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The economics of micromobility: Analysis and development prospects

Ekonomia mikromobilności. Analiza i perspektywy rozwoju

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Abstract

Micromobility is growing rapidly, offering environmental and economic benefits, supporting sustainable development, job creation and improving the quality of life in cities. Based on small, electric vehicles, it can significantly reduce congestion and improve air quality. With its growing importance comes the need to analyse the impact of micromobility on urban economies and transportation. The concept of the economics of micromobility – which examines costs, the viability of business models (ownership vs. sharing), the impact on other modes of transportation and regulatory issues – is proposed. It takes into account micro (costs, revenues) and macroeconomic (labour market, investment, transportation policy) perspectives. The article contains seven parts: introduction, introduction to the economics of micromobility, market description, cost analysis of scooter use, labour market impact, development prospects and conclusion.

Keywords: micromobility, micromobility economics, micromobility market, small electric vehicles, urban transportation

Streszczenie

Mikromobilność dynamicznie się rozwija, oferując korzyści ekologiczne i ekonomiczne, wspierając zrównoważony rozwój, tworzenie miejsc pracy i poprawę jakości życia w miastach. Oparta na małych, elektrycznych pojazdach, może znacząco zmniejszyć zatłoczenie i poprawić jakość powietrza. Wraz z jej rosnącym znaczeniem pojawia się potrzeba analizy wpływu mikromobilności na gospodarkę miejską i transport. Proponuje się wprowadzenie pojęcia ekonomii mikromobilności – badającej koszty, opłacalność modeli biznesowych (własność vs. współdzielenie), wpływ na inne środki transportu oraz kwestie regulacyjne. Uwzględnia ona perspektywy mikro- (koszty, przychody) i makroekonomiczną (rynek pracy, inwestycje, polityka transportowa). Artykuł zawiera siedem części: wstęp, wprowadzenie do ekonomii mikromobilności, opis rynku, analizę kosztów użytkowania hulajnogi, wpływ na rynek pracy, perspektywy rozwoju oraz podsumowanie.

Słowa kluczowe: mikromobilność, ekonomia mikromobilności, rynek mikromobilności, małe elektryczne pojazdy, transport miejski

Introduction

Micromobility has become an important part of urban transport systems in recent years. Micromobility is a transport solution offering environmental and economic benefits, particularly for cities (Lenartowska, 2024). It includes small, lightweight vehicles such as electric scooters, traditional and electric bicycles, and mopeds, which are mainly used for short distances. Micromobility has developed due to technological advances, the growing popularity of shared models, and the pursuit of sustainable urban transport.

As micromobility becomes increasingly significant, it is necessary to analyse its impact on the urban economy and transport market. In this context, the term micromobility economics emerges. This refers to research into the economic aspects of this transport segment. It covers issues relating to the costs and profitability of different business models, such as ownership versus sharing, and the impact of micromobility on other modes of transport, including public transport and taxi services. It also covers regulatory implications and public policy.

Previous research on micromobility has primarily examined its environmental impact (Hollingsworth, Copeland, Johnson, 2019), its integration with public transport (Shaheen, Cohen, 2019), user behaviour (McKenzie, 2019), and safety (Janczewski, Janczewska, 2020b). However, the economic analysis of this phenomenon is still incomplete. The introduction of the economics of micromobility enables a systematic study of the subject, considering both microeconomic factors such as costs, revenues and operators' financial models, and macroeconomic factors such as the impact on the labour market, urban investment and transport policy.

This article aims to address the theoretical issues in the economics of micromobility, presenting the key challenges and opportunities in the field from a micromobility development perspective. Various sources of literature, reports, press articles and scientific papers were analysed to achieve this goal. In addition, the following were used: statistical and market data; case studies; cost-benefit analyses; surveys; and opinion polls. The difficulty of accurately estimating the economic impact of the environmental benefits of micromobility was highlighted. It was noted that such benefits are difficult to estimate because they depend on many different factors. The entire work ended with a conclusion.

Introduction to the economics of micromobility

Although the term "economics of micromobility" makes sense, it is not yet widely established in scientific and industry literature. The analysis covers the economic aspects of micromobility, including the costs and profitability of different micromobility options (e.g. electric scooters, city bikes and pay-per-minute scooters), the business models used in this industry (e.g. rental versus ownership), the impact of micromobility on the urban economy and public and private transport, and the regulations and urban policies that affect the development of the micromobility market.

The concept of micromobility is already well established, but adding the term "economics" creates a new concept that is both understandable and logical. For example, it could be compared to the *sharing economy*, with its main determinants being identified as purchase and maintenance costs, environmental benefits, spatial efficiency, accessibility, and convenience.

The economics of micromobility involves analysing the costs and benefits of using small, zero-emission vehicles for short-distance travel, whether for personal use or as part of a shared scheme provided by specialist operators. These include bicycles and scooters, as well as light electric vehicles. These are three- or four-wheeled vehicles that weigh less than 350 kg and have a maximum speed of 45 km/h. In this paper, they are referred to as "micro" or "small" vehicles.

Traditional motor vehicles are more expensive to purchase and maintain than micro vehicles. They don't use fossil fuels, and their design is simpler and less complicated, which significantly reduces maintenance costs. Micro-vehicles do not require specialised charging stations; they can be charged from a standard domestic power socket. This is particularly relevant for individual micromobility vehicles.

Micromobility helps to reduce air pollution and noise emissions, which benefits the urban environment. Even when emissions associated with the production of electricity for charging are taken into account, micro electric vehicles emit negligible amounts of air pollution. Micro vehicles may be a solution to the problem of traffic congestion in cities due to their small size and, in the case of some vehicles, their ability to move on pedestrian routes.

Micromobility can help solve problems relating to congestion, air pollution, noise, and the organisation of public transport. Urban congestion is reduced by the fact that small vehicles take up less space on roads and in car parks. Micromobility makes it easier for users to cover short distances, often in combination with other modes of transport. This increases the accessibility of public transport.

