

Article

Could It Be a Bike for Everyone? The Electric Bicycle in Poland

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Abstract: The purpose of study was to find out how electric bikes are perceived in Poland, a country with a high level of motorisation and a low cycling culture. A key question was to investigate whether differences in perceptions between traditional (unassisted) and electrically assisted bicycles could bring about greater interest in bicycle transport. The analysis was based on the results of a CAWI survey analysing the perception of the electric bicycle in comparison with the traditional bicycle and the car. Its undoubted advantages are marginalised (only 14% of respondents considered it more practical). The position of the electric bicycle seemed to increase in the opinion of the surveyed only when used by elderly people with poorer fitness, as something that can encourage them to cycle. In general evaluations, it was the traditional bicycle that was seen as better for health. The presented results may serve as a signal that electric bicycles need more promotion in Poland, especially in terms of the benefits of using this mode of transport and the advantages over conventional bikes. The electric bicycle, due to its still low popularity in Poland, may be treated as a certain novelty, which is approached with some distrust and reserve.

Keywords: bicycle; e-bike; bicycle sharing system; cycling policy; Poland



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1. Introduction

Cycling is increasingly seen as a mode of transport in everyday urban traffic [1]. The renaissance of this form of transport has been observed for many years in Western Europe [2,3] and North America [4,5]. However, the situation is slightly different in Central and Eastern Europe, where high levels of motorisation are still observed [6]. This may be influenced by, among other things, the limitations of this form of transport. Electric assistance seems to be addressing this very issue. Electrification of mobility increases transport accessibility and distances, supports clean energy-powered urban travel, thus reducing urban pollution [7,8]. Electric bikes, an element of electro-mobility, have been gaining popularity in recent years both as private bicycles and as part of urban bicycle-sharing systems (BSSs) [9]. In the latter, they can complement the traditional bicycle fleet, as well as fully operate the entire system. Whether private or public, electric bikes can provide a better, more efficient alternative to motorised forms of transport than traditional, unassisted bikes [9].

The aim of this paper is to verify how electric bikes are perceived in a country with a high level of motorisation and a low cycling culture, using the example of Poland. Despite the still low cycling modal share in urban transport in the study area, we want to examine whether the differences in perception between conventional (unassisted) and electrically assisted bicycles (optionally referred to as electric bikes in the text, despite our full awareness of the differences between them) can be translated into a higher interest in cycling. To achieve the objective, we formulated the following research questions:

- Can electrically assisted bicycles be seen as a means of transport extending the hitherto known functionalities and technical capabilities of conventional bicycles?
- Can the electric bicycle be an alternative to car transport and in which area?

- Can electrically assisted bicycles become a link between the passenger car used for transport and the traditional bicycle strongly associated with a recreational function? By the same token, can it be assumed that the electric bicycle will become competitive with the car, and in time possibly bring about a change in transport culture?
- What might be the barriers limiting the use of electric bikes that arise from the way this mode of transport is perceived? Is it legitimate to link them to the wider transport culture?

We do not take it for granted that electrically assisted bicycles will be seen as a better solution than traditional bicycles. This approach will allow us to potentially show that electrification of bicycles and the promotion of this measure may not always bring the desired results for planned changes in urban transport. As mentioned earlier, in CEE countries bicycles are still less important as a means of transport than in Western European countries [10]. In the studied region—but not only there—bicycles are still largely associated with seasonal recreation. The dominant perception of the bicycle is more as a recreational tool than as a means of transport [11]. Despite the fact that most parts of Poland have favourable physical and geographic conditions (topography, climate, etc.), an insufficiently developed cycling infrastructure and the perception of cycling as a means of transport still remains a problem [10].

Therefore, depending on this dichotomous perception, two hypotheses will be verified:

Hypothesis 1. *Electric or electrically assisted bicycles are seen as an opportunity to make cycling more accessible.*

Hypothesis 2. *Electric or electrically assisted bicycles are not seen as a recreational tool.*

- Hypothesis 1 assumes that respondents notice that the electrification of bicycles will make them more accessible to more people. This applies to assisting people with reduced mobility on the one hand and to increasing the distance that can be cycled on the other. This hypothesis is closely linked to the perception of bicycles as a means of transport.
- Hypothesis 2 assumes that respondents consider electric assistance to be a disqualifying feature of cycling and an over-reaching convenience. This hypothesis is linked to the perception of the bicycle more as a recreational tool, but also as a means of transport, with the proviso that cycling should require physical effort on the part of the rider.

In this study we therefore verify whether the role of the electric bicycle is perceived by the Polish society according to its role in urban transport. We also examine whether measures to increase cycling using this means of transport may encounter public resistance due to reluctance to electrify bicycles.

This study has a broad utilitarian dimension—the results obtained will allow us to assess whether the electrification of bicycles can be a tool to promote the bicycle as a means of transport. The aspect of promoting cycling is particularly important in the car-oriented CEE countries. The survey will also indicate whether urban transport systems, including BSSs, should aim to increase the fleet of electric bikes and how the idea of electric bikes should be promoted to city-dwellers. The study also addresses a gap in science by showing how electric bikes are perceived in a highly motorised country, whether they can be an alternative to cars and whether this type of solution will bridge the gap in cycling culture between Western Europe and Central and Eastern Europe.

2. Literature Overview

Cycling is one of the sustainable forms of transport [12–14] and brings a host of benefits to its users [15,16]. These include low negative environmental impact [17], low travel costs [18], reduced travel time [19], and high health values of moving in this way [20–26], including mental health benefits [27]. However, the use of the bicycle in daily transport

has a number of important limitations. Foremost among these are unfavourable weather conditions [28–31] and the resulting perception of the bicycle as a seasonal means of transport [32], large differences in terrain [33,34], lack of sufficiently developed infrastructure [20,35], too long a distance [36] and travel time [37], or physical limitations of the traveller preventing longer-distance travel [34]. The trend observed in recent years in cycling and active mobility in general shows that electric assistance is playing an increasingly important role in this type of transport [38,39]. This extends the group of bicycle users [40–42], includes people hitherto excluded from this mode of transport [43,44], and increases its range [7,45–48].

