EUROPEAN TRANSPORT CONFERENCE 2019

ANALYSIS OF THE FACTORS FOR SUCCESS OF INNOVATIVE MOBILITY CONCEPTS

Kathrin Viergutz
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Institute of Transportation Systems
Florian Brinkmann
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Institute of Transportation Systems

1. SUMMARY

The aim of this conference contribution is to gain an overview of factors for success of innovative digital mobility concepts, with special focus on ridepooling systems. For this purpose, a literature review is carried out and evaluated. The results of this analysis will serve the development of successful business models for public and private providers of future mobility.

In the future, mobility will be increasingly intelligent, integrated, flexible and demand-oriented. This results in a highly available local public transport system for urban areas that includes innovative service concepts, is environmentally friendly and, thanks to flexible pricing models, is cause-fair and cost-effective for users. These demand-driven mobility concepts, which are also known as ridepooling or Demand-Responsive Transport (DRT), are currently available in various large, medium-sized and small cities worldwide. These concepts are based on different business models that have different conditions.

In this conference contribution we describe the conflict between the interests of users and operators by taking both perspectives into account: the users' perspective with their expectations and their willingness to use as well as the operators' perspective with a special focus on market development of ridepooling services in Germany. We analyse different scientific studies that have dealt with the factors for success of innovative mobility concepts, in particular of ridepooling systems. One of the factors for success that is carried out is the adaptation of the degree of flexibility to the requirements of the users – in particular to avoid oversupply.

2. THE CHARACTERISTICS OF RIDEPOOLING CONCEPTS

The mobility concepts considered in this context are characterised by:

- absence of fixed stops, timetables and routes
- internet-based online booking systems with mobile apps
- real-time-based disposition and tracking of vehicles
- pooling (bundling) of spatially and temporally corresponding transport requests.

Ridepooling concepts are digital mobility concepts with a high degree of spatial and temporal flexibility, bundling transport requests of different passengers in real-time. The operation without fixed stops and the high flexibility due to the renunciation of timetables result in a high quality of service for customers, combining the advantages of both individual and public transportation in the sense of a mobility as a service (Laws 2009).

Conventional public transportation systems are based on static timetables which indicate when the stops of the transport network along fixed routes are operated. In contrast, flexible mobility

concepts attune to changes in demand, thus creating demand-oriented transport concepts (Atasoy et al. 2014).

3. DIGITALISATION AS AN ENABLER OF MOBILITY AS A SERVICE IN LOCAL PUBLIC TRANSPORT

In rural areas with disperse settlement pattern conventional demand-oriented local transport systems have long been well-established (König & Viergutz 2017).These so-called dial-a-ride services are in use where, due to weak demand, a regular schedule-based service is not reasonable. This service is a cost-effective contribution during times of low demand (Enoch et al. 2004). The necessary pre-booking time, i.e. the time between expressing a transport request and the beginning of the journey, can vary between one and several hours (Reinhardt 2012). The reason for the long pre-booking time is often the fact that the bundling and routing of transport requests has to be done manually.

Ridepooling concepts differ from these conventional dial-a-ride services by a significantly higher degree of flexibility. These responsive transport systems react dynamically to instant transport requests (Mulley & Nelson 2009). Ridepooling ideally will be offered as ad hoc service. Matching algorithms bundle the spatially and temporally corresponding transport requests of different users, thus creating individual routes.

According to various experts' opinion, digitalisation and interconnection as well as new mobility concepts, especially including shared mobility and on-demand services to enable individualisation of mobility, are the megatrends in public transportation (Frisch 2017). Digitalisation currently leads to a shift in users' habits in various areas of life. Cloud-based music and video platforms (e.g. Spotify, Netflix) establish more and more. Food orders at delivery services are done via apps (e.g. Pizza.de, Foodora) and travels are being booked on internet platforms like HRS, booking.com or AirBNB. The underlying business models comprise the provision of a digital platform to bring demand and supply together. This trend is also noticeable on the transportation market.

