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THE INFLUENCE OF THE SHARED E-SCOOTER SYSTEM ON MODAL SHIFT

Key Words

Mobility

Traffic congestion

Transport demand management

Sustainable transport mode

Abstract

In many cities around the world, e-scooters have emerged as a new sustainable mode of transport. In addition to owning their personal scooter, users in many cities can rent an e-scooter within the shared e-scooter system. The shared use of e-scooters, as an innovative transportation strategy, mainly includes the possibility to pick up and return an e-scooter at any location within a certain zone. Thus, this dockless design of an e-scooter sharing system provides a flexible and efficient option for first/last-mile trips. Bearing that in mind, the aim of this paper is to analyze the modal shift potential of shared dockless e-scooters in Belgrade using different tariff policies. Considering that the introduction of a shared dockless e-scooter system in Belgrade represents a hypothetical situation, a stated choice approach was used. Appropriate descriptive and analytic statistics were used in statistical analysis. The obtained results point out whether and to what extent the application of an appropriate e-scooter shared system would contribute to the reduction of traffic congestion in the Belgrade central zone. Also, based on the obtained results, it is possible to identify the factors that discourage people from using shared e-scooter systems.

1. INTRODUCTION

In the last few years, there has been an expansion in the use of shared e-scooters as one of the micromobility modes by urban residents across the globe [1, 2, 3, 4]. E- scooters can be privately owned, but the large increase in the use of e-scooters can be explained by the introduction of shared e-scooter systems in cities. Since the launch of the first shared e-scooter system in late 2017 (California, USA), e-scooter systems have spread across hundreds of cities worldwide [5]. Paris was one of the first European cities where shared e-scooters were introduced (in June 2018) [6]. As of June 2021, Paris and Berlin have been the hub of e-scooter sharing in Europe, followed by Madrid and Stockholm [7].

The shared e-scooter system is currently one of the most popular micromobility sharing services which usually operates in a dockless form [8]. The dockless shared e-scooter system allows users to pick up and return an e-scooter at any place within a defined area. Using a mobile application, users can check the availability of e-scooters in real time and pay the charge automatically through a registered account [8, 9]. When the e-scooter battery is low or maintenance is needed, one of the provider’s employees collects the e-scooter and brings it to a charging place. Once the battery is fully charged, the e-scooter is then redeployed to strategic locations and users can use it again [10].

Shared e-scooters faced a quick acceptance by users all around the world, and the rates of usage were reported to be higher than shared bicycles when implemented [11]. Namely, after less than one year of availability in some cities in the USA, a remarkably large number of people (3.6%) reported having used them, while 70% of the respondents said that they perceived shared e-scooters as an alternative way to getting around [12]. However, in Tricity (Poland) the public e-scooter sharing system has been significantly less popular than the e-bike sharing system. Namely, when asked about reasons discouraging them from riding, Tricity citizens complained about shared e-scooter prices and were concerned about their safety [13]. During the Covid-19 pandemic, shared e-scooters became a great asset in many cities worldwide, because they promote social distancing and help cities not to rely only on private cars to replace public transport rides, especially for short distance trips [11]. In Braga, it was found that the city still relied on shared e-scooter modes as a mobility option after the pandemic, also promoting special fares for people to start using the service [11]. Generally, many experts are of the opinion that shared e-scooters may become an important component of mobility planning in the coming years, when cities begin to recover from the COVID-19 pandemic [14].

Shared e-scooters are mostly used for short trips in terms of distance and duration. The average distance travelled by shared e-scooters in the USA is about 1.6 km, generally covered in 12 min [15], while in European countries it amounts to around 1.75 km to 1.96 km covered in 13 to 15 min [16]. The charge of this service varies significantly depending on the provider and the city in which the system operates. In the USA the average 12-minute scooter shared trip costs from $2.80 to $4.70 depending on the system [15]. In the city Tricity (Poland) the user pays around €2.21 for a 3 km ride on an e-scooter. The shared e-scooter system is usually more expensive than public transport services comparing the prices for the same trip. For example, in the city Tricity (Gdansk, Poland) the shared e-scooter price is about three times higher than a ticket for a bus or tram [13].

While previous research concur that shared e-scooters are mostly used for very short trips in the afternoon and at weekends mostly [17, 18], it was concluded that the spatial distribution and purposes of e-scooter trips vary according to the local context [19]. Generally, in the previous research it was determined that the intention to use this service was influenced by socio-demographic characteristics of users, service price, trip characteristics, infrastructure characteristics and environmental factors [8, 13, 17, 20, 21].

Having in mind the above mentioned, the aim of this paper is to define an appropriate methodology which should help to determine whether and to what extent the residents of Belgrade would use a dockless shared e-scooter system with certain infrastructure and different tariff policies. The proposed methodology should assist decision makers in evaluating the shared scooter system and deciding on its implementation.

