Summary

Initial situation and research questions
On Swiss roads, cars are occupied on average by only 1.56 people, and in the case of commuter traffic, this figure is only 1.10 people. This is problematic in terms of the consumption of road capacity, area and energy as well as noise and pollutant emissions. Carpooling, which greatly increases the vehicle occupancy rate, has the potential to use resources much more efficiently and to substantially reduce emissions.

Developments over about the last ten years in the field of digitalisation offer opportunities for organising such carpools via Internet-based platforms using an app on mobile digital devices. This app-based formation of carpools between two people who do not necessarily know each other is referred to in the literature as car-pooling (hereinafter referred to as CP) or ride-pooling. *In this study, car-pooling (CP) is understood to mean arranging, carrying out and charging for rides via a platform in which drivers trigger the ride according to their own needs, essentially determine the route, destination and time, and are not guided by commercial interests. Passengers are usually individuals, but there can be up to a maximum of four people at a time.*[2]

The present research paper investigates the social acceptance of CP, the influencing factors on this acceptance and the levers for increasing people's acceptance thereof.

Approach
The approach of the research paper was divided into four phases:

- In the initial phase, the state of research and results from CP projects already implemented in practice in Switzerland were evaluated.
- The second phase included an initial online survey of registered vehicle keepers on the current acceptance of CP and the influencing factors on acceptance. The sampling was carried out based on the "Federal Driver and Vehicle Authorisation Information System" (DVAIS Register) of the Federal Roads Office (FEDRO). A random sample of all registered vehicle keepers in German, Rhaeto-Romansh and French-speaking Switzerland was drawn. In contrast to car owners, registered vehicle keepers are centrally registered in Switzerland and represent car owners in this study.
- In the third phase, a second online survey was conducted with a new sample from the same register data record as in the first survey. In terms of content, the second survey focused on future acceptance. Using a discrete choice experiment, it was investigated which approaches could be used to increase the acceptance of CP in the future.
- In a fourth phase, the results of the two surveys were first validated by a focus group in Lucerne and a focus group in Lausanne with people from the general population, and then reflected and analysed in detail in a workshop with current and potential providers of CP platforms.

State of research and insight into previous carpooling projects
On the supply side, there is a multifaceted picture of CP platforms for Switzerland. At the time the research paper was written, 14 active and publicly accessible CP platforms were counted. In addition, there are various non-public platforms, for example in the area of commuter transport.

If one looks at the national and international state of research on CP, this indicates a general acceptance problem in the population (e.g. Liu et al. 2020; Delhomme & Gheorghiu 2016; Rapp et al. 2001; Anthopoulos & Tzimos 2021). In the recent past, there were several

[2] In the literature, the term ride-pooling is also associated with on-demand services, where journeys with similar routes are pooled and the journey is carried out by a driver from a commercial provider. The present research focused on carpooling between drivers and passengers with the vehicle type "passenger car" (4 - 5 seats) on a non-commercial basis. Since the term car-pooling is often used for this form of pooling and this also seemed more suitable for the surveys among the population, the term car-pooling will be used throughout this report.

services in Switzerland that were discontinued (e.g. Publiride, Tooxme, mitfahrgelegenheit.ch or Mobility-Carpool). Pilot projects which have recently been particularly successful involved ones where carpools were actively promoted through physical meetings in addition to the digital offering. This is also illustrated by the in-depth insight into three CP pilot projects in Switzerland with a focus on commuter transport (Pool2Job, CP project at SwissRe and the Mobalt app for mobility management in companies). They show that face-to-face initiatives (especially active presentations) can work well. It becomes more difficult when carpools are to be formed alone via apps.

The current acceptance of carpooling as a step-by-step process

The results of the first survey show that acceptance can be depicted as a step-by-step process (see *Fig. 5*): just under 20 per cent of car owners are not familiar with the concept of CP using a digital platform. There is therefore only a potential for these people to increase the acceptance of CP by making such services more widely known. About 10 per cent of car owners are familiar with CP, but do not like the concept. Most car owners – depending on the perspective (driver or passenger) and the purpose of the journey around 55 to 60 per cent – are familiar with CP and, although they like the idea, have never considered using CP in the last five years. One main finding was made where the crossing of this threshold is concerned: from the stage of liking the idea to the stage of considering it, most car owners are lost proportionately. Less than 20 per cent have already considered the use of CP or have already actually made use of an offering.