Ridepooling services differ from conventional transportation systems by the usage of real-time-based information and communication technology (Rayle et al. 2016). Passengers are enabled by app-based online platforms to transfer their transport requests directly to the system. The bundling of corresponding requests is processed dynamically by means of matching algorithms and real-time-based disposition. Thus digitalisation creates new opportunities to harmonise transport demand and supply. The faster transmission of transport requests and the matching and routing of rides within the service area lead to increased spontaneity compared to the dial-a-ride service described before. Thus users perceive a higher flexibility in the sense of a mobility as a service.

4. FACTORS FOR SUCCESS OF INNOVATIVE MOBILITY CONCEPTS

In order to understand the success factors of ridepooling concepts, it is necessary to understand both the requirements from the users' perspective and the boundary conditions of mobility providers. On the one hand, the higher the flexibility and the lower the price for the offer, the more users can be attracted to use mobility on demand instead of e.g. an own vehicle. On the other hand, the higher flexibility may require – even with intelligent matching and routing algorithms – a different fleet of vehicles than e.g. a conventional bus operation. These vehicles may be smaller and have less operation costs, but their higher number leads to an increase in labour costs for the

drivers. The trade-off between the level of service that can be offered, the willingness to pay of the riders and the costs for the operator will be crucial for successful mobility on demand concepts. Finding the right degree of flexibility is therefore a core task (Enoch et al. 2004).

In the following these two perspectives will be examined more closely: the users' perspective with expectations and the willingness to use as well as the operators' perspective with a special focus on market development of ridepooling services in Germany.

4.1 The users' perspective: expectations and the willingness to use

Flexible mobility services that are fulfilling the increasing demand of passengers for more flexibility and that are focusing on the individual needs of the users are gaining in importance (Mulley & Nelson 2009). Studies have shown that many users opt for using ridepooling services although they have another means of transport at their disposal. This means that the share of captive riders, who are forced to use this means of transport, is lower for flexible mobility services than for conventional systems (Enoch et al. 2004). Reasons for this are the convenience of door-to-door operation as well as the high degree of flexibility and spontaneity due to short pre-booking times: stopping as close as possible to the starting and destination point of the journey could contribute to reducing the out-of-vehicle-time of the individual travel chain. This time spent for waiting and walking, which is perceived more bothersome than longer travel times (in-vehicle-time) (Iseki & Taylor 2009), adds up to a proportion of 60 percent in scheduled service (Monheim 2010). Thus door-to-door service could contribute to increasing the attractiveness of demand-oriented transport even more. It should be noted that in principle, the shorter the waiting time is, the better is the quality of service. However, this is only valid up to a certain degree. If the waiting time gets too short, the preparation time for the customer is too short and the attractiveness gets reduced.

The ridepooling services which have been described bundle the transport requests. In principle, passengers are willing to share taxi rides with other persons, as long as this has an effect on the fare, even if this requires a minor detour (Viergutz & Brinkmann 2017). In order to foster intermodal transport, demand-oriented mobility concepts which allow the connection to the existing scheduled services provide the highest value in use for the passenger. If ridepooling services are offered as feeder to the superordinate transport system like S-Bahn, they serve as first / last mile connection and thus form a basis for travelling longer distances by public transport.

4.2 The operators' perspective: market development of ridepooling services in Germany

The previous discussion of the users' perspective is now to be compared with the operators' perspective with a focus on market development of ridepooling services in Germany. Figure 1 shows a retrospective and prognosis of the growth of mobility as a service in Germany in connection with the degree of automation of vehicles (Accenture 2018). Around the year 2035 a higher number of mobility as a service rides compared to the number of rides in non-shared vehicles could be expected and even in the present mobility as a service becomes more and more popular. This trend is also international: currently a multitude of private enterprises and municipal transportation companies arises, offering ridepooling services in large cities in Europe and beyond. Examples are BerlKönig and Allygator Shuttle in Berlin, Germany and services by Via Van in Malta and Liverpool. The small Canadian town Innisfil, Ontario has fully relinquished busses and other public transportation since 2016 and offers Uber rides, supplemented by taxi rides for barrier-free

transportation, as mobility service to its residents (Innisfil n.d.). Thus, all public rides in Innisfil are on-demand.

