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ASSESSMENT OF THE QUALITY OF SHARED MICROMOBILITY SERVICES ON THE EXAMPLE OF THE ELECTRIC SCOOTER MARKET IN POLAND

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Abstract: *This paper investigates the phenomenon of micromobility, with particular emphasis on e-scooter sharing services. The aim of the study is to assess the quality of such services in the opinion of users in Polish cities. The research utilizes the Servqual method and the Kano model to assess the perception of quality of sharing e-scooters services. On the one hand it identifies the features that shape customer satisfaction or dissatisfaction and on the other it indicates areas where expectations are not realized and require improvement. The results show, which factors most strongly affect the satisfaction of e-scooter users and that the expected quality of e-scooter services is not sufficient in any of the outlined areas. Findings also prove that customer satisfaction in individual cities is different. This paper can be useful to sharing operators, local authorities deciding on new operator market entry and finally for the e-scooter users.*

Keywords: *Electric Scooters Sharing; Shared Micromobility; Kano Model; Servqual Method; Service Quality; Customers Satisfaction.*

1. Introduction

The number of urban residents is constantly growing, which affects, among other things, the condition of the natural environment and forces changes to be made in the functioning and infrastructure of the agglomeration. Micromobility is a response to new challenges in urban space, which in recent years has become one of the most important trends in urban transport.

Micromobility can play a key role in solving two key problems: the deteriorating state of the environment and the time people spend commuting. The micromobile systems of the future will be based on the use of a fleet of small light vehicles, e.g. electric scooters. Products dedicated to micromobility are important for both private individuals and sharing operators. Particularly electric scooters are gaining popularity at an incredible pace, not only in the largest European cities but also in all urban and non-urban settings around the world.

2. Literature rewiev

2.1. Micromobility

The very term "micromobility" is rather recent, although the means of locomotion utilized within its framework have been known for a long time. The turning point for distinguishing this term was proliferation of the "electromobility (e-mobility)" owing to the preference for electric drives in means of transportation, which was stimulated by the needs of consumers (Nowicka, 2017). Micromobility does not possess an

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unambiguous and explicit definition in the subject literature (Janczewska, 2019). In accordance with needs and its use, this type of mobility is defined in various ways, for instance H. Dediu (2019) characterizes micromobility as a system of individual urban transportation utilizing primarily means of transportation powered by electricity, weighing no more than 500 kg (Bruce, 2018; Dediu, 2019).

Micromobility is a concept, which assumes use of small, lightweight, zero-emission Personal Mobility Devices (PMD) that enable covering of short distances in transportation solutions, most frequently in the initial or the final stretch of the planned travel. These PMDs can utilize the strength of human muscles or other pro-ecological solutions as a means of propulsion. Owing to their modest dimensions and lightweight construction these devices facilitate mobility in narrow and crowded city streets and their alternative propulsion drives eliminate noise and reduce their carbon footprint. Such devices include bicycles, skateboards, in-line skates, roller skates, scooters (Janczewski, 2019), motorbicycles, motorcycles (Uteng et al., 2019), as well as small cars, Segway-like vehicles and numerous other devices (Janczewska, 2019). The micromobility means of transport are characterized by a diversity of their construction and of the technologies they are utilizing. They can be used to carry persons and lightweight loads (Janczewski & Janczewska, 2019).

2.2. Shared e-scooters

The system of transactions in which making certain goods and services available is moderated by online platforms can be called the sharing economy (Hamari et al., 2016). The sharing economy operates in numerous fields ranging from tourism, transport, education, retail, music, logistics, catering industry to many others (Güçlü et al., 2020).

Shared mobility is a part of this system. Shared mobility is the shared use of a vehicle, a bicycle, or other mode of transport that provides users with short-term access to transportation means on the "as-needed" basis (Shaheen et al., 2020). It is a broad term used to describe the shared use of low-speed means of transportation and is an innovative transport strategy, which provides users with short-term access to transport as the need arises. Shared micromobility covers various models of services and means of transport, which satisfy diverse needs of commuters such as bicycle rental stations (a bicycle can be picked up and returned to any of the stations or kiosks) as well as dock-free bicycle and scooter rental (a vehicle can be picked up and left in any location) (Shaheen et al., 2020).

Several types of microvehicles, for shared and private use alike, have been recently made available on the global market and they enjoy increasing recognition and appreciation (Oeschger et al., 2020).

Shared micromobility covers primarily bicycles, scooters, kick scooters, motorbicycles, bicycles and cars which are made available in the urban space in designated locations (Uteng et al., 2019) or which can be picked up and discarded virtually anywhere, usually within the area restricted by GPS and determined by the service provider. (Aasebø, 2019).

