

Ride-Parcel-Pooling: Insights to Integrated Passenger and Freight Transportation through a Customer Survey

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SHORT SUMMARY

This paper deals with the idea of ride parcel pooling (RPP); an on-demand service, where passengers as well as parcels share – if possible - trips within the same vehicle. Potential users are surveyed to find criteria that are crucial for the success of an on-demand service. The survey looks at socio-demographic aspects and tries to assess the participants' attitudes towards ride pooling services. Subsequently, user preferences (e.g. waiting times and detours) for the operation of a future RPP service and possible service scenario parameters are assessed. Finally, we examine reasons for the pros and cons of ride pooling services and the participants' opinions on different types of vehicles.

Results show that the respondents of the survey were very positive about the idea of RPP and that they also deem the service scenarios presented to be beneficial. With respect to service parameters, the potential increase in travel time due to the integrated transport of parcels will be very critical in terms of customer satisfaction. Moreover, results show that financial compensation for inconvenience often changes the opinion of the respondents. In addition, respondents were asked about their preference regarding the potential vehicle. The possible choices included a rickshaw to evaluate its advantages and disadvantages. Finally, we asked participants about their attitudes towards ride pooling in general and RPP in particular, and had them list advantages and disadvantages of the systems compared to traditional transportation modes.

Keywords: shared mobility, customer survey, ride pooling, combined transportation, passenger and freight, mobility on demand

1. INTRODUCTION

In recent years, we have seen an ever-increasing proliferation of mobility on-demand (MOD) providers. On an international level, the big players such as UBER or Didi are well known. In Germany, the ride-pooling service MOIA operates a fleet of up to 500 battery electric vehicles in Hamburg (MOIA GmbH, 2021) and is additionally active in Hannover. The MOD service MOIA is the largest of its kind in Europe. In Munich, the regional mobility provider tested the so-called “IsarTiger” (MVG Münchner Verkehrsgesellschaft mbH, 2021) for several months, which is a MOD Service supplementing the public transport system during off-peak demand times.

With increasing market share of MOD services and technical progress in automation, simulations have been used to develop fleet control models (Alonso-Mora et al., 2016), (Engelhardt et al., 2019) and study impacts on the traffic system (Wilkes et al., 2021). . Additionally, new business models can be tested. In this context, many ideas rely on increasing fleet utilization by incorporating additional tasks into the fleet management. For example, measures for the maintenance and refueling or charging (Dandl et al., 2020), (Fehn, Noack and Busch, 2019) of the fleet as well as

additional transport demand, such as parcels (Fehn, Engelhardt and Bogenberger, 2021) have been suggested recently.

Passenger and freight transportation is increasing at rapid pace, which is especially noticeable in big cities due to poor traffic quality and lack of space. Vehicle automation, digitalization and connectivity enable the operational combination of freight and passenger traffic. So far, these two forms of transport were treated largely independently from each other in practice. However, the combination of both enables, especially in urban areas, to exploit unused capacity of passenger transportation for logistic services in order to optimize capacity utilization and reduce the overall mileage within the urban transport networks. With increasing connectivity, data availability and the rising trend towards MOD, the operational integration of MOD and city logistic, in the following denoted by Ride-Parcel-Pooling (RPP), becomes possible. This could improve the overall traffic situation and by that, reduce air pollution and noise emission, leading to a livable city environment.

In order to make the technical implementation of such a RPP service as realistic and customer-centric as possible, it is necessary to ask potential customers about their attitudes and needs. (Kostorz et al., 2021) for example, studied the usage of the MOIA ride pooling service in Hamburg within a survey. The RPP service on the other hand does yet only exist as a pilot project, leaving room for a customer-oriented design. In order to ensure this, we have conducted a potential customer survey, which is intended to provide these insights.

2. METHODOLOGY

This research focuses on an empirical survey of potential users of the RPP service to investigate what requirements and preferences customers might have. We designed the survey presented in this paper into four main categories: participant socio-demographics and socio-economics, attitude towards ride-pooling services, parameters for ride-pooling simulations and acceptance of RPP scenarios. The more detailed research topics and question categories are stated in Figure 1.