2. METHODOLOGY

A survey of users' attitudes on e-scooters' usage in the current conditions, as well as in hypothetical situations that would imply the existence of the appropriate cycling infrastructure and a dockless shared e-scooter system was conducted for the purpose of this paper. Respondents were asked to answer the question whether they would use an e-scooter (personal or shared) for different trip purposes (work/school purpose and other purposes) if they had the appropriate cycling infrastructure and the option to use a dockless shared e-scooter at different charges. The authors of the paper defined three price levels, based on the prices of this system in other cities, taking into account the economic indicators that are valid in local conditions, as well as the price of public transport in Belgrade. All three price scenarios include a fee of 20 RSD for unlocking the scooter, while the other part of the charge - payment per minute of driving varies among the scenarios (15 RSD/min, 10 RSD/min and 5 RSD/min).

The research was conducted online. The online survey was distributed as a link via email. After the incomplete questionnaires with inconsistent responses had been removed from the sample, the valid sample used in the further analysis consisted of 392 respondents. In addition to the previously mentioned questions, the questionnaire contained general questions about demographic and socio-economic characteristics of the respondents.

3. RESULTS

3.1. Sample characteristics

The study included 392 participants. Out of the total number of the participants, 51.8% were female, while 48.2% were male. According to the respondents' age, 9.5% of the participants were under 18, 45.6% between 19 and 25, 20.5% between 26 and 35, 13.6% between 36 and 45, while 10.9% of the respondents belonged to the age group between 46 and 55. Out of the total number of the respondents, 3.4% have a personal e-scooter.

3.2. Using an e-scooter

Out of the total number of the respondents, 3.4% have a personal e-scooter. For trips with work/school purpose, 1.4% of the respondents use an e-scooter most frequently, while 0.4% of the respondents use an e-scooter and public transport (PT) most frequently. For trips with other purposes, 2.9% of the respondents use an e-scooter most frequently, while 0.5% of the respondents combine an e-scooter and PT most frequently (Table 1). The average distance covered by e-scooter is 2.6 km for trips with work/school purpose and 3.4 km for trips with other purposes.

When analyzing the respondents' willingness to use an e-scooter in a hypothetical situation when the complete cycling infrastructure is built, the results show that for trips with work/school purpose 2.7% of the respondents would most often use an e-scooter, while 1.3% of the respondents would combine an e-scooter and PT. For trips with other purposes, 3.6% of the respondents would use an e-scooter, while 1.4% of the respondents would combine an e-scooter and PT (Table 1).

Table 1 also shows the percentage of users who would use an e-scooter in the case of the built cycling infrastructure and implemented shared e-scooter system at different service prices. For example, in the case of the lowest price, 7.8% of the respondents would use a shared e-scooter (e-scooter only or combination with PT) for trips with work/school purpose, while 9.2% of the respondents would use it for the trips with other purposes. In the case of the highest price these values are significantly lower (3.3% for trips with work/school purpose and 4.3% for trips with other purposes).

Table 1. The share of e-scooter users in the current situation and in hypothetical situations - built bicycle infrastructure/built bicycle infrastructure + implemented shared e-scooter system

<table>
<tr><th colspan="3"></th><th>Work/school purpose</th><th>Other purposes</th></tr>
<tr><td colspan="2" rowspan="2">The current situation</td><td>Personal e-scooter</td><td>1.40%</td><td>2.90%</td></tr>
<tr><td>Personal e-scooter + PT</td><td>0.40%</td><td>0.50%</td></tr>
<tr><td colspan="2" rowspan="2">Bicycle infrastructure</td><td>Personal e-scooter</td><td>2.70%</td><td>3.60%</td></tr>
<tr><td>Personal e-scooter + PT</td><td>1.30%</td><td>1.40%</td></tr>
<tr><td rowspan="12">Bicycle infrastructure + Shared e-scooter system</td><td rowspan="4">Price (15 RSD/min+20 RSD start)</td><td>Personal e-scooter</td><td>2.50%</td><td>3.10%</td></tr>
<tr><td>Personal e-scooter + PT</td><td>1.20%</td><td>1.30%</td></tr>
<tr><td>Shared e-scooter</td><td>2.30%</td><td>3.10%</td></tr>
<tr><td>Shared e-scooter + PT</td><td>1.00%</td><td>1.20%</td></tr>
<tr><td rowspan="4">Price (10 RSD/min+20 RSD start)</td><td>Personal e-scooter</td><td>2.30%</td><td>2.70%</td></tr>
<tr><td>Personal e-scooter + PT</td><td>1.10%</td><td>1.10%</td></tr>
<tr><td>Shared e-scooter</td><td>4.10%</td><td>4.80%</td></tr>
<tr><td>Shared e-scooter + PT</td><td>1.60%</td><td>2.10%</td></tr>
<tr><td rowspan="4">Price (5 RSD/min+20 RSD start)</td><td>Personal e-scooter</td><td>2.00%</td><td>2.40%</td></tr>
<tr><td>Personal e-scooter + PT</td><td>1.10%</td><td>0.90%</td></tr>
<tr><td>Shared e-scooter</td><td>5.50%</td><td>6.30%</td></tr>
<tr><td>Shared e-scooter + PT</td><td>2.30%</td><td>2.90%</td></tr>
</table>

