Unlocking the Wheel: Insights into Shared Micromobility Perceptions and Adoption on Campus

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Abstract: Prior to implementing a shared micromobility system, it is crucial to carefully consider its design and features. Through consulting with stakeholders, system designers must determine the types of vehicles to be included in the shared fleet, which should align with local usage patterns. Additionally, shared micromobility planners must develop an operational concept that reflects local application scenarios. This study examines attitudes and opinions towards shared micromobility, as well as usage intentions and purposes for different types of shared micromobility vehicles such as pedal bikes, e-bikes, e-cargo bikes, e-scooters, e-mopeds, and e-cabin scooters. Additionally, we investigate preferences for free-floating and station-based shared mobility systems. This research links these findings to demographic characteristics, attitudes, and travel behavior. The analysis contributes to the field by understanding perceptions towards shared micromobility, characterizing potential users and non-users, and identifying preferences for certain operational concepts and types of shared vehicles. These insights can be used to design and implement a customized and user-centered shared micromobility system.

1 INTRODUCTION

Shared micromobility (SM) plays an increasingly important role in urban environments, with their usage accelerating rapidly since the COVID-19 pandemic (Li et al., 2022; Pobudzei, Sellaouti, et al., 2022; VEO, 2022; Zhang & Song, 2022). They offer access to “vehicles with a mass of no more than 350 kg and a design speed no higher than 45 km/h” (International Transport Forum, 2020). SM providers distribute their fleets at multiple locations, giving users the benefit of increased accessibility and more options to satisfy mobility needs. The offers range from station-based to free-floating bikes, scooters, mopeds, and cargo bikes with or without electric engines (Pobudzei, Wegner, et al., 2022).

There are several reasons why SM might be an appropriate transportation option in environments such as university campuses. Firstly, universities are often remote from the city centers, and public transport rarely serves large-scale campus areas (McLoughlin et al., 2012). Secondly, there are many regular inside short-distance trips (Moosavi et al., 2022; Noor et al., 2021), and most people drive private cars, even for short distances (Moosavi et al., 2022; Nobis & Kuhnimhof, 2019; Noor et al., 2021). Furthermore, many large university campuses are notorious for parking problems (McLoughlin et al., 2012; Noor et al., 2021). In these conditions, SM could create opportunities for trips not previously possible (Ma et al., 2020), fill transportation gaps (Li et al., 2022), improve accessibility and connectivity (D’Acierno et al., 2022) inside and outside the campus facilities, and reduce the reliance on private cars (May, 2022).

However, perceptions of shared micromobility may vary depending on the individual. For example, some students and staff may see SM as a convenient, accessible, and fun way to get around, while others may have concerns about safety and cost. Therefore,

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to increase the adoption of SM, factors such as availability, the cost of using the service, and safety measures need to be considered (Pobudzei, Wegner, et al., 2022). It is also helpful to provide information and education about the benefits of SM, such as their environmental impact and potential to reduce parking demand on campus.

Before deploying SM, it is necessary to deliberate its design and features. By consulting the stakeholders, the system architects need to consider the kind of vehicles to use in the shared fleet, which should reflect the local application scenarios. Furthermore, the SM planners must formulate the operation concept (free-floating or station-based) and the service geography, as the vehicles must be easily approachable and visible to many people (Karbaumer & Metz, 2021; SWM, 2022). This research addresses these questions by focusing on perceptions and adoption intentions of the university campus population toward a micromobility sharing system. It explores a) the current use of shared micromobility and attitudes and opinions toward it, b) the usage intention and purposes of shared micromobility modes such as pedal bikes, e-bikes, e-cargo bikes, e-scooters, e-mopeds, and e-cabin scooters, c) the preferences toward free-floating and station-based operation approaches. This study links these questions with the survey respondents' demographic characteristics, attitudes, and travel behavior. This analysis contributes to research by explaining views towards SM, characterizing its potential users and non-users, and describing the preferences for certain operation concepts and shared vehicles. The results of this research will help inform decision-making regarding the implementation and operation of local micromobility sharing systems.