We conducted the web-based survey online and additionally approached potential participants with an informational flyer in the city of Munich from September to October 2021. Furthermore, we constantly monitored the incoming answers and evaluated the sample in terms of representation of necessary respondents groups. It took approximately 10 to 15 minutes to answer the survey. Overall, we were able to acquire 102 participants. To evaluate the results, we performed an extensive data analysis and additionally set up a regression model to display potential dependencies of our test variables.

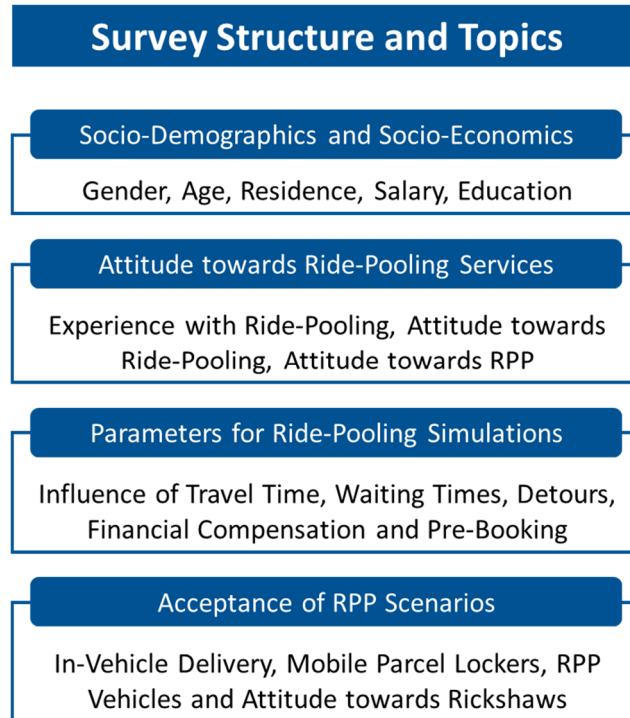


Figure 1: Research topics and categories of survey questions

3. RESULTS AND DISCUSSION

For complementation of the existing ride-pooling surveys and introduction of the new RPP service, we will present results from the survey, addressing the research topics and question categories stated in Figure 1.

3.1 Socio-Demographic and Socio-Economic Parameters

The first section of our survey comprised a short socio-demographic and socio-economic analysis of the survey respondents. It was found, that 51% of the participants were male and 49% female. Most of them live near or close to the city center. The sample is very highly educated: A share of 6% hold a PhD or an equivalent as their highest degree and 54% have a university degree. Regarding the economic status, most of the respondents (30%) receive a salary between 2.000 € to 3.000 €. Figure 2 shows the average net salary of the respondents compared to the German average salaries (Statistisches Bundesamt, 2021). Income classes between 1000 and 2000 euros are underrepresented.

At this point, it is already clear that our sample shows a bias toward a high level of education and above-average income – however, this could fit to the attributes of RPP early adopters.

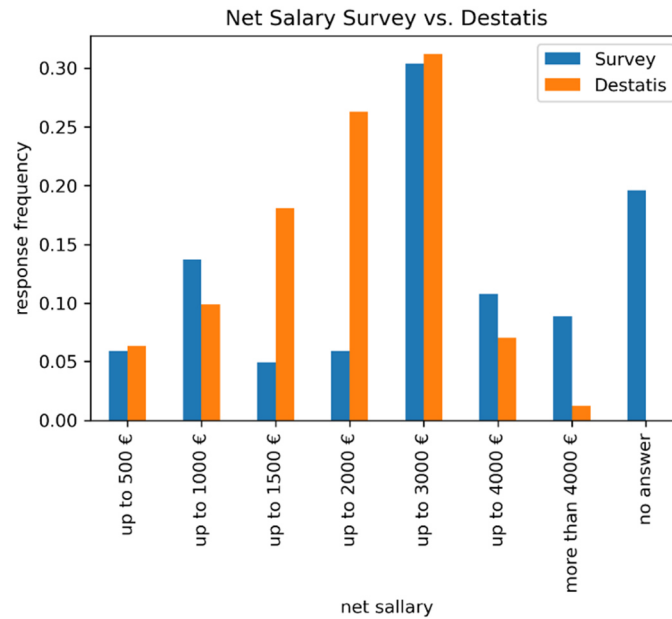


Figure 2: Survey net salaries compared to the German average net salaries (Destatis)

3.2 Attitude towards Ride-Pooling Services

The attitude towards ride-pooling services among the respondents was attempted to be clarified by first asking the participants about their personal experience with ride pooling services. About 36% of the sample stated that they already used ride-pooling services and approximately 82% have a positive attitude towards it. There was no significant difference in positive attitude between people, who already used ride pooling and people, who did not. In the next step, we asked about the attitude towards the idea of RPP. Here again, the majority (87%) expressed a positive attitude and there was no significant difference between respondents with ride pooling experience and the others. We see that the idea of RPP is evaluated even more positively than the classic ride pooling service.