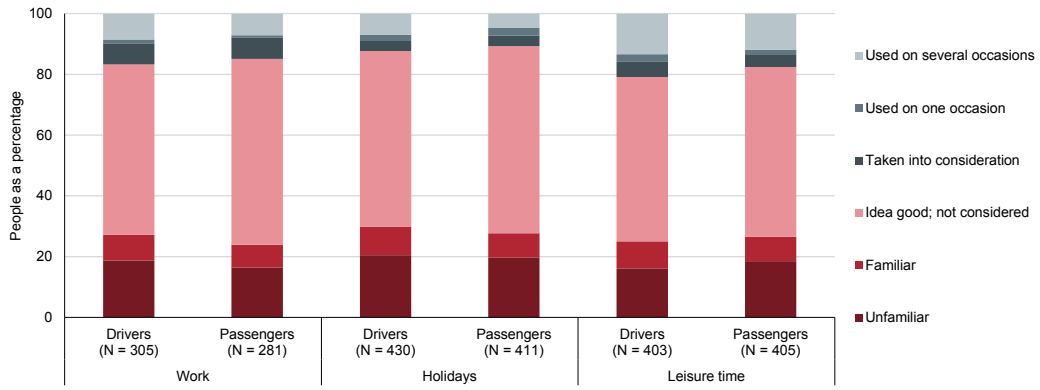

Fig. 5 *Allocation of people to the maximum levels of acceptance achieved, separated by purpose and perspective.*
Source: depiction of interface/Sozialforschungsstelle UZH/mobitrends.

Factors influencing the current acceptance of carpooling

The use of CP is not something the vast majority of car owners think about regularly. This is also reflected in the analysis of the factors which influence acceptance. The car owners have not yet formed a differentiated judgement on CP. Specifically: the better they find the overall concept of CP, the better they assess the individual elements – regardless of whether they are dealing with different things such as privacy, flexibility, security or environmental consequences. Concrete considerations such as what day-to-day routines could mean for the use of CP or what role the CP-relevant conditions at the place of work (e.g. freely available parking space) play in the use of CP are apparently not yet made at present.

The two most important influencing factors are the assessment of whether enough people use CP for the system to function (critical mass) and the assessment of the benefits of CP. The majority do not assess the critical mass as having been reached. Only around a quarter of the people believe that enough drivers or passengers would be found. The benefits of CP include aspects such as privacy, time, money, flexibility, the environment, experience, etc. The most important thing here seems to be the assessment of flexibility. This is currently assessed negatively by a majority with regard to CP. In other words: any measures that increase flexibility should make the use of CP more likely.

The results also show the two alternatives of commuting to work by car or public transport could compete with the use of CP. Tendencies have been observed whereby the better these alternatives are assessed – for example, the practicability of public transport or the congestion problems associated with travelling by car – the less acceptance there is of CP. These are current trends, i.e. statistically significant results only in individual cases. However, it is very conceivable that these trends will intensify as people become increasingly familiar with CP.

The assumed platform quality is of little relevance for the current level of acceptance. People assume that the platform works perfectly and that the basic functions such as clear legal regulation and the usual level of data security are guaranteed. If these conditions are met, this does not lead to increased use according to this interpretation, but if they are not met, CP will not be used.

With regard to socio-demographic and socio-economic factors, it appears that people with higher levels of education are more likely to consider using CP than people with lower levels of education. This is also often accompanied by a higher affinity for public transport, which this group of registered vehicle keepers has. For other socio-demographic characteristics (such as age, gender or income), there are no statistically significant correlations with the acceptance of CP. This is also confirmed by looking at the typology that was formed using a cluster analysis based on the responses from the first survey: of a total of four types created, the so-called “strategists” are the most accepting of CP. This group consists of people over 50 years of age with a comparatively high socio-economic status. The other social groups are the “promoters” (also with a high socio-economic status, but younger people), the “workers” and the “hangers-on” (both types with a comparatively low socio-economic status; the former are under the age of 50, and the latter are over the age of 50). They all show a somewhat lower acceptance of CP, even though the differences are rather small, i.e. in the single-digit percentage range.

