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Perception of Shared Electric Scooters: A Case Study from Poland

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Abstract: Scooter-sharing services, that is, short-term rental of electric scooters, have been gaining popularity among last-mile transport solutions in recent years, winning both their supporters and opponents. Recognizing the different approaches of societies to scooters in the world, the objective of this work was to determine the perception of scooter-sharing services in Poland, that is, the fifth largest European market in terms of micromobility. The study was based on survey data conducted using the CAWI method among the points of active users of scooter-sharing systems. The article presents the results regarding the perception of electric scooters in terms of safety, use, operation, education, and elements of communication behavior. The results indicate that the respondents perceive the Polish market of sharing electric scooters well. They believe that riding a scooter is safe (despite pointing out numerous technical faults that may indicate insufficient technical knowledge about what they can mean for users), and they are against mobility hubs and disrupting free systems. Interestingly, respondents emphasize the need to modernize the regulations, the need for penalties for damage to vehicles, and the need to reduce fees. The results provide valuable clues on how to manage the new electric mobility. They also indicate a different approach of Polish users to the issue of perceiving scooters in relation to other European societies (such as France or Denmark), which is a valuable clue for modeling transport behavior.

Keywords: electric scooter-sharing; e-scooter-sharing; electric kick-scooters; shared mobility; new mobility; sustainable transport; mobility management; electromobility management

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1. Introduction

In recent years, electric scooters (also referred to as e-scooters) have gained popularity around the world. Although the first mention of the use of electric scooters dates to 1915 [1], they have been of particular interest since their dissemination in shared mobility services, i.e., since 2017, when the first systems of short-term rental systems of electric scooters appeared [2]. In 2017, two leading companies on the scooter-sharing market, Bird and Lime, launched dockless e-scooters [3]. Since its inception in Santa Monica, California, United States, Bird has expanded its services to more than 100 cities and achieved a valuation of $2 billion in 2018 [4]. In the same year, its competitor Lime collected over 11.5 million rides [4]. The wide interest in scooter-sharing translated into a significant increase in the number of users of their systems. In 2017, there were 0.52 million registered users worldwide, while in 2022, the number of users reached more than 77 million [5]. Detailed data on the number of users with a view to 2025 is presented in Figure 1.

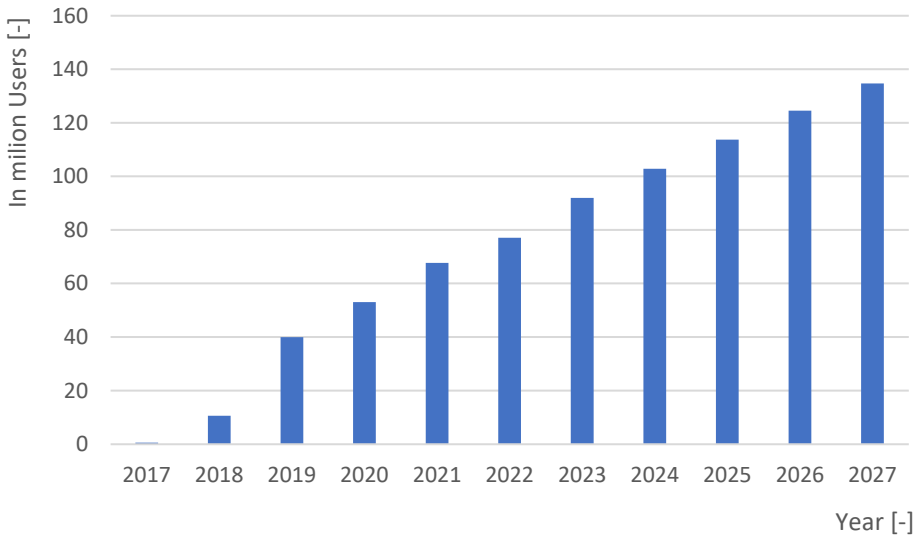

Figure 1. Shared mobility users worldwide. Source: author's own elaboration.

The constantly growing number of users also translates into the value of the global market. Statistics show that by 2025, electric scooters are expected to represent a market of $30 billion, with much of the demand generated by China, Europe, and the United States of America [6]. Scooters have therefore become a large market player among the means of transport available in urban transport systems, especially when it comes to first- and last-mile logistics. There are many factors behind the success of the popularity of scooters among the public, including, among others:

- scooters from scooter-sharing systems are easily and widely accessible [7],
- scooters are easy to use even for people without experience [8],
- riding a scooter in many countries is possible without the need to have a license,
- scooters are a pro-ecological form of transport [9],
- scooters do not cause traffic noise [10],
- scooters give the possibility of quick movement in places often inaccessible to cars [11].

The benefits of using electric scooters have contributed to defining them as synonymous with the word 'rental' [12]. In addition, electric scooters have become a common "introduction" to electromobility for many societies and gave the opportunity to get used to a sustainable, green, and alternative form of mobility without having to invest in electric cars, which are still expensive for many people [13,14]. Moreover, scooter-sharing systems have allowed many transport gaps to be filled and helped to eliminate both transport and social barriers. Scooter-sharing systems also allowed to improve the transport attractiveness of cities for tourists, ensured the autonomy of movement, and translated into familiarization with mobility as a service systems [15,16]. Interest in scooters has also translated into an increasing number of scientific papers and research on the development of scooter-sharing systems. Since the systems have been on the market for only five years, the research covered completely basic issues from the principles of operation of the systems [17], popularization of services among the public [18], optimization of the distribution of scooters in cities [19], their impact on the environment [20], or life cycle assessment [21]. More advanced aspects related to a broader perspective on vehicle operation in cities such as the development of shared scooters business models [22], service loyalty [23], economic models [24], policies and regulations [25], management [26], or the impact of the COVID-19 pandemic on scooter sharing systems [27] were considered. Analyzing the indicated works, it would seem that scooter-sharing services will be a real alternative to the automotive industry and will be able to bring benefits to cities and societies.

Unfortunately, despite the numerous superlatives of scooter-sharing, the development of systems over the last years, as well as the increase in the number of available vehicles,

began to bring more and more problems to urban centers. Among other things, increasing problems with lack of proper system management, fleets of vehicles scattered in public places constituting architectural barriers, vandalized vehicles, technical problems with scooters and their batteries, aspects of user safety and security, or issues with the storage of used vehicles began to be pointed out [28,29]. These problems have begun to be emphasized by leading scooter-sharing urban centers both in America (e.g., Washington, Atlanta), Europe (e.g., Paris, Stockholm, Copenhagen, Wien), or Asia (e.g., Singapore, Shanghai), which have started an attempt to regulate electric scooters and impose various types of restrictions, resulting in a temporary or complete ban on the operation of scooter-sharing systems [30–33]. Furthermore, countries with less developed scooter-sharing systems are also considering implementing various restrictions, citing systems causing danger and communication chaos [34]. However, are these systems really perceived by societies as dangerous and do societies express their reluctance towards electric scooters and local authorities?

In this case, a perfect example is Paris, where almost 15,000 electric scooters have been used so far and over 20 million trips were made annually. Currently, scooters have been banned as a result of a public referendum. However, interestingly, only 7.5% of those entitled to vote participated in the vote [35], and among the public, one can find the opinions of opponents emphasizing that banning scooters deprives them of an ecological and economic means of transport to work, deprives them of a means of transport that allowed them to reach the subway effectively or provided an alternative to the car [36,37]. Moreover, it is emphasized that the referendum was attended by people who do not like scooter-sharing but are not its users themselves [36,37]. Noting such opinions, it can be assumed that there are discrepancies in the perception of scooter-sharing services by societies and the existence of contradictions between public opinions or the lack of monitoring of public opinions by local authorities when planning or implementing specific restrictions and limiting scooter-sharing services. When reviewing the literature on this subject, one can find research papers devoted to German [38], Portland [39], Thessaloniki [40], Dublin [41], and Italian [42] societies. Although they provide excellent knowledge of current or potential users of scooter-sharing systems, involvement in the use of shared mobility, and perception of rights or organizations introduced in the field of shared mobility, little emphasis is placed on the functioning of scooter rental systems from the point of view of maintenance and operational issues. Noting this research gap, as well as the insufficient number of studies conducted for the Polish market and the increasing plans to impose restrictions on scooters in Poland, the aim of the work is to present the perception of e-scooter-sharing systems in terms of use and operation for a case study of the active scooter-sharing users in Poland.

The Polish service market was chosen because it is at the forefront of European short-term scooter rental systems, taking 5th place in 2022 [43]. In Poland, scooter-sharing services appeared to 2018, achieving an intensive increase in interest in the following years [44]. In 2020, 12 scooter-sharing operators offered 18,800 vehicles in 39 cities [44]; for comparison, at the end of September 2022, there were 94,000 scooters available in 161 towns [45]. The latest statistics show that, at the end of June 2023, 104,500 scooters were recorded in Poland, available for rent in 196 towns [46]. Furthermore, against the background of other categories of shared personal vehicles (i.e., bicycles, which decreased by approximately 20% compared to last year, and mopeds, whose availability has been disappearing in Poland for a long time), electronic scooters turn out to be the only consistently growing part of the market for shared micromobility [46]. Statistics show that revenue in the e-scooter-sharing segment is projected to reach US $15,940.00k in 2023, and the number of users is expected to amount to 1890.00k users by 2027 [47]. Due to the continuous growth of the electric scooter market, any research on its proper functioning in urban transport systems is justified.