Micro vehicles are an excellent alternative to traditional internal combustion vehicles for short distances thanks to their low running costs and favourable environmental impact. Although translating the environmental benefits of micromobility into economic benefits is not straightforward, several correlations can be identified. These include:

- A reduction in air pollution means lower healthcare costs related to respiratory diseases.
- Fewer traffic jams means lower fuel consumption for cars and faster transport of people and goods, resulting in real savings in travel time.
- Quiet vehicles improve quality of life for city residents and boost property values in quieter neighbourhoods.

However, it should be noted that the cited economic benefits are difficult to estimate precisely and depend on a number of factors that can be categorised in several ways (see: *Mikromobilność w miastach – jak małe pojazdy zmieniają urbanistykę?*, 2023; *Mikromobilność rewolucjonizuje miejski transport*, 2024; *Mikromobilność zasilana energią słoneczną: Rewolucja w miejskim transporcie*, 2024):

- Technological factors.
- Infrastructural factors.
- Social and political factors.
- Financial factors.

Technological factors include battery life and charging time, as well as the development of new energy storage technologies. The longer the battery life in electric vehicles, the lower the operating and replacement costs. This translates into savings for users. It also means less strain on the environment. Faster battery charging offers greater convenience and reduces the need for charging infrastructure, thereby lowering the cost of implementing micromobility. The development of new battery technologies has led to new, more efficient and environmentally friendly production methods emerging. These methods could revolutionise the micromobility market by reducing costs and increasing environmental benefits.

Infrastructure for micro vehicles includes cycle paths, parking spaces and docking stations, which require investment but can bring indirect economic benefits, such as reducing congestion, improving transport and increasing the attractiveness of cities. In addition, there is the matter of integration with other forms of public transport. Integrating micromobility with public transport and other traditional modes of transport can boost the efficiency of the entire transport system, leading to cost savings and environmental benefits.

Government policy, along with the subsidies, tax breaks and other forms of support for micromobility provided by local authorities, can accelerate the development of this sector, reduce users' costs and encourage investment in infrastructure. It is also important to consider public education and changes in consumer habits here. Understanding the benefits of micromobility – both environmental and economic – is key to changing transport habits and increasing acceptance of this type of solution. The transition to micromobility requires consumers to change their habits and choose alternative modes of transport. These choices may depend on various factors, such as convenience, safety, cost, and availability.

The main financial considerations are the price of electric vehicles, their operating costs, and the availability of financing. The lower the purchase price of micro-vehicles, the more accessible they are to a wider range of consumers. This can stimulate market growth and bring economic benefits. The low operating costs of micromobility, such as battery charging and servicing, encourage the use of this solution and are an additional argument in its favour. Providing easier access to cheap loans, leasing and other forms of financing for micro-vehicle purchases could boost their popularity and accelerate market growth.

These factors all interact with each other, making their combined impact on the economic benefits of micromobility complex and difficult to estimate precisely. Nevertheless, technological development, infrastructure investment, appropriate local government policies and public education can create favourable conditions. These conditions would allow for fully exploiting the economic and environmental potential of micromobility.

Market description

The micromobility market is growing rapidly, offering new solutions for urban transport. According to McKinsey, the global micromobility market was worth around $175 billion in 2022. Forecasts indicate that it could grow to around $360 billion by 2030 (*New types of mobility*, 2024). Similarly, a forecast published a year later estimated the value of the global micromobility market in 2023 at around $180 billion, indicating that it could grow to approximately $440 billion by 2030 (Heineke et al., 2023).

The micromobility market is also growing rapidly in Poland. In 2022, there were around 120,000 micromobility vehicles in Poland, the majority of which (80%) were electric scooters. The remaining vehicles were split between city bikes (20%) and shared electric scooters (less than 0.5%). In 2022, the eight largest cities accounted for almost 80% of the entire shared electric scooter market. These cities were Warsaw, the Tri-City area, Krakow, Poznan, Lodz, Wroclaw, Szczecin, and Lublin (*Mikromobilność w miastach – jak małe pojazdy zmieniają urbanistykę?*, 2023).

The number of electric scooters available in Polish cities is increasing rapidly, and the micromobility industry is growing faster than previously forecast. The sharing

of electric scooters via apps is also spreading to smaller populated places (e.g. *W Kutnie pojawiły się hulajnogi elektryczne. Jak z nich korzystać?*, 2022; *W Gostyninie pojawiły się hulajnogi elektryczne*, 2023).

It should be noted that the above data on the approximate number of micromobility vehicles in Poland does not include individual micro-mobility, i.e. micro-vehicles that are privately owned. Given the growing popularity of electric scooters, it is estimated that the number of privately owned scooters may be similar to or even greater than the number of scooters available from micromobility operators (for more on this topic, see: *Jest już 94 tys. sharingowych e-hulajnóg w 161 miejscowościach w Polsce. Rowerów też przybyło*, 2023; *Mikromobilność. Strefa Danych Rynek i statystyki*, 2023).

The key features of the global micromobility market include its scope and development, the factors driving this development, the associated challenges and trends, and the innovations. This is illustrated in table 1.

