ELECTRIC MOTOR SCOOTER SHARING:

The potential of ESS for sustainable mobility and urban development and the derivation of policy recommendations

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Herzog-Heinrich-Straße 32

80336 München

AUTHORS

Dr. Jessica Le Bris
Julia Münsch
Dr. Alexandra Bensler
Verena Prediger
Julia Korsten

Munich, February 2024

The data was made available and analysed as part of the Civitas Eccentric research project.

The EU-funded project „CIVITAS ECCENTRIC - Rethinking housing and mobility“[1] was looking for solutions for future-oriented mobility in urban peripheral areas to connect decentralized urban areas to the city center - developed, tested and scientifically investigated. In addition to project partners for Madrid, Stockholm, Turku and Ruse, experience consulting has implemented, researched and tested two new e-mobility services for the Domagkpark residential area in Munich. The described and analysed data covers the entire city area, where the electric scooter sharing scheme was available.

Further information about the part of experience consulting GmbH is available on the website:

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We would like to especially thank our partners at the Landeshauptstadt Munich for the fruitful cooperation.

1 https://stadt.muenchen.de/infos/civitas-eccentric.html

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ABSTRACT

Urban areas are particularly faced with congested roads and high rates of harmful emissions. New mobility solutions are popping up at an enormous pace, offering a contribution to solve these problems. One solution in the current mobility mix is electric motor scooter sharing (ESS), which has become increasingly popular within the last years.

Potential effects on sustainability as well as on the existing infrastructures (e.g. cannibalisation of the public transport) are currently being discussed. The following research employs a mixed-method approach based on a data set consisting of (approx. 490,000) automatically tracked rides of an electric scooter sharing offer in Munich. Additionally, a standardised online questionnaire was sent out to the customers to get a better understanding of ESS usage motivation, behaviour, and behavioural change.

The analysis has shown various dimensions of different effects, ESS has on our mobility system. Some consist of direct positive influences. Some others raise the question of further interventions or regulations that may be needed to make it a valuable mobility component that supports the development of a complex sustainable and efficient mobility system. The direct and indirect sustainability effects of ESS will be presented in detail in the following research. From this, political recommendations for action were derived to facilitate the transformation process from a car-centric to a multimodal mobilities system.

Keywords:
Electric motor scooter sharing
sustainable mobility
mobility ecosystem
policy recommendations
mobility practice
multimodal mobility behaviour

1. INTRODUCTION

The 20th century was characterised by the so-called "system of automobility" (Urry, 2004, p25). During the last century, the car was seen as the primary mobility solution that enabled personal freedom and progress in different fields (Ford, 2011). Various developments such as urbanisation, climate change, limited available space in cities and the related potential of an infrastructural collapse – especially in metropolitan regions – are disrupting the existing system of automobility. Transportation and mobility can be considered as the backbone of modern society and reflect its prosperity, since economic development, industrialisation and rising incomes are directly linked to the degree of motorisation of the society (Johnson, Currie and Stanley, 2008, p. 318). Mobility is more than just moving from A to B, it stands for personal freedom and individual movement. The connection between prosperity and mobility shows the importance of the latter. Thus, one could conclude that the aim of mobility in the 21st century should not be to reduce or forbid mobility but to re-design existing structures and create mobility alternatives that are more efficient and sustainable.

Need to act

Despite the infrastructural limitations, the increase of motorisation has a negative impact on CO2 emissions. The transport sector strongly emits greenhouse gas. Globally, the transport sector accounts for 24.00% of all energy-related emissions, with road transport accounting for 45.10% in the year 2018 (Ritchie, 2020). These figures from the time before the pandemic indicate the level of emissions that could be reached anew once the pandemic ends. Regarding climate change mitigation, the German Federal Government (Die Bundesregierung Deutschland, 2022) set the overall goal to lower the emissions in the transport sector by 60.00% compared to 1990. At the same time the emissions in this sector are still increasing. Consequently, there must be a fundamental change to achieve the overall goals.

The emergence of new mobility services as part of our mobility system

Mobility is therefore connected to more than just one scientific field. It is a broader topic, which is also described by the "new mobilities paradigm" (Sheller and Urry, 2006), where mobility is studied by different disciplines. The development of the growing demand for mobility, the urbanisation in connection to both limited space in cities and infrastructure, the climate change mitigation, as well as the megatrend of the shared economy are transforming the existing system of automobility into a new system of mobilities (Urry, 2004). The market reacts to the emerging problems and new mobility services (NMS) like car-sharing, on-demand ridesharing and bike-sharing become increasingly important, especially in metropolitan regions. These "new" products and services are inspired by buzzwords like shared economy, connectivity, digitalisation, electrification and servitisation (Bormann et al., 2018, p. 11–16). NMS foster the shift from a car-centric to a user-centric strategy by providing services when people want to be mobile.
Those user-centric business strategies also correspond to the different demands of (potential) customers driven by their personal decision-making process. With these new approaches a broader system of interconnected mobility concepts is formed.