The innovation and added value of this work is the presentation of:

- results of research not yet performed for the Polish market,
- a different point of view of Polish society for the European trend of perceiving electric scooters,

- the results of research on the safety and reliability of scooters, which are overlooked in scientific research,
- results that may be the basis for making decisions by local authorities on further actions in the field of scooter-sharing restrictions,
- results that may form the basis for further research on scooter-sharing services in Europe.

The work has been divided into five sections. Section 1 presents the general scope of the article. Section 2 is devoted to the adopted research methodology. Subsequently, Section 3 presents the results of the analysis. Section 4 provides a discussion of the results, and Section 5 consists of a summary, further research plans, and limitations.

The article provides support for local and national authorities when making decisions in the field of possibly limiting scooter-sharing services. In addition, it is a useful elaboration for operators wishing to develop services on the Polish market. Finally, the work is an interesting study for scientists, presenting an alternative view of scooter-sharing services among the society in Poland in relation to the current trends in banning electric scooters in cities.

2. Methodology

This chapter presents detailed information on the research sample, the study performed, the construction of the questionnaire, and the research methodology used.

In order to determine the perception of scooter-sharing services by system users in Poland, a four-part research plan was developed, which consisted of research conceptualization, survey development, data collection, and results analysis. A detailed research plan is provided in Figure 2. Individual stages are presented in Sections 2.1–2.3.

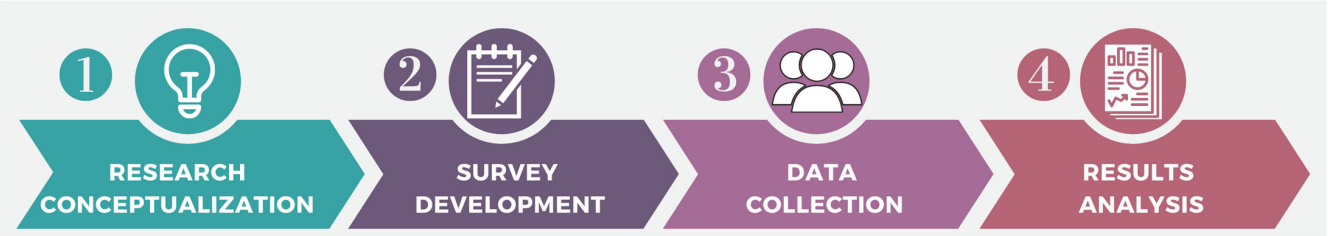

Figure 2. Research plan. Source: author's own elaboration.

2.1. Research Conceptualization, Survey Overview, and Questionnaire Design

An online survey was conducted to analyze issues that affect the perception of scooter-sharing services in Poland and to show factors related to the safety and operation of scooters that are of particular importance among system users. The study was aimed at active users of scooter-sharing systems in Poland. The research questionnaire was disseminated online, using the CAWI (Computer-Assisted Web Interview) technique, among forums of users involved in the scooter-sharing services. The CAWI method is currently gaining in popularity, particularly due to the ease of the distribution of interview questionnaires among respondents and the possibility of quick access to partial results of the investigation conducted [48], being currently the most widely used social research method and allowing researchers to reach the widest group of the population. Currently, 32 million Poles use the Internet, meaning 84.5% of the population is present in the digital world [49,50]. The CAWI method has many advantages, which include, among others [48–52]:

- a wide range of survey respondents, thanks to its availability on the Internet,
- ease of achieving the appropriate level of sample size and representativeness of the research sample,
- high anonymity, which allows us to also collect answers to sensitive questions—no influence of the interviewer,

- a convenient date for completing the survey and the ability to stop and return at a convenient time,
- the ability to complete the survey on a mobile device, e.g., a smartphone or tablet,
- the ability to view the implementation of the study on an ongoing basis,
- easy sharing of the survey,
- low cost of research,
- possibility of precise targeting of research to narrow target groups,
- automated mailing of invitations to the study,
- the ability to insert filtering questions,
- quick access to data and the possibility of quick analysis thanks to data in electronic form,
- the ability to reach people who would not let the interviewer in the house (as in the case of PAPI),
- the ability to reach people who do not have landline telephones or do not have time to talk on a mobile phone (as in the case of CATI).

The universality of the method allows it to be widely used in many areas of science. In the field of transport, research was carried out using the CAWI method on, among others, promoting active mobility behavior by addressing information target groups: the case of Austria [53]; analyses on urban transport in the aftermath of the COVID-19 outbreak: data from 20 cities in Europe [54]; analysis on mobility data across the European Union [55]; analysis of mobility patterns and the intended use of shared mobility services in the Barcelona region [56]; determinants of sharing mobility in Italy [57]; shared micromobility service quality assessment [58].

In the analyzed case study, the CAWI method allows us to reach scooter-sharing systems users throughout the country. In the case of the sample selection, the focus was on the arbitrary, deliberate selection of the sample, thanks to which it was possible to reach only people who actually use scooter-sharing systems and can make reliable answers based on their experience. Purposeful sampling is widely used in qualitative research for the identification and selection of information-rich cases related to the phenomenon of interest [59].

2.2. Data Collection and Description

The survey period covered the period from 2 December 2022 to 2 April 2023. A total of 1203 people participated in the survey, of which 1080 responses were included in the analysis. A total of 123 responses were rejected due to incomplete responses.

The questionnaire consisted of 30 closed and open questions divided into three parts. The first part was devoted to a respondent's sociodemographic characteristics, covering issues such as gender, age, professional situation, education, marital status, and household income.

The second part of the survey was devoted to questions related to the details of using scooter-sharing services. This covered issues such as the frequency of use of systems, the purpose of travel, the place where scooter-sharing services are used, and the length of routes covered with the use of scooters.

The third part of the survey was a major part of the research. It was dedicated to operational, technical, and safety aspects of using scooter-sharing systems. Firstly, it includes questions connected to infrastructure and parking spaces issues, mobile application problems, vandalism penalties, and laws issues. Secondly, it also consist of questions connected to scooter-sharing safety, as well as an assessment of the level of safety by users. Furthermore, this part of the survey also referred to issues related to the technical condition of the scooters available in the systems. Thirdly, it also consists of questions dedicated to the perception of scooter-sharing systems including the size of the available fleet, the level of knowledge of the public about traveling on scooters, decisions regarding the use of systems, and suggestions from users as to the current state of services and their further development.

A detailed questionnaire is provided in Appendix A.

2.3. Analysis Method

Due to the overwhelming number of questions in the questionnaire concerning issues expressed in a qualitative way, the Spearman rank correlation coefficient was used to describe the correlation strength of individual features [60]. Thanks to the use of Spearman's rank coefficient, it is possible to organize the received data and determine the strength of the relationship between these features. The coefficient (r_s) is used to examine the relationship between the obtained data, using the formula (1):

$$r_s = 1 - \frac{6 * \sum d_i^2}{n(n^2 - 1)} \tag{1}$$

where:

n—number of observations,
d_i—the difference between X and Y: RXi—RYi ranks.

Interpretation of the Spearman's coefficient value is determined by dependence (2):

$$r_s = \begin{cases} r > 0 => positive\ correlation \\ r = 0 => no\ correlation \\ r < 0 => negative\ correlation \end{cases} \tag{2}$$

A positive correlation means that when the value of the X feature increases, the value of the Y feature increases. A negative correlation means that in the case of an increase in the value of the X feature, the value of the Y feature decreases. No correlation means that there is no statistical relationship between the features. The specific value of the (r_s) factor also indicates the strength of the correlation (3):

$$|r_s| = \begin{cases} 0 < r_s \leq 0.2 => very\ weak\ correlation \\ 0.2 < r_s \leq 0.4 => weak\ correlation \\ 0.4 < r_s \leq 0.6 => moderate\ correlation \\ 0.6 < r_s \leq 0.8 => strong\ correlation \\ 0.8 < r_s \leq 1 => very\ strong\ correlation \end{cases} \tag{3}$$

Unlike other methods, Spearman's correlation coefficient also indicates the direction of the dependence of the significance of features. Furthermore, its advantage is also that it is not as sensitive to outliers and does not require a normal distribution [61]. The method was used since the answers obtained from the survey results (data) do not meet the conditions of Pearson's correlation analysis, which would allow the study of the strength of the rectilinear relationship between two variables measured with a numerical scale [62–64].

3. Results

This section presents the results of the study. The results are presented corresponding to the individual sections of the survey. Detailed answers of the respondents were presented in the form of tables, charts, and text form if they were concerned with closed questions.

3.1. Sociodemographic Characteristics of the Sample

Based on the first part of the completed survey, detailed information was determined on the respondents who participated in it. The study involved 1080 people, consisting of 881 men and 199 women. The detailed distribution of respondents is presented in Figure 3.

