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Sharing means of transport in urban areas

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This article presents an overview of selected forms of so-called shared mobility in cities, along with current trends. It focuses on bicycles, kick scooters and motor scooters. These forms of transport provide a new, unique method of moving around cities. They enhance freedom of movement and are accessible. They are easy to use and users have a positive experience. The growing popularity of these means of transport is reflected in the annual increase in the number of rentals. Usually, they are used to get to work, school, university, office, or a public transport station and back home, as well as for social and recreational purposes. In addition to user safety concerns, the primary challenges for these modes of transport involve infrastructure accessibility, permitted maximum speed, sensitivity to weather conditions, lack of space for luggage or a passenger, battery charging and the choice of the most appropriate business and operational model. The author concludes that the sharing of bicycles, motor scooters, kick scooters and other similar means of transport, i.e. broadly defined micro-mobility, is only at the initial stage of development and, in the coming years, we should expect an even greater demand for these types of urban transportation systems.

Keywords: urban transport**,** bicycle sharing, motor scooter sharing, kick scooter sharing

Introduction

Due to limited resources that need to be used rationally, being provided with access to goods or infrastructure is preferable to their unnecessary and excessive ownership. City residents have been long accustomed to sharing, for example, hallways or staircases in blocks of flats, as well as elevators, leisure areas, playgrounds, libraries or public

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transport. Many people would rather use specific things for their own benefit without owning them, as ownership entails expenses, it requires time and space, and generates costs that could otherwise be avoided, such as storage and maintenance costs.

Sharing means using something together, for example, computer resources, machines, devices and many other useful things. Modern technologies encourage sharing – popularisation of smartphones and development of digital competences give rise to new business models based on the so-called *sharing economy*.

The change of paradigm from owning to using, from individual use to sharing, contributes to rational consumption of limited resources and promotes a sustainable lifestyle. This is particularly true in the case of urban transportation, whereby heavy traffic, largely created by cars, occurs on a daily basis, with all the associated congestion, noise, air pollution and lack of free parking spaces. Another important factor is the constant increase in human migration to large cities, and thus the necessity of providing an effective transport system.

This article presents an overview of selected forms of so-called shared mobility in cities, along with current trends. Particular focus is given to sharing two-wheeled vehicles, such as bicycles, and kick and motor scooters.

Sharing means of transport

In Poland, shared urban transport is developing exponentially, as environment-friendly electric vehicles, including cars, motor scooters and bicycles, personal transporters, especially kick scooters, become increasingly accessible. Electric bicycles are especially popular with elderly residents or those of lower physical fitness, while electric kick scooters gain increasing popularity among young people. Thus, it should be expected that a system of shared cars, motor and kick scooters, and bicycles, will help to reduce such environmental problems as noise or air pollution, crammed car parks and congested traffic, and make the so-called first and last miles much less arduous to cover. The benefits of sharing means of transport in cities are presented in Table 1.

Table 1. Benefits of sharing means of transport in cities

Benefit categories	Description of benefits
Urban space	As one vehicle is used by multiple individuals, fewer cars and fewer parking spaces are required. In contrast to privately owned vehicles, shared vehicles are in use most of the time, thus not reducing the already limited urban space.
Car traffic	Decreased percentage of private cars in urban travelling. City residents are more inclined to use multiple means of transport while on their way to a particular destination.
Residents' expenses	Owning a car and keeping it in working order always involves certain costs, whether the vehicle is used frequently or not. Adopting the "pay-for-use" principle allows residents to avoid such expenses.

Benefit categories	Description of benefits
Carbon dioxide emission	By reducing car traffic in general, we also reduce our carbon dioxide footprint. The fleets of shared means of transport are made up of new vehicles that meet the current standards. They are also typically include a relatively large percentage of zero-emission vehicles.
First/last mile problem	Light vehicles, such as 'traditional' bicycles, e-bikes or e-scooters, to name some classic examples of shared means of transport, provide an alternative solution to cover the distance between one's home and a station, or between a bus or tram stop and one's work place.
Comfort of travel	Advanced smartphone applications provide easy access to many different means of transport, including mass public transport. Thus, one can find out how to get from point A to point B, plan the travel, check the availability of means of transport and rent one of them using a single app.
Flexible travelling	City residents are offered greater choice of available means of transport.

Source: Own study on the basis of Jędrzejewski, Domaszewicz, 2019: 23–27.