Acceptance of carpooling in automated vehicles

The question of the acceptance of CP in automated vehicles reveals a polarised opinion. Either people can well imagine using CP in automated vehicles themselves (around 40%), or they generally do not like the idea of CP in automated vehicles (around 35%). There are only few people who like the idea but cannot imagine using automated vehicles as opposed to conventional vehicles. This result discrepancy between CP in conventional and CP in automated vehicles can probably be explained by the attitude of people to automated vehicles as such. If a person likes automated vehicles, they can also imagine using them – even if other people they do not know are sitting in the car. Nevertheless, the results seem to give rise to the hope that automated vehicles can be used to pool trips on a larger scale, in other words that around 40 per cent of vehicle keepers can be pooled.

Approaches aimed at bringing about greater acceptance in the future

The results of the discrete choice experiment carried out in the second survey (see *Fig. 6*) as well as the discussions in the two focus groups – regardless of the purpose of the journey – point to concrete characteristics of CP services, which will be important for greater acceptance in the future.

	Commuter traffic		Non-daily leisure traffic	
	Drivers	Passengers	Drivers	Passengers
Does the possibility exist to exclude groups of drivers or passengers?				
Does the passenger contribute towards the full costs (70 rappen per kilometre according to TCS)?				
As a passenger, do you only have to contribute towards the fuel costs?				
Are there designated carpooling lanes on Swiss roads?				
Are there designated parking spaces for carpooling cars at the place of work?				
Is a return journey option guaranteed?				
Is it possible for data to be passed on to third parties for a fee?				
Are other forms of transport integrated into the carpooling platform?				
Are there special security measures?				
Will I be picked up right outside my home?				

Fig. 6 *Overview of the relative importance of the properties in the four discrete choice experiments (DCE).*
Source: depiction of interface/Sozialforschungsstelle UZH/mobitrends.
Note: the darker the colour of a cell, the more important the corresponding property is for the acceptance of CP. The average regression coefficients were used as the basis for the colour scheme. Cells with a white background that are crossed out show properties that were not included in the DCE.

It turns out that from the driver's point of view, the future acceptance of CP depends to a large extent on monetary factors. While maximising revenue is not the primary objective, a fair fee for the CP service is expected. The empirical results give at least indications of an adequate willingness to pay on the part of the passenger.

The fact that monetary aspects play a role in the future acceptance of CP is also shown by the result that a free designated parking space at the workplace for carpooling can be a relevant incentive for CP. Currently, however, such incentives are rarely effective, as at least half of commuters already have such a parking space at their place of work (51% according to the survey).

Similar to the monetary aspects, ensuring a certain level of security is an important characteristic with a positive influence on the future acceptance of CP. From the point of view of drivers, passengers should register with the CP provider and there should be feedback systems that identify untrustworthy persons. For a passenger, the hurdle of getting into a stranger's car seems to be even higher, and security precautions are therefore particularly important. Security precautions are an important prerequisite – but they should also not go too far and lead to permanent monitoring of drivers by the CP provider.

The social aspect can be an incentive to use CP. In French-speaking Switzerland in particular, car owners see a positive side effect of CP in getting to know new people – whether by offering CP as a driver or by using CP as a passenger.

From the perspective of the passenger, guaranteed return journey options and the free choice of the boarding location represent added value.

Regulatory state measures, namely designated carpooling lanes, are poorly received. Either the additional benefits in Switzerland are judged to be insufficient where this is concerned, or there is even a fear of an adverse effect on oneself or the entire transport system due to an increase in traffic jams or an impairment of the bus service in cities, if, for example, bus routes were also approved for carpooling.

The possibility of passing on personal data arising from the use of a CP platform for a fee is also assessed negatively by practically all of those surveyed – even if the individual users are able to decide whether or not their data should be passed on. The results indicate a high level of awareness of the topic of data protection in conjunction with CP services.

Overall, the discussions in the focus groups confirmed the findings from the first survey. Although car drivers can imagine using CP as a passenger or even more as a driver in the future on a case-by-case basis, CP is not considered a substitute for one's own car, and integrating CP into one's own daily routine beyond sporadic use seems to be a distant prospect as a rule.