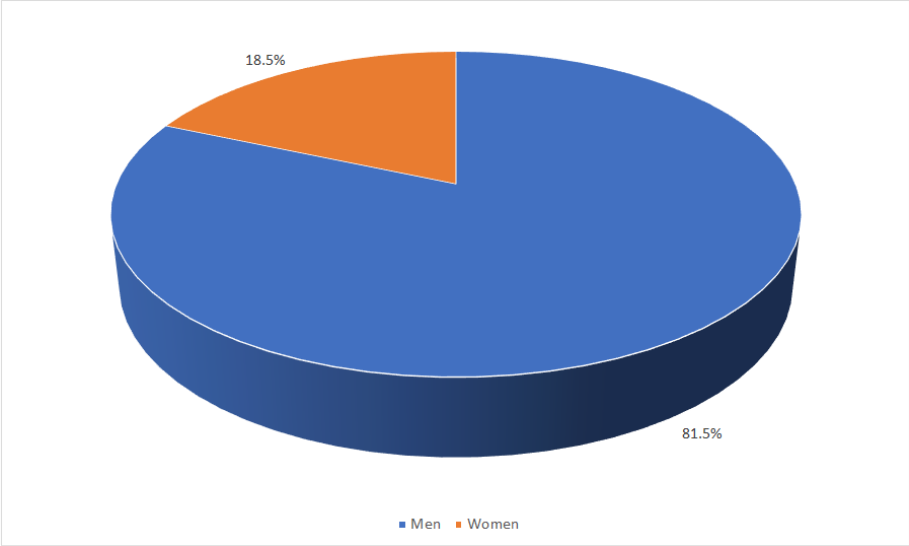

Figure 3. Respondents who participated in the study. Source: author's own elaboration.

The respondents comprised seven social groups in the appropriate age ranges, details of which are presented in Figure 4.

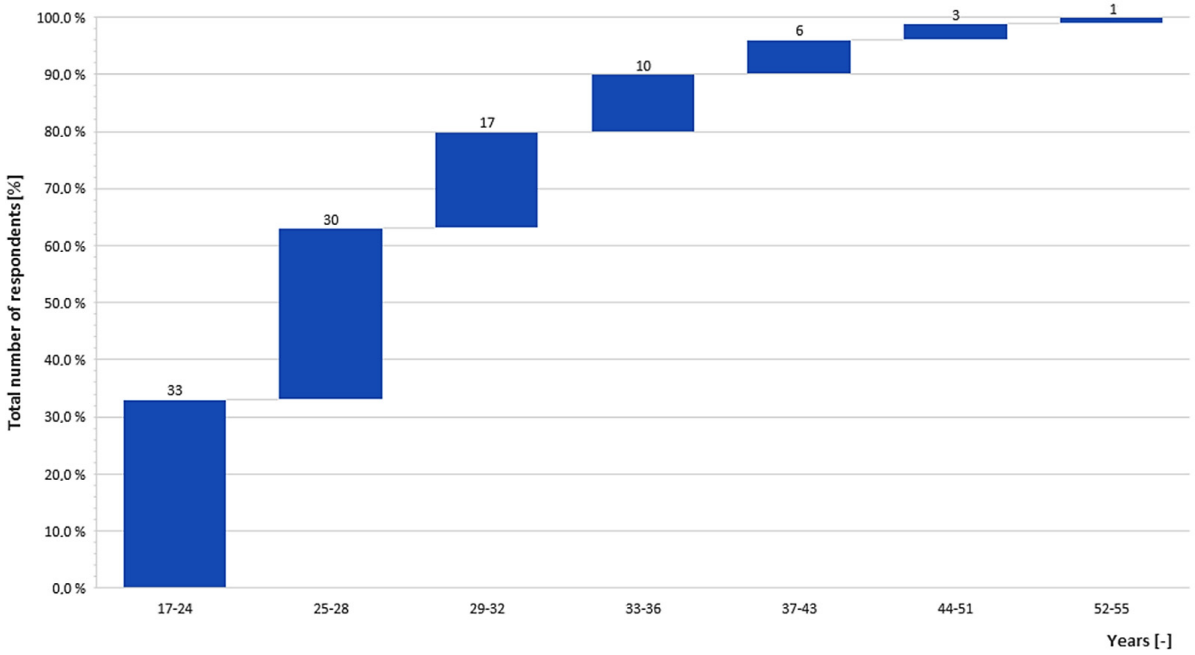

Figure 4. Age groups of respondents participating in the study. Source: author's own elaboration.

The results indicate that the most frequent users of scooter-sharing in Poland are young people aged 17 to 28. The smallest number of users are people over the age of fifty. People older than 55 years were not recorded in the study, which may indicate that not as many people of this age use scooters, as they do not participate in internet forums dedicated to scooter-sharing where information about the study was disseminated.

Subsequently, Table 1 presents detailed information on the socio-demographic aspects of the respondents who took part in the study.

Table 1. Sociodemographic aspects related to respondents.

Feature	Number of Respondents [-]	Number of Respondents [%]
Domicile		
Village	60	5.6%
City up to 50,000 inhabitants	20	1.9%
City up to 100,000 inhabitants	39	3.6%
City up to 250,000 inhabitants	41	3.8%
City over 250,000 inhabitants	920	85.2%
Professional situation		
Learning	460	42.6%
Working	500	46.3%
Unemployed	30	2.8%
Pensioner	11	1.0%
Learning and working	79	7.3%
Family status		
Bachelor/Maiden	960	88.9%
Married	99	9.3%
Divorced	21	1.8%
Monthly earnings		
Up to PLN 1500	178	16.5%
PLN 1500–PLN 2500	51	4.7%
PLN 2500–PLN 4500	496	45.9%
over PLN 4500	355	32.9%
Education		
Basic	70	6.5%
Junior high school	150	13.9%
Basic vocational	10	0.9%
High school	470	43.5%
Higher	380	35.2%

Source: author's own elaboration.

3.2. Using Scooter-Sharing Services

The second part of the completed survey was devoted to the aspects of using scooter-sharing systems by the respondents. First, it was determined which of the Polish cities' respondents used scooter-sharing services. The results show that 35.7% of respondents used services in Warsaw, 16.2% of respondents used the scooter-sharing system in Wrocław, 17.2% in Cracow, 12.4% in Poznań, 12% in Katowice, and 6.5% in Katowice. Detailed values are presented in Figure 5.

The frequency of using scooter-sharing systems by users was then determined. It was indicated that 35.4% of respondents use systems every day, 28.4% once a week, 19.3% a few times a week, 6% once a month, 9.2% several times a month, 0.4% once a year, and 1.3% several times a year. Detailed data are presented in Table 2.

Table 2. Frequency of using scooter-sharing systems by respondents.

How Often Do You Use Scooter-Sharing Services?	Number of Respondents [-]	Number of Respondents [%]
Every day	382	35.4%
Once a week	306	28.4%
A few times a week	208	19.3%
Once a month	65	6.0%
Several times a month	99	9.2%
Once a year	5	0.4%
Several times a year	15	1.3%

Source: author's own elaboration.

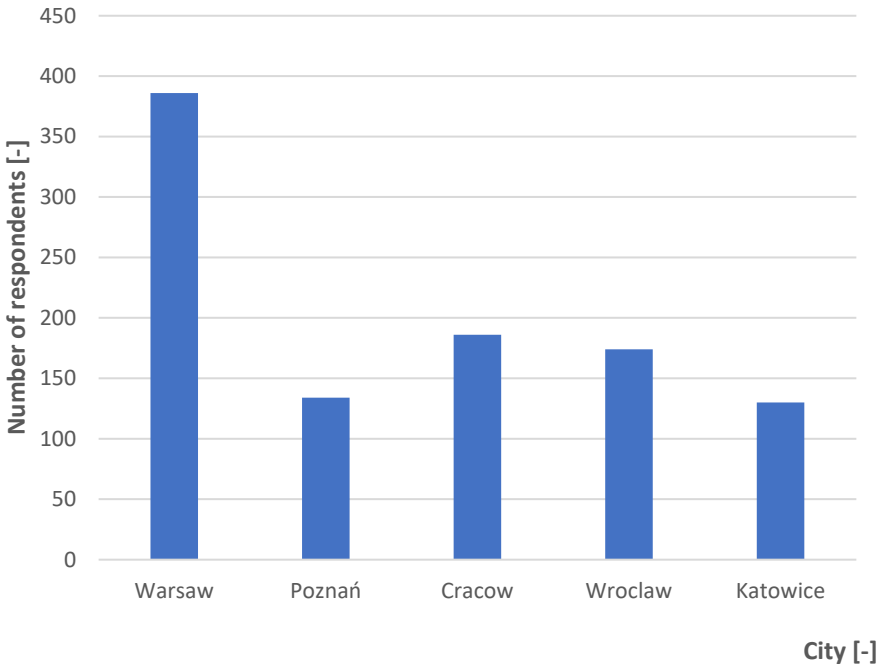

Figure 5. Cities where respondents use scooter-sharing systems. Source: author's own elaboration.

Then, the distances covered by users using scooters from scooter-sharing systems were checked. The results were for single daily trips. It was determined that 48.6% covered distances up to 300 m, 32.7% up to 500 m, 11.5% from 1 km, 4.9% up to 2 km, and 2.3% over 2 km. Detailed data are presented in Table 3.