Research in the Netherlands showed that for daily commuting, electrically assisted bicycles were largely a substitute for traditional bicycles [49,50]. Elsewhere, research by [51] conducted in Norway indicated that the electric bicycle could become a means of transport for people who cycled little and used motorised forms of transport more often. Similar results were provided by a study by [52] conducted in Denmark, which indicated that the conversion of motorised transport to electric bicycles could be observed more in countries with a lower cycling culture than Western Europe. However, there is no clear evidence as to who is most likely to change their mode of daily transport to an electric bicycle. Research by [53] indicated that people who had purchased electric bicycles increased the frequency of cycling on their daily journeys. In this context, the public's perception of e-bikes and the perception of the benefits of using this form of transport is extremely important. Awareness of benefits has a significant impact on increasing e-bike participation in transport. Research by [54] suggests an important role for this aspect in promoting this mode of transport. The realised benefits of an e-bike also favour the decision to purchase it [55]. In this context, it is also extremely important to promote e-bikes as part of a strategy to reduce emissions [56]. Cycling, including electrically assisted cycling, increases, although to a lesser degree than conventional cycling [57], physical activity for daily commuting [58–61]. Despite its documented benefits, the increasing use of electric bicycles, and particularly the fact that the new users are new to any type of bicycle, poses a risk of accidents involving these vehicles [62]. Numerous studies describe the scale of accidents resulting from the dynamic development of this form of transport [63–67].

However, as with traditional bicycles, the share of electric bicycles in transport can be increased through the provision of cycling infrastructure [42,68]. An important way to popularise e-bikes is to make them available for short-term rentals—pilot schemes [69] or BSSs. The research available on this topic shows that making electric-assisted bikes available for hire reduces car use for commuting and encourages future cycling [70]. A similar conclusion was reached in a study by [71] on the pilot provision of e-bikes in Switzerland. Research in Beijing showed that a bike sharing system with electric bikes increased the potential for long-distance travel using this mode of transport [72]. However, the creation of an electric bike sharing system may generate a logistical problem in ensuring the availability of a fleet of fully operational and charged bikes, as shown by the examples cited in the studies by [73,74]. However, considering the role of bicycles in multimodal transport of the first and last mile, [75] indicate after [76] that electric bikes should become part of BSSs. In Poland, the last decade has seen a dynamic development of bike sharing systems, both in cities [77–79] as well as in suburban regions [80,81]. However, few systems have so far offered users electrically assisted bicycles. An exception in this respect was the metropolitan public bicycle system MEVO consisting only of electrically assisted bicycles [74], which was temporarily suspended. This study can therefore fulfil its applicational role by indicating what actions and interventions should be taken by local governments in Central and Eastern Europe to raise the share of e-bikes in transport.

3. Methodology

A survey was used to indicate how the electric bicycle is perceived in Poland in comparison with the traditional bicycle and the car. The survey was conducted using the CAWI (Computer Assisted Web Interview) method, which enables an electronic version of

the survey to be generated and a link to be sent to respondents or placed on websites. The benefits of using the CAWI technique also include:

- (1) using an extended range of functionalities related to the survey design;
- (2) ensuring greater clarity of questions;
- (3) placing precise instructions that help respondents understand and complete the survey;
- (4) greater flexibility in the conduct of the survey itself;
- (5) more efficient management of the collected data, etc. [82–84].

A nationwide CAWI social survey to analyse the perception of the electric bicycle in comparison with the traditional bicycle and the private car was designed and carried out with the use of the LimeSurvey Internet platform by the Nicolaus Copernicus University in Toruń. The survey itself used mainly closed questions, which allowed for greater standardisation of the data and comparability of the results obtained. The survey was conducted in May 2021 and included 456 respondents. The sampling was non-probabilistic and dictated largely by the availability of the sample (cf. [85]). However, given the size of the sample, it was assumed that it was sufficient for cautious inference and generalisation of the results obtained. The raw data collected were coded and validated in the PS Imago 27 programme which also served to prepare statistical analysis. The results of the empirical research were compiled in the form of frequency tables and cross-tabulations, and then graphs were prepared on their basis, showing the structure of answers to individual questions. The variables considered were then tested for statistical significance. For this purpose, the authors used the *t*-test for dependent samples, the non-parametric χ^2 test for one sample, and the Spearman correlation coefficient.

The study sample was predominantly female. Their share was 65.1%, while the share of men was 34.9%. The age range of respondents was 18 to 72 years. Taking into account the size of the settlement unit, 55.9% of respondents declared that they came from a big city with over 100,000 inhabitants, 15.1%—from a medium-sized city (20,000–100,000 inhabitants), 11.8% from a small town (<20,000 inhabitants), 2%—from a suburban area, and 15.1% from a village. The majority of respondents assessed their material situation as good (59.2%) and average (28.9%). Considering the level of education, the sample was dominated by people with higher (69.7%) and secondary (28.3%) education. Among those taking part in the survey, 5.3% used the traditional bicycle every day, 27.6% several times a week, 30.9% several times a month, 30.3% several times a year, 5.9% did not use the traditional bicycle at all. Concerning the e-bike, 0.7% of the respondents used it several times a week, 2.0% several times a month, 5.3% several times a year, and 92.1% never travelled by this means of transport.

4. Results

Determining how the electric bicycle is perceived and what role it is attributed seems to be a very simple, though important task from the point of view of planning the development of cycling and increasing the share of electric bikes in cycling. At the same time, it is necessary to bear in mind the context of the study, which stems from the social specificity of the study area—Poland. With such an approach, the term ‘cycling culture’ mentioned in the introduction directs the survey to consider the issue of the role of the electric bicycle in the context of the other most common means of individual transport, i.e., the private car and the traditional bicycle. It should be added that the collected opinions mainly concerned the respondents’ vision of the electric bicycle, as only 7.9% of them had had the opportunity to use it, according to the survey.

Assuming that users of traditional bicycles are more likely to use the electric bike (they do not have to overcome the barrier of travelling by bike, they are already well-acquainted with cycling routes), it is worth starting with a comparison of how useful both vehicles are rated. This assessment concerned opinions on the role of both bicycles as: a means of transport, a tool for recreation, and one influencing health and fitness. As the results indicate, just over half of the respondents definitely saw both types of bicycle as a means

of transport for daily journeys (see also Appendix A Table A1). The electric bike received slightly more (57.9% to 51.3%) highest ratings ('5'), which on the adopted scale meant the maximum agreement of the respondent with the given statement. An interesting difference emerges in the ratings associated with the other roles of the electric bicycle. The respondents were unanimous in indicating that in their opinion health and fitness and recreational activities were mainly associated with the traditional bicycle. It was perceived as having a positive impact on the human body (85.8% of respondents chose the maximum rating) in contrast to electric bikes, where only 2% of respondents gave such an answer. More than half (53.3%) chose the lowest rating, believing that the usefulness of the electric bicycle in this respect should be acknowledged to the least extent (Figure 1).