This conclusion was confirmed by the discussion and detailed analysis of the empirical findings in the context of a workshop involving current and potential providers of CP platforms. Given the current framework conditions, the potential is estimated to be low, especially because currently potential users do not consider the use of CP to be a sufficiently pressing problem, and past experiences of providers have shown that it is hardly possible to establish profitable business models on the market. However, there was consensus that CP could become more important in the future due to the great potential where efficiency is concerned and the increasingly pressing problems caused by increasing traffic bottlenecks or ongoing climate change. Based on the empirical results as well as the personal experiences and expertise of the workshop participants, strategic guidelines and possible measures for a better exploitation of the potential of CP in the future were discussed at the workshop.

- On a *strategic level*, it was discussed that a focus on target groups which already have a high affinity for forms of collective transport should be strived for in a shorter period of time, so that a critical mass of CP users can be established as quickly as possible. The image of CP also needs to be reconsidered: CP – according to the opinion of the majority at the workshop – should position itself as part of collective mobility and not as private motorised transport with a higher occupancy rate.
- Possible pricing models were discussed at the *level of measures:* according to the workshop participants, flexible pricing models, which enable the two parties to negotiate fair prices themselves, should be more targeted than rigid pricing specifications from platform providers. The potential in the area of employee mobility was further emphasised, for example through car park management or with bans or rules that go beyond incentive measures, which are more likely to be enforced in the operational context than in the case of state regulations. Finally, attention was drawn to the importance of official measures. An active role of the state in shaping CP-promoting framework conditions up to and including financial support is seen by the workshop participants as a prerequisite that the acceptance of CP can be significantly increased in the future and that a CP service can be operated profitably.

Conclusions

The results of this research project show that a clear majority of more than 70 per cent of car owners in Switzerland are familiar with the concept of CP and that they think it is a good idea. However, only a small percentage of less than 20 per cent of all car owners consider using CP – whether as a driver or passenger, whether in commuter or leisure traffic. Overall, the empirical results of the present research paper show that the level of urgency relating to the issue of using CP is still far too low. Unless this problem becomes more pressing, according to the conclusion that is consistent with previous studies, CP will continue to have a niche existence and usage figures would hardly increase at all. Even developments in the field of digitisation and the sharing economy have not fundamentally changed this in recent times.

However, in view of the future challenges facing the transport system, the potential of carpooling is too great from a traffic, economic and ecological point of view, given the 70 per cent of car owners who think CP is a good idea, for investments to be considered futile from the outset. From the point of view of the authorship, the topic of CP should be pursued despite the current very low usage figures, so that in the event that this problem becomes

much more pressing over time, the potential of CP, which is presumed to increase as a result, can be directly developed.

Based on the findings of the research project, six conclusions can be drawn with regard to the better tapping of the potential of CP in the future.

- *Reframing CP:* CP is to be understood as part of collective mobility, a term that is likely to gain further significance in future discourses. CP should position itself here as a "building block" for this mobility.
- *A mix of pull and push measures is needed:* the development of a state agenda for increased funding of CP was not part of the research project, and state intervention must always be carried out with due caution, weighing up all the advantages and disadvantages. Nevertheless, the findings of the research project make it clear that a substantial increase in acceptance even in the short and medium term is only realistic through push measures; in other words, measures that adjust the framework conditions in such a way that the pressure to use CP increases.
- *Using carpooling to bridge the gap between individual and collective mobility:* CP has the advantage that individual and collective mobility are combined in this form of mobility: a car driver, who normally travels alone, is likely to initially use CP as a driver rather than as a passenger. However, if carpools are established and positive experiences are associated therewith, her willingness to also use CP as a passenger may increase in a second step.
- *Taking advantage of employee mobility opportunities:* companies have the opportunity to design the operating framework conditions in such a way that they directly affect how pressing the problem of using CP is considered to be. As the empirical results of this paper show, measures in the area of car park management should have a comparatively large leverage effect here.
- *Do not ignore the potential in leisure transport:* there are also situations involving highly pressing problems in leisure transport, in which collective forms of mobility – and thus also CP – can be part of the solution: for example, in the case of a high level of destination traffic in tourist hotspots.
- *Exploiting potential in order to optimise services:* although improving services alone cannot substantially increase the acceptance of CP, they remain important in order to be able to cope with a possible increase in demand in the future. The results of the present research paper provide specific suggestions for practical use where this is concerned.