Table 3. Average distances covered by respondents during a single ride on scooters with scooter-sharing.

What Is Your Average One-Time Distance Traveled with a Scooter-Sharing Scooter?	Number of Respondents [-]	Number of Respondents [%]
Up to 300 m	525	48.6%
Up to 500 m	353	32.7%
Up to 1 km	124	11.5%
Up to 2 km	53	4.9%
Over 2 km	25	2.3%

Source: author's own elaboration.

The next step was to indicate travel destinations using scooters from scooter-sharing. It was indicated that 12% of respondents use scooters to travel to/from work, 14% traveling to/from school/university, 11% traveling to/from shopping, 14% traveling to/from entertainment venues, e.g., to/from the cinema, or to participate in a mass event, e.g., a concert, a match; for restaurants, cafes, etc. Furthermore, 23% of the respondents used scooters only for testing, because they wanted to check how the service works, 24% of respondents used the system for fun, and 2% of respondents used scooters to travel to tourist attractions, for example, to/from an exhibition or to/from a museum. Detailed data are presented in Table 4.

Subsequently, it was checked whether trips using scooter-sharing are part of other travel chains. The results show that 53.9% of the respondents used public transport and scooters when traveling. In turn, 11.6% used their own car and scooter, 17.6% of participants used other sharing services, e.g., bike-sharing/car-sharing and scooters, 3.7% used scooter-sharing with their own bike and scooter, 2.8% used a taxi and a scooter, 7.4% used Uber and scooters, and 3% do not use combined transport services with scooter-sharing. Detailed results are presented in Table 5.

Table 4. Destination goals of respondents' trips on scooters from scooter-sharing systems.

Destination	Number of Responses [-]	Number of Responses [%]
Travel to/from work.	310	12%
Traveling to/from school/university.	370	14%
Shopping trip.	290	11%
Traveling to/from places of entertainment	360	14%
For testing	610	23%
Just for fun.	620	24%
Touristic	90	2%

Source: author's own elaboration.

Table 5. The complexity of travel chains of respondents using scooter-sharing systems.

	Number of Responses [-]	Number of Responses [%]
Travel combined with public transport	582	53.9%
Traveling with own car	125	11.6%
Travel combined with other sharing systems	190	17.6%
Combined trip with own bicycle	40	3.7%
Trip combined with a taxi	30	2.8%
Combined trip with Uber	80	7.4%
No	32	3.0%

Source: author's own elaboration.

3.3. Infrastructure and Parking Spaces

First, they were asked about their opinion on the need to lay out a special separated infrastructure in the form of a special type of path for scooters. According to 51.4% of the respondents, scooters should have a dedicated infrastructure to move around, while 48.6% believe that it is not necessary.

Staying on the topic of infrastructure, the question about parking issues regarding scooters was asked. Respondents were asked about the need to park scooters in specific places (scooter parking lots) or leave them anywhere in the city. The results show that 27.8% of the respondents believe that scooters should have their own parking spaces, while 72.2% believe that scooters should be generally available in the city without indicating specific parking spaces. Subsequently, the respondents were asked to indicate whether places where parking scooters should not be allowed in public spaces. According to 53.7% of the respondents, places that are not allowed to park should be indicated. In turn, for 46.3% of the respondents, such bans should not be introduced.

3.4. Scooter Vandalism, Penalties, and Law

Another of the thematic groups considered during the analysis was the perception of the technical condition of scooters and vandalism issues related to vehicles available in Polish scooter-sharing systems. First, it was determined whether users encountered a situation where the scooter that was available in the application was not available in a given location. The results indicate that 49.5% encountered such a situation, while in the case of 50.5% of respondents, such a situation did not occur.

Subsequently, it was decided to check whether the respondents had the opportunity to encounter a scooter that was subjected to an act of vandalism. The results show that 61.1% of the respondents encountered this type of damage in scooters, while 38.9% did not report this situation. Concerning acts of vandalism, respondents were asked about their opinion on the introduction of penalties for people who damage scooters. According to the respondents, 88% are in favor of introducing penalties, 5.6% are against it, and 6.5% have

no opinion. Since penalties could also apply to other violations, we asked their opinion on the introduction of penalties for improper parking of scooters that could threaten the safety of other unprotected road users or vehicles. The results show that 72.2% of respondents are in favor of introducing such penalties, 13% of respondents were against the solution, and 14.8% have no opinion on this subject.

From the point of view of regulations regarding the use of scooter-sharing, it was also asked whether the current law governing scooter-sharing is appropriate or whether it should be updated. The results indicate that 65.5% believe that the current law should be updated. According to 7.8% of respondents, the current law is sufficient, and 6.5% have no opinion on this topic.

3.5. Scooter-Sharing Safety

The results of the responses received from the respondents indicate that 80% of people consider travelling with the use of scooters as safe. The level of safety of scooter use was determined using the Likert scale, indicating values from 1 to 5, where 1 is rated very dangerous and 5 as very safe, mainly determined at level 4 or 5. Detailed data are presented in Figure 6.

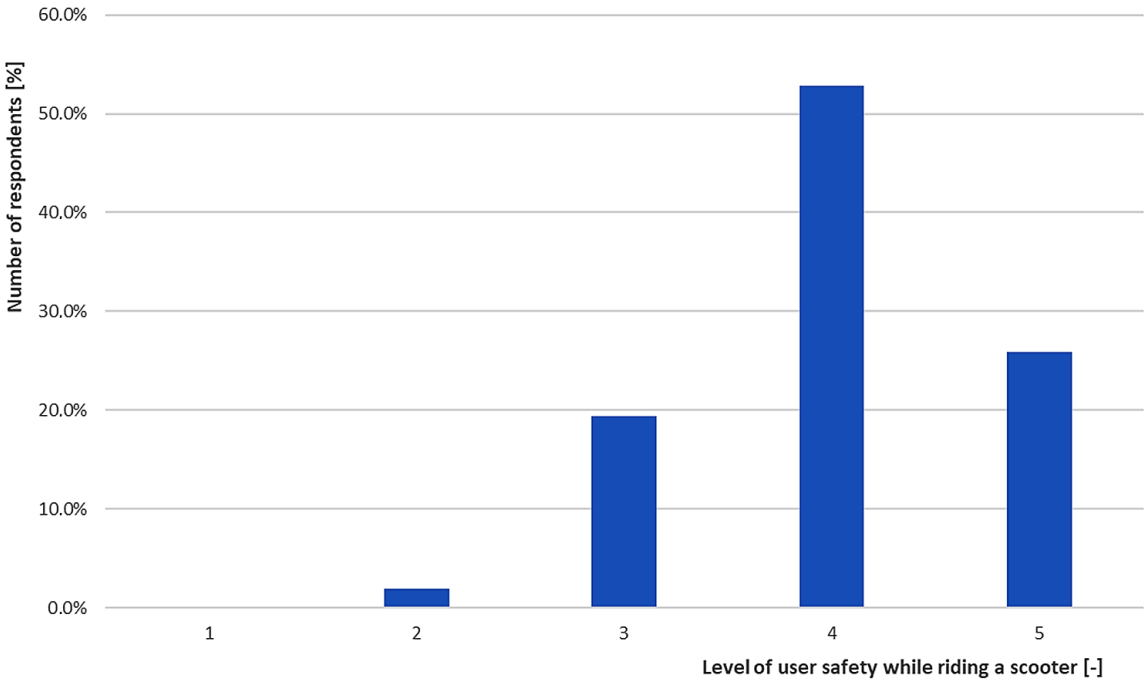

Figure 6. The level of safety when traveling by scooter. Source: author's own elaboration.

Since the safety of using vehicles is closely related to the technical condition of vehicles, the next question focused on determining whether users, while using scooter-sharing, encountered a scooter that was in poor technical condition, e.g., with damaged vehicle elements. According to the respondents, 70.4% encountered a vehicle in poor technical condition while renting scooters, while 29.6% did not notice such a problem. The persons who indicated a poor technical condition were asked to specify the technical problems they found in terms of the technical condition of the vehicle. Detailed opinions of the respondents are presented in Table 6.

Table 6. Identified problems related to the technical condition of scooters from scooter-sharing systems.

Opinion
"No acceleration."
"No response to the throttle grip."
"Several times it happened that the scooters did not want to move after unlocking."
"Sudden shutdown of the scooter repeated throughout the rental period."
"Scooter didn't want to go."
"Vehicle braking unexpectedly."
"Unexpected shutdown."
"Wheel lock."
"During one of the runs the brakes were not properly adjusted—they were too weak."
"Battery discharged in the middle of the road."
"No working front light."
"The battery is not charged even though it says it is fully charged."
"Missing or loose screws securing various components."
"Movable steering wheel."
"Suddenly, the battery level dropped to zero and the scooter stopped."
"No drive."
"Mainly damage to the steering wheel (looseness)."
"Brake not working."
"Uncharged battery"
"Automatic shutdown"
"The engine didn't work."
"The battery drained faster than I expected."
"The bell didn't work."
"The bell was turning off."
"Damaged after 30 s, it lost power and had no electricity, although the application showed information about the battery being fully charged."
"Damaged gas or brakes, broken elements, e.g., plastics."
"The scooter turned off."
"Battery problems."