These results are also confirmed by the answers concerning the choice between the traditional bike and the electric bike in hypothetical situations. Where the questions concerned journeys to work, school, errands (e.g., with the public administration), or shopping, indications for the electric bicycle ranged from 37.5% to 32.9% (and were between 5% and 14% higher for the traditional bike). In the case of journeys associated with recreational purposes, such as a visit to the family, a trip to the allotment, a trip outside the city, the indications for the traditional bicycle prevailed (from 63.8% to 83.6%), with a constant share (10.5 and 11.8%, respectively) of declarations concerning the choice of an electric bike (Figure 2).

Some discrepancies in the answers of the respondents concerning the use of bicycles as a means of transport result from the comparison of assessments (Figure 1) and potential behaviour (Figure 2). The latter seem to point to less confidence in the electric bicycle, which is less often chosen in hypothetical situations (see Appendix A, Tables A1 and A2). However, regardless of this, the picture obtained is in line with the assessments in which the passenger car was additionally included (Figure 3, Appendix A).

If we continue with the general division of uses into transport (in the context of daily commuting), leisure (the main intention is to relax), and fitness (the motivation is to take care of one's health and to get in shape), a clear polarisation of opinions is apparent. In general, the respondents considered the car to be the optimal means of transport for daily commuting (75% of the respondents gave maximum marks), but with other activities they deemed the traditional bicycle more suitable (over 90% of maximum marks). Notably, the electric bicycle was rated on this scale similarly to the car—only around 10–20 percent of the respondents believed that these means of locomotion were most suitable for recreational trips or trips aimed at improving fitness and health. This similarity is lost when we compare the lowest scores, since as many as 85% of those surveyed felt, self-evidently, that the car was not suitable for keeping in shape and 43% did not associate it positively with leisure activities. For an electric bicycle, these indications totalled almost 40% and about 24%, respectively. For the traditional bike, less than 1% of the respondents answered in the same way.

The general conclusion from the analysis is that the position of the electric bicycle was quite low, as the optimum means for daily commuting in the opinion of the respondents was the car, and the recreational function combined with fitness seemed to be fulfilled by the traditional bicycle. Under these conditions, it seems that the electric bicycle is more likely to become popular as a means of transport, especially in cities. In congested city centres, especially in large cities, pragmatism (commuting time) on the one hand, and growing environmental awareness on the other, may lead to greater interest in this mode of transport. This will certainly be facilitated by a BSS that eliminates the problem of high costs for the acquisition, maintenance, or storage of an electric bicycle.

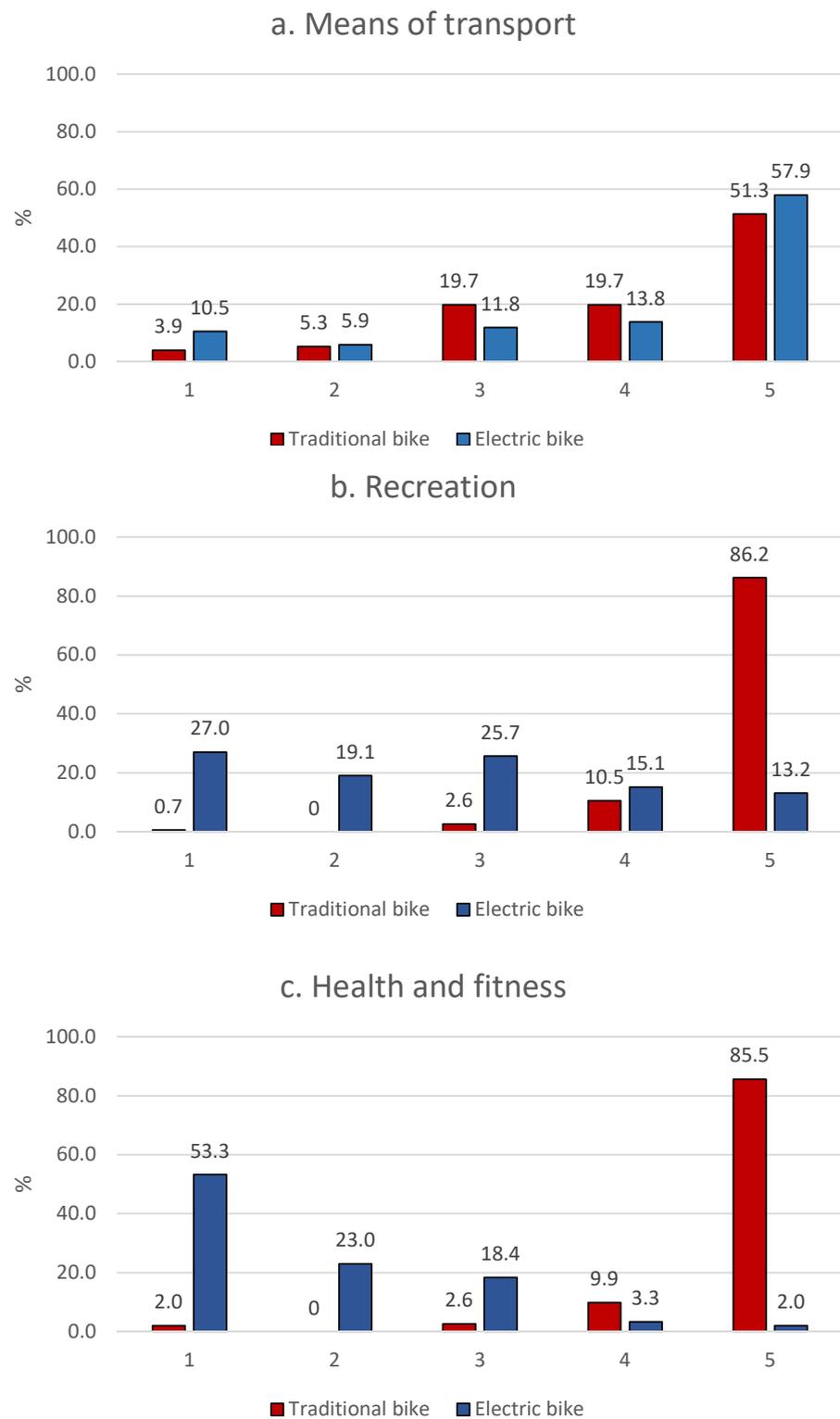


Figure 1. Structure of answers to the question: “What do you think the traditional bicycle and the electric bicycle are used for? (1—least, 5—most)”. Source: Own elaboration on the basis of the questionnaire survey.