One of the micro-vehicles used the most frequently to cover the first and the last kilometer of the route is an urban electric scooter (Janczewski & Janczewska, 2019). Renting a scooter is exceptionally easy, since a user has to simply download an app and send over the information related to the preferred payment method (Satola, 2018).

The issue of electric scooters is surrounded by controversies and is a subject of criticisms regarding recklessness of their users, parking practices, injuries caused to users and pedestrians (Bai & Jiao, 2020), short battery life (Moreau et al., 2020) as well as lack of the legal regulations regarding the use of electric scooters.

In Poland, the use of electric scooters is a relatively recent phenomenon, the market of shared electric scooters has been functioning since 2018, but begun to operate on a wider scale in 2019 (Łukaszewicz, 2019). By the end of 2020 this service has been made available and operational in 39 Polish cities. By the end of October there were nearly 19 thousand electric scooters available (Partner SmartRide.pl, 2020).

The studies concerning urban scooters were conducted in numerous countries as well as multiple cities in Poland and across the world. Various aspects of the subject of electric scooters have been considered, e.g. the use of scooters as an alternative to other forms of urban transportation (Dahl & Haug, 2020; Zagorskas& Burinskien, 2019), their use as a sustainable form of transport for crowded and polluted cities (Møller & Simlett, 2020; Eccarius & Lu, 2020) or as a form of transport for covering the last mile, supplementing, for instance, the transport from home to the municipal public transport station or from the station to the final destination (James et al., 2019; Espinoza et al., 2019). An important topic, which constitutes a very interesting subject of research and frequently serves as the starting point for a broader analysis in this field, is the reasons why people are using this form of transport (Espinoza et al., 2019; Fitt & Curl, 2020; McKenzie, 2019; Noland, 2019).

No nation-wide studies regarding the level of satisfaction with the use of urban scooters have been conducted in Poland. Thus, a peculiar research gap exists in this field which authors attempt to complete with their studies. The levels of satisfaction and quality were not researched so far but the issue of the electric scooters and sharing them was repeatedly the subject of scientific research.

Some aspects of this mode of transport were discussed in the studies pertaining to individual Polish agglomerations, such as Poznan (Sojkin & Michalak, 2019), Kraków or Tri-City (Bieliński & Ważna, 2020) and concerned the frequency of use and the reasons for using these personal mobility devices. These studies also outlined the scale of the scooter sharing phenomenon in the largest Polish cities - Tri-City, Warsaw, Silesian Agglomeration (Pierieguda & Zawieska, 2018).

Among the Polish studies concerning the researched field we may also indicate the review surveys concerning the providers of the e-scooter sharing services for the individual cities (˘Straub & Gajda, 2020; Jurczak, 2019). These are review studies and presentation of data on the scale of the e-scooter scharing in individual, largest Polish cities. The authors of these studies assess the Polish market as rapidly developing and following the idea of sustainable development. They also indicate the share of individual e-scooter operators in voivodeship cities as well as the scope and area of their operation.

The studies concerning the quality of sharing services were already conducted in regards to microvehicles, for instance in Poland the bike-sharing system was researched (Macioszek, Świerk & Kurek, 2020). In turn, in the international literature similar studies were conducted in the city of Tamilnadu in India where the quality of services and Customer Preference regarding the use of Bajaj motorcycles were researched through the use of the Servqual method (Prabakaran & Praveen Babu, 2012) or in China (Wu & Cheng, 2018) and in the City of Munich in Germany (Hardt & Bogenberger, 2019) where the studies concerned the use of electric scooters.

3. Research methodology

3.1. The Scope and The Goals of The Analysis

The subject of the study were city e-scooters rented per minute via operators providing this type of service in Poland. The research aim was to determine the level of satisfaction of users of city e-scooters using this type of

service and to examine the gap between customer expectations and the quality of the service they have experienced.

The authors defined the following detailed objectives:

1. Examination of the gap between customer expectations and the quality of the service provided.
2. Determining the level of satisfaction of users of city e-scooters with the service.
3. Determining the importance of the service features that shape the preferences of users.
4. Comparison of results for selected cities.

The survey was conducted among 584 respondents. The respondents from Cracow (196 respondents) and Poznan (201 respondents) constituted the largest group. From the two mentioned cities, 68% of the opinions of all reviewers were collected. The remaining 32% are the opinions of scooter users in cities such as: Warsaw (8.6%), Gdansk (5.8%), Wroclaw (4.5%), Katowice (2.7%). The remaining 10.5% are the opinions of respondents from 21 Polish cities. The quality of the analyzed e-scooter rental service was assessed for the following groups of respondents:

1. Nationwide group of respondents.
2. A group of respondents who have used the e-scooter rental service in Cracow.
3. A group of respondents who used the e-scooter rental service in Poznan.