3.3 Parameters for Ride-Parcel-Pooling Simulations

The next part of the survey aimed at defining service parameters (i.e. as input parameters for simulations). We wanted to find out, which influence travel time, waiting times, detours, financial compensation and pre-booking options have on the customer satisfaction.

The influence of travel time increase due to the additional transport of parcels in RPP was estimated by asking the respondents about their willingness to share a ride, if the parcel imposes 0%, 10%, 25% or 50% additional travel time on their respective trip. Figure 3 shows the development of customer satisfaction on a scale from 'yes, definitely' to 'no, never' regarding the willingness to share the trip.

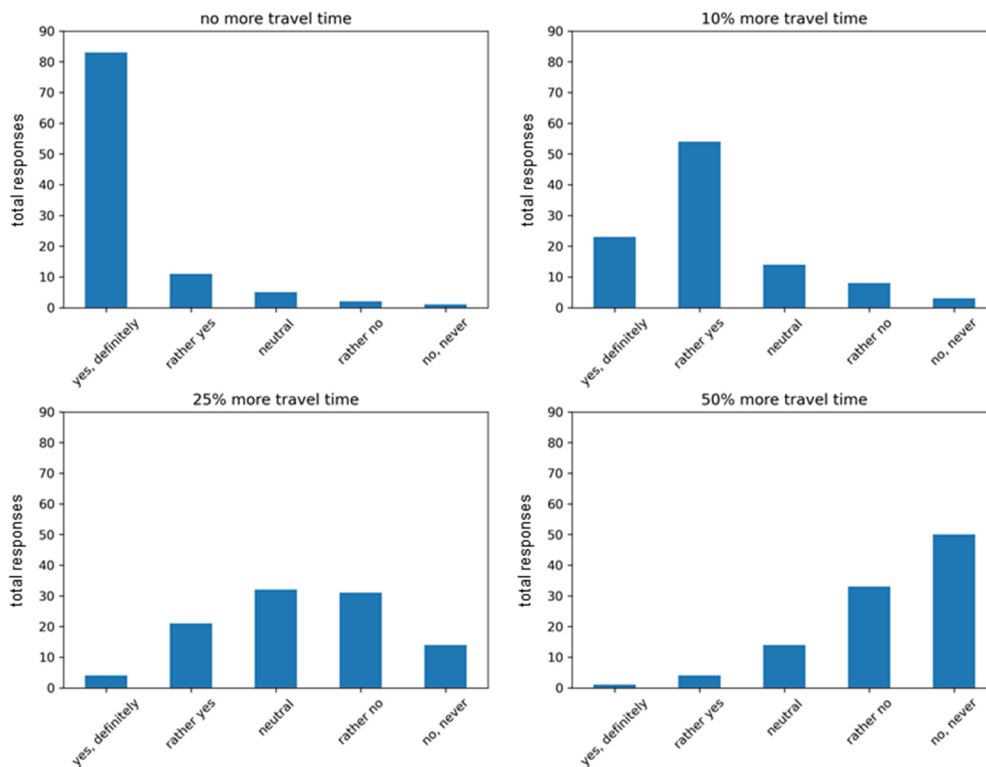


Figure 3: Willingness to share a trip in RPP under the assumption that parcels increase travel time

It is noticeable that, with rising travel time the willingness of customers to share a ride with a parcel declines. The high number of negative answers for a 50% increase in travel time also indicates, that customers are probably not willing to accept a higher increase in travel time. Generally, one can say, that an increase in travel time has a direct influence on the acceptance of RPP among potential customers; however, survey questions using percentages often cause confusion and have to be evaluated carefully, as the respondents might interpret it differently. Directly linked to the previous question was a question about the desire for financial compensation. Three out of four people stated that a discount would affect their willingness to accept higher travel times and the demanded price reduction was directly correlating to the relative increase in travel time. Figure 4 shows exemplarily the demanded discount for a travel time increase of 25%.