Micromobilities and the practice of ESS

One important pillar in this emerging new mobilities system is micromobility. The vehicles are often used for short distances and require less space than a car (Abduljabbar, Liyanage and Dia, 2021). Consequently, they are particularly suitable in urban areas.

Furthermore, the vehicle types are mainly electric and can be run via assistant or non-assistant actuator. With the development into a user-centric strategy the micromobility vehicles are either privately owned or run in a sharing system (Liyanage et al., 2019). This paper focusses on an electric motor scooter sharing offer, in which non-assistant micromobility vehicles are used.

Taking into account the development from the car-centric system into a broader system of mobilities, ESS can contribute to create a mobility system that offers multiple individual mobility choices and thus, reduces the felt dependency on car mobility. Also, as when looking at the entire mobility ecosystem, the multitude of solutions and services need to be studied holistically. Each mobility option must be understood as a part in the complex system. And each subsystem, such as ESS, is interconnected to all the other systems (e.g. public transport). This understanding relates to the theoretical perspective of social practices (Ingram, Shove and Watson, 2007; Shove, Pantzar and Watson, 2012). Each mobility practice is part of a bigger system of practices. They cannot be seen as single phenomena but instead as practices

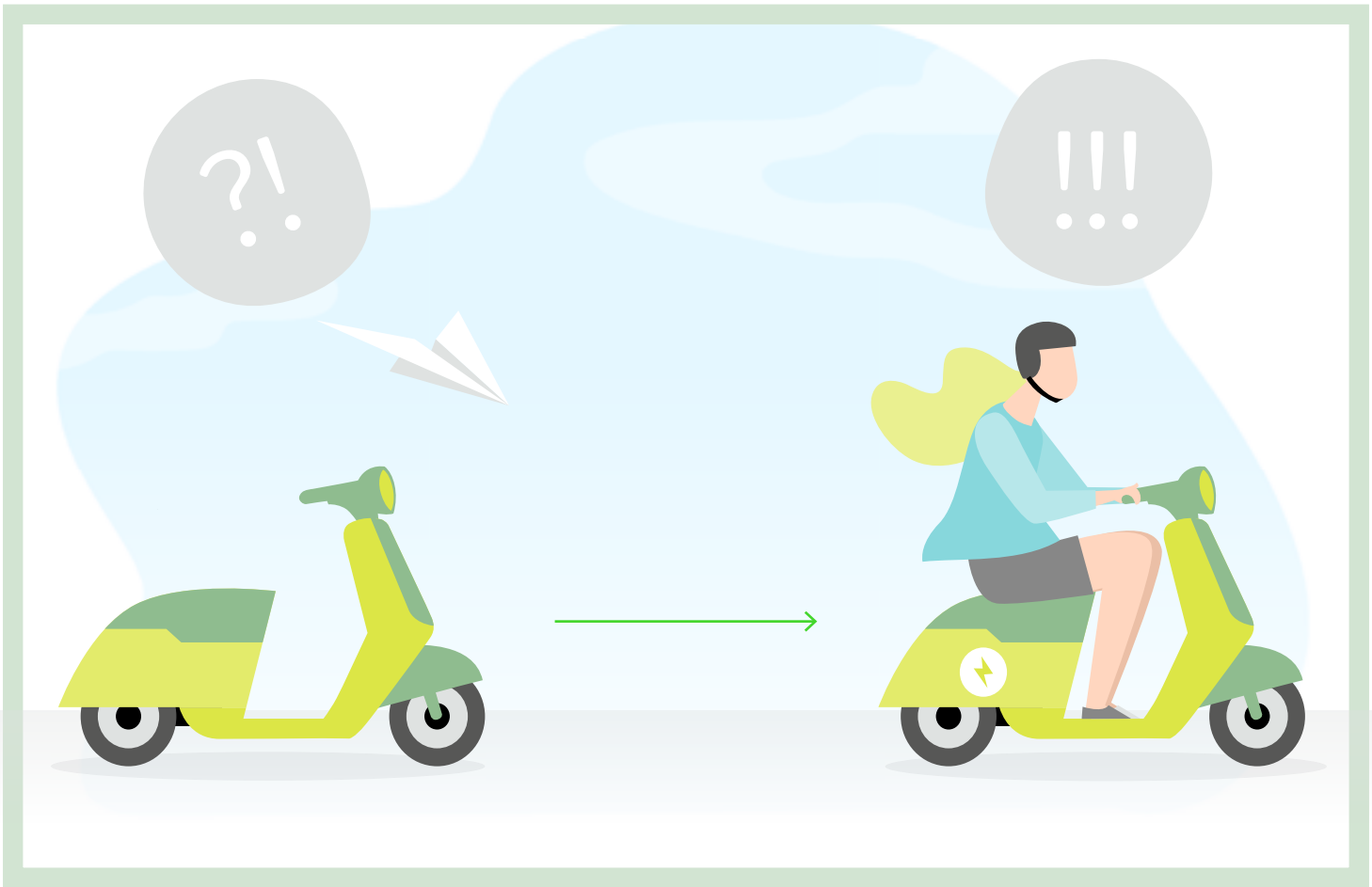
that are interconnected to each other and influence the way all the other components are formed (Le Bris, 2015).