Tab. 1. Key features of the micromobility market

Key features	Characteristics/examples
Global reach and rapid market growth	The regions covered are North America, Europe, Asia, Latin America, Australia, and Africa. Technological development, advances in energy storage and the development of mobile applications and smart vehicles. Diversified business models. Support for the industry includes subsidies, rate relief and legal regulations. Further progress hinges on the development of infrastructure, increased research spending and adaptation to the needs of individual users.
Factors stimulating market growth	Urbanisation, population growth in cities, congestion problems, clean transport zones, lifestyle and user expectations, public policy, low operating costs, business and technological innovation, integration with public transport.
Market challenges	The absence of suitable regulations regarding micromobility is problematic. There are infrastructure issues in terms of both lines and points. Cities do not have a sufficient number of micromobility vehicles and parking zones. Safety issues: Accidents involving scooters and bicycles. In many regions, especially in colder climates, micromobility is limited by weather conditions.
Popularity and market trends	Popularity, modernity, eco-friendliness, convenience and accessibility. Customisable stylish scooters or bicycles. The integration of technology and attractive features on display, as well as an intelligent management system. Promotion of an active and green lifestyle through social media presence. The right way to get around, progress and modernity is shown by using micromobility.
Innovations in micromobility	Vehicle electrification, fleet management technologies, mobile and intermodal applications, shared fleets. Advanced fleet management systems enable monitoring and optimisation of vehicle utilisation. Vehicles are fitted with sensors that monitor their technical condition. Renting and returning vehicles is made easy by smartphone apps. Monitoring battery charge, tracking vehicle location and using artificial intelligence in micromobility. Dedicated cycle paths and charging stations. Automatic braking systems and LED lighting. Innovative business models, vehicles on demand.

Source: own study based on Heineke et al., 2023; *Mikromobilność w miastach – jak małe pojazdy zmieniają urbanistykę?*, 2023; Heineke, Kampshoff, Möller, 2024; *Jazda w stylu smart. Pokolenie Z wybiera mikromobilność,* 2024; Szymański, 2024; *Trendy wśród pokolenia Silver – aż 57% seniorów chce korzystać z mikromobilności*, 2024; Akrel, 2025a; 2025b; *Micro-Mobility Market*, 2025; *New types of mobility*, 2025..

The global micromobility market is growing rapidly, covering areas of varying economic development – both developed and booming. North America has many start-up companies offering micro-vehicles and the progressive integration of micromobility with public transport. There is also numerous individual micromobility users. Europe boasts an extensive micromobility infrastructure, characterised by close collaboration between cities and intense competition among micromobility operators. Micromobility is most popular in Asia, with China leading the way in terms of production and use of such devices. The leading manufacturers are Xiaomi, Ninebot and Yadea. Asian companies are investing in the development of batteries, GPS systems and mobile applications. In megacities such as Beijing, Shanghai and Tokyo, micromobility is a common form of mass transport for short distances. On the other hand, Latin America is introducing and developing systems for sharing scooters and bicycles. This is particularly noticeable in Brazil, Mexico, and Colombia. Meanwhile, Africa is considered an emerging market where the most important challenge is infrastructure (for more on this topic, see: Heineke et al., 2023; Heineke, Kampshoff, Möller, 2024; Akrel, 2025a; 2025b).

The global reach and rapid growth of micromobility has led to advances in technology and industry, including improvements in batteries and mobile applications, as well as the implementation of artificial intelligence and autonomous vehicles. The market's rapid growth has given rise to a variety of business models, including sharing and access to micromobility transport, subscription models, and both matched (*Rower za abonament: innowacyjna oferta Orange w Holandii*, 2025) and retail sales. It is also important to provide support for companies in the micromobility sector, such as subsidies and rates relief, as well as appropriate legal regulations and standards.

The micromobility market is experiencing growth driven by social, environmental, technological and economic factors. The urbanisation and densification of cities are the result of population growth and the associated increase in mobility. An increase in the number of cars leads to congestion and traffic jams, slowing down movement. The growing awareness of environmental issues, the need to reduce CO_2 emissions, the introduction of clean transport zones, and the growing popularity of zero-emission transport options are all leading to increased interest in micromobility solutions. Essential factors here include the development of mobile applications, the role of artificial intelligence, the integration of micromobility services with public transport, improvements in energy storage, and changes in the lifestyles, expectations, public policy, usage costs and business models of different user groups. For example, an increasing number of people, particularly those belonging to Generation Y (Millennials) and Generation Z, expect to benefit from transport services rather than owning their own means of transport, which is the traditional approach for many Poles.

In the context of the micromobility market, popularity has specific consequences for users and manufacturers that form part of broader social and cultural trends.

Younger generations (e.g. Millennials and Generation Z) are particularly keen on micromobility, which is a lifestyle and a mode of transport (see: *Jazda w stylu smart. Pokolenie Z wybiera mikromobilność*, 2024; *Trendy wśród pokolenia Silver – aż 57% seniorów chce korzystać z mikromobilności*, 2024). Using scooters and electric bikes is seen as a modern, environmentally friendly choice that reflects real values and concern for the environment. They are convenient and accessible, making it easy to get around the city quickly without owning a car. Aesthetics and design are considered to be important. Users are increasingly focusing on the appearance of devices, such as stylish scooters and bicycles. Personalised design, trendy colours and attractive features such as LED displays, mobile apps and intelligent management systems are all offered. Micromobility is popular on social media. Users can view photos and reports on trendy means of transport. This trend is being driven by influencers who are promoting an eco-friendly, active lifestyle. In many cities, the adoption of micromobility is increasingly viewed as a sign of progress and environmental consciousness. This makes it practical and prestigious in certain social circles (for more on this topic, see: Jaskóła, Bielkiewicz, 2024; *Mikromobilność, czyli nowoczesne rozwiązania transportowe*, 2024; *Rola mikromobilności w urbanistyce*, 2024; *Trendy mobilności i w motoryzacji*, 2024; Akrel, 2025a; 2025c).

Innovative solutions are essential for success in the micromobility market. This sector is being shaped by innovations such as vehicle electrification, advanced fleet management technologies, mobile applications, infrastructure and safety, and shared fleets.