Source: author's own elaboration.

In trying to determine the comparison of the technical condition of scooters in Polish scooter-sharing systems, we asked about the condition of scooters concerning vehicles used in other countries. According to the respondents, 66.7% do not have an opinion on this subject, 25% of the respondents indicate the worse condition of the scooters, while 8.3% believe that the condition of the scooters in Poland is better.

3.6. Perception of Scooter-Sharing Systems in Poland

When determining the perception of scooter-sharing systems in Poland, the focus was first on determining the opinion of the respondents regarding the size of the fleet of vehicles available in the systems.

Detailed data are presented in Table 7.

Table 7. Opinion of respondents on the size of the fleet of vehicles used in scooter-sharing systems.

Is the Current Number of Scooters Available in Cities:	Number of Respondents [-]	Number of Respondents [%]
Too small.	404	37.4%
Optimal	586	54.2%
Too big	60	5.6%
I don't know	30	2.8%

Source: author's own elaboration.

Subsequently, the focus was on indicating what, according to the respondents, is the general level of education on traveling on scooters in Poland. Respondents indicated that

47.2% believe that the level of knowledge about scooter travel is insufficient, 39.8% believe it is sufficient, and 13% of the respondents have no opinion on this subject. To specify the answers, the persons who stated that the level of knowledge is too low were asked for a more precise answer as to how, in their opinion, the level of knowledge should be increased. Detailed responses are presented in Table 8.

Table 8. Educational activities aimed at raising the level of knowledge about the use of scooters in the scooter-sharing system.

Opinion
"Schools should teach scooter handling."
"Cities should train their citizens."
"Scooter companies should provide instruction on how to ride."
"There should be a subject in school dedicated to using different means of transport."
"Driving license courses should also teach about scooters."

Source: author's own elaboration.

The penultimate aspect was to check whether respondents remain faithful to scooter-sharing systems regardless of the costs of other shared mobility services. For this purpose, it was asked whether the costs of all sharing services are the same per minute of travel, and if a given respondent would need to move to the city center, to decide which of the shared mobility services would be the first choice. Detailed answers are presented in the form of Figure 7.

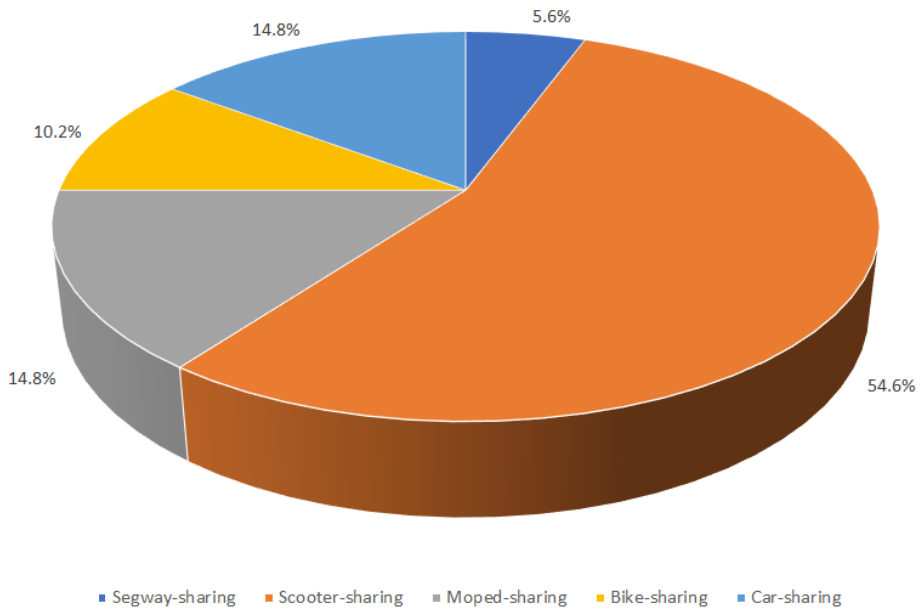

Figure 7. The first choice in shared mobility services. Source: author's own elaboration.

The last aspect was asking the respondents to indicate their suggestions on scooter-sharing services. Detailed opinions are presented in Table 9.

Table 9. User opinions about scooter-sharing systems operating in Poland.

Thematic Scope	Opinion
Fleet issues	*"More generations of scooters are needed. Current models are too heavy and not comfortable."*
	"The new scooter model is too big. I don't feel safe on it. The first was better."
	"Better brake and education on how not to use them."
Economic issues	*"Too high prices for using the systems."*
	"A little cheaper, now it's too expensive."
	"The initial fee is way too high."
	"Lower prices."
	"Cheaper please. It is also worth to mention that the subscription and promotional codes last longer as long as the system is disabled, e.g., *in situations when it is snowing and the system is suspended and the codes or subscription are forfeited."*
	"The price should be drastically reduced. Uber is cheaper..."
	"They are too expensive to rent. Going home from school on a scooter or a bicycle (bike-sharing) takes me a similar amount of time, but I have to pay over PLN 10 for a scooter and PLN 1 for a bicycle, and it happens that I will make it within this free limit and pay nothing. The conclusion is that renting scooters is unprofitable, especially since much cheaper bikes give more satisfaction from riding a certain distance."
	"Scooter rental should be cheaper."
	"Refund for renting a defective scooter."
	"A lower price would be nice, and above all, free unlocking."
	"The prices are definitely too high (not for Polish earnings), PLN 3 starting fee + PLN 0.50 for each minute is unprofitable when I have 8 km one way to work, which is why I decided to buy my scooter. For this money, someone who doesn't care what they drive and just wants to move will rent a car with car-sharing and take an additional 4 people..."
	"The fee should be per kilometer, not based on time."
Areas of systems operation	*"Nice as if they were available in more districts of Warsaw, e.g., Bielany closer to Młociny, these districts are omitted."*
	"More districts."
Operational issues	*"What is missing from some operators is the ability to rent more (2–3) scooters by one user."*
	"There should be no charge for the last minute because you can't use the phone on the scooter and when we go down, we take out the phone, unlock it and block the phone, it often takes about 30 s."
	"You can think about letting the user take such a scooter home and charge it himself, because unfortunately the main factor here is the battery. For example, I ride the scooter home in the evening, charge it overnight, and drive it to work in the morning. Only pluses, you don't have to look for where the scooter is and you can be sure that it is fully charged, so you can take it wherever you want."
	"Scooters are placed in places that make it difficult for pedestrians to move. The city looks cluttered. They look unsightly and, in addition, they make unpleasant sounds."
	"Scooters that are charged at home should not be visible or should be indicated so."
Legal issues	*"Regarding the questions about liability for improperly leaving the scooter: the idea is right, but not feasible, because in its current form it is impossible to determine whether the user parked/damaged the scooter incorrectly or it was done by a bystander."*
	"Financial penalties are a very important issue. I put the scooter down correctly and in 5 min some teenager or a drunk guy will come and destroy it? What if there are no cameras here? Will I be responsible for this?"
	"It would be nice to be able to ride on bike paths."
	"Riding scooters without a helmet should be prohibited. Also driving under the influence of alcohol. Fines for non-compliance enforced by the police."
	"No clear legal rules."

Source: author's own elaboration.

4. Discussion

To determine the correlation between the responses to individual questions, Spearman's analysis was performed to calculate the value of the rank correlation coefficient (r_s). Due to the qualitative nature of the variables, it would not be possible to apply the Pearson correlation analysis. The analysis confirmed the statistical correctness of the performed research. Detailed data on the rank coefficient values are presented in Appendix B (Table A1). The highest values of the rank correlation coefficient r_s were determined for pairs of ques-

tions concerning the purpose of the journey and open-ended questions. The highest values of the rank correlation coefficient (r_s) were determined for pairs of questions concerning the purpose of the journey and open-ended questions.

In the analyzed study on the perception of scooter-sharing services in Poland, the overwhelming majority of respondents, 81.5%, were men. Women constituted 18.5% of the respondents. This situation is consistent with the global trend of using scooter-sharing systems, which states that it is mainly men who are users of the systems. This is emphasized both in the reports published by scooter-sharing operators [65] and in the results of research conducted for other urban centers, for example, Portland, USA, Paris, France, or San Francisco, USA Populus [66–68].

The data obtained as part of the survey indicate that respondents primarily use scooter-sharing services in large cities with a population of over 250,000. The respondents are people who work or study.

Considering the results obtained in terms of infrastructure requirements, it is worth emphasizing that the respondents do not have a specific opinion. The results indicate that 51.4% are in favor of implementing a special type of infrastructure for scooter mobility, while 48.6% consider this issue unnecessary. Discrepancies in this matter may result from difficulties in interpreting the road traffic regulations in force in Poland. Currently, electric scooters can be used on bicycle paths. The maximum speed allowed for a scooter on a bike path or street is 20 km/h. The regulations specify that if there is no separate road for bicycles, the scooter can enter the driveway. When there is no bicycle path and the speed on the road is higher than 30 km/h, the user can enter the pavement. When using a footpath or footpath, the user must drive only at a walking speed [69].