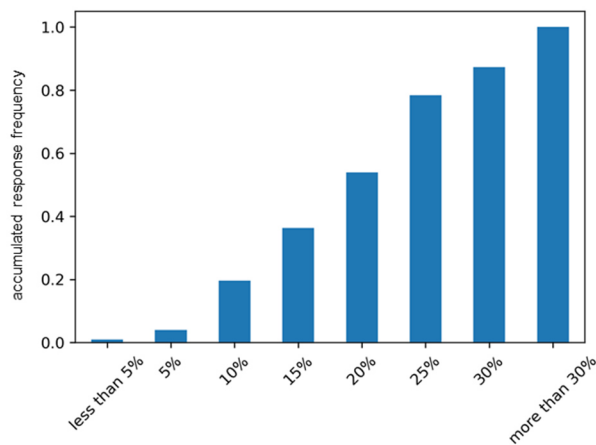


Figure 4: Demanded discount for a travel time increase of 25%.

The influence of waiting and detour times of a RPP service were also considered in this survey. Respondents specified the acceptable waiting time before the driver arrives after the request and the maximum detour time in a pooled trip according to Figure 5. Most participants indicated a waiting time of up to 10 minutes and detour time of up to 5 minutes for a representative trip of 7 km length and 15 minutes travel time.

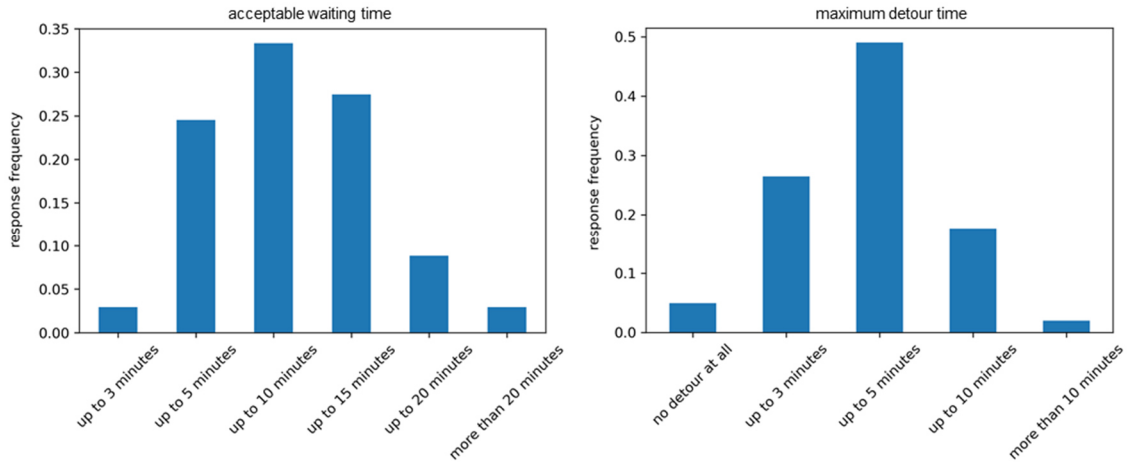


Figure 5: Acceptable waiting time and maximum detour time for a pooled trip with 15 minutes direct travel time.

A very interesting question for ride-pooling services, is the option to offer pre-booking of trips. On the one hand, pre-booked trips give the operator the possibility to better plan the service in advance, on the other hand, it has to be guaranteed, that the service will be provided at the specific time and place, which brings new constraints on the fleet management side. In this survey, we asked the participants how likely it would be for them to book a ride more than one hour in advance and how financial compensation would increase the usage. The results show that there is a general willingness to pre-book their rides and that a financial compensation reinforces this effect (see Figure 6 left and middle). The respective discount rates the respondents asked for can be found in Figure 6 (right).