Users can travel quickly and in an environmentally friendly way over short distances, thereby reducing CO_2 emissions and air pollution. Companies that offer micromobility services use advanced fleet management systems to monitor and optimise the use of their vehicles. This improves the management of resources and increases the number of vehicles available to users. Vehicles are fitted with sensors that monitor their condition, thereby preventing breakdowns and scheduling servicing. The process of renting and returning vehicles is made simple for users by smartphone apps. They can also be used for tracking battery levels, vehicle location, and route planning. Cities are building cycle paths and charging stations for electric vehicles. In addition, user safety is being enhanced through innovations such as automatic braking systems and LED lighting. The popularity of vehicle sharing is growing, as it makes efficient use of resources and reduces the number of private cars on city streets. Users can access on-demand vehicles, increasing the flexibility and convenience of their travel.

Innovations in micromobility improve the quality of life for city dwellers and contribute to sustainable development and environmental protection (for more on this topic, see: Strągowski, 2020; Janczewski, Janczewska, 2022).

Cost analysis of scooter use

The cost of using an electric scooter can vary significantly, depending on whether you own the device or use a rental service. The decision between purchasing or renting an electric scooter is influenced by various factors, including personal preferences, intended usage frequency, budget, and numerous other considerations. The degree of scooter usage, as determined by the number of kilometres travelled, is important. So is ensuring that the device has a safe and convenient place to park or wait for its next use. For the busy and overworked the majority of our society, this may be a dominant factor in the decision to purchase or rent a device.

When it comes to a private scooter, significant factors include the purchase price, battery charging costs, insurance costs, and maintenance and repair costs. Prices for new electric scooters on the Polish market start at around PLN 1,500 for short-range models, PLN 3,500 for medium-range models, and significantly more for advanced, long-range models that offer greater comfort. These can cost PLN 6,000 or more. The Techlife X5 2.0 electric scooter (10.4Ah, 36V) costs PLN 2,299 and has a range of around 30 km (*Hulajnoga elektryczna Techlife X5 2.0 – 10,4Ah 36V*, n.d.).

A scooter's power consumption is related to many factors, the most important of which is the distance travelled. It is estimated that the cost of the electricity required to travel 100 km on an electric scooter is PLN 3–6, meaning approximately PLN 0.03–0.06 is spent per kilometre. It is assumed that users charge their batteries on their home network. Other costs incurred by private users include depreciation, insurance, and maintenance and repair costs. This includes the replacement of small parts and the periodic replacement of batteries and tyres. Taking into account purchase price, charging costs, depreciation, insurance, battery replacement and maintenance, travelling one kilometre on your own electric scooter (e.g. the TECHLIFE X5) may cost approximately PLN 0.15–0.25.

When renting an electric scooter, users usually pay an initial fee, followed by a charge for each minute of use. The cost of renting electric scooters is determined by the operator. For example, one company charges PLN 0.99 per minute of driving, whereas another charges an initial fee of PLN 2.50 plus PLN 0.59 per minute. Therefore, it can be estimated that a 5-kilometre journey at an average speed of 15 km/h takes approximately 20 minutes. The cost of such a journey is 19.80 PLN, which is equivalent to 0.99 PLN per minute.

A comparison of the above shows that travelling one kilometre on a private scooter costs an estimated PLN 0.15 to PLN 0.25, whereas the cost of renting a scooter can range from PLN 3.96 for a 20-minute journey over 5 km. Therefore, although a private scooter has lower operating costs per kilometre travelled, it requires an initial investment to purchase the device, as well as subsequent maintenance and repair costs. It also requires convenient and safe storage when not in use. Renting a scooter, on the other hand, incurs higher costs per kilometre, but requires no initial investment and involves no responsibility for maintenance, repairs or proper storage.

Labour market impact

Using small, lightweight vehicles such as bicycles, electric scooters, mopeds and microcars has a significant impact on the labour market. It increases job accessibility and enhances employee flexibility and mobility. It also creates new jobs and contributes to local economic development.

Micromobility provides easier and faster access to workplaces that were previously only accessible by car. Research in the US has shown that combining micromobility with public transport can increase access to jobs by several dozen per cent (see: *Mikromobilność poszerza rynek pracy. Badania w USA*, 2019).

Thanks to micromobility, employees can travel more easily between different locations, making them more flexible and employable. This is particularly important in large cities, where traffic jams and parking issues can hinder the efficient movement of people.

The growth of micromobility is also generating new job opportunities within sectors related to the production, servicing and fleet management of micromobility vehicles. Companies that offer scooter or electric bike rental services require employees to work in technical support, Logistics, and management. Examples of such offers include those from the Scooter Operator in Konin (*Tier dott operator hulajnog Konin CID4ID*, n.d.), as well as Dott (*Praca dott*, n.d.) and Mobi (*Rekrutacja*, n.d.).

Micromobility can support local businesses by increasing the number of pedestrians and cyclists around shops, restaurants, and other service points. This can lead to increased sales and job creation in these areas. Using micromobility for product deliveries enables companies to bring their products to market quickly, deliver them to the right destination on time, and do so at the lowest possible cost. These companies also recognise the importance of implementing and enforcing sustainable development principles.

Scooters and electric bikes are increasingly being used for last-mile deliveries of various products in many cities around the world, including Poland. Thanks to micromobility, the *delivery* industry is growing. This means that the production and availability of micromobility devices must also increase. For example, Hop. City provides electric bikes and scooters to companies and restaurants that deliver products on demand. The company also offers micro vehicles to employees of other companies for professional travel around the city or commuting to work, known as professional/corporate mobility (for more on this topic, see: Hop.city, n.d.) Hop.City works with well-known brands such as Domino's Pizza and Just Eat. An interesting solution comes from Polish start-up Delivery Couple, which produces small delivery robots. These autonomous robots are used for delivering various products and parcels around cities (see: Delivery couple, n.d.). The courier company DPD Estonia also uses autonomous robots to deliver parcels within a 5 km radius (Patyk, 2022). On the other hand, FourKites uses artificial intelligence to optimise deliveries by pre-

dicting risks and potential delivery disruptions, enabling it to respond automatically to such events (see: Fourkites, n.d.). While this is not directly related to micromobility, these technologies support the efficiency of last-mile deliveries, in which micromobility plays a significant role. In Poland, food delivery companies such as Uber Eats, Glovo and Pyszne.pl use electric scooters and bicycles to transport food from restaurants to customers' homes. This makes the service both fast and environmentally friendly. Some supermarkets and grocery stores, such as Carrefour and Auchan, offer electric bike deliveries, particularly in large cities where traffic jams can cause delays to deliveries by car. Courier companies such as InPost are experimenting with using electric bicycles for parcel deliveries, as this allows for faster and more flexible delivery in congested areas. Pharmacies are also starting to use micromobility to deliver over-the-counter medicines and other pharmaceutical products straight to customers' doors (see: Glovo, n.d.; Wolt, n.d.).