The analysis for the three defined groups of respondents was carried out according to the following stages:
Stage 1 - Defining the quality of the service, which is created by a set of features ensuring satisfactory satisfaction of customer needs.
Stage 2 - Preparation of a questionnaire examining the gap between customer expectations and the experienced quality of the service provided and the significance of features that shape user preferences.
Stage 3 - Determining the gap between customer expectations and the experienced quality of the provided service using the Servqual method.
Stage 4 - Identifying the features that shape user preferences using the Kano model.
Stage 5 - Using one-way analysis of variance to identify whether the two selected city in which the respondents used the e-scooter rental service was a determinant influencing the shaping of the final Servqual score.
Stage 6 - Comparing the identified gaps with the characteristics that shape consumer preferences for Cracow and Poznan.

3.2. The Servqual method

In order to determine the gap between customer expectations and the experienced quality of the provided city e-scooter rental service, the Servqual method was used. The Servqual index was used to measure the difference between the level of satisfaction of expectations and the perception of services by the customer. There is an assumption that the quality of service is meeting the expectations of the consumer, and therefore this indicator requires establishing the characteristics of the quality of services.

For this purpose, the features affecting the quality of the provided city e-scooter rental service were defined and assigned to five dimensions, characteristic of the Servqual method. Table 1 presents the list of features broken down into five dimensions.

On the basis of the features listed in Table 1, a questionnaire was created, in which the respondents assessed, on the one hand, the expected level of service and, on the other hand, the level of the service received. An example of the structure of questions included in the survey is presented in Table 2.

Table 1. A set of features for assessing the quality of the service provided

Dimension	Feature
Tangibles	Clean and aesthetic appearance
	Ease and convenience of driving
	Intuitive application interface
Reliability	Adequate technical condition
	Battery level compatible with the application
	Fees charged in accordance with the tariff and time
	The charge level of the e-scooter is sufficient for a minimum one hour ride
	Security
	Parking in designated zones
	Speed min. 25 km per hour
Responsiveness	The possibility of issuing an opinion about the used e-scooter
	Possibility to order / reserve the device in the application
	Accessibility in public space
Assurance	Staff with expert knowledge
	Helpful and patient staff
	Easy access to technical service points
	Access to the hotline
Empathy	Loyalty programs (discounts)
	Price per minute lower than PLN 1

Source: own elaboration.

Table 2. Example of a query from a worksheet examining the gap between user expectations and delivered quality

Questions	Variants of answers
The interface of the application that supports the rental of e-scooters should be intuitive	1 - I strongly disagree 2 - I rather disagree 3 - I have no opinion 4 - I rather agree 5 - I strongly agree
Was the interface of the application you used intuitive?	1- I strongly disagree 2 - I rather disagree 3 - I have no opinion 4 - I rather agree 5 - I strongly agree

Source: own elaboration.

In order to determine the gap between the expectations of the respondents and the quality experienced, the analysis was conducted according to the following steps on the basis of the opinions collected through the questionnaire:

1. Based on the average opinion of the respondents, for each feature listed in Table 1, the expected and experienced quality of the tested service was determined.
2. Calculation of the average grade for the expected quality and the experienced quality for each dimension.
3. Calculating the gap between the expected and experienced quality for each dimension.
4. Calculation of the final Servqual score for each respondent.

3.3. The Kano model

The Kano model was used to determine the importance of features shaping customer preferences. In the questionnaire used in this

method, the respondent was asked to respond with one of the five proposed answers to the occurrence of a factor or its lack. Table 3 shows an example of a question posed in the research on the quality of the offer of e-scooter rental operators.

The analysis of the features shaping the respondent's preferences was carried out according to the following steps:

1. For every respondent, the types of features for the tested features were determined according to the Table 4 describing the combinations of negative and positive responses.

Table 3. Example of an assessment questionnaire question which features affect user preferences

Questions	Variants of answers
E-Scooters should be clean and neat in appearance	1. That's fine for me 2. It must be so 3. It does not matter to me. 4. I can accept it 5. I don't like it
How would you feel if the e-scooters were not clean and did not have an aesthetic appearance?	1. That's fine for me 2. It must be so 3. It does not matter to me. 4. I can accept it 5. I don't like it

Source: own elaboration.

Table 4. Kano Evaluation Table

		Dysfunctional (negative)				
		That's fine for me	It must be so	It does not matter to me	I can accept it	I don't like it
Functional (positive)	That's fine for me	Q	A	A	A	O
	It must be so	R	I	I	I	M
	It does not matter to me	R	I	I	I	M
	I can accept it	R	I	I	I	M
	I don't like it	R	R	R	R	Q

Source: Gupta & Srivastava (2011).

Individual matrix symbols, shown in the Table 4 refer to the following attributes of the examined feature:

A – Attractive,

M - Expected (must be),

O – One factor,

Q - Questionable responses (when the customer is unsure of their preferences (they both like and dislike the feature),

R - Divergent responses (inverted) - when the customer likes the non-occurrence of a feature, but does not like its occurrence.