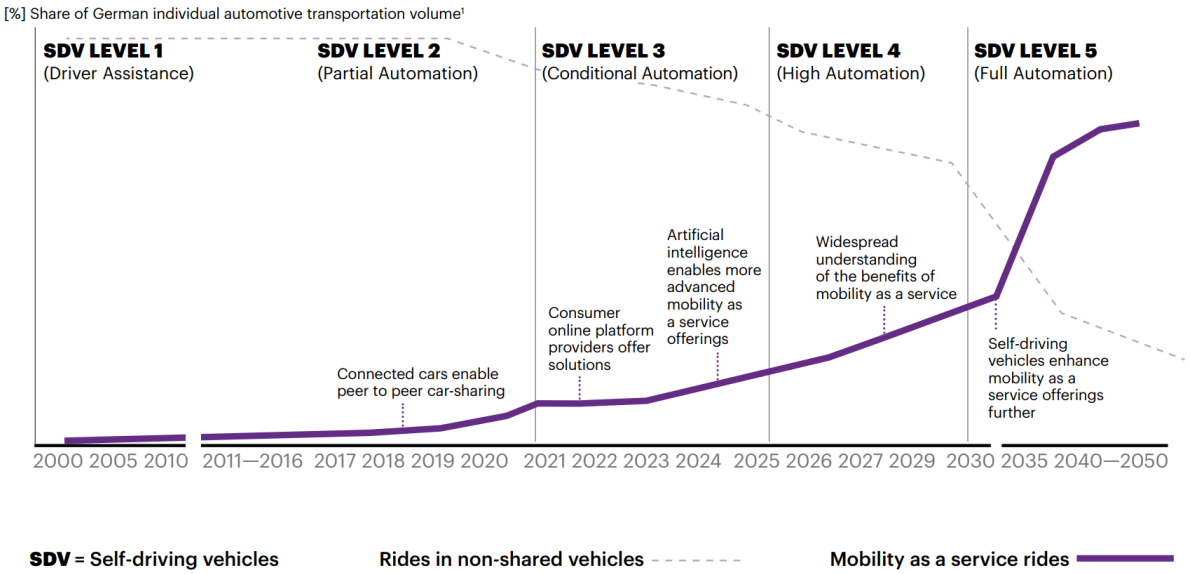

Figure 1: Retrospective and prognosis of the growth of mobility as a service in Germany (Source: Accenture 2018)

Table 1 shows an excerpt of a market observation of ridepooling operators, mainly in Germany, over the past few years. This results in the insight that at the beginning of the market penetration of digital ridepooling systems, services of private enterprises (technology enterprises such as start-ups, spin-offs of automotive groups and others) have entered the market. Only after that, also municipal transportation companies have started operation, often calling in consulting services from the technology enterprises and building on their experience. In some cases the start-ups are connected with OEMs. E.g. BerlKönig of the Berlin transport company is supported by ViaVan, which is a joint venture of Mercedes-Benz Vans and Via Transportation, Inc. (Daimler n.d.). BerlKönig is the largest deployment of on-demand-shuttles by a public transport provider worldwide, measured by the number of vehicles (BVG 2018).