Framework conditions needed to foster sustainable mobility developments

The transformation of our existing system is facing a lot of obstacles to overcome. Politics are part of the system – clearly, this has to be adapted, too. Political interventions such as push and pull measures have the power to accelerate this change/ transformation. By relating to the understanding of social practices the existing options must form a setting of elements that ultimately supports the generation of sustainable practices. Or – when taking the perspective of a user-centric approach – the system should help users to take more sustainable decisions[1] .

New framework conditions are needed to create an efficient and sustainable mobility system. “Mobility is a user-centric concept – recognizing that transportation products and services must be responsive to the needs, habits, and preferences of travellers and society” (Spulber et al., 2016, p1). Within these days, there is a window of opportunity for new mobility services. The new technological developments in the field of digitalization have led to an enormous upgrade of shared mobility options. In this sense, technology has created the chance to make the use of public and at the mean time individual vehicles much easier. Sharing options have a great potential to make our individual mobility more comfortable.
But solutions like ESS are still niche products.

The overall question is, should they remain a niche product or - what they promise - do they have the potential to foster a more sustainable mobility system? And if so, which specific promotional support should they experience to enhance its sustainable effects? By doing so, the paper addresses experts from planning practice, politicians and everyone who is interested in sustainable perspectives on new mobility solutions such as ESS.



1 Sustainability in general is a cross-system approach, whose measures are often intertwined. There are three dimensions of sustainability: economic, social and environmental perspectives. The impacts are therefore also linked to the different dimensions of sustainability as well as various interests of the stakeholders involved. Within this context especially the environmental perspective and the sustainability in regard to a long-term change in mobility behaviour is analysed and understood as sustainability. The economic and social perspective are taken up in parts.

2. METHODOLOGY AND MOBILITY PRACTICES

The following section describes the methodological approach including the theoretical concept of mobility practices. The data collection for the mixed-method approach comes from an electric scooter sharing offer that is run in Munich, Germany. The data was obtained in Munich, Germany, in the year 2019.
The study was carried out within the framework of the EU-funded Horizon 2020 project Civitas Eccentric [2].

Mobilities research and the practice of electric motor sharing systems

The paper refers to the theoretical concept of mobilities research, focussing on mobility practices. Mobility practices (such as the practice of public transport, biking, driving a car or micromobilities etc.) never stand alone and must be understood as part of a complex and interconnected system of different practices. Each practice inhabits different components. Following Shove et al. (2012) social practices consist of competences (individual skills and knowledge as well as technique), meanings (connotations, images, symbols – on an individual and collective level) and materials (physical elements such as artefacts, products, technologies, infrastructures etc.). The practice itself is seen as a product of all these different elements and characterized by their performance.

The evaluation of ESS – the data set

The herby presented results are part of a bigger study on the evaluation of ESS within the city of Munich. An earlier paper mainly examined the qualitative aspects of ESS systems based on the subjective perspectives of its users and the appropriation process of the ESS practice (Le Bris et al., 2021). Within this paper, the focus lies on the results of the quantitative data collected. The analysed data set accounts for almost 490,000 rides in a period from March to December 2019. At this point in time, the analysed ESS had more than 30,000 customers. Through the tracked data, usage patterns could be described such as usage frequencies, duration and utilisation rate.

Customers

> 30,000

Period of time

March till December 2019

Methods

Mixed methods approach

1) Quantitative – number of rides
2) Qualitative – standardised questionnaire

Number of rides

Approx. 490,000

(automatically tracked)

2 https://civitas.eu/cities/munich

In addition to the automatically generated data on ESS trips taken, the customers were surveyed with a standardised online questionnaire. Based on the standardised online questionnaire survey data like usage motivation, mobility habits and behaviour change could be collected based on 30 questions. The user survey data set includes 553 completed questionnaires.

Together with the qualitative interviews, the aim of the study was to generate in-depth knowledge of customers' usage behaviour, motivation, and behavioural change in relation to the ESS. This user-centric approach has always been connected to the understanding of mobility as system of social practices – where the practice itself is at the centre of the investigation. There, the behaviour is just the natural outcome of the setting of the elements. The complete methodological approach is based on a mixed-method strategy that aims at strengthening the quantitative findings with the results of the qualitative data (interviews with ESS users).

From theory 2 practice – deriving policy recommenda-tions

The final part of the study was the discussion of the findings with experts from the mobility department of Munich. A focus group was set up in which the main results of the study were presented with the policy recommendations proposed by the research team.

The dialogue with the different actors from planning practice was a fundamental and important part of the study to validate the scientifically grounded recommendations and underlay them with first-hand experiences. Within this circle of experts, policy recommendations were developed that not only function as guidelines for the optimization of ESS in Munich. The derivations also offer a framework and guideline for other cities that want to further establish an integrated mobility system in order to turn away from the existing car dependency.

With that overall approach and the implementation of different perspectives the following research questions have guided the analysis: First, how does ESS contribute to sustainable urban transportation? And second, which policy regulations or governance solutions are needed to further strengthen the advantages and counterbalance the weaknesses of such a sharing service?