Local governments draw up plans for integrated mobility, invest in infrastructure and adopt new legal regulations concerning shared transport to make it complementary to municipal public transport. Research on car sharing reveals that one shared car can replace as many as 8, or even 10, private cars. In numerous European cities, during rush hour, only one in five cars is occupied by more than one person. Thus, many seats remain empty and unused, which only contributes to traffic jams. In addition, such cars are frequently used to cover only short distances and most of the time they remain parked, often at private properties, while access to urban space is being limited (see: *Police Advice Note*, 2010: 2–3).

Municipal support for companies offering shared vehicles, travel planning applications and transport fee payments facilitates the integration of shared transport with public transport at hubs and city centres. Features such as electronic unlocking of vehicles and digital user identification, offered by intelligent shared transport systems, have solved many problems of municipal systems, including on-line payment safety, vandalism and misuse (Mizielińska, 2018).

The situation should be improved even further with the popularisation of self-driving cars. If the current trends in autonomous vehicles, electric cars powered with renewable energy and shared means of transport were combined into one integrated transport system, this could reduce travel costs by up to 10 times, while still guaranteeing the same level of mobility. In addition, the estimated number of accidents would be 10 times lower, while the number of cars in use would be 20 to 100 times lower. Many car manufactures are taking active steps to help that vision come true. For example, the Tesla company announced the launch of a new programme, whereby the owners of self-driving cars can rent them out when they are not using them. Meanwhile, Uber is working on its own fleet of autonomous cars, and the entire automotive industry is in active search of partnerships to follow that

trend. For example, one can already have an Audi that not only pays for itself, but even generates additional income (Sokołowski, Starzyński, Rok, Zgiep, 2016: 24).

To sum up, sharing means of transport can bring such benefits as better use of already limited city space, less traffic, lower travel expenses incurred by city residents, reduction in carbon dioxide emissions, solving the first/last mile problem, and greater comfort and flexibility of urban travel.

Shared transport systems in cities

The classic example of a system based on shared means of transport is a municipal public transportation system the integral components of which include trams, buses, trolleybuses, subway or commuter rail. To reach a specific destination within the city limits, one only needs to get on a bus or another mass transport vehicle and then get off at the right stop. Another method of sharing means of transport is so-called carpooling, based on driving one's own vehicle and offering a ride to other people going in the same direction. Let us imagine that you and your neighbours or friends have similar destinations. They can, for example, work or study near the place to which you are going or somewhere on the way. Instead of going separately, each in their own car, you simply need to arrange shared transport (see: https://www.inonecar.com/).

Some companies (e.g. manufacturing or logistics businesses) offer special bus transport to their employees. Such company buses stop at specific hours in pre-arranged places to collect the employees from individual parts of the region or the city and deliver them to their workplace. It is a very convenient solution, as it guarantees that everyone will arrive at work on time and then return home without delay.

In case of going to or from the airport, a good solution is a so-called *shuttle bus*, i.e. a minibus or a coach (or a train of similar function, for example in Warsaw or Amsterdam) that usually departs from the city centre to deliver passengers directly to the airport.

Yet another way of sharing means of transport is sharing a taxi (quite literally). Not so long (around 20–30 years) ago, sharing a taxi was nothing unusual, and not necessarily due to financial or environmental reasons. This solution is still used by students. In Warsaw, for example, *my Taxi Match* service allows one to organize a shared taxi together with another person (a stranger) going in the same direction. This can reduce travel costs by fifty% in comparison with an individual taxi ride (more details: Piechowiak, 2018).

A much simpler solution seems to be making one's own vehicle available for others to rent (for example via the *SnappCar* app). In Europe, 250 million cars are used for only one hour a day – a resource that could be exploited much more efficiently. A car owner simply needs to agree to rent his or her car to other people. This follows the same principle as a *car-sharing* service, but instead of investing in a fleet of new cars, drivers are provided access to existing ones (see: wolneauto.pl). Ac-

cording to the originator, if the idea caught on with the drivers, by 2022 the number of cars on European streets could be reduced by 5 million (more details: *Lubimy się dzielić…*, 2017). A different solution, though based on a similar concept of shared transportation, is offered by Uber, an American enterprise with headquarters in San Francisco and the creator of the Uber mobile app that allows its users to order car transport services by matching passengers with available drivers. Uber provides its services in 528 cities around the word (*Uber przedsiębiorstwo* entry in Polish Wikipedia, 2019). Another company offering shared transport solutions, but for longer distances, is BlaBlaCar. The Polish branch of the company has been operating since 2012. It matches drivers having free seats in their cars with passengers going in the same direction. BlaBlaCar app is available in 22 countries and has over 40 million users. Anyone interested in shared rides has to create his or her on-line profile, which will display the reviews and comments of other users, along with links to other social media profiles (*BlaBlaCar* entry in Polish Wikipedia, 2019).