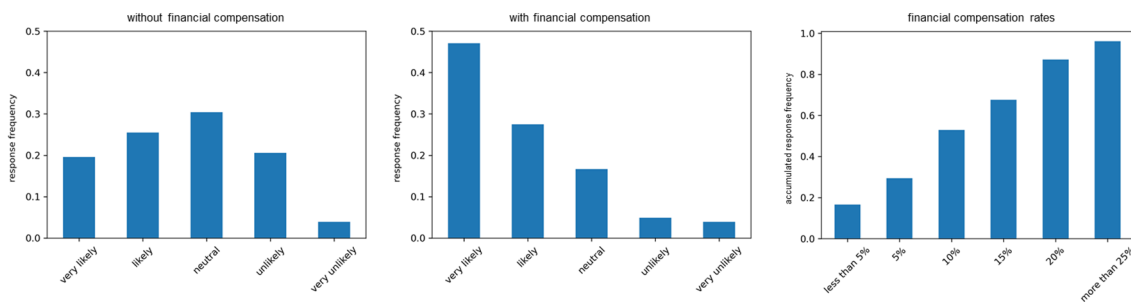


Figure 6: Willingness to pre-book rides 1 hour in advance in ride-pooling services

3.4 Acceptance of RPP Scenarios

Within the process of designing a RPP service, we came up with different use cases a provider could offer. To test the acceptance of the use cases among potential RPP users, we introduced them to the survey participants and asked for their opinions and preferences.

The first scenario is called ‘in-vehicle delivery’ and describes the combination of a pre-booked trip with an integrated in-vehicle parcel delivery for one specific customer. The parcel was pre-ordered and is now delivered directly en-route instead of to the customers’ homes. The survey results show that 83% of the respondents like the idea, 12% are not sure and 5% dislike the idea.

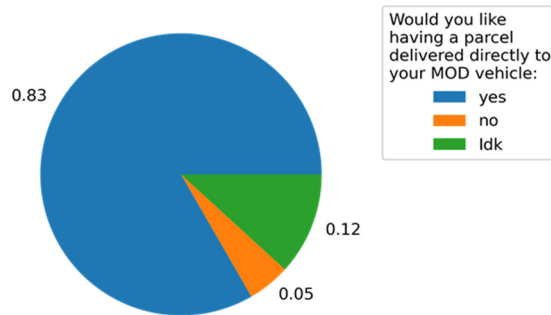


Figure 7: In-vehicle delivery of parcels during pre-booked trips

In the second scenario, the RPP vehicle acts as a mobile parcel locker, where customers can pick up or drop off parcels close to their homes within specific time windows. We found that three out of four people like the idea of mobile parcel lockers and could imagine using such a service, 19% answered with ‘I do not know’ and only 6% of the respondents did not like it (see Figure 8, left). In terms of maximum acceptable distance of the mobile parcel locker, the most chosen answer was 0.25 to 0.5 kilometers (see Figure 8, right).

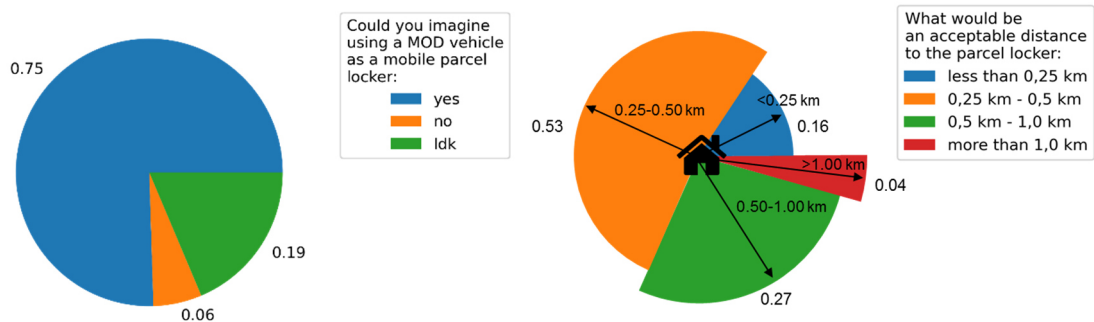


Figure 8: RPP vehicles as mobile parcel lockers close to customers’ homes

Finally, we asked the participants about their attitude towards their favorite vehicle for RPP services. The respondents could choose between the four vehicle categories, namely city bus, minivan, passenger car, and rickshaw. Around 40% of the participants liked the classic bus as an RPP vehicle, 65% chose a minivan, 58% chose the passenger car and 37% voted for the rickshaw. At this point, it should be mentioned that multiple selection was possible. A rickshaw is a very sustainable, space saving and affordable transportation mode. Therefore, we wanted to gain a deeper understanding about the respondents’ attitudes towards this vehicle type. We asked the potential users how they feel about a rickshaw as a mode of transportation for the RPP services (see Figure 9). It becomes clear that the rickshaw as a means of transport is not viewed positively throughout. However, there are also people who have purely positive attitude towards rickshaws.