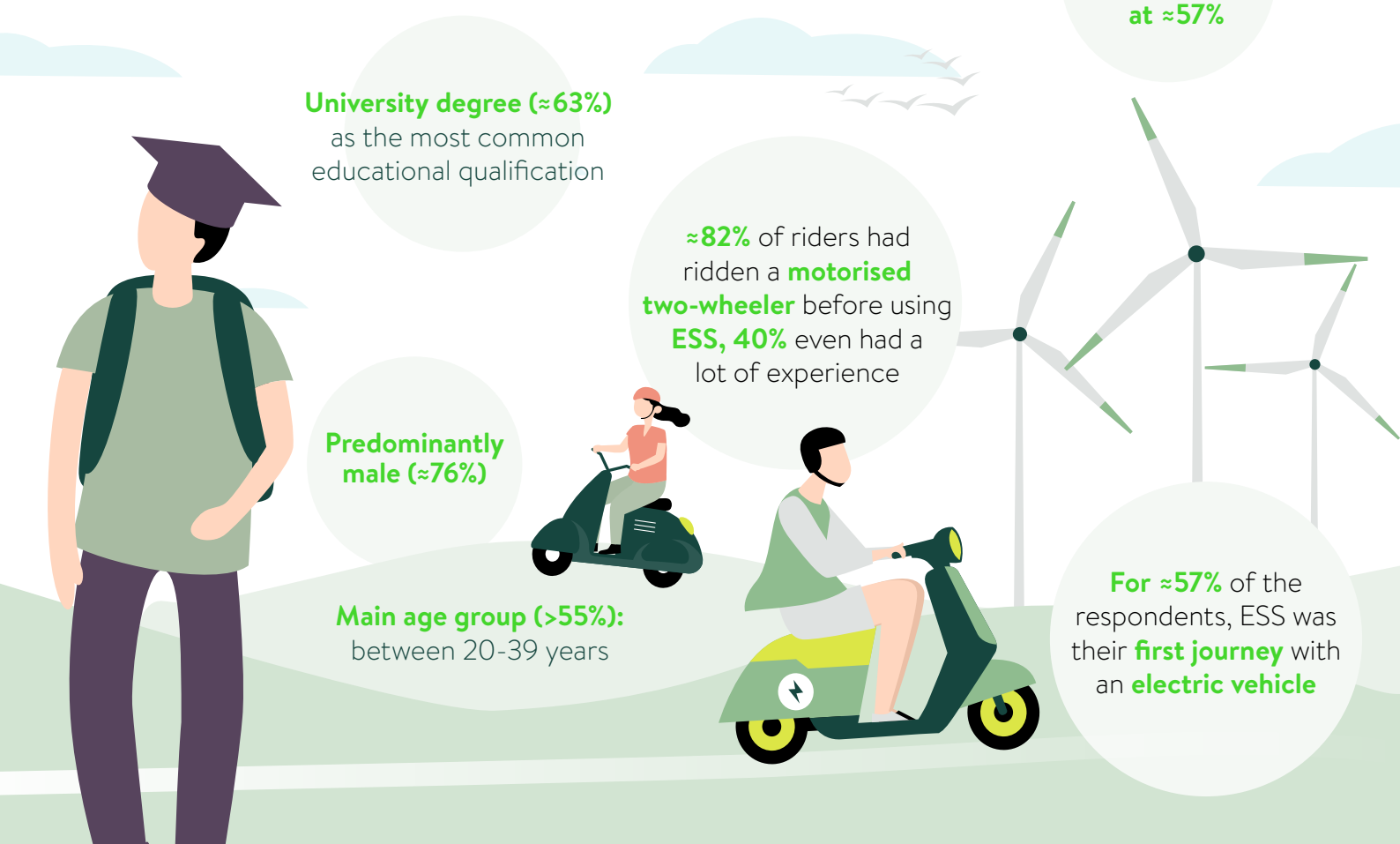
3. DESCRIPTIVE ANALYSIS OF THE DATA

As described in the methodological approach, the basis – to derive policy recommendations as well as to evaluate ESS sustainability – is the quantitative data set of the ESS rides in the city of Munich. The data is supplemented by the standardised questionnaire. At some point, the quantitative outcomes are underlined by the findings from the qualitative study where customers were interviewed.

Characteristics of the ESS survey respondents

More than 75.00% of ESS survey respondents are male. Generally, the customer group is relatively young – more than 55.00% of the survey participants are aged 20 and 39 (years) – and has an above-average education: 63.30% of respondents have a university degree compared to a national average of 31.90% (Statistisches Bundesamt, 2020). More than half of the respondents purchase green electricity, which suggests an ecological value orientation.