The following two examples show that in the field of ridepooling concepts have to be tried out and then reconsidered:
The start-up Shäre was founded in Munich in 2014 and launched the app SHÄRE-a-Taxi in 2015, with which taxi rides could be booked, paid for and shared with other users. The app was based on intelligent sharing, matching and route optimisation algorithms and thus makes taxi driving cheaper and more environmentally friendly. However, after a short time the founders had to realise that an extensive commercial operation would require significantly higher marketing expenses to establish their offer at a time when the market was not yet mature enough and the competitors had greater resources. Instead, the company now uses its expertise in the B2B market to develop and implement innovative mobility concepts (Deglmann 2016).
The ridepooling operator Allygator Shuttle from Berlin has been pausing its offer since 29 March 2019 in order to develop new concepts and open up new service areas while focusing on the

connection of their offers with conventional public transport systems. The aim is to intelligently link Allygator Shuttle with traditional local public transport (Allygator Shuttle n.d.). Behind the brand Allygator Shuttle stands the consulting startup door2door GmbH that brings in its expertise to ridepooling pilots in cooperation with public transport operators like DVG (MyBus Duisburg) and MVG (IsarTiger Munich) (Door2door n.d.).

Table 1: Examples of ridepooling operators in Germany (Source: Authors)

Name	Operator green = cooperation (transport company + private operator) purple = research project orange = private operator	Location (selection)	Start of operation (year)	End of operation (year) (*= orderly planned)
SHÄRE	SHÄRE GmbH	Munich, Frankfurt DE	2015	2015
Allygator Shuttle	Door2door GmbH	Berlin DE	2016	*2019 (pausing)
Clevershuttle	GHT Mobility GmbH	Leipzig, Munich DE	2016	ongoing
MOIA	MOIA GmbH	Hanover DE	2017	ongoing
ioki	ioki (Deutsche Bahn Connect GmbH)	Frankfurt DE	2017	ongoing
MyTaxiMatch	MyTaxi (Intelligent Apps GmbH)	Hamburg DE	2017	ongoing
MyBus	DVG AG, door2door GmbH	Duisburg DE	2017	ongoing
Lümo	Stadtverkehr Lübeck GmbH, Clevershuttle	Lübeck DE	2018	ongoing
Bedarfsbus Schorndorf	Reallabor Schorndorf (DLR and others)	Schorndorf DE	2018	*2019
BerlKönig	BVG, Via Van	Berlin DE	2018	ongoing
EcoBus	Research partners (Max Planck and others)	Bad Gandersheim DE	2018	*2018
ArrivaClick	Via Van	Liverpool UK	2018	ongoing
Cool	Via Van	Malta MT	2019	ongoing

5. CONCLUSION

The megatrend of digitalisation is currently leading to a change in user habits in many areas of life, including transport. The analysis of the current market situation has shown that both private enterprises as well as public transport companies develop ideas of improving public local transport by means of digitalisation. For several years now, various ridepooling providers are on the market, trying in different ways to serve customer needs. First examples show that the experience gained may require an evolutionary approach. It is recognised that an important factor is not to see the ridepooling offer in isolation, but to connect it with other traffic systems.

For economic reasons, providers must be careful not to offer oversupply. From a user's perspective there is a need for more flexibilisation of public transport.
However, demand-oriented services can fail if the degree of flexibility is higher than required by the users, which usually results in extensive operational costs. Therefore the right degree of flexibility, which on the one hand is accepted by the customer and on the other hand is economically and operationally realisable, is decisive.

It is expected that with the increasing degree of automation of vehicles, the utilisation concepts will change and other economic framework conditions will result for the operation of fleets with smaller vehicle units, so that Mobility as a Service will be able to offer a wider range of services.

The German Aerospace Center (DLR) conducts research on different aspects of new mobility concepts based on ridepooling offers, for example on the level of service, operational concepts and business models.

LITERATURE

Accenture (2018): Mobility as a Service. Mapping a route towards future success in the new automotive ecosystem. https://www.accenture.com/t00010101t000000z__w__/nz-en/_acnmedia/pdf-71/accenture-mobility-service.pdf

Allygator Shuttle (n.d.): https://www.allygatorshuttle.com

Atasoy, B.; Ikeda, T.; Ben-Akiva, M. (2014): *The Concept and Impact Analysis of a Flexible Mobility on Demand System*.