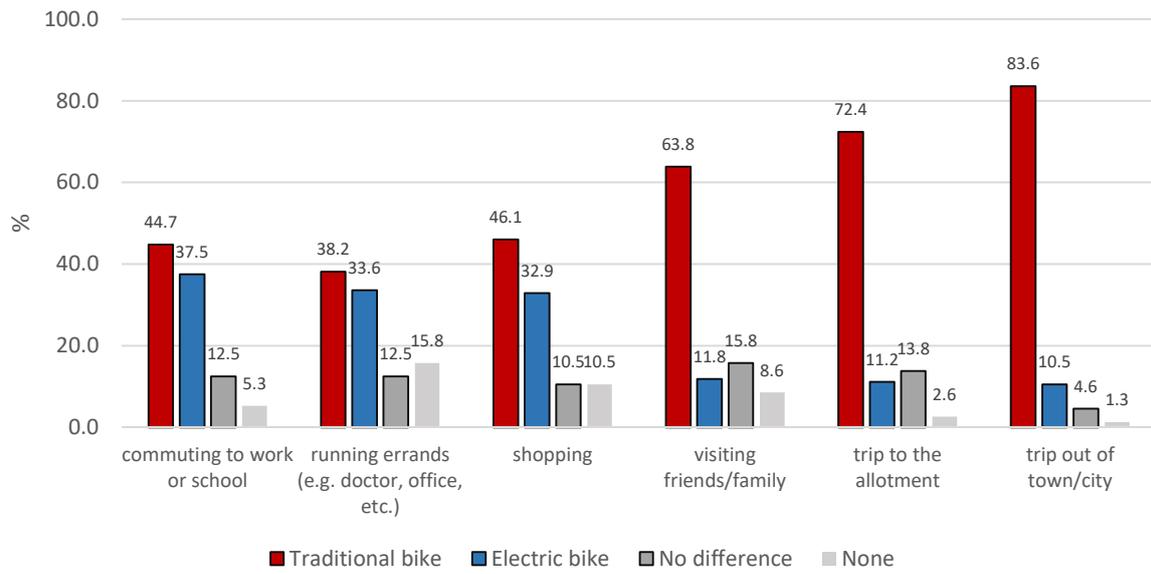


Figure 2. Structure of answers to the question: “Assuming you have access to both a traditional bicycle and an e-bike, please indicate which one you would use in each situation?” Source: Own elaboration on the basis of the questionnaire survey.

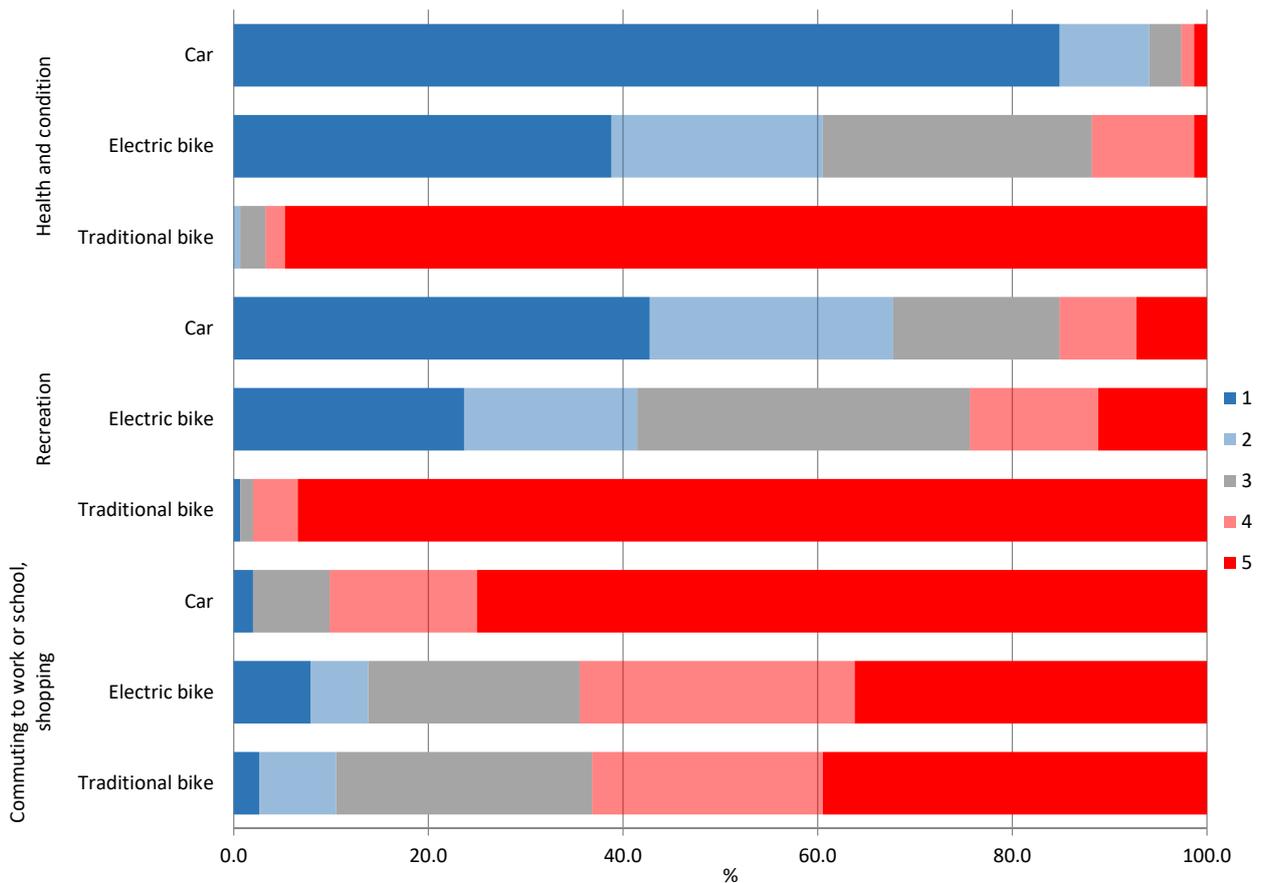


Figure 3. Structure of answers to the question: “Please rate the following means of transport in the aspects indicated (1—not suitable, 5—best suitable)”. Source: Own elaboration on the basis of the questionnaire survey.