As urban mobility is undergoing a digital revolution, city residents are offered more and more options to cover the distance between point A and point B using various means of transport. These new solutions, however, are still neglected by legislators and decision-makers in terms of legal regulations and possible benefits for users of shared transport services (more details: Janczewski, 2019: 137–138). Thus, municipal authorities are introduced to a new category of urban transportation – a sort of a hybrid between individual and mass transport, and complementary to both (Suwart, 2018).

Sharing bicycles, personal transporters, motor scooters and cars in urban areas

According to the authors of *Współdzielona mobilność w Polsce w lipcu 2019 (Shared Mobility in Poland in July 2019)*, in Poland there are almost 37 000 shared vehicles, including bicycles, electric kick scooters, motor scooters and paid-per-minute cars. Many cities offer at least one of those types of vehicles as part of their pay-per-minute rental systems. Thus, almost 11.5 million people in Poland have access to shared mobility services.

The most popular of these is naturally *bicycle-sharing*, first implemented almost 10 years ago and acting as a sort of spur for further development of individual shared transport. Currently, 67 Polish cities offer a total of 24 700 bicycles for rent, and the number is growing.

The second most popular shared mobility vehicle is also the newest one – the first electric kick scooters in Poland appeared only recently, in November 2018. Now there are over 7 200 of them in 9 different cities, and each month brings more news of cities, towns and service providers deciding to expand their offer with shared e-scooters. Their popularity is soaring, unhindered by the lack of relevant traffic regulations.

The so-called *car-sharing* system in Poland consists of almost 3 600 pay-per-minute cars and is available in 12 cities. One should also not forget about motor scooters – almost 1 500 in total. All these vehicles are equipped with electric drives. Shared electric motor scooters are available in 18 cities in Poland. In addition, one Polish company successfully launched the service abroad (Jędrzejewski, Domaszewicz, 2019: 12–14). It can also be expected that Poland will soon introduce three-wheeled bicycles (similar to electric rickshaws, popular in Southern Asia), either for individual rent, or following the same principle as electric tuk-tuks in Stockholm (Turula, 2017), or similar micro-vehicles adapted to our weather conditions.

In Poland, 25% of all shared means of transport are electrically-driven (or even 30%, if we include e-bikes). While nowadays light personal vehicles equipped with electric drives are nothing unusual, the high percentage of electric cars available in the *car-sharing* system (over 17%) is quite surprising. It means that 616 shared cars, i.e. one in five, are electrically-driven. Considering the current trends in *car-sharing*, that number is expected to keep growing.

The actual number of active users of shared mobility services in Poland is hard to determine, as service providers do not disclose such customer data. Even so, we can estimate it on the basis of the number of registrations in their systems (i.e. we can assume that the number of users is more or less equal to the number of active accounts in individual applications). However, in this way some data might be counted twice (as some people might use more than one rental service, and thus they can have more than one account). Nevertheless, this can give us some idea of the popularity of specific shared mobility services, so we can make a forecast about their further development (Jędrzejewski, Domaszewicz, 2019: 15).

Sharing bicycles in urban areas

Bike rentals can operate according to the following business models (Table 2):

- public rentals, subsidised by local authorities – almost the entire *bike-sharing* market in Poland is based on this model;
- public rentals, not subsidised – a rare solution, e.g. the Wavelo system in Cracow, launched on December 31, 2019;
- private system, purely commercial – dockless bicycles, e.g. Acro Bike in Warsaw.

Table 2. Bicycle rental business models

Business model	Description of the model
Public	Local authorities order a complete city bike system, including its several-year maintenance, and the whole initiative is paid for with public money. The contracting company assumes only minimal market risk and its task is to provide the city residents with adequate access to the system. In most cases, users can enjoy the first 15 to 20 minutes of use free of charge, which is a powerful incentive.
Public, but not subsidised	In this case, the service provider is not paid from the public budget, but makes a profit on the system as such, mostly rental fees paid by users. The contract is awarded by tender, similarly to the publicly subsidised model, but the difference is that the economic risk is born by the service provider (see: Kusy, 2019).
Private	City bike system launched by a private service provider, at its own economic risk, without concluding any agreement with the local authorities. These are so-called dockless bicycles, which means there are no bike stations. The system is purely commercial and operates in parallel to other city bike systems (see: acro.bike).

Source: Own study on the basis of Jędrzejewski, Domaszewicz, 2019: 34–35.