Using micromobility transport, such as electric bicycles and scooters, to distribute over-the-counter pharmaceutical products is becoming increasingly popular due to advantages such as speed, efficiency, environmental friendliness and accessibility. Micromobility allows medicines to be delivered quickly, particularly in cities where traditional vehicles may struggle to move swiftly. This means that people in need can get their medication more quickly. Micromobility makes it possible to deliver medicines to places that are difficult for larger vehicles to access, such as narrow streets or areas with restricted traffic.

Using electric bicycles and scooters reduces exhaust emissions and noise, which benefits the environment. This is especially important given the growing awareness of environmental issues. In Poland, InPost is testing the use of electric bicycles and scooters for parcel delivery, including pharmaceutical products. This is intended to increase the efficiency of its services and implement sustainable development principles.

InPost is introducing parcel lockers that are equipped with charging stations for electric scooters and other lightweight electric vehicles. The implementation of this project was a joint effort between Hop.City and MorAmp (*Nowy projekt; Paczkomat InPost…*, 2020). These parcel lockers are designed to enable the parking, security and charging of small vehicles, thereby increasing the convenience for couriers who use micromobility transport. The share of electric delivery vehicles in the InPost fleet is also being gradually increased. Nearly 30 million parcels were delivered by electric vehicle in 2022 (*Dostarczyliśmy niemal 30 mln paczek autami elektrycznymi w 2022 roku!*, 2023). While this is not directly related to micromobility, it nevertheless shows the company's dedication to providing environmentally friendly transport solutions. InPost is investing in infrastructure development and opening new technology hubs with the aim of automating processes and improving delivery efficiency (*85 tys. paczek na godzinę: InPost otwiera nowy hub technologiczny w Polsce*, 2024). This supports micromobility by enabling the more efficient

management of electric vehicle fleets, including micro-vehicles, through better logistics infrastructure. These measures are all extremely important for creating new jobs in the micromobility sector.

Development prospects

Micromobility shows great potential for development, particularly in cities where increasing congestion and the need to reduce exhaust emissions are prompting a fresh approach to urban transport. These measures are also important for creating new jobs in the micromobility sector. Such opportunities also exist in tourist regions. Key trends and forecasts relating to the development of micromobility include infrastructure development, new technologies, regulation and lawmaking, ecological and climate-friendly procedures, integration with public transport, social changes, new business models and safety solutions.

In order to develop micromobility, infrastructure must be modernised and expanded. This includes constructing cycle paths, building charging stations and creating parking spaces for bicycles and scooters, as well as introducing low-emission zones. Such investments improve the quality of life for city residents, while also promoting tourism development. Many cities around the world can be considered leaders in the development of micromobility. Examples include Amsterdam, which has an extensive network of cycle paths and bike-sharing programmes, as well as San Francisco and Paris (see: *Trendy w mikromobilności miejskiej*, 2025). Similar examples of micromobility infrastructure development, particularly cycle paths, can be found in Polish cities and tourist regions. These include the Baltic Sea Cycle Trail (EuroVelo 10) and the Vistula Spit Cycle Route (also known as the Mikoszewo-Piaski Cycle Path), among many others. According to Nextbike executives, most European cities should have complete control over their micromobility infrastructure by 2030, as some parts of it are currently in a state of confusion. This is evident from the existence of various applications for providing micro-vehicles, as well as different parking and usage rules, and rental prices. The lack of readily available 230-volt battery charging sources also hinders the efficient use of micromobility transport. The automotive industry is primarily focused on developing fast-charging stations for electric cars, neglecting the needs of smaller vehicles (for more on this topic, see: *Elektromobilność, eko miasta i cyfryzacja transportu – trendy w branży automotive*, 2025). It is expected that dedicated mobility hubs, charging points and designated parking spaces will be created in urban areas in the near future. Micromobility operators should not be responsible for deciding where to park their vehicles, as it is the cities that manage the space in which bicycles and scooters move. This is similar to how bus stops and electric vehicle charging stations are managed (for more on this topic, see: *Przyszłość kołem się toczy, czyli mikromobilność w 2030 roku*, 2025). In Warsaw, for instance, there are bicycle stations designed for both scooters and private bicycles.

The development of micromobility is greatly influenced by new technologies and the electrification of transport modes. In urban areas, there's a growing trend of people opting for electric scooters and bicycles as a more environmentally-friendly and efficient way to travel short distances. For example, users of shared micromobility in Europe make around 550 million journeys a year, which demonstrates the growing importance of these vehicles in everyday urban transport. Nevertheless, these 550 million journeys represent only 0.5% of all urban journeys in Europe. According to A. Friedel, an expert in the micromobility industry, this suggests great potential for micromobility growth, but also indicates that dissemination may be a longer and more complicated process (*550 mln sharingowych mikromobilnych podróży rocznie w Europie. Ale…*, 2024). Friedl predicts that, in the future, electric bicycles will make up an increasing proportion of shared vehicle fleets, setting the direction for the entire micromobility sharing industry. By contrast, the number of electric scooters in circulation may be declining due to people choosing to dispose of and own them individually. New technologies in micromobility are being introduced through intelligent docking stations that communicate with users and vehicles via mobile apps or intelligent traffic management systems, among other things. For example, DUCKT offers solutions for parking, securing and charging electric scooters and bicycles at designated stations (see: *Nowe standardy mikromobilności na świecie*, 2021). On the other hand, modern systems such as System-on-Chip (SoC) support the development of electromobility while offering solutions for micromobility. These solutions make it possible to create more efficient energy management systems and integrate advanced functions, such as vehicle status monitoring and route optimisation (for more on this topic, see: *Nowe, wydajne układy SoC wspomagają rozwój e-mobilności*, 2024) which encourages the development of micromobility.