Respondents were also asked to refer to the opinions quoted in the survey indicating which type of bicycle they were more suited to (Figure 4). The pattern of responses strongly suggests that electric bikes were perceived worse than traditional bikes (see

also Appendix A Table A4). First of all, almost 93% of those surveyed believed that the indication ‘it is expensive’ was more suitable for the electric bike. On the contrary, as many as 96% say that the term ‘it is environmentally friendly’ should be attributed to the conventional bicycle. Respondents did recognise the positive features of the electric bike: that it can be particularly useful for the elderly (61% vs. 22% for the traditional bike), that it can be used to cover long distances (53% vs. 36%), and that it is ‘useful when the terrain is not flat’ (50% vs. 41%), but although the responses seem quite obvious given the objective advantages of an electric bike, these are not particularly high percentages.

The answers of the respondents quite unambiguously indicating the advantage of the traditional bicycle seem to be puzzling. This vehicle type was considered safe by 72%, 85% said it was suitable for everyday use, 82% said it was more practical, 90% responded that it was more fun to ride, 87% thought that they would prefer to have this type of bike. Interestingly, the traditional bicycle was indicated as being better suited to both urban-dwellers (55%) and rural-dwellers (79%), despite the long distances that rural-dwellers usually have to cover in the absence of or a limited local transport network.

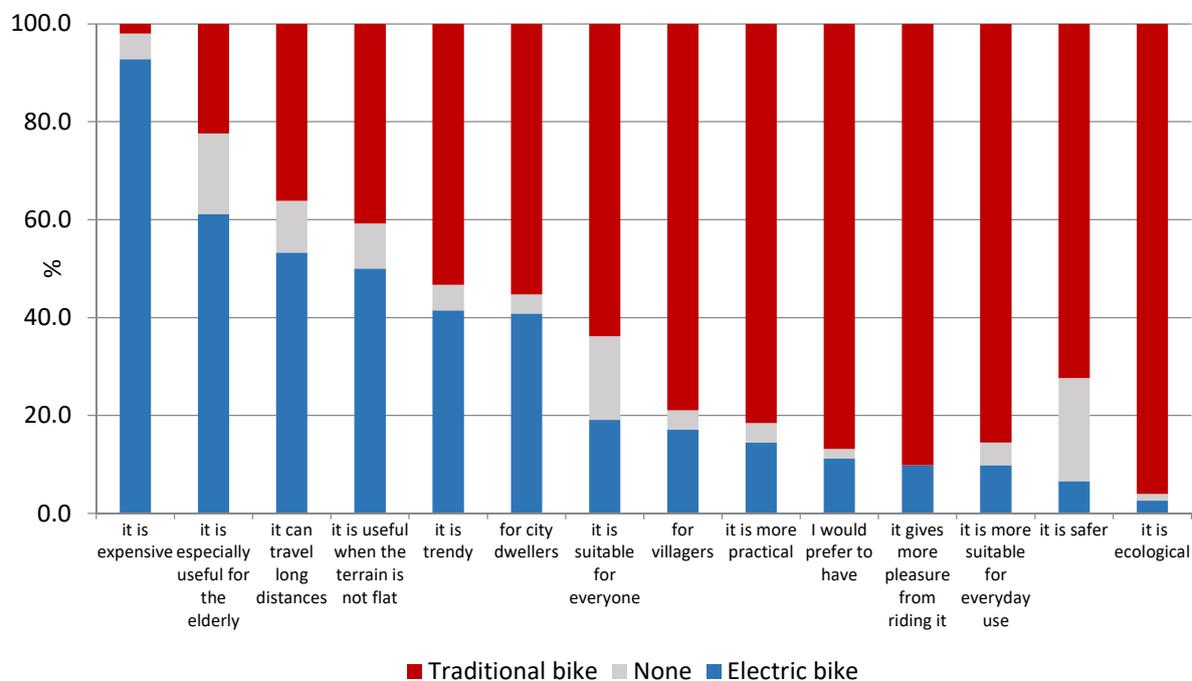


Figure 4. Structure of answers to the question: “Which of the options listed below best fits the characteristics indicated”.

Source: Own elaboration on the basis of the questionnaire survey.

The results obtained in the survey confirm that the electric bicycle is treated in a rather distrustful way. Its undoubted advantages are marginalised (only 14% of respondents considered it more practical). Safety was questioned and even if it was considered ‘trendy’ it was not deemed suitable for everyone. Nearly one third of respondents thought that the fashion for electric bikes was temporary and would soon pass. A similar percentage wanted to see electric bikes available in bike sharing schemes. In competition with the car, the bicycle (both electric and traditional) seems to be on the losing end, especially as almost 30% of those surveyed admitted to using the car very often, even for short distances, and 51% said that “a bike is good for a trip but a car is better for everyday life”. In the opinion of only 8% of respondents the car is an indicator of higher material status (a similar percentage—9% refers to the electric bicycle in that respect) (Figure 5). Perhaps the car is increasingly starting to be regarded as a commonplace item that seems more and more indispensable to everyday life.