Bicycle rental operating models are as follows:
- station models based on 3G bike technology;
- models based on dockless, or free-floating bikes, requiring 4G technology;
- mixed models (Table 3).

In Poland, self-service city bike rentals can be found in almost 70 cities and towns. They offer 24 700 bicycles, which are shared by over 2 million users. The number of docking stations is almost 3,000. In 2019, the value of the city bike rental market (understood as the total income from all *bike-sharing* services) exceeded PLN 90 million. Some forecasts suggest that the amount can double in coming years to reach over PLN 200 million in 2025. By then, as A. Jędrzejewski and Z. Domaszewicz estimate, as many as 30% of adult city residents in Poland (that is, 5.9 million people) might be registered as users of *bike-sharing* systems (Jędrzejewski, Domaszewicz, 2019: 33).

Table 3. Bicycle rental operating models

Operating model	Description of the model
Station-based	Bicycles are rented and returned only at selected points (stations), by locking and unlocking them to and from a special rack (a docking station). 3rd generation bikes (see: *3. Generacja*, 2019).
Free-floating	Bicycles can be rented and returned anywhere within the specified area (the rental zone). Docking stations are not required, as bicycles are already equipped with all the necessary technology, including GPS and GSM localisation and communication modules. 4th generation bikes required (see *4. Generacja*, 2019).

Operating model	Description of the model
Mixed	Station-based system, but bicycles can be also left in other locations specified by the service provider, following the free-floating model. This often involves an additional fee.

Source: Own study on the basis of Jędrzejewski, Domaszewicz, 2019: 36–37.

In 2019 Nextbike Polska, the largest self-service bike rental company in Poland, registered around 14 million individual bike rentals, most of them – almost 70% – in Warsaw, Wrocław, Łódź and Poznań. In other cities and towns, rentals amounted to several thousand. Bike-sharing enjoyed the greatest popularity in June 2019, with as many as 2 558 311 rented bikes.

Since the launch of the first city bike system in 2011, the number of rentals has reached 55.9 million. The number of registered users has been growing accordingly. Nextbike Polska statistics reveal that over 2.4 million people have registered in the system since its implementation in 2011, while the 2019 season (from March) saw over 456 100 new registrations.

The cities that can boast the largest number of shared bike users are Warsaw (over 900,000 registered accounts), Wrocław (253 900), Poznań (179 600), Łódź (147 300), Lublin (112 200) and Białystok (92 400).

In 2019, many cities and towns introduced new systems, along with numerous complementary innovations. In Wrocław, for example, Nextbike provided access to 2000 4th generation (4G) bicycles and 65 non-standard bicycles (including 35 children's bikes, family 'cargo' bikes, e-bikes, folding bikes and handbikes). These bicycles are available all year round, but in the winter season their number is limited to 600. Users can book and park their rented bicycles. In addition, Nextbike supplemented its 3rd generation city bike system in Poznań with dockless 4G bikes (including electric ones). The town of Luboń has become the first commune in the Poznań District to synchronise a bike-sharing system with Poznań public transport. Also, thanks to an agreement between the Commune of Komorniki, the City of Poznań and the Town of Luboń, users of standard 3rd generation bikes are for the first time provided with an opportunity to move between all three destinations within a single system (More details in: *Miliony kilometrów przejechanych…*, 2019).

In Warsaw, the Veturilo system by Nextbike consists of 390 stations. Users are provided with access to 5 700 bicycles, including 60 children's bikes, 45 tandems and 110 e-bikes. In the 2019 season, the Warsaw city bikes were rented over 5.9 million times. The largest numbers of rentals were registered in June and April – over 900 000, which gives an average of 31 900 and 30 100 rented bikes a day, respectively. This would mean that each available bike was rented 168 times (in June) and 158 times (in April), on average. The average rental time in Warsaw in 2019 was 22 minutes and 59 seconds. Around 77% of rentals did not exceed the free 20-minute period. The next 18% were rentals for the period from 20 minutes to 1 hour, involving a small fee of PLN 1. The most active Veturilo user used the city bike system as

many as 363 times during the whole season. The most popular bicycle, No. 29005, was rented 2012 times in 2019, which gives over 7 rentals a day, on average (more details in: *Veturilo – podsumowanie…*, 2019).

Current world trends reveal that the number of city bike rentals grows in parallel with their electrification. In New York and Washington, D.C., the introduction of e-bikes resulted in an increase in the average number of rentals per bike per day from 5 to 15 (*Shared Micromobility in the U.S.: 2018*, 2019). The same phenomenon is observed in Western Europe, where e-bikes[1] enjoy much greater popularity than in Poland (Jędrzejewski, Domaszewicz, 2019: 37).

