Solution Paths – Paving the Way to Mobility as a Service by Analysing the Attitudes, Acceptance, and Barriers to the Use of On-Demand Mobility Services in East Styria, Austria

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1 ABSTRACT

Background & Aim: Although public transport and active mobility are increasingly common in urban areas, private cars remain the dominant mode of transport in most rural areas. Although many regions offer public transportation, including some micro-transit or sharing services, their potential is not yet being fully exploited. The project "Lösungswege" (Solution Paths) recognizes the potential of rural areas and small towns as a major lever for driving sustainable transformation in the mobility sector and eliminating inequalities caused by poor mobility. It aims to understand the mobility needs of people in the region and identifies the obstacles that prevent them from using existing public services. The wishes and visions of the local population are taken into account in order to build a digital platform that ist tailored to the users' needs and offers Mobility-as-a-Service in Eastern Styria.

Methods: Within the project two group workshops in differet municipalitites were conducted with 35 participants in total. Methods such as self-reflection, perspective shifts and design-thinking were used to analyze personal mobility needs and the needs of certain groups such as older people with mobility restrictions. Based on that participants (further) developed existing and new mobility solutions. A complementary quantiative survey among 557 participants analyzed the mobility habits, needs, acceptance of and barriers for the use of micro transit and sharing services in East Styria.

Results: The workshops revealed, that most people would like to see cars become less important. Nevertheless, it is clear that the existing public mobility services need to become more flexible and reliable, as they are currently often perceived as impractical and difficult to integrate into everyday routines. Participants' ideas to promote the use of existing offers included, for example, expanding the validity of annual public transport tickets for the use of micro-transit and sharing, introducing autonomous vehicles in the area, or charging shared electric vehicles with solar power. The survey results confirmed that private cars are perceived considerably more flexible and comfortable by the citizens than public transport. Many participants cite pricing, limited availability nearby as well as complicated reservation and booking processes as dominant barriers. Nevertheless almost half of the participants can imagine using micro-transit and sharing services more frequently in the future. As motivation factors free test rides or closer facilities were mentioned.

Conclusions: The collected data provides valuable insights about mobility needs and requirements that a platform for booking various mobility services must meet. Thus it forms the basis for the successful introduction of MaaS in Eastern Styria, which suits the needs of all (potential) users, including vulnerable groups.

Keywords: shared mobility, on-demand, mobility-as-a-service, sustainable mobility, micro-transit

2 BACKGROUND

2.1 Mobility in rural areas in Austria

Due to advancing climate change, Austria has set itself ambitious goals as part of the "Green Deal," with the long-term aim of achieving a climate-resilient and climate-neutral society (Bundesministerium für Land- und Forstwirtschaft, Klima- und Umweltschutz, Regionen und Wasserwirtschaft, 2026). The transportation sector is a important lever for this. While the level of motorization in Austria's urban centers increased only slightly or even declined between 2005 and 2018, the level of motorization in peripheral areas of Austria increased significantly. Similarly, a significantly higher number of annual kilometers traveled by car is evident in rural regions of Austria than in urban centers, which highlights the potential of rural regions in terms of mobility transition and reduction of emissions (VCÖ, 2019). According to Poltimäe et al. (2022) this car depencence in rural areas is mainly due to longer distances and poor public transport coverage.

2.2 Mobility poverty and equitable mobility

The observed car dependence in rural areas can lead to transportation poverty, especially when people have limited or no access to a private car due to financial constraints, physical limitations (e.g. impairments), or age for instance (Mattioli, 2016; Rangel Guevara, 2024). This can lead to unequal opportunities and social exclusion. According to Ringhofer et al. (2025) sharing and micro transit could counteract that, but the acceptance and usage has to be given.

2.3 Mobility services in the project region East Styria

The project region is located northeast of Graz, the capital of Styria and Austria's second largest city. In smaller cities like Weiz, Hartberg, Gleisdorf and Fürstenfeld the public transport coverage is partly classified as very good. However, many villages in between have basic access or even no access to public transport at all (Land Steiermark, 2026). Therefore, there are various micro-transit and sharing services available in the region, which are intended to supplement the existing, but in some cases insufficient, public transport system. SAM for instance is a shared taxi, which has several predetermined stops in the project region, East Styria. During the operating hours it runs on-demand and can be booked via telephone hotline and the SAM Webapp (Tourismusverband Oststeiermark, 2026). Additionally, there is WASTI, which is also a shared taxi, operating according to the same principle, but only in the area of Weiz. Weiz furthermore offers E-Carsharing and (E-) Bikesharing (Stadtgemeinde Weiz, 2026).