2 LITERATURE REVIEW

SM is typical for densely populated urban environments (Shaheen et al., 2022; Tießler et al., 2023). Rural areas and smaller towns with fewer populations are usually excluded from the operation zones (Friedel, 2021). Users of bike, scooter, or moped sharing tend to be younger adults, who are well-educated, have middle and upper income, have no children, have a lower car ownership rate, and travel multimodally (Großmüller et al., 2021; Krier et al., 2019; Pirra & Diana, 2020; Pobudzei, Wegner, et al., 2022; Reck et al., 2022; Winter et al., 2020).

Regarding micromobility trip purposes, leisure activities and private errands are the most frequently mentioned for pedal bikes, e-bikes, e-scooters, and e-mopeds (Aguilera-García et al., 2021; Großmüller et al., 2021; Krauss et al., 2020; Nobis & Kuhnimhof, 2019). People use pedal bicycles for recreation and exercise (Ling et al., 2017). On the other hand, e-bikers tend to ride longer distances and take more trips during workdays (Ling et al., 2017). Groceries shopping and transporting larger loads are the most mentioned trips for cargo bikes (Becker & Rudolf, 2018; Behrensen & Sumer, 2020). In contrast to car sharing, commonly used in a targeted and planned manner, shared micromobility modes are rented more spontaneously and impulsively out of curiosity or for transport needs (SWM, 2022).

Primary beneficiaries of SM are public transport users covering the first and (or) last part of their trip and pedestrians replacing part or all of their journey (D'Acierno et al., 2022; Tießler et al., 2023). On the other hand, the ownership of private vehicles might prevent the use of sharing services (Dorner & Berger, 2019). For example, private car or bicycle owners continue to confirm their mobility choices, and the presence of micromobility sharing solutions does not influence their mobility preferences (D'Acierno et al., 2022; Großmüller et al., 2021).

Regarding the factors behind the adoption of electric micromobility, environmental concerns (Eccarius & Lu, 2020), innovativeness, and belonging could influence individuals, travel costs, and time savings (Bretones & Marquet, 2022). Furthermore, people might use shared mobility if they perceive it as socially beneficial, contributing to improved livability, equity of access, improved health, and diversity of choice (Bretones & Marquet, 2022; Ling et al., 2017). On the other hand, a perceived lack of safety and reliability negatively affects micromobility usage (Bretones & Marquet, 2022; Eccarius & Lu, 2020; Großmüller et al., 2021; Pobudzei, Wegner, et al., 2022). Additional obstacles are uncertainty about where to ride and park (Bridge, 2023; SWM, 2022) and mandatory ownership of a smartphone with internet access and a credit card (Curl & Fitt, 2019; SWM, 2022). Furthermore, Großmüller and colleagues (2021) showed that especially older persons would not imagine using shared micromobility even if various criteria improve in the future.

Some SM projects have already been implemented at university campuses (Aliari et al., 2020; Bicicleta Livre, 2021; Block, 2020; Eifling, 2020; Integra UFRJ, 2022; Kuhn et al., 2021; NABSA, 2022; Quinones et al., 2019; Thornton, 2021; Woodman & Shepherd, 2022). Their entitled members are the university's students, academic staff, and employees. Providers such as Bird, Spin, and Capital Bikeshare report that campus programs are integral to their business (NABSA, 2022). They created university-specific teams focused on unique operating needs and currently operate on multiple university campuses in the U.S, reporting minimal marketing needed for their services to be adopted (NABSA, 2022). In a survey among student riders (VEO, 2022), 35% of students would have used a car for their most recent SM trip, and 7% would not have taken the trip if SM was not available. Comparing the demand between city sharing programs and campus use, Aliari and colleagues (2020) showed on-campus usage proximate to the transit hubs, supporting the complementary relationship between SM and transit. Furthermore, institution-internal sharing systems are more popular and accepted than public SM offers (Kuhn et al., 2021).