Bicycles equipped with a supportive electric drive can be used also by people of lower fitness, or those avoiding too much physical effort. This is particularly important in cities situated in hilly areas. Such a bicycle is considerably more expensive than a regular bike and its maintenance poses a much greater logistical challenge for service providers (mostly due to the batteries requiring re-charging or replacement) (*ibid*.). Nevertheless, supportive electric drives have a significant impact on bicycles' performance as regards such aspects as average speed, travelling time, distance range, acceleration, riding against the wind or luggage transport. They also encourage elderly people to consider using this type of two-wheeled vehicle. E-bikes are also safe, equipped with rechargeable batteries, and adaptable to many different applications, e.g. cargo transport, travelling with children, etc.

The idea of a bicycle powered by electricity dates back to the end of the 18th century. However, it was long abandoned due to the lack of appropriate batteries. Even at the beginning of the current century, electric bikes were still a rare sight. For example, in the Unites States in the period between 2006 and 2012, only 1% of all purchased bicycles were e-bikes. An exception to the rule was China, which, during the said period, produced 37 million electric bicycles and sold 32 million of them in 2013. By way of comparison, in the same year, 1.8 million e-bikes were sold in Europe, 440 000 in Japan and 185 000 in the US. Currently, mostly thanks to new developments in battery technology, which made batteries lighter and less expensive, and increased their capacity, the e-bike market is growing exponentially and customers are offered all sorts of e-bikes adapted to individual needs and preferences.

According to forecasts made by analysts from Deloitte, by 2023 the total global number of electric bikes will be around 300 million, which means a 50% increase in relation to 200 million e-bikes sold in 2019. For example, in 2018 e-bike sales in Germany increased by 36%, reaching almost 1 million. Even more such bicycles were sold in that country in the first half of 2019. In the Netherlands, over a half of all

[1] Bicycle – a vehicle having a maximum width of 0.9 m, driven by the muscle power of the person riding it; a bicycle can be equipped with a supportive electric drive, activated by pushing the pedals, whereas the said drive generates a voltage not higher than 48 V, with the continuous rated power not higher than 250 W, and its output gradually decreases to zero after exceeding a speed of 25 km/h (*Traffic Law Act, Chapter I, Article 2, item 47*). According to current regulations, each bicycle that does not meet the above definition is considered a moped.

adult bikes sold in 2018 were equipped with an electric drive. Meanwhile, the number of electric bikes sold in the United States reached over 400 000 – a 73-per cent increase in relation to the previous year, while Spain recorded a 55-per cent increase, with 111 000 e-bikes sold in 2018. This data reveals that the number of electric bikes on city streets around the world is growing (*Technology, Media, and Telecommunications Predictions 2020, Deloitte Insights*, 2019: 120).

Electric kick scooters in urban areas

The electric kick scooter, considered a type of personal transporter, is the most recent invention in shared urban mobility. Its electric drive can reach 25 km/h and its range is between 10 to 20 km, depending on the battery capacity and the operating conditions. Each scooter must be equipped with brakes and an acoustic signal (a bell), as well as front and rear reflectors. Users are also advised to wear helmets. As regards the business model, kick scooters are offered as part of private shared mobility systems, without subsidies and docking stations. Scooters are placed at various locations around the city. To rent them, users have to install an application on their smartphones and provide their payment card details. Then, having reached their destinations, they can leave scooters there, without looking for a docking station. Scooters should be parked in public, easily accessible areas, usually specified by the service provider – in general, any place permitted by law.

Table 4. Benefits cities derive from shared electric kick scooters

Benefits for cities	Description of benefits
Complementary to municipal public transport	Allows door-to-door travel, readily available, easy to rent, quickly activated, deployed at various locations around the city and awaiting users.
Improved travelling multimodality	Greater choice of available means of transport, improved urban mobility, encouragement to change one's commuting habits, e.g. to give up travelling in a private car.
Promoting environment-friendly transportation	Zero-emission device, compact and quiet, contributes to traffic reduction and prevents congestion in the city.
Low investment costs	Relatively inexpensive, low investment costs, fleets can be financed from fees imposed on the users.
Positive feedback	Scooters are manoeuvrable, easy to use and effortless to steer, popular among young people.
Triggering changes	Searching for new business and operational models, adopting the infrastructure to account for battery replacements or multi-modal parking hubs.
New job creation	Specialists in dispersed fleet management and relocation required, new tasks for repair workshops and computer specialists.