2. On the basis of the assessment of the importance of features by individual respondents, features that shape user preferences were determined.
3. The size of consumer satisfaction associated with the presence of a given feature in the tested product was determined, as well as the extent of dissatisfaction in the absence of this feature.

3.4. One-way analysis of variance

In order to identify whether the two selected cities, Cracow and Poznan, in which the respondents used the e-scooter rental service, were a determinant affecting the final

Servqual result for individual respondents, a one-way analysis of variance was used. The analysis was performed according to the following steps:

1. Division of observations into groups based on an independent variable (city).
2. Verification of the assumptions of a one-way analysis of variance:
   a. Test the assumption of normality – Shapiro-Wilk's test.
   b. Uniformity of variance: Bartlett's test (in the case of normal distribution), Levene'a test (in the case of non-fulfilment of assumptions about normality).
3. In the case of the fulfilment of the assumptions, ANOVA was used.
4. If the assumptions of ANOVA were not met, non-parametric U Mann-Whitney test was used.

4. Results

4.1. Nationwide survey

Determining the gap between customer expectations and the experienced quality of the provided service

The subject of this research step was to determine the quality of the provided city e-scooter rental service, taking into account the opinion of all respondents. The Servqual method was used to identify the gap between user expectations and experienced quality. The study was carried out for five dimensions characteristic of the Servqual method: *tangibles, reliability, responsiveness, assurance, empathy* and the gap for each of the above-mentioned areas and the total unweighted Servqual score were determined.

Figure 1 shows the expectations of users as to the quality of services (blue field) and the evaluation of the service provided (orange field) for 5 dimensions.

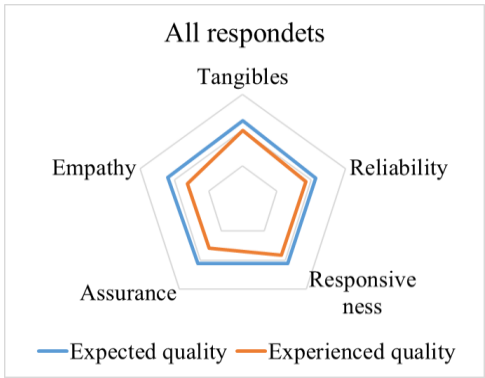

Figure 1. Expected and experienced quality of city scooter service for all respondents
Source: own elaboration

Customer expectations were not met or exceeded, which means the presence of a negative satisfaction gap. Respondents indicated the greatest requirements in the area of *tangibles* – 4,54/ 5. The *tangible* dimension concerns the external, perceivable aspects of service like scooter appearance or ease of driving. Interestingly, despite the high level of expectations, the gap in this area was the smallest. The second dimension in which respondent expectations were the greatest, was empathy 4,39/ 5. The *empathy* dimension is related to an individualized approach to the client like loyalty programs or individual prices. In this dimension, respondents indicated the greatest discrepancy between expectations and the service experienced. Three subsequent dimensions were characterized by similar expectations of the respondents 4,25-4,26/ 5. The *reliability* dimension is focused on the accuracy and solidity of the service, such as safety or proper technical condition. The *responsiveness* dimension is related to the timely and accurate performance of the service. Finally, the *assurance* dimension concerns knowledge and courtesy of employees and their ability to build trust. In this area, respondents also indicated a large gap between expectations and the service experienced. The other 2 areas - *responsiveness* and *reliability*, were characterized by a small gap of expectations and experience – similar to *tangibles*.

The size of the gap between the expectations and the assessment of the service for the adopted dimensions is shown in Table 5.

Table 5. Gap between the expectations and the completed service

Dimension / group	Gap
Empathy	-1,14
Assurance	-1,10
Reliability	-0,58
Responsiveness	-0,58
Tangibles	-0,55

Source: own elaboration

With regard to individual features, the respondents had the greatest requirements as to e-scooters *technical condition*, *battery level*, *ease and convince of driving*, *fees accordance*, *security*, *accessibility in public space* and *application interface* (more than 4,5). Respondents had the lowest expectations for *parking in designated zones*, *long range* and *speed* (lower than 4).

Identifying the features that shape user preferences

The next step of the analysis was to identify the features that shape the preferences of users of city scooters rented per minute. For this purpose, the Kano model was used. The results for the Kano method were illustrated for 19 features by Figure 2, where the vertical axis represents satisfaction <0, 1>, while the horizontal axis represents dissatisfaction <-1, 0> with the service provided. The numbers shown in the Fig.2 relate to the examined features. The features and corresponding numbers are listed in Table 6. Among the factor classes of the Kano method, 3 of 5 were detected in the study: attractive, indifferent and one-dimensional were detected. The colours of the bubbles represent the individual classes, the position in the coordinate system - satisfaction and dissatisfaction, while the size of the bubble represents the gap from the Servqual method.