To the best authors' knowledge, no campus SM comprises different micromobility modes but offers a single vehicle type. However, offering various options can provide greater flexibility and convenience and attract a broader range of users, as different micromobility vehicles may be more suitable for different trips or terrain. On the other hand, managing a system with multiple vehicle types may be more expensive and technically complex. Furthermore, users may need help understanding and comparing the different options. Ultimately, the decision to offer multiple SM options will depend on various factors, including the needs and preferences of the target user group and the resources available to manage the system (Pobudzei, Wegner, et al., 2022).

Regarding the operation concept, the preferences towards station-based or free-floating SM might vary depending on the context and goals of the program, the availability and accessibility of the vehicles, and the overall user experience. Some research suggests that people prefer free-floating systems for convenience and flexibility (Kou & Cai, 2021; Liao & Correia, 2020; Mooney et al., 2019). However, some studies indicate that people may prefer station-based systems for reliability (Stellar Market Research, 2020). Overall, it is essential to consider the specific context and goals of the program when deciding whether to implement a station-based or free-floating SM. This research investigates potential shared mobility users and their preferences towards SM vehicle types and operation concepts to inform the design process for the shared micromobility system.

3 METHODOLOGY

The University of the Bundeswehr in Munich is on a 140-hectare site in the municipality of Neubiberg, in the immediate neighborhood of Munich. This is one of the largest campus universities in Germany. Approximately 5,300 persons are university members: 72% are students, 16% are academic staff, 8% are non-academic personnel, and 4% are professors (UniBw, 2022). The students are military officers and non-military persons from diverse German and foreign regions. Most students are between 20 and 30, live on campus premises, and have a solid middle income. Other persons working at the university are paid according to their field of activity.

A voluntary and anonymous survey in July 2022 targeted the attitudes and previous experiences with shared mobility. The respondents were asked whether and how they would use SM if available on campus. In addition, attitudes (openness to technology, an affinity for environmental protection), commuting behavior, structural and personal boundary conditions, and socio-demographics were considered. The survey invitation was sent via e-mail to the university members in Munich. 259 persons filled out the questionnaire. This population consists of academic (36.4%) and non-academic (40.6%) staff, students (12.7%), and professors (10.3%). Respondents who answered less than 50% of the questions were excluded from the analysis. In addition, the categories "I prefer not to answer" or "Not applicable" were treated as missing values, affecting the number of valid cases for a particular indicator.

The collected data is representative of the Munich city population to some extent (Table 1). 43.6% of the survey participants were female, which differs only slightly from Munich. The majority were between 20 and 49 years old. Those under 20 and over 65 were strongly underrepresented. Most respondents have a monthly net income of 2,000 to 3,000 euros. Only 27.2% of the Munich population had this income level. The majority have completed a university degree. In the urban group, this proportion is 17.3% lower. On the other hand, the number of households with minor-aged children and the household size is similarly distributed in the Munich city population. In summary, the socio-demographic background of the survey participants is representative of an urban population only regarding gender, household size, and the number of households with minors. Age, income, and educational attainment differ from the urban population.

Table 1: Sample demographics compared to the Munich population.

		Survey	Munich	Difference
		%		
	Female[1)]	43.6	50.6	-7.0
Age[1)]	< 20	0.0	17.1	-17.1
	20-34	43.6	24.7	+18.9
	35-49	32.7	22.1	+10.6
	50-64	21.2	19.0	+2.2
	65 <	1.8	17.1	-15.3
Monthly net income[2)], €	< 1k	2.1	5.9	-3.8
	1k – 2k	9.8	24.6	-14.8
	2k – 3k	53.1	27.2	+25.9
	> 3k	35.0	43.3	-8.3
	University degree[2)]	73.3	56.0	+17.3
Household size[2)]	1	24.3	26.0	-1.7
	2	38.2	43.0	-4.8
	3	15.3	15.0	+0.3
	4	18.8	12.0	+6.8
	> 4	2.8	4.0	-1.2
	Households with underage children[2)]	28.6	24.0	+4.6

1) Landeshauptstadt München, 2022;
2) Landeshauptstadt München, 2021.