2.4 Aim of the study

However, the question arises as to whether and how regularly these services are used, how well they are accepted in the region, and what barriers prevent the use of public transport, micro-transit and sharing services. In addition, it should be examined how the booking processes are currently perceived and what wishes there are in the region with regard to ease of use, low effort, and accessibility for all when booking mobility services. Future visions for mobility in the region from the perspective of citizens should also be taken into account.

3 METHODS

3.1 Workshops

Two workshops with citizens from East Styria were conducted. The aim was to generate a heterogeneous group of citizens aged 12 to 85, users and non-users of regional mobility services and people with as well as without disabilities. Therefore, convenience sampling was used at first. Building on that, social organizations, schools and other local facilities were contacted to complement the group especially with younger people, that were underrepresented in the sample so far (Nagele, 2026).

One of the workshops was held in Weiz, which took three hours and the second one was held in Hartberg and took around two and a half hours. In total 35 citizens participated in the workshops. 15 identified as female and 20 as male. 74.29% of the sample have a driver's license. 2 participants indicated to have an impairment that limits their mobility (Nagele, 2026).

The procedure of the workshops was as follows:

(1) Activating interventions to get to know each other

(2) Presentation of the results of the previously completed mobility diaries from the participants to reflect on own mobility patters.

(3) Definition of central mobility terms to ensure a common and uniform understanding.

(4) Brainstorming to different questions and documentation of the ideas on a bulletin board (e.g. where would on-demand mobility services be meaningfully applicable? What would foster or hinder the use of those services?)

(5) Perspective shift exercise in small groups: Putting onesef temporarily in the perspective of an older person with mobility impairments, a young person, a comfortable and an economical person. The task was developing the requirements or needs of those groups regarding mobility services and obstacles that they face.

(6) Collection of measures to meet the needs of all citizens with regard to different focus points like adaptability, rural barriers, costs or booking (e.g. how could existing services be improved so that they are used more frequently? Are existing services suitable for vulnerable groups? Which barriers for the use of micro-transit need to be overcome in rural areas?)

(7) Formulation of requests to companies and politicians as well as long-term and short-term visions. (e.g. how could shared mobility in the region look in the near future? Which framework conditions are necessary?)

The audio of the workshops was recorded and the documented results on flipcharts and bulletin boards were collected for later digitalization. With the help of MAXQDA and the reflexive thematic analysis according to Braun and Clarke (2024) the qualitative data was structured, categorized and analyzed (Nagele, 2026).

3.2 Quantiative Survey

The quantitative questionnaire is based in part on standardized questions about socioeconomic status and vulnerability from the Austrian ministry for innovation, mobility and infrastrucure (BMIMI, 2011) and Schasché's (2024) UTAUT model for user acceptance.

The questions cover the general mobility behavior, satisfaction with and attitude towards public transport, micro-transit and sharing as well as the barriers for using such services. It also addresses the question of what needs to change in order for the services to be used more, and how residents would like to book these services.

The survey was spread online (e.g. Social Media), but there was also the possibility to fill it in on paper. To this end, senior citizens' facilities and farmers' markets for instance were specifically visited in order to enable older residents of the region to participate.

There was a total of 925 responses. After adjusting for surveys that were terminated prematurely and adjusting for individuals who neither lived nor worked in the project region, 557 completed questionnaires remained and were included in the analysis.

The data analysis was conducted using SPSS.

4 RESULTS

4.1 Workshops

4.1.1 Mobility behavior, mobility decisions, and satisfaction with different modes of transportation

Almost 50% of the participants use the private car for commuting (e.g. to work, school, shopping or appointments). 20% use active transport (e.g. walking, (E-)cycling) and also 20% use a combination of active public and private transport. Only 11% stated that they mainly commute by public transport.

Investigating the attitudes toward various modes of transportation revealed that participants see many advantages to private cars (e.g., time, effort, flexibility, safety, reliability, weather dependence). Only in

terms of environmental friendliness did private cars score poorly. Active mobility is also perceived as advantageous, except for the factors of safety, weather dependency, and transporting objects.