One-dimensional factors are grouped in the upper left corner because the level of realization of these features can constitute both high satisfaction and dissatisfaction. It is worth mentioning that these features turn into must-have features over time. Their implementation at a high level does not constitute satisfaction, while their implementation at low level is a cause of strong dissatisfaction (bottom left corner).

The attractive factors are grouped in the upper-right corner of the chart, because the realization of these traits is highly satisfying, but is not the reason for dissatisfaction. These features also change their position over time, becoming one-dimensional.

Indifferent factors are grouped in the lower right corner, because the level of their implementation does not translate into satisfaction or dissatisfaction. From the operator's perspective, this is the least important group of factors.

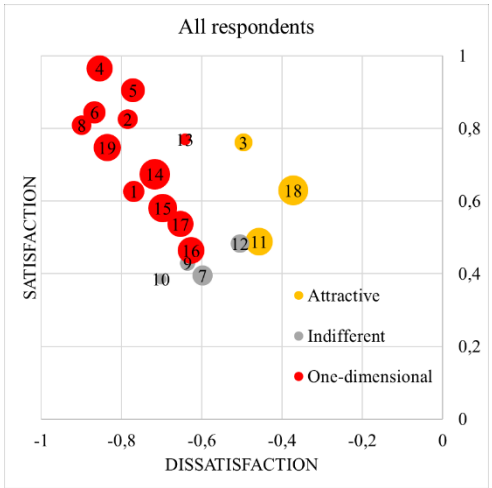

Figure 2. Kano method evaluation results for all respondents

Source: own elaboration

The biggest gaps occurred in features related to *staff* characteristics (No.14 and 15), where both were one-dimensional but their significance for satisfaction is average. Other factors worth noting were *loyalty programs* and *price* (No. 18 and 19). *Loyalty programmes (discounts)* were an attractive factor and *price was* one-dimensional. In both

cases, the gap between expectation and experience was high. Another feature linked with price - *Fees charged in accordance with the tariff and time* (No. 6), also was one dimensional but the expectation gap was lower. There were also significant gaps in the one-dimensional features - *technical condition* (No. 4) and *battery level* (No. 5), both had the greatest significance for satisfaction. *Security* (No.8) and *accessibility in public space* (No. 13), the next one-dimensional features, were also very significant for satisfaction, but the gap was lower in first case and in the second expectations almost achieved. The last dimension *tangibles* was characterized by a similar expectations gap. *Aesthetic appearance* (No. 1) and *ease of driving* (No. 2) were one-dimensional, while *intuitive application interface* (No. 3) was attractive. All other factors were indifferent and did not have a big expectations gap.

Table 6 presents both the size of the gap for each examined feature and for five dimensions as well as the importance of the service features that shape the preferences of users.

Table 6. Servqual gaps and Kano assessment for 19 features in 5 dimensions

Dimension	No.	Feature	Feature gap	Feature importance	Dimension gap
Tangibles	1	Clean and aesthetic appearance	-0,63	O	-0,55
	2	Ease and convenience of driving	-0,56	O	
	3	Intuitive application interface	-0,46	A	
Reliability	4	Adequate technical condition	-0,95	O	-0,58
	5	Battery level compatible with the application	-0,80	O	
	6	Fees charged in accordance with the tariff and time	-0,70	O	
	7	The charge level of the scooter is sufficient for a minimum one hour ride	-0,55	I	
	8	Security	-0,55	O	
	9	Parking in designated zones	-0,33	I	
	10	Speed min. 25 km per hour	-0,17	I	
Respon-siveness	11	The possibility of issuing an opinion about the used scooter	-1,07	A	-0,58
	12	Possibility to order / reserve the device in the application	-0,50	I	
	13	Accessibility in public space	-0,19	O	
Assurance	14	Staff with expert knowledge	-1,30	O	-1,10
	15	Helpful and patient staff	-1,16	O	
	16	Easy access to technical service points	-0,99	O	
	17	Access to the hotline	-0,97	O	
Empathy	18	Loyalty programs (discounts)	-1,24	A	-1,14
	19	Price per minute lower than PLN 1	-1,05	O	

Source: own elaboration

4.2. Comparing the results of the analysis for the studied groups of respondents

The next stage of the study was to identify the determinant of the city in which the respondent used the service of renting e-scooters per minute. Due to a very large disproportion in the number of respondents from individual cities, Cracow and Poznan were taken into account. From the two mentioned cities, 68% of the opinions of all reviewers were collected. The remaining 32% are the opinions of scooter users in cities such as: Warsaw (8.6%), Gdansk (5.8%), Wroclaw (4.5%), Katowice (2.7%). The remaining

10.5% are the opinions of respondents from 21 Polish cities.