To explore the relationship between attitudes and personal characteristics, the actual use of SM, preferences towards specific micromobility vehicles in a sharing system, and views on the SM operation concept, we computed the strength and direction of the association using bivariate correlations. We used Spearman's rank-order correlation (r_S) for pairs of ordinal variables and the point-biserial correlation (r_{pb}) for categorical and ordinal variables. For data exploration, we chose a significance level of alpha less or equal to 5 %.

4 RESULTS AND DISCUSSION

4.1 Actual Use of SM

Understanding how shared micromobility (SM) is used helps planners determine the actual demand, needs, preferences, and degree of experience among the population. 46% of the survey respondents have shared mobility apps on their devices. Among them, 37% are registered users of car sharing (Figure 1). The (e-)bike is the most popular SM option, with 32% registered users. In addition, 22% have e-scooter, and

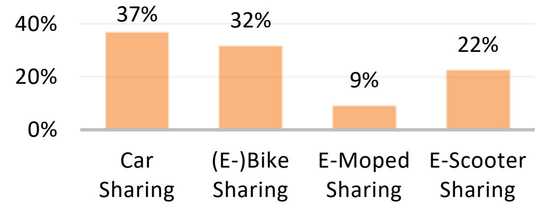

Figure 1: Shared mobility registered users among survey respondents.

9% have e-moped sharing applications. However, just because an app is installed on a mobile device does not necessarily mean the service is used frequently. For example, only 19% use shared mobility at their residence, and 31% use it while traveling. In addition, 56% of respondents prefer owning a vehicle instead of using it on an as-needed basis. On the other hand, the other 44% do not necessarily want to own a personal vehicle but need access to mobility. This suggests that there is a potential market for SM. By providing convenient, cost-effective, and reliable options, SM operators can meet the needs of this segment of the population and potentially reduce the overall number of personal vehicles on the road.

Table 2 depicts the relationship between attitudes and personal characteristics and the use of shared micromobility services. Older people are not prone to using SM. A moderate negative correlation between frequent car commuters and those who prefer owning a vehicle instead of only being able to use it implies that these groups are not currently using SM programs. The study found that there is a statistically significant difference in the usage of shared micromobility (SM) between males and females, with males being more likely to use SM than females. Additionally, individuals who regularly commute via public transportation, use car sharing and are considered tech-savvy are more likely to be current adopters of SM. This suggests that individuals with prior experience and comfort with public or shared transportation and technology may have a greater inclination towards using SM, and may possess the necessary knowledge to access and utilize SM options. These findings imply that targeting marketing and education efforts towards these demographic groups may increase the likelihood of successful adoption of SM among these populations.

4.2 Opinions About SM

The opinions about shared micromobility (SM) identify potential barriers to use and areas for improvement. For example, if the target population generally supports SM, this can build momentum and support for the program. On the other hand, if the population is reluctant to use these services, this may indicate that more work is needed to address concerns and build an acceptance foundation. For example, SM can be perceived as prestigious, modern, tech-savvy, and environmentally friendly transport. If friend circle use SM services, a person may feel social pressure to do the same to fit in or be seen as part of the same social group. In our population, 46% think their friends already use SM options. 50% consider SM a prestigious way to move around. 69% see it as an environmentally friendly transport mode.

Riding SM can be fun, especially with dedicated bike lanes or micromobility-friendly streets. People might like to grab a vehicle at a starting point, ride it, and then leave it at the destination for the next person to use. This can be a convenient and enjoyable alternative to driving or public transportation. 56% stated they consider SM fun. Most of the respondents (62%) think it is uncomplicated to rent a shared vehicle. A substantial portion of respondents (85%) consider SM would allow them to reach destinations that public transport does not reach. 43% think they would find SM in their neighborhood if needed.