The complexity of these issues and, above all, the insufficient number of bicycle paths may be, firstly, incomprehensible to users and problematic when deciding on which part of the infrastructure traveling is correct. Literature shows that e-scooter users are willing to cover longer distances to ride on bicycle paths or multifunctional paths [70].

An interesting aspect is the approach of users to parking scooters. The results show that for most of the respondents (72.2%), parking should not be performed in specially designated places. The conclusion is that users choose scooter-sharing services because of the freedom offered by free-floating parking. It should be noted that this proposal is inconsistent with the initiatives currently being carried out in the form of creating mobility hubs or parking spaces for scooters, which would arrange their cities [71–73]. Considering the results obtained, it is important that the authorities who want to organize scooter-sharing in such a way, as well as limit the places where scooters can be parked, should check the users' opinion on this subject so as not to mistakenly discourage them from using the services.

Taking into account the results obtained from the point of view of the availability of the scooter at the location indicated in the application, almost half of the respondents experienced such a situation. This type of problem may be related to, for example, the occurrence of technical problems with the vehicle's GPS, theft of the vehicle, the devastation of the vehicle, or taking the scooter from a private space to which a common person will not have access, e.g., to a private property or a private apartment. These are issues that are widely discussed in the scientific literature and relate to issues directly affecting the operational management of scooter-sharing services. Vandal acts against scooters are also visible among users, as 61.1% of them emphasized that they had the opportunity to encounter a vandalized scooter in an urban space. What is more, it should be emphasized that scooters are also often tipped over. An example of a damaged and scattered scooter is shown in Figure 8.

To reduce the problems associated with the devastation of scooters, the respondents unanimously emphasize that the law should regulate a system of penalties related to improper use of scooters. It should be emphasized that currently, despite the amendment of the Road Traffic Law Act as of 1 January 2022, and the regulation of fines for speeding on scooters, driving illegally, or after drinking alcohol, there is no clear scale of fines for

damage scooters [74]. These types of issues are also not regulated by other legislation related to scooter-sharing—the Electromobility Act, which mainly defines what a scooter is [75]. The implementation of this type of penalty and the updating of the current law are emphasized as needed by the respondents, which is a very important conclusion for the current legislators.

Figure 8. Vandalized and scattered scooters. Source: author's own elaboration.

When analyzing the comments received as part of the open questions, the importance of technical issues regarding electric scooters should be emphasized. Analyzing the answers, it can be concluded that, according to the respondents, the use of scooters is considered safe, and 80% of the respondents rated the systems as safe or very safe. Despite the high security, the respondents unanimously emphasize that the systems contain scooters that are in poor technical condition, which is consistent with the result of Spearman's rank correlation. Moreover, analyzing the detailed answers of the respondents in terms of technical aspects with which problems were encountered, there are several common problems, including issues related to the scooter battery, brakes, steering wheel, or unexpected engine shutdowns. However, the study does not allow us to determine whether, according to the respondents, the condition of scooters available in Poland is worse, because the majority of respondents have no opinion on this subject.

However, it is worth emphasizing that the respondents pointed out various aspects of irregularities in the technical condition of vehicles, which may be related to the fact that technical inspections of scooters, which are used, for example, in Germany, are not carried out on the Polish market. The application of such a requirement, as compared to inspections of the technical condition of motor vehicles, which are carried out every year, would certainly avoid many problems affecting both the safety of vehicles and the safety of their users. This is a very important issue, especially since scooters are mainly used by young people, often inexperienced in using electric vehicles. Furthermore, it is worth emphasizing that the results indicate a very frequent use of scooters for fun or testing. Such trips may not only have a negative impact on the safety of users, but also translate into poor technical condition of vehicles that are often not used properly, e.g., several people riding one scooter, excessive load on the vehicle battery, and incompetent braking. The need for research on linking travel destinations and the technical condition of vehicles is also

emphasized by other scientists, e.g., Nikiforiadis et al. and Heydari et al., who performed research in Greece and the United Kingdom. This, therefore, proves the wide scale of the problem at the international level [76,77].

The last of the thematic groups of the study was to determine the perception of scooter-sharing systems existing in Poland. According to the majority of the respondents, the number of vehicles available in fleets is optimal, resulting in the high interest of users in using vehicles.

Almost half of the respondents assess the knowledge about traveling on scooters represented in Polish society as insufficient, thus emphasizing that additional training on scooters in schools should be paid attention to. What is more, the respondents emphasize that a good solution would also be to provide education about riding scooters during driving license courses. The respondents also emphasize that additional training campaigns offered by operators of shared mobility systems would also be useful.

It is worth emphasizing that the respondents of the survey are people faithful to scooter-sharing systems, who, even if other shared mobility systems were available, would still use scooter-sharing among other shared mobility opportunities offered.

The last of the results obtained from the survey were opinions on the functioning of scooter-sharing systems. The results show that most opinions are devoted to economic issues. The respondents emphasize that these systems should be cheaper to be a real alternative to other forms of transport. The issue of too high prices of scooter-sharing services is also emphasized in industry reports. Boston Consulting Group indicated that to build critical mass, providers will need to offer promotional discounts, which will drive up their customer acquisition costs. However, this emphasizes that oversupply might necessitate price cuts and trigger a price war [78].

Respondents also point to issues related to the fleet, emphasizing aspects that relate to the comfort and safety of using scooter models, size, brakes, and weight. Based on this type of guidance, it can be concluded that operators should focus on reviewing whether the current fleet meets customer expectations, and on this basis, consider a possible replacement or diversification of the vehicle fleet.

The respondents also emphasize that although the number of vehicles in the systems is generally considered optimal, scooters should be available in more districts. This indicates the need to monitor the scope of system operation by operators.

Respondents also point to factors that would improve the functioning of the systems, emphasizing, for example, that a convenient solution would be the possibility of renting several scooters by one person. This type of solution is a chance for greater popularization of services, including among people who are not users of a given application. Another suggestion is to revise the charging period, providing free time before the start of renting a vehicle to check its technical condition or prepare for driving, and after the end of the rental. Such solutions are used in the case of car-sharing services, so their implementation in scooter-sharing systems should not be problematic. Moreover, it is worth emphasizing that this conclusion indicates the need to draw good practices from other mobility-sharing systems, which would be even more common when applying the concept of open business innovation, which is also emphasized in the literature [79,80].

5. Conclusions

In conclusion, the research carried out allowed us to achieve the research goal in the form of determining the perception of scooter-sharing services by people using the services. Research shows that respondents' opinion about the services is good. Respondents willingly and often use the services, treat the fleet of vehicles as optimal, and point to the use of services for everyday trips. Moreover, respondents are willing to stay with scooter-sharing services even if other scooter-sharing services are at the same price. The study allowed the development of the following conclusions in the field of scooter-sharing in Poland, which can be valuable tips for operators and city authorities who want to properly manage systems operating in cities:

(1) Despite the perception of the level of safety when using scooters as high, the fact of the technical condition of these vehicles is overlooked, among which users indicate numerous faults that may translate into safety issues when riding a scooter.
(2) The freedom to park scooters in the city is a very important factor in the development of the systems. The imposition of indicated parking spaces may translate into a reduction in demand for the use of services.
(3) Increasing the number of bicycle paths on which scooters will be able to move and defining specific provisions regarding bans on riding in specific infrastructural areas are necessary for the proper development of the systems.
(4) The current law applicable to scooters is insufficient. It is important to develop more detailed regulations, not only in the field of infrastructure and rules of movement on public roads or sanctioning damage.
(5) Devastation is visible among the scooters available in the systems, and sanctioning damage to equipment is considered necessary.
(6) Checking the technical condition of scooters in the form of annual tests at the Vehicle Inspection Station would allow for avoiding many technical problems, and as a result, would increase the safety of users.
(7) The level of education on scooter mobility is considered insufficient. The possibility of increasing the level of knowledge through the implementation of additional education in the field of scooters in primary schools and during driving license courses is suggested.
(8) Scooter-sharing services available in Poland should be less expensive for users and should also draw on good practices available in other shared mobility systems.
(9) Frequent scooter-sharing users in Poland are men, with a very small percentage of women; moreover, among the purposes of scooter-sharing, it is very common to use services only for fun or for testing, which proves the need to implement broader educational activities and popularize alternative forms of mobility by system operators or city authorities.
(10) Compared to other European centers where electric scooters are criticized, the study shows great trust in the systems and willingness to use them even if other shared mobility systems, such as car-sharing, were at the same price.

To sum up, analyzing the results obtained for the Polish market, it can be said that despite the general trend of development of electric micromobility, its advantages and disadvantages cannot be generalized to all countries at the same time. Therefore, it is advisable to carry out further research on the perception of scooter-sharing in other countries to obtain, for example, a European service database, because the results can vary dramatically. This is especially important in the era of plans to develop electromobility in Europe. Unlike other urban centers, scooters gain a good opinion from the public. This is especially important in the era of actions to stop the operation of scooters, which are already being undertaken in some urban centers.

