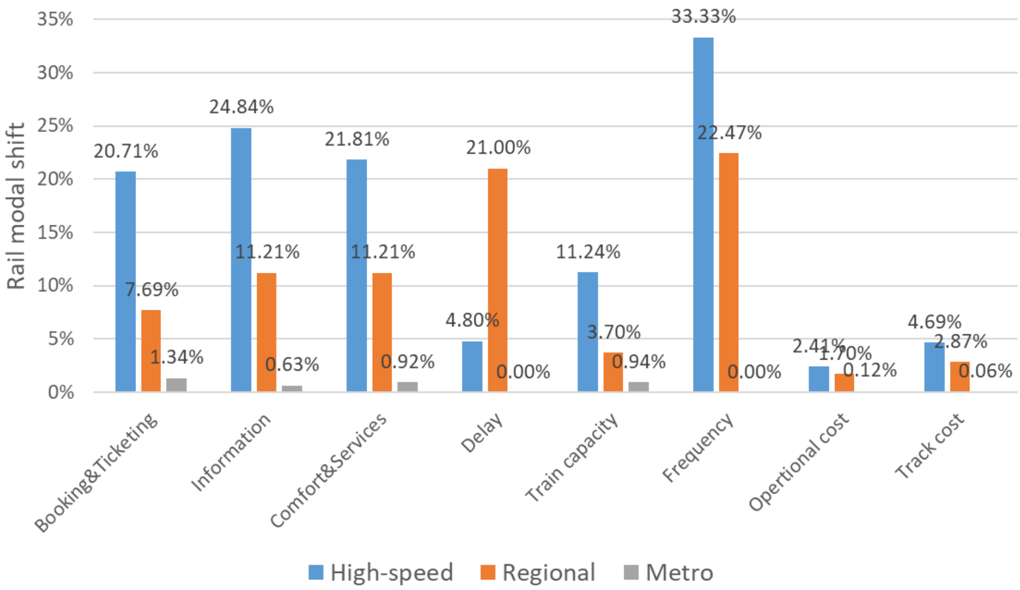

Figure 4: Individual effects of customer experience variables on rail modal share, compared to other Shift2Rail innovation variables, high-speed use case.

It is worth mentioning that the effects presented above are under the assumption that there are no innovations for the competing modes. However, this is probably not true, especially given the rapid development in car industry. Therefore, further future scenarios are tested by assuming that there are substantial developments in electric vehicles and autonomous vehicles, in addition to Shift2Rail innovations. Modal shift is then calculated in the different alternative future scenarios. Detailed results are presented in Deliverable D3.3 [12] of the IMPACT-2 project. Results suggest that rail modal shift driven by Shift2Rail innovations could be substantially reduced by innovations in autonomous and especially electric vehicles. The conclusion is that in the coming decades, the electrification of road transport is likely to be one of the major factors affecting the passenger rail demand, in combination with how fast Shift2Rail innovations can be rolled out. The development of automated vehicles probably will occur later in time and have a weaker impact.

5. Conclusion

By using classic KPIs such as life-cycle-cost, capacity and punctuality, the impact of innovation can be valued and analysed. Therefore, the KPI methodology is known as a popular tool in classic investment decision-making. But by focusing on the economic impacts of innovations only, classical KPIs distort other secondary benefits that are associated with the customer's experience. In a functioning competitive market, the long-term decrease of revenue caused by unsatisfied customers would be unbearable. Only through subsidies or monopolism can such behaviour be more economical in the long run. For both the European Union has agreed to minimize them. As a result, the challenge was identified that decision-makers in the railway system do not possess a sufficient basis for decision-making in order to implement investments that cover operational as well as customer-oriented aspects. For this reason, a methodology that allows the inclusion of customer experience was developed in the IMPACT-2 project of the Shift2Rail initiative.

Through the modal shift model, it could be shown that factors regarding the customer experience do have a significant influence on a potential modal shift and thus on the achievable revenue. Hereby, it is important that an increase in demand through more attractive offers can be met by the available capacity in the railway system. At the same time, an increased rail capacity, can provide a more frequent service, which is also a more attractive offer for the customer. This shows that a balance between demand and offer is essential to reach the goal of a "shift to rail". Thus, sufficient tools to provide decision-makers with a holistic view on consequences of investments are needed to enable a sustainable, customer-oriented, and competitive railway system of the future.

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