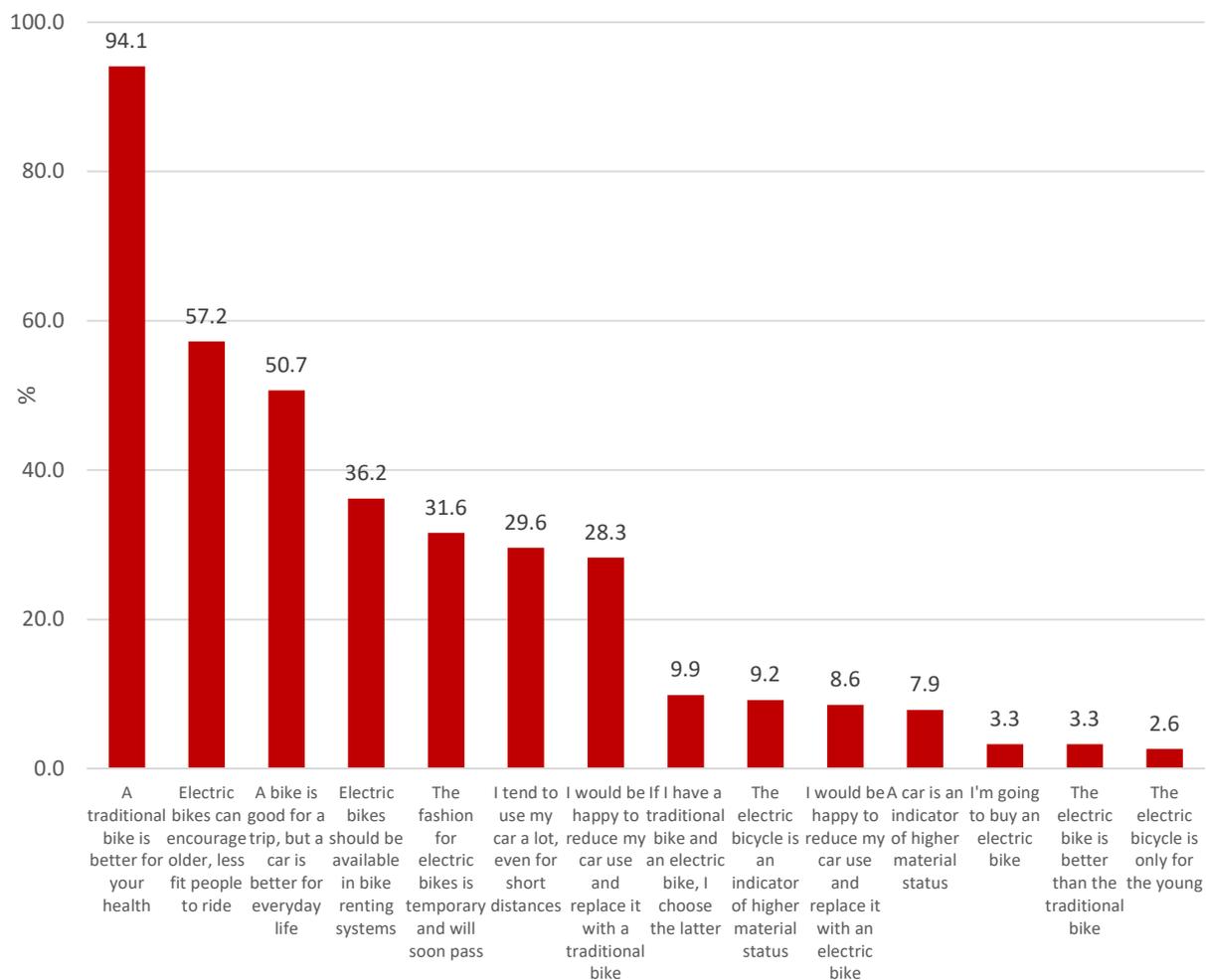


Figure 5. Structure of answers to the question: “Please tick the statements with which you agree”. Source: Own elaboration on the basis of the questionnaire survey.

On the other hand, the bicycle is unambiguously associated as a recreational solution with the option to realise a transport function, if it cannot be ensured by a passenger car. The position of the electric bicycle seemed to gain in the opinion of the surveyed only when used by elderly people with poorer fitness, as something that can encourage them to cycle. In general evaluations, it was the traditional bicycle that was seen as better for health (94%). Only 3% of those surveyed agreed that the electric bike was better, and the same number said they were interested in buying one.

It is also worth noting the opinion regarding the willingness to reduce the use of the private car in favour of traditional and electric bicycles. Almost 30% of the surveyed declared that they were willing, mainly under the influence of the increase of environmental awareness, but also in connection with the growing interest in taking care of their health, to reduce the use of the car in favour of the traditional bicycle. A similar declaration concerning the use of electric bikes was made by only 8.6%.

5. Discussion

The results collected in the survey indicate that demand for electric bikes in Poland is currently at a low level. The survey found that in many respects, respondents did not perceive significant differences between the conventional bicycle and the electric bicycle—especially in the context of transport. Differences between bicycles were only recognised in their recreational and health functions. This is a crucial observation from the point of view of attempts to electrify cycling understood as increasing the share of cycling in general.

The results obtained mainly confirm the conclusions of [54,55], that pointed to the need to raise awareness of the benefits that come with electric cycling. The small level of perceived differences between the two types of bikes allows us to conclude that:

- (a) In Poland, e-bikes are perceived as a means of transport to a very small extent and in principle respondents do not see a difference between the conventional bicycle and the electric bicycle in this respect.
- (b) Electric bicycles in Poland could be a substitute for car transport, but at this stage it makes no difference whether they are electric or traditional, so electrification is no incentive given the low level of cycling to date.
- (c) At this stage, electric bicycles in Poland will not change the transport culture, just as traditional bicycles have not done so, or have done so to a small extent so far.
- (d) A barrier to the development of electric bikes in Poland is their perception manifested by:
 - a. the unawareness of the benefits/advantages of electric bikes;
 - b. the imperception of differences apart from making travel easier for the elderly and increasing travel distance;
 - c. the awareness of the higher cost of an electric bicycle, which, in the absence of visible differences between traditional and electric bikes, clearly disqualifies electric bikes.

In view of this, if the electric bicycle is largely perceived as a normal bicycle, it can be pointed out that there is no chance to radically change the transport culture by electrifying bicycles. On the other hand, differences in respondents' perceptions of the two analysed types of bikes are marked in terms of their use for recreation and for improving health and fitness. The electric bicycle is regarded as a tool that is not suitable for these purposes, whereas the traditional bicycle can successfully fulfil this role. The juxtaposition of these two functions—transport, and recreation and health—shows that electric bicycles do not find their place in either field. The verification of the hypotheses set in the study reflects this observation.

Hypothesis 1: 'Electric or electrically assisted bicycles are seen as an opportunity to make cycling more accessible' has not been verified positively in its entirety. Only for some respondents do electric bicycles allow for an increase in travel distance, easier traversing of uneven terrain, and inclusion of new groups (especially older or less physically active people). For a large proportion of the respondents, the differences between the types of bicycles in this respect were not visible, so there could be no significant increase in the availability of cycling. Hypothesis 2: 'Electric or electrically assisted bicycles are not seen as a recreational tool' has been confirmed. Respondents indicate that regular bikes that require physical effort are better for health and fitness than electric bikes. This is to some extent obvious, although as indicated in the research of [58–61], riding an electric bicycle also stimulates physical activity, thus providing health benefits.

When relating the results of the survey to those obtained in other countries, it is important to bear in mind the differences between the perception of transport in Western and Central and Eastern European societies. In this field, however, there are too few publications referring to CEE countries, which probably also results from the still low popularity of electric bikes. Lessons from Western European countries remain important guidelines for actions supporting the promotion of electric bikes also in Central and Eastern Europe.