This was underlined by some of the interviewees that specifically highlighted, that values like a conscious green lifestyle play an important role in their lives. The sample of ESS riders in Munich uses less private motorized transport (22.00% car usage daily or almost daily) and more active forms of mobility than the average resident of German metropolis (38.00% car usage) (infas et al., 2019). Most ESS users have already ridden a two-wheeler before. More specifically, four out of five respondents had ridden a motorized two-wheeler before their ESS use, 40.00% even routinely (i.e., regularly for a while). Within the interviews some especially pointed out their affinity towards this kind of movement, riding a motorcycle has always been fun. This may lead to the conclusion: the use of ESS is more likely adapted by people that got the competence to ride motorized two-wheelers. The knowledge and skill / confidence with this kind of movement is clearly part of the social practice. Similarly, ESS has the potential to act as an ‚icebreaker' for the use of other e-vehicles: for more than three quarters of the users (77.10%), ESS was their first ride on an e-vehicle.



ESS usage frequencies, trip lengths and duration and scooter utilization

One central finding when looking at the data is that ESS is mainly used for occasional trips. In detail, this means that on average, a customer rents a scooter from the sharing offer 11.4 times. This number results from different user patterns: 21.00% of the customers have only taken a single ride. Furthermore, 37.00% of the customers are using the sharing offer between two and ten times. This corresponds to the theoretical framework of mobility practice that ESS is one solution in an entire system. In each situation a mobility solution is picked out that fits the best for the actual needs in that moment. In addition to the user frequencies, the trip lengths and durations were analysed. On average, 4.21 kilometres are travelled with one scooter/day. In detail, 10.00% of the trips were shorter than 1 kilometre and 15.00% were 1 kilometre. Considering the travel lengths, one could assume that they are used to supplement public transport as well as a last mile solution, another possibility is that these rides with less than 1 kilometre are test rides. In this case further research is necessary. The trip lengths can be put in direct relation to the trip duration. On average, the trip duration was 13 minutes, whereas 10.00% of trips were shorter than 4 minutes. The average time each scooter was used per day amounts to 43 minutes, which is a utilisation rate of 2.98% per day. In comparison to that number and according to the study Mobility in Germany (infas et al., 2019, p. 5), a privately owned car is used for 1 hour per day on average.

Temporal trip distribution

When looking at the trips distributed throughout time, there appears to be a connection of the number of trips taken and the external weather conditions: most of the trips are taken during the summertime in June and July. Consequently, the number of the trips corresponds to the average monthly temperature as well as rainfall. Furthermore, usage patterns on weekdays differ from those on the weekend. During the week, the usage increases steadily from 6 am and peaks at 8 am (15,363 rides). Another peak is recorded at 6 pm (31,850 rides). It seems as ESS is used for commuting during the week – and (naturally) during weekends for leisure trips. According to the data, Friday (23,137 rides) and Saturday (21,555 rides) are the days with the highest utilisation. Also, there is a difference in regard to the time distribution compared to the weekdays. Here the usage increases steadily from 6 am and peaks at 5 pm.

Spatial distribution of the starting and ending points of the trips

The spatial distribution also reflects the results from the trip lengths and durations. Most trips start and end in the same postal code area, mostly in areas in the inner city. The movement in the inner-city district reflects the operational area of the ESS. The suburban areas were not developed when the data was collected.

Traffic modes substituted by ESS according to traffic volume and performance

The analysis of the questionnaire shows that the number of trips, that ESS in Munich mainly replaces, are trips by public transport (25.72%), whereas individually motorised trips have a replacement rate of 11.80%. At first glance, it appears that there is a cannibalisation between the public transport and the ESS practice. At the same time is becomes visible, that ESS in terms of vehicle kilometres replaces are attributable to the individual car (60.00%). Analysing the different means of transportation in terms of number of trips, ESS replaces public transport, cycling and walking to a similar extent. At the same time, looking at the number of kilometres the ESS practice replaces the car the most. By looking at the effects on CO2 emissions and space consumption and the amount of car kilometres that are replaced by ESS, one can argue, ESS is more sustainable than using the car (Hofman, 2013).

Moreover, only a very small proportion of trips would not have been made at all without ESS. 4.20% of the trips in Munich are trips solely taken for fun. Most respondents (98.00%) make such trips infrequently (e.g., on a maximum of three days/month), the largest proportion of respondents (69.00%) never or almost never do so. The majority of customers (87.00%) use ESS ‚only' occasionally, e.g. max. three times per month, while the share of daily ESS users amounts to 1.30%, which is vanishingly small. Furthermore, it has become clear that ESS does not strongly take away customers from environmentally friendly modes of transportation: 85.95% of the respondents who substitute public transport do so on 1 to 3 days per month or even less. Only 5.40% report substituting public transport on a daily basis. At the same time, only 1.30% of the respondent's ride ESS daily.

Similarly, active forms of mobility are substituted slightly more often: 89.35% of the respondents who ride ESS instead of biking do so on 1 to 3 days per month or less frequently. Walking trips are even substituted slightly less frequently, with 90.66% of Munich respondents overall substituting these trips on 1 to 3 days per month or less frequently. In summary, most respondents rarely use ESS for trips that would have otherwise been taken by environmentally friendly modes of transport.