Source: Own study on the basis of Jędrzejewski, Domaszewicz, 2019: 58–59.

In contrast to bicycles, kick scooters lack clear legal status under Polish traffic law. Current regulations do not even provide an unambiguous definition of such vehicles. So, from the legal perspective, scooter riders are considered pedestrians and as such they are entitled to use pavements and other pedestrian traffic routes, which results in many misunderstandings, as well as dangerous situations and accidents (more details in: Perzyński, 2019). Even if users are obliged by the service provider to adhere to safety rules, the said legal ambiguities make local authorities unable to adopt adequate control measures or impose penalties. For example, it is unclear where exactly scooters can be parked or if the service provider's requirements concerning urban travel are legally binding when specific behaviours are not explicitly prohibited by law. Thus, many local governments, instead of waiting for amendments in national legislation, have decided to take matters into their own hands and introduce their own regulations concerning the use of kick scooters (see: *Kraków porządkuje hulajnogi – bez czekania na rząd*, 2019; *Włochy mają patent na hulajnogi. Mandat na 1000 euro*, 2019).

Even so, shared electric kick scooters are gaining more and more popularity and, as complementary to public transport, they have already become an inherent part of the urban transportation system, providing such benefits as improved travel multimodality, promotion of environment-friendly travel, low investment costs, positive feedback, triggering positive changes and new job creation (see: Table 4). Kick scooter sharing requires carefully prepared, but also flexible legal solutions in order to guarantee the safety of both the users and other traffic, provide safe parking spaces, develop appropriate business and operating models, increase local governments' involvement and improve the services provided. In addition, a large-scale educational program is necessary to build users awareness of safe conduct.

Table 5. Differences between bicycles and kick scooters as regards their construction and use

Difference category	Bicycle	Kick scooter
Kerb weight and dimensions	A bicycle is equipped with a seat and a drive system that increases its speed, but also its weight.	A folding scooter is easier to transport than a folding bike and takes up less physical space.
Manoeuvrability	Harder to manoeuvre between obstacles due to protruding pedals and wider handlebars.	Easier to manoeuvre between obstacles.
Distance range	More suitable for longer distances and open space.	More suitable for shorter distances and crammed space.
Speed/stability	At lower speed, it is difficult to control a bike when pedalling.	Kick scooters are very stable at lower speed.
Luggage	Equipped with a small luggage carrier. In addition, the rider can have a backpack.	No luggage carrier, but the rider can have a backpack.

Difference category	Bicycle	Kick scooter
Short break in travel	As bicycles are tall, getting off quickly to push a bike across a short distance and then getting on again is more difficult.	In case of scooters, the riders' feet are closer to the ground, which facilitates getting on and off quickly.
Sharing/business model/operating model	Low rental cost, as the rental system is subsidised by local authorities. Must be returned to a dock. Inconvenient station-based model.	Higher rental cost. Commercial rentals. More parking and return options. Floating model.
Infrastructure	Bicycle paths, or pavements, if no path is available. Infrastructure is constantly being improved and expanded.	Lack of appropriate legal regulations. As for now, riders can use pavements and other pedestrian traffic routes. From a legal perspective, a scooter rider is considered a pedestrian. Riders can use paths inaccessible to bicycles.

Source: Own study.

Pay-per-minute electric kick scooters were first introduced in the United States towards the end of 2017. By the end of 2018, a total number of 85 000 e-scooters were available in 100 American cities. They were rented 38.5 million times. Two years later the devices were popularised around the world, thus becoming a global phenomenon. In Poland, in March 2019, the Lime company registered around 60 000 users in Warsaw. At present, the scooters are available in most Polish cities and, as their number is constantly increasing (see: *Kolejne hulajnogi elektryczne na minuty w Poznaniu*, 2019), they constitute competition for shared bicycles, the latter being gradually replaced by the former (see: Kromer, 2019; *Szczecin. Gorsze statystyki roweru miejskiego*, 2019). Selected differences between bicycles and kick scooters as regards their construction and use are presented in Table 5.

Motor scooters in urban areas

Similarly to electric kick scooters, shared motor scooters are equipped with electric engines. An electric city scooter provides an alternative to an electric bicycle. It allows people to reach a specific destination quickly and effortlessly. Electric bikes have, however, one advantage over electric motor scooters – riders can use bicycle paths and do not get stuck in traffic jams. Nevertheless, an electric drive in a bike is only supportive and physical effort is necessary to cover a distance. Table 6 presents the most important differences between a motor scooter and a bicycle with a supportive electric drive.