6. Summary

The results obtained in the survey may serve as a signal that electric bicycles need more promotion in Poland, especially in terms of the benefits of using this mode of transport and the advantages over conventional bikes. The electric bicycle, due to its still low popularity in Poland, may be treated as a certain novelty, which is approached by the respondents with some distrust and reserve. This is also confirmed by the fact that the vast majority

of participants in our survey had never used an electric bicycle, hence possibly creating a certain perceived distancing from this solution.

The obtained results clearly show that the electrification of cycling in Poland is a problem and requires an extensive promotional campaign, first of all raising awareness of the benefits of e-bikes. Research by [71] relating to pilot schemes indicated that such measures can bring some success and encourage more frequent cycling [70]. A study by [74] also indicated that despite suspension, the first electric bicycle sharing system in Poland enjoyed very high interest, which also constitutes a certain factor in the promotion of this type of transport.

6.1. Conclusions

The study has drawn the following conclusions:

- (1) In Poland, electric bicycles are still a niche matter, not yet recognised—therefore, like other innovations, they are treated with reserve and distance.
- (2) The perception of the electric bicycle is due to the unawareness of its benefits, which in turn may also stem from the lack of previous use of this mode of transport.
- (3) The electrification of bicycles in Poland needs promotion and pilot schemes that increase the availability of electric bicycles as part of BSS fleets. Such measures are in line with the postulates from the studies conducted so far by [75,76,86].
- (4) According to the respondents, electric bicycles will not increase cycling for transport or the use of bikes for leisure and health purposes. This is related to the lack of perceived differences between electric and traditional bikes within the transport function and the clearly indicated superiority of traditional bikes over electric bikes within the recreational function.

6.2. Future Research Directions

Further research on the possibilities of increasing the popularity of electric bikes in Poland should focus on the socio-economic diagnosis of the users. This research would identify social groups that:

- (1) Are excluded from this type of transport, mainly for economic reasons;
- (2) Have the possibility to use this type of transport, but are not interested in it.

Precise identification of these groups will allow decision-makers to properly target measures to promote the development of this form of transport.

Researchers should also carry out studies which would clearly show the benefits of e-bike transport and its advantages over other means of transport.

6.3. Recommendations

On the basis of the results of the study we would recommend giving the opportunity to try electric bikes to as many potential users as possible. Convincing people of the benefits of this form of transport is the appropriate course of action, but it should also be supported by the opportunity for potential future users of this form of transport to experience these benefits for themselves. We therefore suggest that decision-makers and those responsible for transport in local authorities should promote e-bikes in three stages:

- (1) Promoting the benefits of electric bikes for everyday transport;
- (2) Creating long-term rental schemes for electric bikes;
- (3) Providing electric bikes as part of the bike sharing fleet.

This set of measures can make electric bikes more accessible and widespread, thus increasing their potential as an everyday means of transport.

We assume, however, that the interest in electric bikes in Poland will grow as their popularity and the popularity of other electric means of transport increases. We observe that e-bikes are currently treated as a novelty, hence the very cautious attitude of respondents towards this mode of transport. The increasing availability of electric bikes in BSSs is also of importance in the development of electric bikes in Poland. It may be key to reduce the

cost of using this mode of transport and make it more accessible for testing if we are to change people's perceptions. It should therefore be stressed once again that the primary role of those shaping sustainable transport is to promote this solution widely and raise awareness of the benefits. These two aspects are particularly important in countries with a highly motorised transport culture.

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Appendix A

Table A1. Results of the *t*-test for dependent samples for the question: “What do you think a traditional bicycle and an electric bicycle are used for? (1—least, 5—most)”.

Statistics for Dependent Samples					
		Mean	N	Standard Deviation	Standard Error of the Mean
Pair 1	Traditional bike as a means of transport	4.09	456	1.127	0.053
	Electric bike as a means of transport	4.03	456	1.373	0.064
Pair 2	Traditional bike for recreational purposes	4.82	456	0.531	0.025
	Electric bike for recreational purposes	2.68	456	1.361	0.064
Pair 3	Traditional bike for health and fitness	4.77	456	0.684	0.032
	Electric bike for health and fitness	1.78	456	0.989	0.046

Correlations of Dependent Samples			
	N	Correlation	Significance
Pair 1	456	0.369	0.000
Pair 2	456	−0.081	0.086
Pair 3	456	0.011	0.808

<i>t</i> -Test for Dependent Samples								
	Mean	Standard Deviation	Standard Error of the Mean	95% Confidence Interval for Difference in Means		<i>t</i>	df	Significance (Two-Tailed)
				Lower Tail	Upper Tail			
Pair 1	0.066	1.419	0.066	−0.065	0.196	0.990	455	0.323
Pair 2	2.132	1.500	0.070	1.994	2.270	30.340	455	0.000
Pair 3	2.993	1.196	0.056	2.883	3.103	53.441	455	0.000

Table A2. Results of the non-parametric χ^2 test for the question: “Assuming you have access to both a traditional bicycle and an e-bike, please indicate which one you would use in each situation?”.

Summary of Testing Hypothesis				
	Zero Hypothesis (Ho)	Test	Statistical Significance^{a,b}	Decision
1	Category “shopping”—all options occur with equal probability	χ^2 test for one sample	0.000	Rejection of Ho
2	Category “commuting to work or school”—all options occur with equal probability	χ^2 test for one sample	0.000	Rejection of Ho
3	Category “trip out of town/city”—all options occur with equal probability	χ^2 test for one sample	0.000	Rejection of Ho
4	Category “visiting friends/family”—all options occur with equal probability	χ^2 test for one sample	0.000	Rejection of Ho
5	Category “trip to the allotment”—all options occur with equal probability	χ^2 test for one sample	0.000	Rejection of Ho
6	Category “running errands (e.g., doctor, office, etc.)”—all options occur with equal probability	χ^2 test for one sample	0.000	Rejection of Ho
Summary of the χ^2 Test for One Sample				
a. shopping				
	N		456	
	Test statistics		168.632a	
	Degree of freedom		3	
	Asymptotic significance (two-tailed test)		0.000	
b. commuting to work or school				
	N		456	
	Test statistics		199.105a	
	Degree of freedom		3	
	Asymptotic significance (two-tailed test)		0.000	
c. trip out of town/city				
	N		456	
	Test statistics		841.737a	
	Degree of freedom		3	
	Asymptotic significance (two-tailed test)		0.000	
d. visiting friends/family				
	N		456	
	Test statistics		371.211a	
	Degree of freedom		3	
	Asymptotic significance (two-tailed test)		0.000	
e. trip to the allotment				
	N		456	
	Test statistics		558.158a	
	Degree of freedom		3	
	Asymptotic significance (two-tailed test)		0.000	
f. running errands (e.g., doctor, office, etc.)				
	N		456	
	Test statistics		88.895a	
	Degree of freedom		3	
	Asymptotic significance (two-tailed test)		0.000	

^a The significance level is 0.050. ^b Asymptotic significance is presented. a There are 0 cells (0%) with an expected value below 5. The minimum expected value is 114.