Usage motivations

There are various reasons and motivations of the customers when using ESS such as fun, curiosity or practical reasons like speed. Primary the main reasons for a behavioural change were collected. For that purpose, the customers were asked for their reasons to use ESS instead of other means of transportation. In regard to the shift from public transport to ESS, the reasons are speed (29.91%), fun (23.06%) and accessibility of poorly connected places (15.53%). The reasons to replace cycling trips are also speed (42.03%), fun (32.14%) and environmental protection (5.49%). For walking trips, the main motivations for shifting to ESS are speed (54.44%), fun (20.63%) and accessibility of poorly connected places (5.73%). The main reason for using ESS instead of the car is the search for a parking space (34.29%), which can be connected to the speed variable. Other reasons were fun (13.81%), speed and environmental protection (13.57%). The data from the interviews underlines these outcomes. It fits their practical needs and for some the practice even serves as relief time after a stressful day or a tool, that “saves my day”.

The usage motivations can be categorised in practical reasons like speed and time, emotional reasons like fun and in the personal belief with the environmental protection. The findings show: Using ESS is not only an act of overcoming a physical distance. It is more than that. It contains individual meanings and symbols that are an integral part of this social practice.

4.DISCUSSION OF THE SUSTAINABLE POTENTIAL OF ESS

In the following section, the sustainable potential of ESS will be discussed. At a first glance, several results such as the utilization rate, trip lengths and durations as well as rides taken for fun indicate that ESS may not be a sustainable mobility solution. But this might draw a precipitate picture. When looking at this mobility practice from the perspective of a broader ecosystem, it becomes visible that the presumed negative effects turn into a solution that obtains the potential to foster sustainable practices.

Interconnections of the mobility practice of ESS and other mobility practices

A significant proportion of ESS users cultivates alternative rather than car-centric mobility styles: the most popular daily modes of travel among ESS users are walking, cycling and public transport. Approximately 61.00% of the respondents engage in daily multimodal travel, using two or more modes of transportation each day. In addition, monthly or annual public transport passes are widely used by customers (40.50%), as is signing up with sharing providers, which is well above average compared to residents of German metropolitan regions (infas et al., 2019). ESS is thus used by people who travel alternatively or multimodally as one of numerous mobility options. ESS is mostly not used as an area-wide substitute, but as a tailor-made add-on to public transport. The descriptive analysis has shown that ESS does not systematically (e.g., often and regularly) replace trips. Instead, it serves as one mobility solutions amongst a bouquet of multiple options that are used. Consequently, the ESS stands as a supplement in the existing mobility system and is not a substitution of e.g. public transport per se, but acts as a selective alternative. The analysis also pointed out that there is no cannibalisation effect between the different means of transportation in regard to the traffic volume. Moreover, especially during peak times, the public transport network often achieves its capacity limits. When looking at the usage peak times of ESS during the weekdays (8 am and 6 pm), ESS can be an effective supplement to relieve congestion on the roads and in public transport.

This has an impact on the efficiency of the existing mobility ecosystem as well as on sustainability. Moreover, ESS is advantageous for multimodal mobility styles because it can be used spontaneously – for example, in unpredictable weather – for one-way journeys and at times when public transport is delayed. Furthermore, it was found out that most of the kilometres that ESS replaces are attributable to the individual motorised traffic. Consequently, ESS is a solution that substitutes the car to a certain extent.

In summary – in regard to the specific mobility needs and motivations – a user-friendly ESS can contribute to a greater flexibility of our public mobility systems and thus, in the long run, supports the break of our car path dependency.

ESS as door-opener for electric mobility

For almost half of the respondents (49.00%), using ESS has led to a change in their interest in e- mobility, mostly by strengthening it. More than half of the respondents with a changed interest in e-mobility had a more positive attitude towards e-vehicles, e-mobility and sustainable transport, after they have experienced the electrical run ESS. Additionally, 42.00% have opened up towards e-mobility and show a grown interest in using e-solutions and potentially buying an own e-vehicle. Just under 5.00% have subsequently bought their own e-vehicle or consciously decided against it because they were so satisfied with ESS that they did not want to own an e-vehicle (anymore). Briefly summarised, ESS can act as an „icebreaker“ for electric mobility. For 57.00%, ESS was their first ride with an e-vehicle. For 43.00% of the respondents, the ESS ride inspired them to test other electrically powered vehicles.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These numbers indicate that ESS has a positive impact on the general attitude towards new, sustainable, and efficient mobility (solutions) which is reflected as well within the interviews undertaken with some of the users. Thus, ESS could contribute to changing the mobility attitudes and behaviour of citizens in the foreseeable future. ESS has the positive side-effect to act as door-opener for an openness towards e-mobility and possibly other new mobility solutions.

Conclusion - ESS sustainability effects

The sustainability effects of ESS cannot be assessed one-dimensionally. This means that the data collected needs to be put into a broader context of mobility practices. There are additional spill-over effects towards a sustainable mobility style, which include a behavioural change in mobility.

ESS can be a significant element that helps making our public mobility system more attractive, thus reducing the car dependency. In general, there is no clear definition about the time that is needed to achieve the overall goal in the transformation process. But when looking on processes in other fields – like the energy transition process – it becomes visible that the appropriate political support can speed up the transition.