Like any scientific work, this one also has limitations. The main limitation of the article is the focus only on a group of people who have been involved in scooter-sharing systems so far. The work does not consider the opinions on scooters of people who have not used the systems so far. Therefore, in future research, the authors plan to extend the research sample to people who have not used scooter-sharing systems so far to check their approach to the security of services and the functioning of systems in urban conditions. Moreover, considering the obtained research results, the authors plan to perform similar studies for other European Union countries to present a credible comparison of the perception of electric micro-mobility. Furthermore, based on the indicated respondents' technical problems encountered with scooters, the authors also plan to expand the diagnostics in this matter. In addition, due to the indication by respondents of an inadequate price for services in the system, the authors plan to focus in subsequent works on detailed financial analyses of Polish scooter-sharing concerning other forms of vehicle sharing, especially on electric vehicles. In addition, the authors of the work recommend that researchers dealing

with the perception of scooter-sharing by societies should perform detailed public opinion research, especially in countries where these services have been limited, which may be an interesting field for discussion on the development of micromobility and electromobility.

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Institutional Review Board Statement: According to our University Ethical Statement, following, the following shall be regarded as research requiring a favorable opinion from the Ethic Commission in the case of human research (based on document in polish: https://prawo.polsl.pl/Lists/Monitor/Attachments/7291/M.2021.501.Z.107.pdf (accessed on 21 March 2022): research in which persons with limited capacity to give informed or research on persons whose capacity to give informed or free consent to participate in research and who have a limited ability to refuse research before or during their implementation, in particular: children and adolescents under 12 years of age, persons with intellectual disabilities persons whose consent to participate in the research may not be fully voluntary prisoners, soldiers, police officers, employees of companies (when the survey is conducted at their workplace), persons who agree to participate in the research on the basis of false information about the purpose and course of the research (masking instruction, i.e., deception) or do not know at all that they are subjects (in so-called natural experiments); research in which persons particularly susceptible to psychological trauma and mental health disorders are to participate mental health, in particular: mentally ill persons, victims of disasters, war trauma, etc., patients receiving treatment for psychotic disorders, family members of terminally or chronically ill patients; research involving active interference with human behavior aimed at changing it research involving active intervention in human behavior aimed at changing that behavior without direct intervention in the functioning of the brain, e.g., cognitive training, psychotherapy psychocorrection, etc. (this also applies if the intended intervention is intended to benefit (this also applies when the intended intervention is to benefit the subject (e.g., to improve his/her memory); research concerning controversial issues (e.g., abortion, in vitro fertilization, death penalty) or requiring particular delicacy and caution (e.g., concerning religious beliefs or attitudes towards minority groups) minority groups); research that is prolonged, tiring, physically or mentally exhausting. Our research is not done on people meeting the mentioned condition. Any of the researched people: any of them had limited capacity to be informed, any of them had been susceptible to psychological trauma and mental health disorders, the research did not concern the mentioned-above controversial issues, the research was not prolonged, tiring, physically or mentally exhausting.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available upon request from the authors.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

I. Socio-demographic information

1. Year of birth

Own answer: ….

2. Sex

☐ Female
☐ Male.

3. Education level

☐ Basic
☐ Junior high school

- ☐ Basic vocational
- ☐ High school
- ☐ Higher

4. Domicile

- ☐ Village
- ☐ City up to 50,000 residents
- ☐ City up to 100,000 residents
- ☐ City up to 250,000 residents
- ☐ City over 250,000 residents

5. Professional situation:

- ☐ Learning
- ☐ Working
- ☐ Unemployed
- ☐ Pensioner
- ☐ Learning and working

6. Family status

- ☐ Bachelor/Maiden
- ☐ Married
- ☐ Divorced

7. Monthly earnings

- ☐ Up to PLN 1500
- ☐ PLN 1500–PLN 2500
- ☐ PLN 2500–PLN 4500
- ☐ Over 4500

II. Using of scooter-sharing systems

8. In which city in Poland did you use the scooter-sharing service?

Own answer:. . .

9. How often do you use scooter-sharing services?

- ☐ Every day.
- ☐ Once a week.
- ☐ A few times a week.
- ☐ Once a month.
- ☐ Several times a month.
- ☐ Once a year.
- ☐ Several times a year.

10. What is your average one-time distance traveled with a scooter-sharing scooter?

- ☐ up to 300 m
- ☐ up to 500 m
- ☐ up to 1 km
- ☐ up to 2 km
- ☐ over 2 km.

11. For what purpose did you travel with the rental scooter?

- ☐ Traveling to/from work.
- ☐ Traveling to/from school/university.
- ☐ Travel to/from shopping.
- ☐ Traveling to/from entertainment venues, e.g., to the cinema; in order to participate in a mass event, e.g., a concert, a match; for restaurants, cafes, etc.
- ☐ As a test, I wanted to check how the service works.
- ☐ Just for fun.

- ☐ Travel to tourist places, e.g., to an exhibition, to a museum.
- ☐ Own answer: . . .

12. Has it ever happened to you that traveling by scooter was one of several forms of transport chosen to get to a given place? For example, you used public transport and scooters, cars and scooters, etc.

- ☐ Yes, I have used public transport and scooters.
- ☐ Yes, I used my own car and scooter.
- ☐ Yes, I have used other sharing services, e.g., bike-sharing/car-sharing and scooters.
- ☐ Yes, I used my own bike and scooter.
- ☐ Yes, I used a taxi and a scooter.
- ☐ Yes, I have used Uber and scooters.
- ☐ No.

III. Operational, technical and safety aspects of using scooter-sharing systems

13. In your opinion, should scooters have specially separated infrastructure for riding, e.g., paths?

- ☐ Yes.
- ☐ No.
- ☐ I don't know.

14. In your opinion, should scooters be able to be returned in specific places or, as before, anywhere in the city?

- ☐ Yes, in certain "parking" locations.
- ☐ No, anywhere in the city.

15. In your opinion, should there be defined places where scooters are not parked, e.g., on pedestrian sidewalks, etc.?

- ☐ Yes.
- ☐ No.

16. Has it happened to you that despite the availability of the scooter in the application, it was physically not there?

- ☐ Yes.
- ☐ No.

17. Have you ever seen a vandalized scooter?

- ☐ Yes.
- ☐ No.

18. In your opinion, should a system of penalties for people who damage scooters be introduced?

- ☐ Yes.
- ☐ No.
- ☐ I don't know.

19. In your opinion, should a scale of fines be defined for people who would leave a scooter in an unauthorized place, thus introducing a threat to the traffic of other people, including pedestrians?

- ☐ Yes.
- ☐ No.
- ☐ I don't know.

20. In your opinion, should scooter movement around the city be defined by additional than current law?

- ☐ Yes.
- ☐ No.

☐ I don't know.

21. In your opinion, is it safe to move around using an electric scooter?

☐ Yes.
☐ No.
☐ I don't know.

22. Please rate the user's level of safety while riding the scooter, indicating the rating from 1 to 5, where 1—very dangerous, 5—very safe.

☐ 1
☐ 2
☐ 3
☐ 4
☐ 5

23. Have you ever used a scooter in poor technical condition, e.g., with damaged vehicle elements?

☐ Yes.
☐ No.

24. (If answer in question 15 was YES) What damage to the scooter have you encountered while using the services?

Own answer: . . ..

25. In your opinion, are the scooters available in Poland in a worse technical condition than abroad?

☐ Yes.
☐ No.
☐ I don't know.

26. Please assess the number of scooters in cities. Is the current number of scooters available in cities:

☐ Too small.
☐ Optimal.
☐ Too big.

27. In your opinion, is the level of public education on the use of electric scooters sufficient?

☐ Yes.
☐ No.
☐ I don't know.

28. (If answer in question 19 was NO) What kind of educational activities targeted at which social groups are needed?

Own answer: . . ..

29. Assuming that the costs of all sharing services are the same per minute of travel, and you need to move in the city center, please decide which of the shared mobility services would be your first choice?

☐ Car-sharing.
☐ Bike-sharing.
☐ Scooter-sharing.
☐ Moped-sharing.
☐ Segway-sharing.

30. A place for your suggestions related to scooter sharing:

Own answer: . . ..