Table 6. Differences between motor scooters and electric bicycles as regards their construction and use

Difference category	Electric motor scooter	Bicycle with a supportive electric drive
Kerb weight and dimensions, construction	Motor scooter has a larger kerb weight. Two people can ride it at the same time. Larger dimensions, smaller and wider wheels, equipped with turn indicators and a stop light.	Lower kerb weight, adapted for one person only, smaller dimensions, larger and narrower wheels, different/lighter frame construction, no turn indicators nor stop lights.
Manoeuvrability	Harder to manoeuvre between obstacles. Sensitive to surface quality.	Easier to manoeuvre between obstacles. Easier to ride over uneven surface.
Distance range	More suitable for longer distances. Distance range depends on battery capacity and the user's riding style.	More suitable for shorter distances and crammed space. Distance range depends on the user's physical fitness and riding style, in addition to battery capacity.
Speed/stability	Very stable at lower speed. Higher maximum speed, however limited to 45 km/h.	At lower speed, a bike is difficult to control.
Luggage	Equipped with a trunk for a small piece of luggage. In addition, the rider can have a backpack.	Equipped with a small luggage carrier or a basket. The rider can have a backpack.
Liability insurance/ licence	Requires liability insurance and an appropriate licence.	No liability insurance or licence required.
Sharing/business model/operating model	Higher rental cost. Commercial rentals. More parking and return options. Floating model.	Low rental cost, as the rental system is subsidised by local authorities. Must be returned to a dock. Inconvenient station-based model. Problems with battery recharging and replacement.
Infrastructure	Infrastructure the same as in the case of cars or similar four-wheeled vehicles.	Bicycle paths or pavements, if no path is available. Infrastructure is constantly being improved and expanded.

Source: Own study.

A city motor scooter is equipped with an electric engine, usually with 4 kW output power. Its design allows one to reach a maximum speed of 45 km/h. It has an average range of 60 km. Riding a motor scooter requires an AM or B category driving licence. This regulation, however, does not apply to people born before 19th January 1995 or to holders of a moped licence valid for life. The vehicles are light and usually equipped with an easy-to-use automatic transmission. A major advantage is also their size. As motor scooters are small enough to be parked virtually anywhere, users do not waste precious time looking for a free parking space. When going around the city on a rented motor scooter, a rider is obliged to observe the same traffic regulations as any other road user. In contrast to city bikes, motor scooters are dockless. The service

provider's app includes a map with their exact locations, which allows users to book a scooter and collect it within 15 minutes. The rider is required to wear a helmet that can be found in the trunk. Returning a motor scooter is as simple as its rental. After reaching his or her destination, the user only needs to find the nearest parking zone and leave the vehicle there (see: *Skuter miejski – jak działa i kto może z niego korzystać*, 2019). Motor scooters provide access to road infrastructure, can be used by two people simultaneously, and can be parked on a pavement, free of charge – to name just a few benefits. On average, shared motor scooters cover a distance of 4 to 5 kilometres within 15 to 20 minutes. In high season, each vehicle can be rented several times a day. The 'official' name for motor scooter sharing is either *mopedsharing* or *scootersharing*. However, the latter term is more often used in reference to electric kick scooters (Jędrzejewski, Domaszewicz, 2019: 47).

Electric motor scooters, registered as mopeds, are environment-friendly and easy to use. As an urban mode of transport, they are faster and more efficient than cars. City motor scooters are reliable, designed for heavy use. Their service life is estimated at 3 to 6 years.

The first shared motor scooters appeared in San Francisco in 2012, and the market has been growing exponentially since 2015. In 2019, motor scooter rentals operated in more than 60 cities worldwide and the total number of registered users was around 1.8 million (see: *Electric Scooter Sharing Market in US and Europe 2019–2024*, 2019).

The largest market growth and the greatest interest in this kind of services are observed in Europe. In the period 2017–2018, motor scooter sharing increased by over 200%. Spain has the largest number of scooters available. Previously, the country that could boast the largest motor scooter fleet was Germany. In Madrid, there were over 4 500 shared scooters. By way of comparison, in the same period the number of shared cars available in Madrid was around 2 600. This, however, does not mean that motor scooters are popular only in countries with a mild climate. For example, in France in 2018, the number of shared motor scooters increased by as much as 130%. The vehicles were also introduced in the Netherlands and Switzerland. Despite the fact that the average winter temperature in Germany is 3 degrees Celsius, almost 3 000 shared scooters are used there all year round (more details in: Aguilera-García, Gomez, Sobrino, 2020: 2–4; Lam, 2019).