In many cases, SM services are less expensive than a car or taxi, especially for short trips. Also, it can be a faster way to get around, especially in congested urban areas with heavy traffic. In our population, only 37% think SM is cost-effective for frequent use. On the other hand, more than half of the respondents (55%) think SM would save them time, and 47% could imagine using it under time pressure. While SM can be a convenient and popular transportation option, there might be concerns regarding visual clutter on the streets, with bikes and scooters scattered throughout the city. There may also be safety concerns, as people riding bikes or scooters may not always follow traffic laws or may not be visible to other road users. Among our respondents, the majority (87%) do not think SM disrupts the street landscape.

Overall, the opinions regarding SM vary, with some people supporting these services and actively using them and others somewhat reluctant. Therefore, it is essential to address issues and concerns that prevent people from using shared micromobility. This could include overcoming concerns by keeping the vehicles well-maintained and reliable and promoting the environmental benefits of using SM. Another critical factor is ensuring that the vehicles are accessible and convenient for all users. This could involve expanding the service area, increasing the availability of vehicles, and offering flexible payment options. It will likely take a combination of addressing the issues and promoting the benefits of SM to build a positive image and encourage more people to use these sharing services.

4.3 Intention to Use SM

We proposed that respondents select which vehicles they would use in the context of a campus SM. They could select multiple options among pedal bikes, e-bikes, e-cargo bikes, e-scooters, e-mopeds, or e-cabin scooters. 84% picked at least one option. 27% said they would use shared pedal bikes. E-bikes and e-cargo-bikes were both selected in 19% of the cases. E-scooters (17%), e-mopeds (11%), and e-cabin scooters (8%) followed the chosen options. Travel purposes for the SM on campus varied (Figure 2). Shared pedal bikes and e-bikes were mainly selected for work-related errands, reaching a public transport stop, and leisure. Some respondents also considered traveling to work or studies, settling private errands, or accompanying other persons by shared (e-)bikes. Work-related, private errands, and shopping were the use cases for e-cargo bikes, e-mopeds, and e-cabin scooters. E-scooters were mostly chosen for leisure and work-related errands.

A closer look into the correlation of the potential users for micromobility (Table 2) showed that younger individuals might use shared pedal bikes. Furthermore, those who do not carry heavy items on the way to the campus, commute by public transport, and use bike sharing, would prefer using shared pedal bikes. There might be several reasons why pedal bikes were more popular than other micromobility modes. For example, pedaling a bike can provide a low-impact cardiovascular workout, which may appeal to some people. Furthermore, pedal bikes do not require a driver's license or any special training to operate, making them accessible to a broader range of people.

Potential e-bike usage (Table 2) was associated with individuals bringing children to daycare or carrying heavy items on the way to the campus, suggesting that the extra carrying capacity of e-bikes may be a factor in their appeal. E-bikes might be an alternative mode of transportation for short distances and may be seen as a more convenient option for some car commuters. Furthermore, current e-scooter sharing users and frequent e-commerce users are potential shared e-bike users. This implies that people already comfortable with shared electric vehicles and new e-commerce technologies may be more likely to try shared e-bikes.

The potential utilization of e-cargo bikes (Table 2) was associated with current e-moped sharing

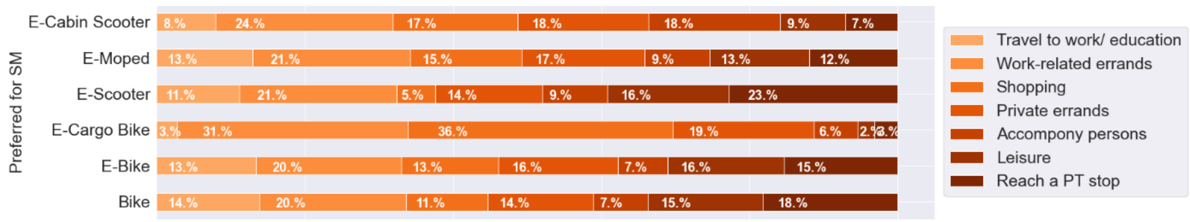

Figure 2: Stated travel purpose for shared micromobility (SM).