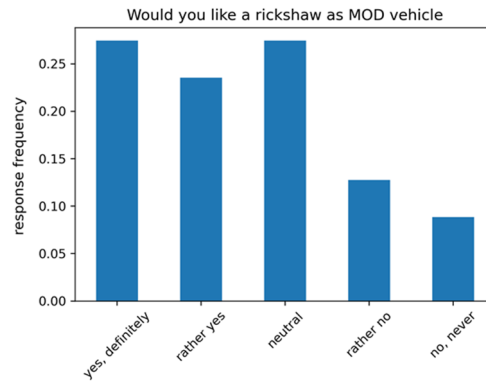


Figure 9: Attitude towards the rickshaw as means of transportation for RPP services

Additionally, we asked for a reasoning of the chosen option among the participants. Out of the responses, we found the statement categories stated in Table 1.

Table 1: Advantages and Disadvantages of a rickshaw as RPP vehicle

Rickshaw Pros	Rickshaw Cons
Environmentally friendly (lower CO2 footprint, emissions, noise) Solves space problem in cities and more flexible during rush hours Great means of transportation for short distances, little luggage, crowded streets Fresh air/ see more riding experience in urban space Attractive appearance	Effort of the driver (smell, discomfort, pity, etc.) Confined space (especially when pooling), limited pooling capacity Insufficient weather protection Unfamiliar, one feels observed, safety concerns (accidents, luggage, parcels) Low speed, only suitable for short trips Unattractive appearance

The results suggest that a rickshaw is perceived as a very sustainable, space saving and eco-friendly means of transportation. Some see it as a great opportunity for short trips, offering a nice riding experience. However, many participants might feel unpleasant, because of the physical effort of the driver, the confined space and the insufficient weather protection. Some respondents also mentioned the feeling of being observed and safety concerns.

As user acceptance of ride pooling is already well investigated in the scientific literature, we rather focused on the perceptions of RPP in particular (see Table 2).

Table 2: Advantages and Disadvantages of RPP

Ride Parcel Pooling Pros	Ride Parcel Pooling Cons
Savings in vehicle mileage/ space in the city Sustainable means of transportation Cheaper than other means of transport	Problems with the delivery of the parcel Delay/ detours for passengers Content and state of the parcel (drugs, damage, etc.), fear of being blamed Lack of space in the vehicle due to parcels

The pros and cons for RPP show a similar structure to those mentioned for ride pooling (Kostorz et al., 2021). However, many respondents mentioned the ‘green’ image of RPP in terms of emissions, space savings and less road traffic. Some also mentioned it might be cheaper than other modes of transportation. On the negative side, many participants mentioned problems due to the additional transport of parcels, such as lack of space, content and damage of the parcel and inconvenient delays or detours.

Finally, we set up a regression model to find interesting correlations in our survey. The following dependencies were conspicuous:

- Older people seem less likely to be in favor of ride pooling and RPP compared to younger respondents.
- Especially respondents who live in or near the city center have already used ride pooling.
- Young people and respondents with high salaries tend to accept less detour and waiting times.
- Younger respondents are more receptive to RPP scenarios (in-vehicle delivery, parcel station) than older respondents are.
- People who live further away from the city center accept longer distances to a parcel station.
- Female respondents want the mobile parcel stations closer than male respondents do.

The found dependencies match with our expectations, especially in terms of value of time of busy people, and the phenomenon, that especially young people could be early adopters to a future RPP service.

4. CONCLUSIONS

This research paper focused on the idea of ride parcel pooling and tried to gain a better understanding of potential customer’s preferences and opinions. In summary, the idea of RPP was perceived very positive and the introduced service scenarios were evaluated well. We were able to collect insights into service parameters, such as waiting times, delays, detours and pricing policies. One shortcoming of this survey is the limited sample size and the bias towards young and highly educated people, who might however also be the early adopters for a RPP service.

ACKNOWLEDGMENT

This research was supported by the project TEMPUS, a research project funded by the German Federal Ministry for Digital and Transport. We would also like to thank all the participants of the survey for their contribution.

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