So-called microcars – small electric three- and four-wheeled vehicles – can play an important role in shaping the future of micromobility. They could provide an alternative to conventional passenger cars in urban areas. Thanks to their compact size and zero emissions, they are an attractive solution for those looking for an efficient way to get around town (for more on this topic, see: *Rola mikromobilności w urbanistyce*, 2024).

The future of micromobility is being shaped by pro-climate regulation and legislation. Consequently, an increasing number of cities are introducing legislation to reduce emissions and encourage the use of environmentally friendly transport. Additionally, the European Union is introducing various regulations to encourage sustainable mobility. The "Fit for 55" package aims to reduce CO_2 emissions by 55% by 2030. This will encourage greater investment in clean transport modes, including micromobility systems. Thanks to climate-friendly and environmentally-friendly regulations, cities are introducing clean transport zones that restrict combustion engine vehicles from entering. Such measures speed up the development of micromobility in cities, thereby improving air quality. The legal regulation of micromobility transport modes and their status is also significant.

Integrating micromobility with public transport is key to creating efficient, sustainable transport systems. Integrating different modes of transport can reduce the number of traditional vehicles on city roads, alleviating congestion and improving traffic flow. This can lead to an increase in micromobility. Apart from the development of micromobility itself, the most important benefit of integrating micromobility with public transport is the increased accessibility of public transport. Micromobility makes it easier to access public transport stops, particularly in areas with poor connections. In addition, replacing short car journeys in cities with micromobility solutions can help to reduce CO_2 emissions and improve air quality. It can also make better use of urban space, increase the attractiveness of public transport, and improve public health by promoting active travel. The implementation of the MaaS (Mobility as a Service) concept, which combines different modes of transport – including public transport and micromobility – into one coherent service accessible via a mobile app, is also significant. Users can plan and pay for journeys involving different modes of transport on a single platform (see: Štraub, 2020).

Societal changes and new business models have had a significant influence on the development of micromobility. The growing awareness of environmental issues and the desire to lead more sustainable lifestyles are encouraging more and more people to opt for micromobility as an alternative to traditional modes of transport. Population growth in cities has led to greater demand for efficient and flexible means of transport, such as electric bicycles and scooters. Vehicle-sharing business models are also important for the development of micromobility. These services are often offered on a subscription basis or with per-minute usage charges. Some micromobility operators are turning to crowdfunding to raise money for growth and expansion. The development of micromobility infrastructure, such as charging stations and cycle paths, can be facilitated through cooperation between the public and private sectors (for more on this topic, see: Janczewski, Janczewska, 2022a).

An important factor influencing the development of micromobility is safety. Introducing advanced safety technologies, such as speed monitoring systems, collision sensors and LED lighting, can significantly reduce accidents involving micromobility. The safer micromobility vehicles are, the more confident users will be in them. This, in turn, leads to more people using these modes of transport. Introducing regulations and safety standards for micromobility vehicles, such as the mandatory use of helmets and speed limits, can improve safety and boost public acceptance. Developing infrastructure in the form of cycle paths and charging stations can improve the safety of micromobility users and encourage more people to use these modes of transport. It is also important to educate and train users of micromobility transport modes (see: Janczewski, Janczewska, 2020b).

Conclusion

Micromobility offers a promising solution for transporting people and goods within cities. The small electric vehicle sector is constantly developing. It offers numerous environmental and economic benefits and contributes to sustainable development. It also creates new jobs and improves the quality of life for city dwellers.

As micromobility becomes increasingly important, it is necessary to analyse its impact on the urban economy and the wider urban transport market. In this context, the term "economics of micromobility" is introduced. This refers to research into the economic aspects of this mode of transport. Among other things, it covers issues related to the costs and profitability of different business models (e.g. ownership versus sharing), the impact of micromobility on other modes of transport (e.g. public transport and taxi services) and regulatory implications and public policy.

Introducing the concept of micromobility economics will enable systematic research in this area to be conducted, taking into account both microeconomic factors such as costs, revenues, and operators' financial models, and macroeconomic factors such as the impact on the labour market, urban investments and transport policy.

The article addresses the following key issues: the potential of micromobility; technological factors; policy and legal regulations; the labour market; safety; business models; and social changes. According to the authors, the potential of micromobility hinges heavily on the development of infrastructure, including the construction of cycle paths, charging stations, and parking spaces for micro-vehicles. It also requires integration with other forms of public transport. Technological factors such as battery life and the development of new energy storage technologies must be taken into account, as these will reduce operating costs and increase environmental benefits. Local government policies and legal regulations play a key role in promoting micromobility by providing subsidies and rates relief, as well as raising public awareness of the advantages of this solution.

The micromobility sector is creating new jobs in vehicle manufacturing, servicing and fleet management, thereby impacting the labour market. The popularity and acceptance of micromobility is influenced by safety, which is a key factor. The development of micromobility is supported by appropriate business models, such as vehicle-sharing schemes, as well as social changes and growing environmental awareness in urban communities. It is emphasised that in order to fully exploit the potential of micromobility, further investment is required in infrastructure (points and lines), technology, legal regulations and public education. Integrating micromobility with public transport and implementing innovative solutions such as fleet management systems and mobile apps can help create efficient, sustainable transport systems.