Table A3. Spearman correlation results for the different response options to the question: “Please rate the following means of transport in the aspects indicated (1—not suitable, 5—best suitable)”.

a. commuting to work or school, shopping				
		traditional bicycle	electric bicycle	car
traditional bicycle	Correlation coefficient	1.000	0.380 **	−0.207 **
	Significance (two-tailed)	.	0.000	0.000
	N	456	456	456
electric bicycle	Correlation coefficient	0.380 **	1.000	0.149 **
	Significance (two-tailed)	0.000	.	0.001
	N	456	456	456
car	Correlation coefficient	−0.207 **	0.149 **	1.000
	Significance (two-tailed)	0.000	0.001	.
	N	456	456	456
b. recreation				
		traditional bicycle	electric bicycle	car
traditional bicycle	Correlation coefficient	1.000	−0.110 *	−0.183 **
	Significance (two-tailed)	.	0.019	0.000
	N	456	456	456
electric bicycle	Correlation coefficient	−0.110 *	1.000	0.368 **
	Significance (two-tailed)	0.019	.	0.000
	N	456	456	456
car	Correlation coefficient	−0.183 **	0.368 **	1.000
	Significance (two-tailed)	0.000	0.000	.
	N	456	456	456
c. health and fitness				
		traditional bicycle	electric bicycle	car
traditional bicycle	Correlation coefficient	1.000	−0.003	−0.088
	Significance (two-tailed)	.	0.954	0.059
	N	456	456	456
electric bicycle	Correlation coefficient	−0.003	1.000	0.297 **
	Significance (two-tailed)	0.954	.	0.000
	N	456	456	456
car	Correlation coefficient	−0.088	0.297 **	1.000
	Significance (two-tailed)	0.059	0.000	.
	N	456	456	456

* Correlation significant at the 0.05 level (two-tailed). ** Correlation significant at the 0.01 level (two-tailed).

Table A4. Results of the non-parametric chi² test for the question: “Which of the options listed below best fits the characteristics indicated”.

Summary of Testing Hypothesis				
	Zero Hypothesis (Ho)	Test	Statistical Significance^{a,b}	Decision
1	Category “it is suitable for everyone”—all options occur with equal probability	chi ² test for one sample	0.000	Rejection of Ho
2	Category “it is especially useful for the elderly”—all options occur with equal probability	chi ² test for one sample	0.000	Rejection of Ho
3	Category “it can travel long distances”—all options occur with equal probability	chi ² test for one sample	0.000	Rejection of Ho
4	Category “it is useful when the terrain isn’t flat”—all options occur with equal probability	chi ² test for one sample	0.000	Rejection of Ho
5	Category “it is trendy”—all options occur with equal probability	chi ² test for one sample	0.000	Rejection of Ho
6	Category “it gives more pleasure from riding it”—all options occur with equal probability	chi ² test for one sample	0.000	Rejection of Ho
7	Category “it is safer”—all options occur with equal probability	chi ² test for one sample	0.000	Rejection of Ho
8	Category “it is expensive”—all options occur with equal probability	chi ² test for one sample	0.000	Rejection of Ho
9	Category “it is more suitable for everyday use”—all options occur with equal probability	chi ² test for one sample	0.000	Rejection of Ho
10	Category “it is more practical”—all options occur with equal probability	chi ² test for one sample	0.000	Rejection of Ho
11	Category “for villagers”—all options occur with equal probability	chi ² test for one sample	0.000	Rejection of Ho
12	Category “for city dwellers”—all options occur with equal probability	chi ² test for one sample	0.000	Rejection of Ho
13	Category “it is ecological”—all options occur with equal probability	chi ² test for one sample	0.000	Rejection of Ho
14	Category “I prefer to have”—all options occur with equal probability	chi ² test for one sample	0.000	Rejection of Ho
Summary of the chi² Test for One Sample				
a. it is suitable for everyone				
	N		456	
	Test statistics		190.934a	
	Degree of freedom		2	
	Asymptotic significance (two-tailed test)		0.000	
b. it is especially useful for the elderly				
	N		456	
	Test statistics		161.566a	
	Degree of freedom		3	
	Asymptotic significance (two-tailed test)		0.000	
c. it can travel long distances				
	N		456	
	Test statistics		126.750a	
	Degree of freedom		3	
	Asymptotic significance (two-tailed test)		0.000	

Table A4. Cont.

Summary of the chi² Test for One Sample		
d. it is useful when the terrain isn't flat		
N		456
Test statistics		125.211a
Degree of freedom		3
Asymptotic significance (two-tailed test)		0.000
e. it is trendy		
N		456
Test statistics		171.276a
Degree of freedom		3
Asymptotic significance (two-tailed test)		0.000
f. it gives more pleasure from riding it		
N		456
Test statistics		293.763a
Degree of freedom		3
Asymptotic significance (two-tailed test)		0.000
g. it is safer		
N		456
Test statistics		327.000a
Degree of freedom		2
Asymptotic significance (two-tailed test)		0.000
h. it is expensive		
N		456
Test statistics		725.487a
Degree of freedom		2
Asymptotic significance (two-tailed test)		.000
i. it is more suitable for everyday use		
N		456
Test statistics		560.882a
Degree of freedom		2
Asymptotic significance (two-tailed test)		0.000
j. it is more practical		
N		456
Test statistics		485.211a
Degree of freedom		2
Asymptotic significance (two-tailed test)		0.000
k. for villagers		
N		456
Test statistics		438.789a
Degree of freedom		2
Asymptotic significance (two-tailed test)		0.000
l. for city dwellers		
N		456
Test statistics		191.526a
Degree of freedom		2
Asymptotic significance (two-tailed test)		0.000
m. it is ecological		
N		456
Test statistics		807.316a
Degree of freedom		2
Asymptotic significance (two-tailed test)		0.000

Table A4. Cont.

Summary of the χ^2 Test for One Sample	
n. I prefer to have	
N	456
Test statistics	593.329a
Degree of freedom	2
Asymptotic significance (two-tailed test)	0.000

^a The significance level is 0.050. ^b Asymptotic significance is presented.

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