Using the one-way analysis of variance, it was checked whether the final Servqual result, calculated for each respondent, was influenced by the place of using the scooter rental service, i.e. Cracow or Poznan. The analysis was carried out according to the following stages:

1. In the first step, it was checked whether the variables had distributions close to the normal distribution. For this purpose, the Shapiro-Wilk test implemented in the *stats* package in the R environment was used. The following research hypotheses were formulated in the conducted analysis:
   H_o - the data are normally distributed.
   H_1 - the data are not normally distributed.

Table 7. Shapiro-Wilk normality test

```
>tapply(Deter_PK$SQk,
Deter_PK$City, shapiro.test)
$Krakow

          Shapiro-Wilk normality
test

data:  X[[i]]
W = 0.97741, p-value = 0.002958


$Poznan

          Shapiro-Wilk normality
test

data:  X[[i]]
W = 0.94543, p-value = 6.627e-07
```

Source: own elaboration

Based on the results presented in Table 7, the null hypothesis that the data were normally distributed was rejected.

2. In the second step, the assumption of homogeneity of variance was checked. For this purpose, the Levene test implemented in the *car* package in the R environment was used:
   The following research hypotheses were formulated in the conducted analysis:
   H_o - The variances in the analyzed groups are equal
   H_1 - The variances in the analyzed groups differ.

Table 8. Levene's Test for Homogeneity of Variance

```
>leveneTest(Deter_PK$SQk,
Deter_PK$City)
Levene's Test for Homogeneity of
Variance (center = median)
       Df F value Pr(>F)
group   1  0.7704 0.3806
      395
```

Source: own elaboration

In the conducted analysis, the p-value was 0.3806. By comparing the p-value with the significance α= 0.05, the null hypothesis that the variances in the analysed groups were equal was confirmed.

3. The assumptions of ANOVA were not met. Therefore, in the next step, the U Mann-Whitney test, implemented in the *stats* package in the R Environment was used.
   The following research hypotheses were formulated in the conducted analysis:
   H_o - The distribution of the variable in the compared groups of respondents are equal
   H_1 - The distribution of the variable in the compared groups of respondents differs.

Table 9. Wilcoxon rank sum test with continuity correction

```
>wilcox.test(Deter_PK$SQk~Deter_PK$
City)

          Wilcoxon rank sum test
with continuity correction

data:  Deter_PK$SQk by
Deter_PK$City
W = 24088, p-value = 0.0001232
```

Source: own elaboration

In the conducted analysis, the p-value was 0.0001232. By comparing the p-value with the significance α= 0.05, the null hypothesis that the distributions of the variable in the compared groups of respondents were equal was rejected. Therefore, it can be concluded that the city was the determinant influencing the Servqual score.

4.3. Comparative study for selected cities

In the last stage of the analysis, the opinions of two groups of respondents were compared:

1. A group of respondents who used the e-scooter rental service in Cracow.
2. A group of respondents who used the e-scooter rental service in Poznan.

The analysis was performed according to the following steps:

1. Determining the gap between customer expectations and the experienced quality of the provided service using the Servqual method, for respondents using e-scooter rental services in Cracow and Poznan.
2. Identifying the features that shaped user preferences using the Kano model, for respondents using scooter rental services in Cracow and Poznan.

Figure 3 shows the expectations of users as to the quality of services (blue field) and the evaluation of the service provided (orange field) for 5 dimensions, separately for Cracow and Poznan.

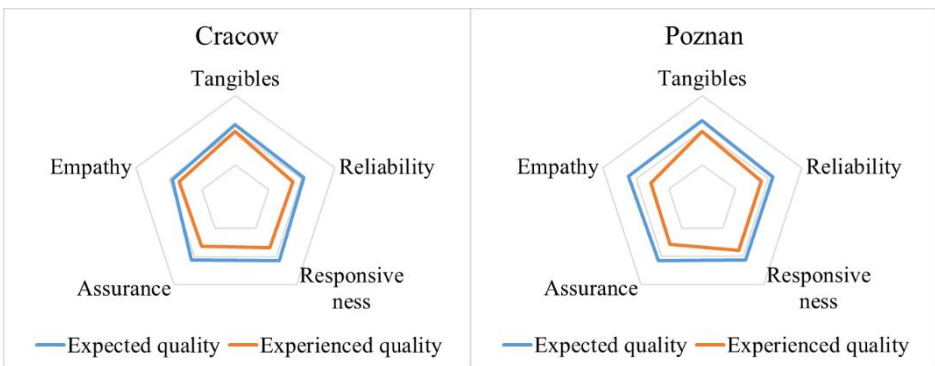

Figure 3. Expected and experienced quality of city scooter service in four selected groups of respondents
Source: own elaboration