BVG (2018): *Der BerlKönig rollt durch Berlin.* Press release from 7. September 2018 https://www.bvg.de/de/Aktuell/Newsmeldung?newsid=2772

Daimler (n.d.): *Berliner Verkehrsbetriebe (BVG) und ViaVan, ein Joint Venture von Mercedes-Benz Vans und Via: Das kommt wie gerufen* - BVG, Mercedes-Benz Vans und Via bringen On-Demand Ridesharing nach Berlin. http://media.daimler.com/marsMediaSite/de/instance/ko/Berliner-Verkehrsbetriebe-BVG-und-ViaVan-ein-Joint-Venture-von-Mercedes-Benz-Vans-und-Via-Das-kommt-wie-gerufen---BVG-Mercedes-Benz-Vans-und-Via-bringen-On-Demand-Ridesharing-nach-Berlin.xhtml?oid=32393717.

Deglmann, F. (2016): *Pivot bei SHÄRE: „Es ist wichtig, seinen Weg zu gehen!“*. https://www.munich-startup.de/15742/pivot-bei-shaere-es-ist-wichtig-seinen-weg-zu-gehen.

Door2door (n.d.): https://www.door2door.io

Enoch, M.; Potter, S.; Parkhurst, G.; Smith, M. (2004): *Intermode: innovations in Demand Responsive Transport. [Report for] Department for Transport and Greater Manchester Passenger Transport Executive.* Final report. London : Department for Transport.

Frisch, R. (2017): *Drei Megatrends prägen den Nahverkehr. Interview mit Dipl.-Ing. Ralf Frisch, Solution Director MaaS – Mobility as a Service bei der PTV-Group in Karlsruhe.* DER NAHVERKEHR 11/2017. S. 18-19.

Innisfil (n.d.): *Bringing Transit to Innisfil.* https://innisfil.ca/mygovernment/planningforourfuture/BringingTransittoInnisfil.

Iseki, H., Taylor, B.D. (2009): *Not all transfers are created equal: Towards a framework relating transfer connectivity to travel behaviour.* Transportation Review 29 (6), S. 777–800.

König, A.; Viergutz, K. (2017): *Der Fahrschein für den Anrufbus: Tarifgestaltung von bedarfsgesteuerten Bedienformen des öffentlichen Verkehrs im ländlichen Raum*, published in: Der Nahverkehr, 6-2017. S. 11-15.

Laws, R. (2009): *Evaluating publicly funded DRT schemes in England and Wales*, PhD Thesis, Loughborough University, Loughborough.

Monheim, H. (2010): *Gutachten Finanzierung der Verkehrssysteme im ÖPNV – Wege zur Nutzerfinanzierung oder Bürgerticket?* http://www.leipzig.de/fileadmin/mediendatenbank/leipzig-de/Stadt/02.6_Dez6_Stadtentwicklung_Bau/66_Verkehrs_und_Tiefbauamt/Fachgutachten_Monheim.pdf.

Mulley, C.; Nelson, J. (2009): *Flexible transport services: A new market opportunity for public transport.* Research in Transportation Economics, 25. Aufl., S. 39-45.

Rayle, L.; Dai, D.; Chan, N.; Cervero, R.; Shaheen, S. (2016): *Just a better taxi? A survey-based comparison of taxis, transit, and ridesourcing services in San Fransisco.* Transport Policy 45 (2016), S. 168–178.

Reinhardt, W. (2012): *Öffentlicher Personennahverkehr. Technik. Rechtliche und betriebswirtschaftliche Grundlagen.* Wiesbaden. S. 584ff.

Viergutz, K.; Brinkmann, F. (2017): *Demand Analysis and Willingness to Use of Passengers of Flexible Mobility Concepts.* European Transport Conference, 4.-6. Oktober 2017, Barcelona.

1 September 2019