Combined mobility was generally viewed rather critically. This form of mobility is rated significantly lower than the others, especially in terms of reliability and time required.

Participants mainly chose the private car due to convenience, flexibility, habit, transportation of luggage and reliability. Active mobility on the other hand is mainly chosen due to habit, environmental friendliness and convenience.

4.1.2 Mobility needs, obstacles and chances and the attitudes toward alternatives to private cars

The participants describe very individual mobility needs, that are shaped by their daily routines and life situations. The workshops highlited the desire for better conntections: “Connections must be better coordinated, otherwise waiting times are unrealistic”. As barriers they also name the lack of reliability and punctuality as well as the limited operating hours. Especially for elderly they point out the booking of mobility services via app or website as obstacle. For younger people mobility services that provide a safe ride to festivities, music and sports clubs would be relevant.

For younger people, who want to be independent from their parents, shared student taxis could also be a suitable alternative to parent taxis for the last mile. Participants also see a chance to arrive relaxed at work through the use of public transport and point out the potential of expanding existing Bike-Sharing services to more regions in East Styria.

The use of transportation services like public transport and micro transit is strongly connected with social norms, emotions and cultural attributions, as the workshops showed. Although those mobility services are perceived practical for rides to the doctor, for students and for seniors, they are also often considered uncool or annoying and stressful due to delays and waiting times. On the one hand participants see the potential that those mobility services can improve life quality and reduce loneliness, but not for themselves, but primarily for people with disabilities (“bus travel is only for people with impairments”). Social norms or values such as environmental awareness can nevertheless be a driving force and a motivation to forego buying another car and using alternatives instead.

4.1.3 Technical and digital accessibility

During the workshop, participants emphasized that there is a need for a uniform, lucid and user-friendly app that makes it easy to book all mobility services. Nevertheless, there is also a need for offline-booking options. Limited network coverage and user-friendliness for senior citizens, for example, require the option of booking by telephone and the availability of various payment options.

4.1.4 Governance, politics and cooperations

Participants pointed out that politics and companies need to be more involved and act in concert. Push and pull factors against cars, such as fewer parking spaces at companies, financial incentives for active and public mobility, or better public transport connections to large employers in the region, are considered sensible measures, for example.

4.1.5 Marketing and future visions

It became clear that SM offerings in Eastern Styria can only be successful if they are communicated in a more visible, attractive, and understandable way. Implementation ideas include campaigns such as car fasting and information events that alleviate fears about sharing one's own car. Future visions for the region reach from a comprehensive sharing network and sharing within neighborhoods to the integration of all mobility services into the “Klimaticket” (annual national/regional public transport ticket) to the introduction of electric autonomous vehicles. Generally, participants would like to see private cars become less important in the future.

4.2 Quantitative Survey

4.2.1 Demographic characteristics

The survey included 557 participants living or working in the region. 91.56% conducted the survey online and around 9% on paper. The participants were aged 14 to 93 years (mean: 42 years). 50.45% identify as female, 48.11 as male and 1.44% in total identify as diverse or did not specify. Most people live in rural areas (61.22%) and 38.78% live in smaller cities like Weiz, Hartberg, Fürstenfeld, Gleisdorf or even in Graz (but work in East Styria). 7.25% of the participants indicated to have an impairment (hearing. Seeing, walking or others) that influences their mobility. In terms of mobility, they are mainly dependent on other people, public transport or micro-transit.

4.2.2 Mobility behavior and dependence

For all considered routes (commuting to work, shopping, passenger transport and leisure time) the car is the most used means of transport. More than 54% mainly commute to work by car for example, whereas only 26.39% mainly use public transport and 15.74% use micro mobility (walking, (E-)Bike, (E-)Scooter). Other options like taxis, motorcycles, micro-transit and sharing are rarely used (less than 5% in total) (n = 451). Most of them commute 11-30min to work (n = 453). Participants living in rural areas have a longer commute than participants living in more urban areas.

Over 80% have a driver's license (n = 552) and 76% indicated that they have a private car. Around 6% partly have access to a private car. 32.49% of the participants drive more than 15,000km per year (n = 477). This share is higher among male (41.77%) participants than among female (22.32%) and higher among people living in rural areas (37.24%) than in cities (n = 25.13%).