Table 2: Correlation of SM actual use, intention to use SM, and SM operation concept.

			Actual	Intention to use SM						Operation
Category	Variable	Correlation	SM user	Pedal bike	E-bike	E-cargo bike	E-scooter	E-moped	E-cabin scooter	Station-based
SD	Age.	r_S	-0.3***	-0.2***	0.07	-0.08	-0.16**	0.06	0.09	0.07
	Male.	r_{pb}	0.22***	-0.01	-0.01	0.05	0.07	-0.03	-0.04	0.02
Campus	Accommodates on campus.	r_{pb}	0	0.07	0.03	-0.08	-0.05	0.04	-0.08	0.13*
	Brings children to care/ school.	r_S	-0.02	-0.02	0.2**	0.08	0.07	-0.04	0.09*	0.05
	Carries heavy or oversized items (e.g., purchases).	r_S	-0.12	-0.16**	0.13*	-0.03	0.1	0.1	0.03	-0.01
Commuting	By car.	r_S	-0.18**	0.01	0.15*	-0.16**	0.22***	-0.06	-0.01	0.15*
	By public transport.	r_S	0.31***	0.3***	0.07	-0.13	0.05	0.06	-0.08	-0.12
	By bike.	r_S	0.07	-0.04	-0.2***	0.16**	-0.3***	-0.15**	0	0
	On foot.	r_S	0.1	0.01	0.03	0.11	-0.02	0.17**	0.03	-0.12
Signed up for	Car sharing.	r_{pb}	0.4***	0.09	0.01	0.1	0.01	0.14**	0.2***	-0.09
	(E-)bike sharing.	r_{pb}	-	0.23***	0.09	0.01	0.06	0.07	0.05	-0.1
	E-moped sharing.	r_{pb}	-	0.06	0.04	0.11*	0.11*	0.26***	0.01	-0.08
	E-scooter sharing.	r_{pb}	-	0.1	0.13*	0.06	0.21***	0.13*	0.01	-0.13*
Mobility	Is annoyed to wear a helmet.	r_{pb}	0.03	0.08	-0.05	-0.05	0.18**	-0.05	0.03	-0.15**
	Prefers owning a vehicle instead of just being able to use it.	r_{pb}	-0.2***	-0.17**	0.06	-0.01	0.01	0.03	0.09	-0.05
	Tries to reduce one's carbon emissions.	r_{pb}	-0.08	-0.11	-0.06	0.2***	-0.07	-0.11	-0.11	0.04
Personal	Laws should be strictly enforced.	r_{pb}	0.04	-0.07	0.05	0.08	0.02	-0.03	0.05	0.17**
	Likes to draw attention to oneself.	r_{pb}	0.06	-0.08	0.07	0.02	-0.03	0.15**	0.04	-0.05
	Prefers a change to routine.	r_{pb}	0.05	0.07	0.02	-0.14*	0.05	0.15**	0.07	0.05
Technology	Enjoys learning new computer programs and technologies.	r_{pb}	0.15**	0.02	0.02	-0.01	0.1	0.04	-0.02	0.05
	Orders goods online rather than goes to the store.	r_{pb}	0.02	0.05	0.24***	-0.09	0.12*	-0.04	-0.06	0.03
	Pays with a smartphone or smartwatch.	r_{pb}	0.32***	0.04	0.13*	0.08	0.1	0.04	0.02	-0.07

* $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

usage, suggesting that this group may be open to trying new modes of transportation. Selecting shared e-cargo bikes was related to bike commuters and environmentally-concerned individuals. This implies that the environmental benefits of e-cargo bikes may be appealing to these groups. The potential use of e-cargo bikes is also connected to individuals who prefer stable routines over change. This suggests that these modes may be seen as more reliable and predictable than other shared e-vehicles. No significant correlations were found between the intention to use e-cargo bikes and individuals transporting children to daycare or carrying heavy items to the campus, which was the expected usage scenario.