Appendix B

Table A1. Spearman's rank correlation coefficient table.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
Q1	1.000	0.011	0.715	0.155	0.570	0.568	−0.394	0.043	0.075	0.017	−0.134	−0.314	−0.082	0.103	−0.011	−0.067	−0.135	−0.026	0.027	0.091	0.051	0.138	0.178	−0.005	−0.115	0.013	0.035	−0.307	0.127	−0.128
Q2	0.011	1.000	0.125	0.012	0.001	−0.154	0.094	−0.037	0.088	−0.094	−0.014	−0.069	−0.046	−0.063	−0.083	−0.117	−0.004	0.098	−0.05	−0.175	0.336	0.181	0.234	−0.165	−0.101	−0.204	−0.075	−0.235	−0.047	−0.393
Q3	0.715	0.125	1.000	0.104	0.491	0.385	−0.209	−0.086	−0.053	0.073	−0.204	−0.367	−0.018	−0.05	−0.02	−0.17	−0.059	−0.012	−0.034	0.046	0.106	0.124	0.16	0.015	−0.063	−0.063	−0.123	−0.199	0.016	−0.228
Q4	0.155	0.012	0.104	1.000	0.077	0.156	−0.025	0.101	−0.023	0.043	−0.029	0.187	0.038	0.003	0.065	−0.002	0.188	−0.036	0.032	−0.021	0.152	−0.06	0.029	0.353	0.189	−0.078	−0.04	0.079	0.048	0.127
Q5	0.570	0.001	0.491	0.077	1.000	0.504	−0.243	0.002	−0.111	0.089	−0.089	−0.297	−0.06	0.152	0.178	0.035	0.067	−0.009	−0.025	0.215	0.16	0.023	0.061	0.267	0.061	−0.124	0.084	−0.058	0.019	−0.007
Q6	0.568	−0.154	0.385	0.156	0.504	1.000	−0.206	0.019	0.04	0.092	−0.154	0.055	0.012	0.114	0.039	−0.153	−0.084	−0.179	−0.044	−0.01	−0.041	0.007	0.128	0.332	0.06	−0.002	−0.057	0.091	0.006	0.151
Q7	−0.394	0.094	−0.209	−0.025	−0.243	−0.206	1.000	−0.045	0.01	−0.104	0.037	0.15	−0.088	−0.122	−0.27	−0.105	−0.103	0.048	−0.09	−0.083	0.169	−0.186	0.021	−0.06	0.023	−0.013	−0.134	0.434	−0.018	0.245
Q8	0.043	−0.037	−0.086	0.101	0.002	0.019	−0.045	1.000	0.069	0.053	0.183	0.04	−0.172	0.053	−0.086	0.199	0.147	−0.303	−0.108	−0.01	0.061	0.086	−0.221	0.161	0.205	0.041	0.025	0.315	0.018	0.114
Q9	0.075	0.088	−0.053	−0.023	−0.111	0.04	0.01	0.069	1.000	−0.075	0.083	0.101	0.032	−0.044	0.011	−0.046	−0.164	0.096	−0.037	−0.158	0.106	0.186	0.182	−0.22	0.048	0.036	−0.055	−0.205	0.031	0.254
Q10	0.017	−0.094	0.073	0.043	0.089	0.092	−0.104	0.053	−0.075	1.000	−0.181	−0.06	0.06	0.107	0.178	0.144	0.157	0.006	0.035	−0.053	−0.025	0.016	−0.074	−0.167	0.183	−0.017	−0.131	−0.085	0.002	−0.041
Q11	−0.134	−0.014	−0.204	−0.029	−0.089	−0.154	0.037	0.183	0.083	−0.181	1.000	0.059	0.166	0.154	0.067	0.205	0.081	−0.111	0.013	−0.026	0.111	−0.061	0.01	0.367	−0.062	0.046	−0.15	0.303	0.115	0.661
Q12	−0.314	−0.069	−0.367	0.187	−0.297	0.055	0.15	0.04	0.101	−0.06	0.059	1.000	0.031	−0.04	0.12	0.037	0.086	−0.079	−0.081	−0.093	−0.071	−0.028	−0.015	0.033	0.066	−0.022	0.045	0.288	0.156	0.06
Q13	−0.082	−0.046	−0.018	0.038	−0.06	0.012	−0.088	−0.172	0.032	0.06	0.166	0.031	1.000	0.085	−0.043	−0.012	0.011	−0.104	0.133	−0.214	0.136	−0.148	0.036	0.147	−0.034	−0.009	−0.234	−0.085	0.066	0.506
Q14	0.103	−0.063	−0.05	0.003	0.152	0.114	−0.122	0.053	−0.044	0.107	0.154	−0.04	0.085	1.000	0.075	0.113	0.188	0.027	0.001	0.077	0.045	−0.009	−0.079	0.197	0.073	−0.112	−0.028	0.196	0.121	0.219
Q15	−0.011	−0.083	−0.02	0.065	0.178	0.039	−0.27	−0.086	0.011	0.178	0.067	0.12	−0.043	0.075	1.000	0.11	0.13	0.169	0.196	0.248	−0.033	0.124	−0.017	−0.132	0.035	−0.324	0.047	−0.138	0.025	−0.015
Q16	−0.067	−0.117	−0.17	−0.002	0.035	−0.153	−0.105	0.199	−0.046	0.144	0.205	0.037	−0.012	0.113	0.11	1.000	0.291	0.08	0.056	0.047	−0.072	0.067	−0.166	0.026	0.11	0.005	0.014	0.188	−0.14	0.177
Q17	−0.135	−0.004	−0.059	0.188	0.067	−0.084	−0.103	0.147	−0.164	0.157	0.081	0.086	0.011	0.188	0.13	0.291	1.000	0.003	0.046	0.148	0.063	0.077	−0.434	0.167	0.312	−0.135	−0.059	0.233	0.044	0.254
Q18	−0.026	0.098	−0.012	−0.036	−0.009	−0.179	0.048	−0.303	0.096	0.006	−0.111	−0.079	−0.104	0.027	0.169	0.08	0.003	1.000	0.294	0.089	0.151	0.199	−0.012	−0.094	0.079	−0.031	0.127	0.177	−0.087	0.081
Q19	0.027	−0.05	−0.034	0.032	−0.025	−0.044	−0.09	−0.108	−0.037	0.035	0.013	−0.081	0.133	0.001	0.196	0.056	0.046	0.294	1.000	0.147	0.105	0.087	−0.085	−0.024	0.037	−0.03	0.092	0.008	0.17	0.017
Q20	0.091	−0.175	0.046	−0.021	0.215	−0.01	−0.083	−0.01	−0.158	−0.053	−0.026	−0.093	−0.214	0.077	0.248	0.047	0.148	0.089	0.147	1.000	0.082	−0.02	−0.222	0.029	0.17	0.004	0.296	−0.061	−0.003	−0.249
Q21	0.051	0.336	0.106	0.152	0.16	−0.041	0.169	0.061	0.106	−0.025	0.111	−0.071	0.136	0.045	−0.033	−0.072	0.063	0.151	0.105	0.082	1.000	0.118	0.076	0.228	0.084	−0.128	0.115	0.052	0.088	0.061
Q22	0.138	0.181	0.124	−0.06	0.023	0.007	−0.186	0.086	0.186	0.016	−0.061	−0.028	−0.148	−0.009	0.124	0.067	0.077	0.199	0.087	−0.02	0.118	1.000	−0.138	0.027	0.127	−0.202	−0.039	−0.204	0.168	−0.104
Q23	0.178	0.234	0.16	0.029	0.061	0.128	0.021	−0.221	0.182	−0.074	0.01	−0.015	0.036	−0.079	−0.017	−0.166	−0.434	−0.012	−0.085	−0.222	0.076	−0.138	1.000	−0.016	−0.432	−0.035	−0.02	−0.188	0.01	−0.183
Q24	−0.005	−0.165	0.015	0.353	0.267	0.332	−0.06	0.161	−0.22	−0.167	0.367	0.033	0.147	0.197	−0.132	0.026	0.167	−0.094	−0.024	0.029	0.228	0.027	−0.016	1.000	0.039	0.049	0.085	0.99	0.015	1.000
Q25	−0.115	−0.101	−0.063	0.189	0.061	0.06	0.023	0.205	0.048	0.183	−0.062	0.066	−0.034	0.073	0.035	0.11	0.312	0.079	0.037	0.17	0.084	0.127	−0.432	0.039	1.000	0.055	0.156	−0.186	−0.076	0.204
Q26	0.013	−0.204	−0.063	−0.078	−0.124	−0.002	−0.013	0.041	0.036	−0.017	0.046	−0.022	−0.009	−0.112	−0.324	0.005	−0.135	−0.031	−0.03	0.004	−0.128	−0.202	−0.035	0.049	0.055	1.000	0.181	0.087	0.092	0.313
Q27	0.035	−0.075	−0.123	−0.04	0.084	−0.057	−0.134	0.025	−0.055	−0.131	−0.15	0.045	−0.234	−0.028	0.047	0.014	−0.059	0.127	0.092	0.296	0.115	−0.039	−0.02	0.085	0.156	0.181	1.000	0.127	0.067	−0.148
Q28	−0.307	−0.235	−0.199	0.079	−0.058	0.091	0.434	0.315	−0.205	−0.085	0.303	0.288	−0.085	0.196	−0.138	0.188	0.233	0.177	0.008	−0.061	0.052	−0.204	−0.188	0.99	−0.186	0.087	0.127	1.000	0.16	1.000
Q29	0.127	−0.047	0.016	0.048	0.019	0.006	−0.018	0.018	0.031	0.002	0.115	0.156	0.066	0.121	0.025	−0.14	0.044	−0.087	0.17	−0.003	0.088	0.168	0.01	0.015	−0.076	0.092	0.067	0.16	1.000	−0.268
Q30	−0.128	−0.393	−0.228	0.127	−0.007	0.151	0.245	0.114	0.254	−0.041	0.661	0.06	0.506	0.219	−0.015	0.177	0.254	0.081	0.017	−0.249	0.061	−0.104	−0.183	1.000	0.204	0.313	−0.148	1.000	−0.268	1.000

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