The expected level of city scooter service differed in selected groups, but in all cases the most demanding field was *tangibles* – 4,33 for Cracow and 4,56 for Poznan. In this dimension, the gap between expectations and experienced service was the smallest for both cities. On the other hand, in terms of *empathy*, the differentiation of respondent assessments was the greatest. In Poznan, the level of expectations in this area was second (4,45), while in Krakow it was last (3,79). It is similar with the dimension gap, which was the largest in Poznan and the second smallest in Cracow. A large gap was also indicated by the respondents in the *assurance* dimension, while the level of expectations in both cities was similar: Cracow – 4,26 and Poznan 4,31. Similar differences in the level of respondent expectations also occurred in *responsiveness* – 4,3 for Cracow and 4,25 for Poznan. However, in terms of the gap of expectations and experience, there were larger differences - in Cracow it was one of the largest, while in Poznan one of the smallest. Finally, the *reliability* dimension was characterized by the expectation levels 4,13 for Cracow and 4,23 for Poznan. The expectation gap was identical in both cases. Overall, expectations

and the satisfaction gap were higher for Poznan than for Cracow.

The size of the gap between the expectations and the assessment of the service for the adopted dimensions and groups is shown in Table 10.

Table 10. Gap between the expectations and the completed service for selected city

Dimension / group	Cracow	Poznan
Empathy	-0,40	-1,34
Assurance	-0,99	-1,19
Reliability	-0,67	-0,67
Responsiveness	-0,92	-0,67
Tangibles	-0,38	-0,63

Source: own elaboration

With regard to individual features, the biggest differences in respondent's expectations were in terms of price, safety, intuitive application and parking in designated zones - more than 0,8. On the other hand, respondents in both cities were most agreeable about the expected implementation in terms of access to hotline, accessibility in public space, helpful and patient stuff and ease and convince of driving.

The results for the Kano method are illustrated for 2 groups of respondents and 19 features by Fig 4. As in the case of the entire sample, there were 3 classes of factors. The numbers shown in Fig 4. relate to the examined features. The features and corresponding numbers are listed in Table 11.

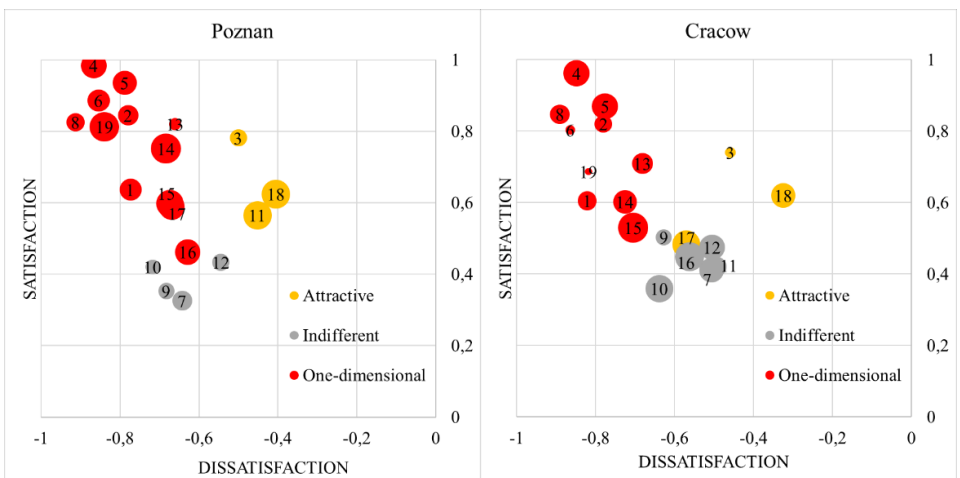

Figure 4. Kano method evaluation results for Cracow and Poznan
Source: own elaboration

The greatest variability between Cracow and Poznan occured in the dimension of *empathy*. In case of *price per minute* (No. 19) expectations in Krakow were met while Poznan had one of the largest gaps. In both, it was a one-dimensional feature, lying in the middle of the zone length. *Loyalty programs (discounts)* (No. 18) turned out to be attractive features with relative big gaps. In the *assurance* dimension, the different assessment of the respondents concerned the features related to the *technical service* (No. 16), and *access to hotline* (No. 17). In Poznan, these features turned out to be one-dimensional, while in Cracow indifferent (No. 16) and attractive (No. 17). The other 2 features, concerning *staff* characteristics (No. 14 and 15) were one dimensional. All features in these dimension had relatively big gaps. In the *responsiveness* dimension, the most divergent assessments of importance concerned the feature of *issuing an opinion about the used scooter* (No. 11). In Cracow this feature was indifferent while in Poznan

attractive with very big gap. The entire group was highly variable in terms of gaps. It can also be seen that in *accessibility in public space* (No. 13) in Poznan the requirements were almost reached. In the *reliability* dimension all the features turned out to be of the same class. The greatest differences in achieving the target satisfaction were in *fees accordance* (No. 6), and *parking in designated zones* (No. 9), the last one with big gap in Cracow. In both cities there were large gaps in the technical characteristics (No. 4 and 5). In the *tangibles* area there was no difference in features importance or significant gaps, but they were all one-dimensional or attractive.