5. DERIVATION OF POLITICAL RECOMMENDATIONS

ESS corresponds to current megatrends, supports the mobility transition process (from car-centric to a multimodal and flexible system), needs less space (efficient use of the existing infrastructure) and has a positive impact towards sustainability, by substituting a noteworthy number of trips originally made by car. The study has shown that ESS embraces seeds of sustainable mobility. These seeds should be strengthened to scale up the sustainable effects of the new system. Mobility practices are a product of a great variety of different elements. The individual decision-making process referring to the perspective of users is only one part of the system. Thus, the responsibility of the usages of new solutions can neither mainly be put on the customer nor on the business drivers that have to fulfil their market targets.

Politics have a fundamental role in setting up the guiding framework with push- or pull- actions that sustainable solutions can develop their full potential and the transformation process can speed up. To do so, regulations should counterbalance possible negative effects and support the enfolding of its positive aspects to foster a sustainable urban development. The outlined policy recommendations have been discussed with administrative actors and the presented solutions have been validated. The recommendations are linked to the concept of social practices, which indicates that all three components (competences, meanings and materials) of the practice have to be addressed to unfold the best sustainable outcome.

Expansion of the target group

The sample of customers of ESS can briefly be characterized as follows: mainly middle aged, male with academic degree and previous experiences with the practice of motorbiking or scooters. They seem to have a high affinity towards sharing solutions and for some, ecological values influence their decision to use ESS. By looking at this quite homogenous user group it appears that the ESS practice is right now a niche solution for a specific target group and therefore not an inclusive mobility solution.

Marketing actions help expanding the actual target group and gain new customer segments. Next to practical advantages such as saving time when looking for a parking spot or driving through the dense traffic, the emotional aspects should be picked up (meaning by Shove et al. 2012). Riding a ESS stands for fun and freedom. Further values to be pointed out: environmental advantages of ESS and electric mobility solutions together with the argument of space efficiency within cities. Here, the discovered spill over effects suggests addressing green electricity owners directly. Another option would be to cooperate with other sharing operators. Its users are generally open to a variety of different sharing options. Thus, e.g. car sharing users could explicitly be a target group to gain new customers.

An active communication via different channels is supportive to reach other potential customers. Communication strategies should use the windows of opportunities when changes in life contexts occur (Franke, 2001; Darnton et al., 2011). Especially in situations of personal changes such as moving to another city, a change of job or changing health conditions routines are often interrupted and by that, the openness towards new information (and new solutions) is much higher. A widely used possibility of such an intervention are new citizens packages. They could offer additional free ESS rides to create a first contact with the new tool.

Another option is the integration of multipliers such as employers. Companies that integrate the sharing solution into their portfolio of business ride options have a great potential to support their employees in following a multimodal lifestyle.

As the results have further shown: the competence (Shove et al., 2012) of riding a motorbike or a scooter seems to be an important element that supports the appropriation of ESS. Consequently, a pull measure would be offering possibilities to strengthen the skills for riding motorised two-wheelers, e.g. through driving safety training. Moreover, creating occasions to try out the new mobility tool help reducing the adoption risks of innovations. In combination with the skill trainings to experience ESS, just by trying possible concerns can be eliminated, and people familiarise with the product.

Integrated mobility system

With the aim to design an integrated mobility system, physical interconnections between the different mobility options are indispensable. Ideally, ESS appears as part of the public transport system and not as separate solution. Especially in regard to the extension of the accessibility a targeted financial support might be an approach in order to expand the availability of ESS at termini of the public transport. By doing so multimodal mobility behaviour is encouraged and the attractiveness of the public transport increases.

In regard to the development of an integrated mobility system traditional (customer) touchpoints can be used for communication and information, e.g. the communication of sharing offers on public transport stations. Hereby the benefits of a multimodal and entire system can be marketed. Another building block to close the gap between the new mobility solutions and the existing public transport infrastructure is the integration of sharing price packages in the pricing of public transport tickets to incentivize the sharing offers on the one hand and to and to promote the expansion of an overall system on the other hand.

Promoting multimodality via one platform

One step further and to make ESS as well as other NMS visible to an expanded audience and to promote multimodality it is recommended to integrate the ESS into a multimodal mobility platform. This has the potential to point out sustainable alternatives next to public transport in a traditional way. By that, niche products (like ESS) become visible – also for new customer groups - and the attractiveness of those alternatives increases. Furthermore, within the digital platform booking and payment should be integrated to have a smart solution. This finding is also in line with the findings of the Invers study (Howe and Gmelin, 2021) which concludes that it would be desirable to have a central platform across all modes of transport to promote multimodality, including all solutions. Here additional features can be implemented like an alert when the public transport is shown busy (but this would then be with the transport company, not only the local policy).

In additional to the information and to equalize the peaks, price incentives could be an instrument to encourage the shift to mobility alternatives - especially at those times. Furthermore, targeted communication measures to ESS users could be installed. Such a platform can be connected to the first policy recommendation with the expansion of the target group. A simple tool could be a recommendation like “if you liked this, you might like that”. For this idea further research in regard to the data accessibility as well as data protection is needed.