In Poland, shared scooters also enjoy considerable popularity. Most motor scooter sharing systems operate in Warsaw, Tricity, Poznań, Wrocław and Łódź. The first feedback received after their launch suggested that supply does not meet demand. In addition, the vehicles, due to their relatively large distance range, were scattered around the city and often parked far from the centre. According to the *Współdzielona mobilność w Polsce w lipcu 2019 (Shared Mobility in Poland in July 2019)* report, at the time of publication, 5 service providers offered a total number of 1 484 motor scooters (Jędrzejewski, Domaszewicz, 2019: 70–71). Despite the fact that the ma-

jority of rentals operate according to the commercial model, some local authorities, having noticed the positive impact of pay-per-minute e-scooters on urban transportation, included them into their offer. For example, the City of Rzeszów issued a call for tenders for a shared mobility system that would combine electric motor and kick scooters, and conventional bicycles (Kruczek, 2019).

Apart from shared, publicly available systems, electric motor scooters are also an attractive alternative for business (as part of B2B models), e.g. food delivery (*Pizza Hut będzie dostarczać…*, 2017) and courier services (Völklein, 2020), being much more cost-effective and both user- and environment-friendly than their diesel counterparts.

In Poland, due to weather conditions, motor scooters are largely a seasonal means of transport. Thus, in the period from November to February, their accessibility is reduced. The exact numbers depend on the specific city and service provider, but in general only 15% of the entire fleet is available all year round. As regards middle-sized cities and towns, shared scooters completely disappear from the streets in winter and are re-deployed with the coming of spring (Jędrzejewski, Domaszewicz, 2019: 68).

Summary

Shared bicycles, motor and kick scooters considerably facilitate urban transit. More and more of them can be noticed on city streets. These forms of transport provide a new, unique method of moving around cities. They enhance freedom of movement and are accessible. They are easy to use and users have a positive experience. The growing popularity of these means of transport is reflected in the annual increase in the number of rentals. Usually, shared bicycles, motor and kick scooters are used to get to work, school, university, office, or a public transport station and back home, as well as for social and recreational purposes. In addition to user safety concerns, the primary challenges for these modes of transport involve infrastructure accessibility, permitted maximum speed, sensitivity to weather conditions, lack of space for luggage or a passenger, battery charging and the choice of the most appropriate business and operational model.

To sum up, one can risk the statement that the sharing of bicycles, motor scooters, kick scooters and other similar means of transport, i.e. broadly defined micro-mobility, is only at the initial stage of development and, in the coming years, we should expect an even greater demand for these type of urban transportation systems. As micromobility enjoys considerable interest and there is growing demand for new methods of travel, municipal authorities have new problems to solve, including the provision of innovative infrastructure and business solutions. This will involve detailed analysis of all safety issues and ongoing research.

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Streszczenie

Współdzielenie środków transportu w podróżach miejskich

Artykuł ma na celu przegląd wybranych form tzw. współdzielonej mobilności w miastach oraz wskazanie aktualnych trendów i kierunków rozwoju. Szczególną uwagę poświęcono współużytkowaniu pojazdów jednośladowych: rowerów, hulajnóg i skuterów. Umożliwiają one nowy i wyjątkowy sposób podróżowania w mieście oparty na takich atrybutach, jak swoboda, dostępność, kontrola środka transportu, przyjemność z jego użytkowania i emocje. O popularności tych środków przemieszczania się świadczy rosnąca z roku na rok liczba ich wypożyczeń. Najczęściej wykorzystuje się je na dojazdy lub powroty z pracy, szkoły, uczelni, dojazdy do urzędów, jako połączenie z transportem publicznym, w celach towarzyskich i rekreacyjnych.
Kluczowe wyzwania dla tych form przemieszczania związane są z przystępnością infrastruktury, dopuszczalną prędkością, wrażliwością na warunki pogodowe, brakiem przestrzeni dla bagażu i pasażera, ładowaniem akumulatorów, modelem biznesowym i operacyjnym. Pojawiają się również wyzwania z zakresu bezpieczeństwa użytkowników. Autor konkluduje, że współdzielenie rowerów, skuterów, hulajnóg i innych podobnych środków transportu zaliczanych do szeroko rozumianej mikromobilności jest dopiero w początkowym stadium rozwoju, a najbliższe lata przyniosą jeszcze większy popyt na tego rodzaju systemy podróżowania w miastach.

Słowa kluczowe: transport miejski**,** współdzielenie rowerów, współdzielenie skuterów, współdzielenie hulajnóg