Table 11. presents both the size of the gap for each examined feature and for five dimensions as well as the importance of the service features that shaped the preferences of users for Cracow and Poznan.

Table 11. Servqual gaps and Kano assessment for 19 features in 5 dimensions – Cracow and Poznan

Dimension	No	Feature	Cracow			Poznan		
Tangibles	1	Clean and aesthetic appearance	-0,53	-0,38	O	-0,78	-0,63	O
	2	Ease and convenience of driving	-0,43		O	-0,65		O
	3	Intuitive application interface	-0,17		A	-0,46		A
Reliability	4	Adequate technical condition	-0,99	-0,67	O	-1,02	-0,67	O
	5	Battery level compatible with the application	-0,97		O	-0,94		O
	6	Fees charged in accordance with the tariff and time	-0,13		O	-0,79		O
	7	The charge level of the scooter is sufficient for a minimum one hour ride	-0,36		I	-0,62		I
	8	Security	-0,55		O	-0,52		O
	9	Parking in designated zones	-1,11		I	-0,41		I
	10	Speed min. 25 km per hour	-0,58		I	-0,34		I
Responsiveness	11	The possibility of issuing an opinion about the used scooter	-0,93	-0,92	I	-1,27	-0,67	A
	12	Possibility to order / reserve the device in the application	-1,20		I	-0,47		I
	13	Accessibility in public space	-0,62		O	-0,24		O
Assurance	14	Staff with expert knowledge	-0,81	-0,99	O	-1,42	-1,19	O
	15	Helpful and patient staff	-1,29		O	-1,21		O
	16	Easy access to technical service points	-0,74		I	-1,04		O
	17	Access to the hotline	-1,14		A	-1,05		O
Empathy	18	Loyalty programs (discounts)	-0,86	-0,40	A	-1,30	-1,34	A
	19	Price per minute lower than PLN 1	0,07		O	-1,37		O

Source: own elaboration

5. Discussion

The aim of the study was to assess the satisfaction of users of city e-scooters rented per minute and to indicate the features that shape the preferences of the research respondents. The survey was conducted for all respondents and for respondents who used the surveyed service in Cracow and Poznan. Based on the analyses carried out, we can draw the following conclusions:

1. The obtained results showed that the expectations of customers regarding

the service of city e-scooters were not met in any dimensions.

2. Taking into account the opinion of all respondents, the highest level of the gap between expectations and experienced reality occurred for the dimensions: Assurance and Empathy.
3. Taking into account the opinion of all respondents, the lowest level of the gap occurred for the dimensions: Tangibles, Reliability and Responsiveness.
4. For respondents, the most important were: adequate technical condition, battery level compatible with the application and ease and convenience of driving.
5. For respondents, the least important thing was the fact of parking vehicles in designated zones and the charge level of the scooter was sufficient for a minimum one-hour ride.
6. Respondents' assessments of satisfaction with the city e-scooter service differ between Cracow and Poznan.

Operators of e-scooters should pay attention to the ease of driving and safety of the devices, instead of advanced technical parameters, such as speed or battery capacity. They should also consider introducing the assessment of device condition as well as the quality of the entire service function and the possibility of reporting device failures through the mobile application.

Another important aspect was the problem of parking scooters in public space. By averaging respondent answers, parking in designated zones was an indifferent element of the service. For operators, this can be an important signal in connection with the social dispute about the place of scooters in the public space and the regulations that may emerge as its result, which wil affect scooters.

An attractive feature for users were loyalty programs and benefits related to the use of sharing operator services. The respondents assessed the performance of this function as low The reason may be the increasing competition in the market of e-scooter operators, which translates into increased expectations related to the elements of the service. Activity in this area could contribute to increasing user satisfaction and operator attractiveness.

6. Conclusion

The main contribution of this study is assessment of user preferences choosing e-scooters. This is the first attempt to determining factors that quantify the satisfaction of using e-scooters and first such study in Polish cities.

Our study is valuable for e-scooter operators by informing them how to improve their service, for local authorities to set requirements for operator’s and finally for users, who want to hear the opinions of others.

The study had several limitations, mainly in the way of distributing the questionnaire - CAWI led to the over-representation of young people. One of the significant limitations of the conducted analysis was the significant disproportion of opinions collected in individual cities. The opinions of users from Cracow and Poznan constituted the vast majority of respondents' answers. This fact made it impossible to include in the analysis of determinant all the locations from which the opinions were collected.

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