ESS and public space

During the focus group with experts from the mobility department a risk factor came up when discussing the advantages and disadvantages of the system within public space. Everyone agreed on ESS as integral part of the new range of micromobility solutions. Here, it can be seen as a highly space efficient form of mobility. Nevertheless, it is an additional mobility tool that – even though very small – needs space to park (materials such as parking infrastructures, Shove et al., 2012).

Until now the problem occurs that there are wildly parked on the sidewalk. Extra parking areas only exist for car sharing or station-based bike sharing solutions – but not for other sharing options, at least in Munich. The installation of parking spots that are specifically reserved for micromobility solutions might help solving the conflict. Additional price incentives could support the preferred parking on these spots. In addition to that a communication strategy that sensitizes the customers to a mutual consideration can support a more thoughtful behavior in dealing with public spaces.

Improved connection of suburban areas

The descriptive analyses have shown that there is a huge potential to expand the operational area. Here a collaboration with the public transport sector to install mobility stations for specific areas as well as the exchange with local companies is recommended to install targeted and therefore successful measures. Hereby the attractiveness of the public transport can be enhanced, especially in suburban areas.

Additionally, the multimodal mobility behaviour could be strengthened. The political support can be divided in the provision of adequate space, to install the mobility stations on the one hand, but also by monetary incentives. Targeted offer of sharing solutions at public transport termini Consequently, ESS can be used as an add-on to public transport or for areas with a poorly developed public transport.

With the connection in the suburban areas the ESS can be used as a first mile solution, with the result that the operation area can be strengthened through the combination of new solution and existing structures – like good public transport connections, as well as P&R possibilities, etc. Especially this recommendation shows the intertwined strategy that is needed in order to establish an efficient and sustainable mobilities ecosystem. In the long term, a cross-city MaaS platform would be advisable.

6. CONCLUSION AND OUTLOOK

The paper has shown that the ESS practice can embrace sustainable effects for the transport sector depending on the existing mobility system and its integration within the system. The mobility practice concept indicates that it is important to analyse the mobility sector as a complete and integrated ecosystem instead of a single means of transport. Furthermore, the motivations as well as purposes for being mobile are important to get an overall understanding. With the ongoing transformation process from a car-centric to a multimodal mobilities system it is important to consider the interconnections.

What became visible is that there is no cannibalisation effect to the public transport system in terms of traffic volume – ESS functions as an additional mobility offer. Especially in dense inner-city areas the focus should clearly be on incentivising space-efficient mobility (micromobility, which can be run via assistant or non-assistant actuator) and consequently on space-efficient travel modes. In addition, the ESS fleet is locally emission-free because they are electrically powered. The promotion should be strengthened with appropriate measures to promote the mobilities ecosystem as a whole. Only an integral system helps to solve the overall problems.

The understanding should be that the different solutions and services can benefit from each other instead of a cannibalisation.

NMS solutions like ESS are mainly operated by privately owned companies, whereas the public transport system is operated by the public sector. ESS – in a whole ecosystem – was described as a sensible supplement when it is needed based on the interconnected nature of mobility practices. This leads to the result that an intelligent, efficient, and sustainable transport network means a combination of the public and private sector.

The derived political recommendations have shown that there are gaps, and supportive political actions are needed to optimize the whole system with the integration of ESS. The aim is to simultaneously provide political frames and user-centric mobility solutions to cause a shift in behaviour to create a future-orientated mobility sector, which can also lead to a “post-car” scenario (Urry 2004, p. 33). In summary, the ESS practice by itself may not be sustainable but when looking at the mobility ecosystem and the overall described challenges as well as megatrends, this practice can be an integral element towards a sustainable, efficient, and multimodal mobilities system.

KEY FINDINGS FOR ESS UTILISATION IN 2019

FREQUENCY OF USE

ESS is mainly used for occasional journeys (in the analysed period of time)

21%
of customers only made one journey

37%
of customers use the scooter 2 to 10 times

On average, a customer rents a scooter 11.4 times

TRIP LENGTH AND DURATION

On average, a scooter covers 4.21 kilometres per day

10%
of journeys are less than 1 kilometre

15%
of journeys are 1 kilometre long

The average journey time was 13 minutes, 10% of journeys are shorter than 4 minutes

SCOOTER UTILISATION

The scooter utilisation rate per day was 43 minutes

The descriptive analysis has shown that ESS is still a niche product. In this paper different initial approaches have been derived in order to optimize ESS in a way it goes along with a sustainable city development. As an outlook it is recommended to use the theorical model of Geels (Geels, 2012), where the multi-level perspective in a complex transformation process is described. In this model it becomes apparent that through the targeted use of policy instruments, niche products can appeal to the masses and therefore they can contribute to the development of a sustainable mobility system.

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experience consulting GmbH
Herzog-Heinrich-Straße 32
80336 Munich
Germany

www.experience-consulting.de

Dr. Jessica Le Bris
Julia Münsch
Dr. Alexandra Bensler
Verena Prediger
Julia Korsten

The data was provided and analysed as part of the
Civitas Eccentric research project.

Written in 2022
Reviewed in 2023
Published in 2024

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