It is expected that micromobility will play a significant role in cities in the future, contributing to reduced congestion, improved air quality, and increased transport accessibility.

References

550 mln sharingowych mikromobilnych podróży rocznie w Europie. Ale… (2025), https://smartride.pl/550-mln-sharingowych-mikromobilnych-podrozy-rocznie-w-europie-ale/?utm_source=chatgpt.com [accessed: 15.02.2025].

85 tys. paczek na godzinę: InPost otwiera nowy hub technologiczny w Polsce (2024), https://mamstartup.pl/85-tys-paczek-na-godzine-inpost-otwiera-nowy-hub-technologiczny-w-polsce/ [accessed: 3.02.2025].

Akrel S. (2025a), *Micro Mobility Market Size*, https://www.marketresearchfuture.com/reports/micro-mobility-market/market-size [accessed: 5.01.2025].

Akrel S. (2025b), *Micro Mobility Market Analysis*, https://www.marketresearchfuture.com/reports/micro-mobility-market/market-analysis [accessed: 5.01.2025].

Akrel S. (2025c), *Micro Mobility Market Trends*, https://www.marketresearchfuture.com/reports/micro-mobility-market/market-trends [accessed: 5.01.2025].

Delivery couple (n.d.), https://www.deliverycouple.com/pl/pl [accessed: 3.02.2025].

Dostarczyliśmy niemal 30 mln paczek autami elektrycznymi w 2022 roku! (2023), https://inpost.pl/aktualnosci-dostarczylismy-niemal-30-mln-paczek-autami-elektrycznymi-w-2022-roku [accessed: 3.02.2025].

Elektromobilność, eko miasta i cyfryzacja transportu – trendy w branży automotive (2025), https://esgtrends.pl/elektromobilnosc-eko-miasta-i-cyfryzacja-transportu-trendy-w-branzy-automotive/?utm_source=chatgpt.com [accessed: 15.02.2025].

Fourkites (n.d.), https://www.fourkites.com/ [accessed: 3.02.2025].

Glovoapp (n.d.), https://glovoapp.com/pl/pl/ [accessed: 3.02.2025]

Heineke K., Laverty N., Möller T., Ziegler F. (2023), *The future of mobility*, https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-future-of-mobility-mobility-evolves [accessed: 4.01.2025].

Heineke K., Kampshoff P., Möller T. (2024), *New types of mobility in: Spotlight on mobility trends*, https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/spotlight-on-mobility-trends#section-header-5 [accessed: 5.01.2025].

Hollingsworth J., Copeland B., Johnson J.X. (2019), *Environmental Impacts of Shared Dockless Electric Scooters.*, "Environmental Research Letters", vol. 14(8), 084031.

Hop.city (n.d.), https://www.hop.city [accessed: 3.02.2025].

Hulajnoga elektryczna Techlife X5 2.0 – 10,4Ah 36V (n.d.), https://techlife.pl/produkty/21-hulajnoga-elektryczna-techlife-x5-104ah-36v.html [accessed: 19.01.2025].

Janczewski J., Janczewska D. (2022), *Innowacje w systemach mikromobilności na przykładzie elektrycznych hulajnóg*, "Zarządzanie Innowacyjne w Gospodarce i Biznesie" nr 1(34), pp. 147–159.

Janczewski J., Janczewska D. (2022a), *Modele biznesowe współdzielonej mikromobilności*, "Zarządzanie Innowacyjne w Gospodarce i Biznesie", nr 2(35), pp. 135–156.

Janczewski J., Janczewska D. (2020b), *Problemy bezpieczeństwa urządzeń transportu osobistego*, "Zarządzanie Innowacyjne w Gospodarce i Biznesie", nr 1(30), pp. 149–163.

Jaskóła E., Bielkiewicz M (2024), *Jazda w stylu smart. Pokolenie Z wybiera mikromobilność*, https://goodonepr.prowly.com/344840-jazda-w-stylu-smart-pokolenie-z-wybiera-mikromobilnosc [accessed: 5.01.2025].

Jazda w stylu smart. Pokolenie Z wybiera mikromobilność (2024), https://electroride.eu/blog/jazda-w-stylu-smart-pokolenie-z-wybiera-mikromobilnosc/ [accessed: 6.01.2025].

Jest już 94 tys. sharingowych e-hulajnóg w 161 miejscowościach w Polsce. Rowerów też przybyło (2023), https://smartride.pl/jest-juz-94-tys-sharingowych-e-hulajnog-w-161-miejscowosciach-w-polsce-rowerow-tez-przybylo/ [accessed: 5.01.2025].

Lenartowska A. (2024), *Mikromobilność – moda czy konieczność*, https://magazyn-biomasa.pl/mikromobilnosc-moda-czy-koniecznosc/ [accessed: 27.12.2024].

McKenzie G. (2019), *Spatiotemporal comparative analysis of scooter-share and bike-share usage patterns in Washington, D.C.*, "Journal of Transport Geography", vol. 78, pp. 19–28.

Micro-Mobility Market (2025), https://www.marketsandmarkets.com/Market-Reports/micro-mobility-market-71389422.html [accessed: 5.01.2025].

Mikromobilność, czyli nowoczesne rozwiązania transportowe (2024), https://www.logistyczny.com/aktualnosci/z-ladunkiem-w-drodze/item/8677-rola-mikromobilnosci-w-urbanistyce [accessed: 5.01.2025].

Mikromobilność poszerza rynek pracy. Badania w USA (2019), https://smartride.pl/mikromobilnosc-poszerza-rynek-pracy-badania-w-usa/ [accessed: 22.01.2025].

Mikromobilność rewolucjonizuje miejski transport (2024), https://ecoekonomia.pl/2024/05/02/mikromobilnosc-rewolucjonizuje-miejski-transport/ [accessed: 2.01.2025].