The obtained results showed that for trips with work/school purpose, the number of shared e-scooter users would grow significantly with the fall in service prices. Also, the percentage of using one's personal e-scooter decreases with the reduction of shared e-scooter prices (Figure 1).

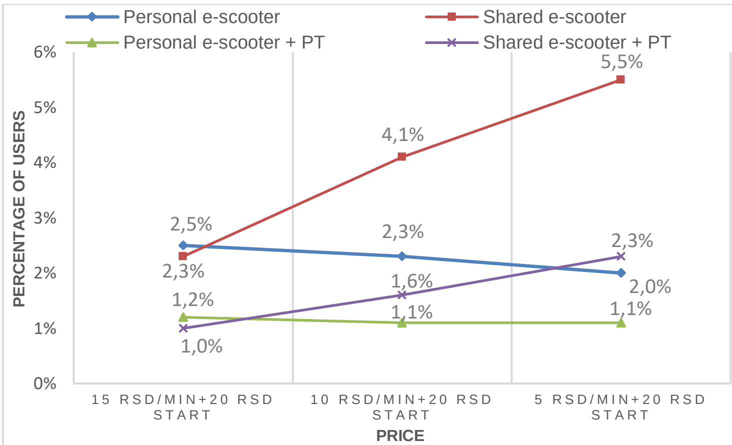

Figure 1. Percentage of the shared e-scooter usage for trips with work/school purpose depending on the service price

On the other hand, for the stated hypothetical situation and for trips with other purposes, a similar trend could be observed. However, the percentage of shared e-scooter users was higher for this purpose, as opposed to the trips with work/school purpose (Figure 2). Based on the above given figures, the percentage of potential shared e-scooters can be determined, depending on the service price.

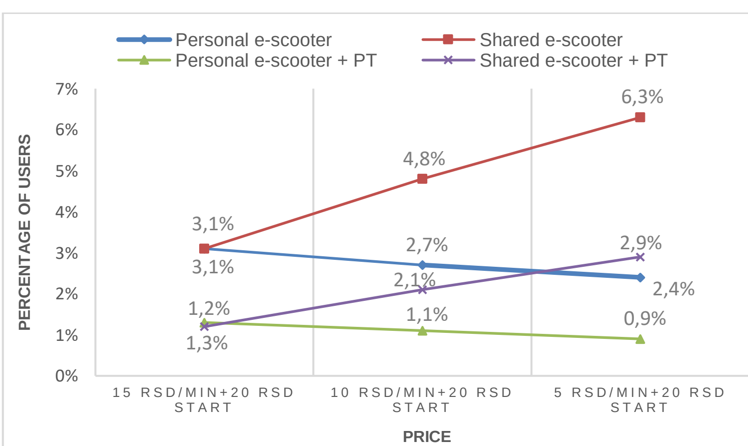

Figure 2. Percentage of the shared e-scooter usage for trips with other purposes depending on the service price

4. CONCLUSION

Based on the data analyzed, the conclusions of this research are as follows:

- for trips with work/school purpose 1.8% of the respondents use an e-scooter (scooter only or combination with public transport), while for trips with other purposes 3.4% of the respondents use an e-scooter;

- in the hypothetical situation in which the complete cycling infrastructure is built, 4% of the respondents would use an e-scooter for trips with work/school purpose, while for trips with other purposes 5% of the respondents would use this transport mode;

- in the hypothetical situation which includes the built bicycle infrastructure and shared e-scooter implementation, in the case of the lowest service price, 7.8% of the respondents would use a shared e-scooter for trips with work/school purpose, while 9.2% would use it for trips with other purposes. In the case of the highest service price these values are lower (3.3% and 4.3 % of the respondents, respectively).

Urban planners and municipal authorities need to consider the potential of this new micromobility mode when developing infrastructure and creating new sustainable policies. The proposed methodology should help to determine whether and to what extent the residents of Belgrade would use a dockless shared e-scooter system with certain infrastructure and different tariff policies. The directions of future research should be aimed at increasing the number of participants of the research, as well as examining wider price ranges for shared e-scooters.

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