Younger adults, car commuters, current e-scooter, e-moped sharing, and e-commerce users were opting for e-scooters (Table 2) to be an integral part of an SM system. Interestingly, the rejection of wearing a helmet correlated with the choice of e-scooters. The relationship suggests that e-mopeds (Table 2) are a good alternative for those who walk to campus, as they might save time and energy, especially for longer distances. Individuals already comfortable with shared transportation may be more likely to try shared e-mopeds. Furthermore, those who prefer change over routine and like attention were choosing shared e-mopeds. That implies that e-mopeds appeal to people looking for something new, exciting, and different from their usual routine. This could be particularly true for areas where e-mopeds are not commonly used. E-cabin scooters (Table 2) were popular among current car sharing users and those who need to bring kids to school or daycare. These vehicles may be an alternative to cars, as they provide the same comfort and protection as cars but with the added benefit of being more environmentally friendly, less expensive, and more maneuverable.

Regarding the operation concept, 60% of the survey respondents preferred a free-floating over station-based sharing model. A medium-strong correlation suggests that individuals residing on campus prefer the station-based concept (Table 2). One reason could be that it may be more convenient for campus residents to access and return vehicles to designated locations. Another contributing factor could be the concern for vehicular clutter among those residing on campus. Furthermore, car commuters were opting for station-based SM operation as it could be more reliable and predictable than the free-floating concept. This could be particularly true in areas where parking is limited and finding a parking spot is challenging. The correlation implies that those who strongly believe in the importance of laws and regulations may feel more comfortable with the predictability and structure of a station-based operation. On the other hand, the free-floating operation may be preferred by individuals who already have experience with shared micromobility as they may see it as a continuation of the same kind of service and may be more comfortable with the flexibility it offers.

5 CONCLUSIONS

Introducing a new transportation mode can be challenging, as it requires changing user behavior. Understanding the needs and habits of the community and addressing any concerns or resistance to the new system is crucial to its success. Collecting and analyzing data on potential usage patterns and behavior is essential to optimize the system and adapt it to the community's needs. This data can be used to make informed decisions about designing and improving the system. User intentions are based on the community characteristics and the adopted technology. Some people may be more resistant to change than others, and it may take time to adjust to the new system. However, with proper marketing and education campaigns, the changes can be positive and beneficial to the community.

This study explored the perceptions of shared micromobility and intention to use modes such as pedal bikes, e-bikes, e-cargo bikes, e-scooters, e-mopeds, and e-cabin scooters. It also investigated the preferences regarding the shared micromobility operation concept. Assessing the perception and stance towards shared mobility can give an understanding of the potential success of a new system's implementation. Furthermore, it can help identify potential challenges and opportunities for the system, which could make it more cost-effective. On the other hand, if the community has a positive view of the concept, the chances of a successful deployment may be increased.

Knowing the preferences for the various forms of shared micromobility can aid in customizing the system to suit the community's needs. For example, if the targeted public is inclined to use specific micromobility modes, it would be wise to focus on providing those vehicles. Understanding the characteristics of both potential users and non-users also helps identify and address any specific needs, such as accessibility requirements or safety concerns. On the other hand, as users become more familiar with shared micromobility and vehicles not previously available, they may use it more frequently and for a broader range of trips. Furthermore, as users get to know the different types of vehicles and their capabilities, they may start choosing various shared modes for different types of trips and explore destinations they previously may not have been aware of.

This study concentrated on theoretical use, but comparing it to actual usage data would give a more precise understanding of how the system is functioning in reality. This can assist in identifying any disparities between the projected and actual usage and make necessary adjustments to enhance the system's performance. Furthermore, contrasting theoretical use with actual usage data can assist in identifying any obstacles to adoption, such as lack of knowledge or difficulty using the system, and direct efforts to tackle these issues. To sum up, comparing the study's theoretical use with actual usage data can give a more comprehensive understanding of how the system is being used and guide efforts to improve it.

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