4.2.3 Awareness and use of micro-transit and sharing

When asked about the frequency of use of various mobility services, over 30% stated that they were unaware of Wasti, WeizBike, CarsharingWeiz and other micro-transit and bike-/carsharing services. However, only 8% did not know SAM (n = 543). From the aroung 92%, who know SAM, about 76% indicated that they never use it. Generally, only 26.82% of the sample use micro-transit (n = 548) and 16.95% use sharing services n = 547). 38.75% use at least one micro-transit or sharing service (n = 542). Older participants (above 65 years), participants living in urban areas and participants with disabilities rather use micro-transit or sharing than younger participants, from rural areas and without disabilities.

But 46.34% indicate that they could imagine using micro-transit (more frequently). This willingness is lower in the younges age group (14-18 years) than among participants older than 18 years and lower among male than among female participants. Especially participants who are already using micro-transit are considerably more willing to use it more frequently.

4.2.4 Mobility needs, barriers and motivations

60% state that they feel that their mobility needs are at least rather taken into account. 40% (rather) disagree. People living in urban areas and with disabilities rather agree with that than people in rural areas and without disabilities. Users of different mobility services (bus, train, SAM, Wasti, other micro-transit services, Weiz Bike, other bikesharing services, Carsharing Weiz and other carsharing services) were asked how satisfied they are with the service. The satisfaction was the highest for Carsharing Weiz (n = 52) and WeizBike (n = 58) and lowest for other micro-transit (n = 45) and bike sharing services (n = 26), SAM (n = 185) and the bus (n = 421). The satistfaction is higher in urban areas and female participants tend to be more satisfied with most services than male participants. People with at least one disability are more satisfied with bus, train, SAM, Wasti and other micro-transit options, but not with sharing services.

Reasons for their dissatistfaction are for example prices, time effort, limited operation hours, reliability and poor connections.

The main obstacles for the use of micro-transit are costs, the complicated purchase or booking process and the avaibalibity of information (n = 153). For sharing the main barriers include limited availability nearby, the rental costs, complicated reservation, payment and booking processes as well as th availability of information (n = 96).

37.02% stated that they would use micro transit or sharing more often if there would be free test rides. Also information events, sharing locations and micro-trannsit stops nearby are considered as reasonable motivation factors. However, 20.99% indicate, that they would not use micro-transit or sharing despite everything (n = 543).

4.2.5 Booking of mobility services

The survey revealed, that most people would like to book via smartphone app or webapp, but more than 30% count booking via phone-call and more than 7% booking at the municipality to their preferred options (n = 545). Especially older participants (65 and above) and people with impairments prefer those two options.

5 DISCUSSION

The findings of the workshops and survey clearly demonstrate the continued dominance of the private car in Eastern Styria, which is primarily explained by its superior everyday practicality rather than by negative attitudes toward alternative mobility options. Convenience, flexibility, reliability, habit, and the ability to transport goods consistently favor car use.

Despite low actual usage, both the workshops and the survey reveal a considerable openness toward micro-transit and sharing services. A large share of participants would be open to try the services if there were for exanple free test rides or if the services were nearby. This indicates that resistance to sustainable mobility does not stem from general skepticism, but from concrete performance deficits such as poor connections, limited operating hours, high costs, and insufficient distribution.

Social norms and values shape mobility choices in ambivalent ways. While public transport and micro-transit are socially recognized as useful and environmentally beneficial, they are often perceived as unattractive or inconvenient for personal use.

Strong spatial and sociodemographic inequalities persist. Rural residents face higher car dependence and lower satisfaction with public mobility services due to structural constraints, while older adults and people with disabilities rely more on public and micro-transit services but encounter significant digital access barriers. These groups prefer booking personally or via telephone instead of using apps.

The results of this study, as well as the study by Klementschitz et al. (2024), conclude that the use and booking of on-demand transport should be geared towards the needs of customers and be as low-threshold and simple as possible. This means that complete connections with different modes of transport must be bookable via one platform and that there must be barrier-free and non-digital booking options in order to promote the use of the services.

6 CONCLUSIONS

Overall, the results suggest that sustainable mobility in rural regions fails not because of a lack of acceptance, but because alternative services do not yet match the everyday performance of the private car.