Mikromobilność. Strefa Danych Rynek i statystyki (2023), https://smartride.pl/strefa-danych/ [accessed: 5.01.2025].

Mikromobilność w miastach – jak małe pojazdy zmieniają urbanistykę? (2023), https://magnifier.pl/mikromobilnosc-w-miastach-jak-male-pojazdy-zmieniaja-urbanistyke/ [accessed: 2.01.2025].

Mikromobilność zasilana energią słoneczną: Rewolucja w miejskim transporcie (2024), https://faktysatakie.pl/mikromobilnosc-zasilana-energa-sloneczna-rewolucja-w-miejskim-transporcie/ [accessed: 2.01.2025].

New types of mobility (2024), https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/spotlight-on-mobility-trends#section-header-5 [accessed: 4.01.2025].

Nowy projekt; Paczkomat InPost z ładowarką dla mikromobilnych pojazdów (2020), https://smartride.pl/nowy-projekt-paczkomat-inpost-z-ladowarka-dla-mikromobilnych-pojazdow/ [accessed: 3.02.2025].

Nowe, wydajne układy SoC wspomagają rozwój e-mobilności (2024), https://mikrokontroler.pl/2024/07/02/uklady-soc-wspomagaja-rozwoj-e-mobilnosci/?utm_source=chatgpt.com [accessed: 15.02.2025].

Nowe standardy mikromobilności na świecie (2021), https://swiatoze.pl/nowe-standardy-mikromobilnosci-na-swiecie/?utm_source=chatgpt.com [accessed: 15.02.2025].

Patyk A. (2022), *DPD Estonia dostarcza paczki w Tallinie za pomocą robotów*, https://obserwatorlogistyczny.pl/2022/05/20/dpd-estonia-dostarcza-paczki-w-tallinie-za-pomoca-robotow/#google_vignette [accessed: 3.02.2025].

Praca dott (n.d.), https://pl.jooble.org/praca-dott?comp&searchSource=146 [accessed: 3.02.2025].

Przyszłość kołem się toczy, czyli mikromobilność w 2030 roku (2025), https://www.transport-publiczny.pl/wiadomosci/przyszlosc-kolem-sie-toczy-czyli-mikromobilnosc-w-2030-roku--85961.html?utm_source=chatgpt.com [accessed: 14.02.2025].

Rekrutacja (n.d.), https://mobi.pl/rekrutacja.php [accessed: 3.02.2025].

Rola mikromobilności w urbanistyce (2024), https://www.logistyczny.com/aktualnosci/z-ladunkiem-w-drodze/item/8677-rola-mikromobilnosci-w-urbanistyce [accessed: 5.01.22025].

Rower za abonament: innowacyjna oferta Orange w Holandii (2025), https://transinfo.pl/infobike/rower-za-abonament-innowacyjna-oferta-orange-w-holandii/?utm_source=newsletter&utm_medium=email&utm_campaign=twoj_newsletter_transinfopl_2025_01_03&utm_term=2025-01-04 [accessed: 4.01.2025].

Štraub D. (2020), *Wiele środków transportu – jeden system. Czym jest Mobility as a Service?*, https://obserwatorium.miasta.pl/wiele-srodkow-transportu-jeden-system-czym-jest-mobility-as-a-service/ [accessed: 15.02.2025].

Strągowski M. (2020), *Sztuczna inteligencja napędza rozwój pojazdów. Hulajnogi same odnajdą miejsce ładowania, a samochody dopasują się do upodobań kierowcy*, https://innowacje.newseria.pl/news/sztuczna-inteligencja,p1676176284 [accessed: 23.12.2024].

Tier dott operator hulajnog Konin CID4ID (n.d.), https://www.olx.pl/oferta/praca/tier-dott-operator-hulajnog-konin-CID4-ID14ctQA.html [accessed: 3.02.2025].

Trendy mobilności i w motoryzacji (2024), https://magazyn.cartrack.pl/trendy-mobilnosci-motoryzacji-cartrack/?utm_source=chatgpt.com [accessed: 5.01.2025].

Trendy w mikromobilności miejskiej (2025), https://edpol.net.pl/motorsfera/trendy-w-mikromobilnosci-miejskiej/?utm_source=chatgpt.com [accessed: 14.02.2025].

Trendy wśród pokolenia Silver – aż 57% seniorów chce korzystać z mikromobilności (2024), https://electroride.eu/blog/trendy-wsrod-pokolenia-silver/ [accessed:6.01.2025].

W Gostyninie pojawiły się hulajnogi elektryczne (2023), https://www.gostynin24.pl/artykul/9879,w-gostyninie-pojawily-sie-hulajnogi-elektryczne [accessed: 4.01.2025].

W Kutnie pojawiły się hulajnogi elektryczne. Jak z nich korzystać? (2022), https://kutno.net.pl/wydarzenia/w-kutnie-pojawily-sie-hulajnogi-elektryczne-jak-z--nich-korzystac-foto/sKrmal5Bv1gcUat5nCOX [accessed: 4.01.2025].

Wolt (n.d.), https://wolt.com/pl/discovery/category/pharmacy?srsltid=AfmBOoqGkWN813ciMh6zidqSySMGZ7swNPpidZm6RwF6uP9kCgsvr3RL [accessed: 3.02.2025].

Shaheen S., Cohen A. (2019), *Shared Micromoblity Policy Toolkit: Docked and Dockless Bike and Scooter Sharing, UC Berkeley: Transportation Sustainability Research Center*, https://escholarship.org/content/qt00k897b5/qt00k897b5.pdf [accessed: 28.03.2025].

Szymański K. (2024), *Mikromobilność w miastach. Czy rowery i e-hulajnogi robią różnicę?*, https://wyborcza.pl/AkcjeSpecjalne/7,183959,30860465,mikromobilnosc-w-miastach-czy-rowery-i-e-hulajnogi-robia-roznice.html [accessed: 4.01.2025].

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