However, the results provide valuable insights into the needs of the population and thus offer the opportunity to address barriers in a targeted manner. The participatory workshop approach proved particularly valuable, as it generated solution ideas developed by the population itself rather than imposed top-down, which can enhance acceptance. Overall, the findings indicate that existing mobility services need to be better coordinated and expanded in order to reduce waiting times and improve everyday practicality. In addition, accessible non-digital booking options are essential. Beyond service provision, effective marketing that highlights the benefits of these services for all citizens, as well as close cooperation between political actors and companies, play a decisive role in counteracting car dependency. Based primarily on the workshop results, it can be concluded that many residents would welcome a reduced importance of private cars in the region.

7 REFERENCES

BMIMI (2011). Handbuch für Mobilitätserhebungen. KOMOD – Konzeptstudie Mobilitätsdaten Österreichs. V1. Retrieved January 21, 2026, from https://www.bmimi.gv.at/themen/verkehrsplanung/statistik/oesterreich_unterwegs/komod.html

Braun, V. & Clarke, V. (2024). Supporting best practice in reflexive thematic analysis reporting in Palliative Medicine: A review of published research and introduction to the Reflexive Thematic Analysis Reporting Guidelines (RTARG). Palliative Medicine, 38(6), 608 616. https://doi.org/10.1177/02692163241234800

Bundesministerium für Land- und Forstwirtschaft, Klima- und Umweltschutz, Regionen und Wasserwirtschaft (2026, January 01). Die österreichische Klimaschutzstrategie/Politik. Retrieved January 20, 2026, from https://www.oesterreich.gv.at/de/themen/umwelt_und_klima/klima_und_umweltschutz/1/Seite.1000310

Klementschitz, R.; Woloschtschuk, I.; Gkavra, R.; Husner, G. & Susilo, Y. (2024). Bedarfsverkehr im ländlichen Raum zur Sicherung der letzten Meile, Analyse erfolgreicher Fallbeispiele aus dem Bundesland Salzburg. Retrieved January 30, 2026, from https://repository.corp.at/1075/

Land Steiermark (2026). Digitaler Atlas Steiermark. Retrieved January 20, 2026, from https://www.landesentwicklung.steiermark.at/cms/ziel/141979637/DE

Mattioli, G. (2016). Transport needs in a climate-constrained world. A novel framework to reconcile social and environmental sustainability in transport. Energy Res. Soc. Sci. 18, 118–128. https://doi.org/10.1016/j.erss.2016.03.025.

Nagele, D. (2026). Lösungsansätze zur Steigerung der Akzeptanz für Shared Mobility in zersiedelten Gebieten: Eine Mixed-Methods-Studie mit Mobilitätsworkshops. [Unpublishes master's thesis]. University of Graz.

Poltimäe, H., Rehema, M., Raun, J. & Poom, A. (2022). In search of sustainable and inclusive mobility solutions for rural areas. Eur. Transp. Res. Rev. 14 (1), 13. https:// doi.org/10.1186/s12544-022-00536-3.: Title of the source. Vienna, 2009.

Rangel Guevara, A.C. (2024). Identifying the losers in the transport transition: Evidence from Germany. Human. Social Sci. Commun. 11 (1), 741. https://doi.org/10.1057/ s41599-024-03163-6.

Ringhofer, S.; Thaller, A.; Fleiß, E.; Ritter, S. & Posch, A. (2025) Overcoming challenges facing innovative, sustainable mobility services in rural areas. In: Transportation Research Interdisciplinary Perspectives, Vol. 32 (2025) 101491. https://doi.org/10.1016/j.trip.2025.101491

Schasché (2024). User acceptance of demand-responsive transport services in rural areas. Retrieved January 20, 2026, from https://netlibrary.aau.at/obvuklhs/content/titleinfo/10524443

Stadtgemeinde Weiz (2026). Retrieved January 20, 2026 from https://www.weiz.at/

Tourismusverband Oststeiermark (2026). SAM – Sammeltaxi Oststeiermark. Retrieved January 20, 2026, from https://www.steiermark.com/de/Oststeiermark/Urlaub-planen/Ausflugsziele/SAM-Sammeltaxi-Oststeiermark_isd_5921418

VCÖ (2019). In Gemeinden und Regionen Mobilitätswende voranbringen. Mobilität mit Zukunft (01/2019). Wien: VCÖ.