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Development of the Parcel Machines Market for Last Mile Deliveries – The Case of Poland

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Joanna Miklinska[1]

Abstract:

Purpose: *The main objective of this study is to determine the specificity and state of the parcel machines market in Poland, taking into account its entity structure, location issues and problems of their environmental impact in the context of the challenges created by e-commerce last mile deliveries, as well as the possibilities and potential directions of its further development.*

Design/Methodology/Approach: *To achieve the main objective of the article, mainly secondary sources of information were used. Literature on last mile logistics, city logistics and e-commerce was analysed. In addition, statistical data of the Statistics Poland and annual reports of the Office of Electronic Communications were utilised in the study. An in-depth analysis of a number of reports of national and international institutions, consulting companies and opinions of experts in the field of e-commerce and logistics real estate market was also carried out. The author studied national legal acts, as well as local regulations concerning guidelines for parcel machines located in cities, and source information of operators developing networks of these devices.*

Findings: *The results of the research indicate that the market for parcel machines in Poland is developing dynamically and, against the background of European markets, occupies one of the leading positions. This fact has favourable implications for last mile deliveries involving these machines. There are currently several operators on the parcel machines market, which come from different business spheres, these are mainly Logistics Service Providers and entities running large e-commerce sales platforms. This makes it quite convenient for customers to make their delivery choices to the parcel machine as part of their e-commerce purchases - as a large share of the population (mainly city dwellers) has good access to the nearest device. The use of parcel machines in last-mile logistics, compared to traditional courier deliveries, contributes to reducing negative externalities. One parcel delivered in this way leads to significantly lower CO_2 emissions and less fuel consumption.*

Practical Implications: *The analysis of secondary sources allowed for the identification of practical implications concerning selected aspects of the parcel machines market in Poland. The need for further development is noted, especially the location of this type of equipment outside the largest cities. Furthermore, it should be pointed out that customers show interest in dedicated, specialised machines for specific product groups. In view of the negative externalities that occur due to the location of parcel machines near housing estates, further efforts should be made to reduce the resulting nuisance for residents, such as the covering of machines with plants already used by some operators and, in the context of wider effects, powering them with renewable energy.*

[1]*Dr., Gdynia Maritime University, Faculty of Management and Quality Science*
j.miklinska@wznj.umg.edu.pl;

Originality/Value: *This article attempts to determine the specificity and state of the parcel machines market in Poland. This approach, which has the character of a specific case study of Polish market conditions, is intended to help enrich the literature on the subject with theoretical and utilitarian aspects. In view of the fact that the development of the parcel machines network has been extremely dynamic recently, it is crucial to constantly notice the trends occurring within this process, to draw people's attention to them, especially in a context as important as last mile deliveries, which affect the majority of the population. This is where changes in the purchasing behaviour of individuals, due to the scale on which online purchases are now made, can contribute effectively to sustainability of the last mile section within e-commerce logistics.*

Keywords: *Retail, e-commerce, distribution, sustainability.*

JEL Classification: *D39, F18, L81.*

Paper type: *Research article.*

1. Introduction

Shopping is one of the most common activities of people's daily lives. Over the centuries, as a result of socio-economic development, technological advances and evolving customer demands, not only have products changed, but also the ways and places in which they are purchased.

Nowadays, people can choose from a whole range of possible forms of purchasing - at stalls located in city markets, high street shops or shopping centres. Mail order, among other things, has also emerged in response to the needs of individual customers, making it possible to order products without leaving home. The real revolution, however, came about thanks to the development of the worldwide web, the Internet, and the online shopping that it makes possible.

Each form of retail and the associated delivery of products to final consumers involves, to varying degrees, the need to carry out transport operations for products to different points of sale or for individual customer mobility. The transport of freight and passengers results in negative externalities (such as air pollution, noise, etc.) of varying magnitude.

The specific assessment of these externalities, in addition to comfort and convenience, is nowadays becoming a decisive factor in choosing a particular form of shopping, both from the point of view of individual consumer decisions and the social and economic activities mentioned.

The development of e-commerce undoubtedly accelerated due to the Covid 19 pandemic. Although its effects were negative in many areas of life, there are sectors for which the restrictions introduced at that time had a kind of positive

impact. During the period when many facilities were closed, e.g., shops, cinemas, restaurants or even offices and schools, in order to maintain the continuity of social life, many activities were transferred to the virtual sphere (Sułkowski, Kolasińska-Morawska, Brzozowska, Morawski and Schroeder, 2022).

Customers at this time started to use online shops very intensively and this entailed an increase in courier shipments. For example, in the early days of the pandemic in Poland, there was a record increase in their volume - in 2020/2019 of 44.2% (UKE, 2023), resulting from the development of e-commerce.

It is noted that a significant share of customers have also shifted their purchasing behaviour to the already post-pandemic period. The development of e-commerce, and a form of delivery such as omnichannel, is considered one of the most current trends in the logistics services market.

Due to the experience of the pandemic time, out of home (OOH) deliveries, i.e., collection of parcels at selected pick-up points or using parcel machines, have become a popular form in recent years. These machines have proved to be a real phenomenon. Although they were already in operation, currently an increasing number of them can be seen in the urban landscape .

In this context, it was decided to refer to the solution of using parcel machines for e-commerce logistics as gaining popularity in a European setting. Now, after several years of operation of these machines, both their advantages and disadvantages, as well as their attributes, in the context of externalities, have become apparent.

Against the backdrop of European conditions, Poland is in the top five, in terms of the number of collection points per person, among EU countries (SwipBox, as pointed out in Jędrak, Szwech and Gobcewicz, 2021) and is one of the fastest growing OOH markets here - between 2019 and 2020, the number of pick-up points of various types increased by approximately 32%, while the number of parcel machines grew by as much as 75% (Czechowski, as cited in Jędrak, Szwech and Gobcewicz, 2021).

For this reason, the Polish market for parcel machines was chosen as the research area for this study. In Poland, there is a clear interest from various stakeholders in the development of a network of these devices.

Having in mind already several years of experience resulting from the operation of parcel machines, the main objective of this study is to determine the specificity and state of the parcel machines market in Poland, taking into account its entity structure, location issues and problems of their environmental impact in the context of the challenges created by e-commerce last mile deliveries, as well as the possibilities and potential directions of its further development.

2. Literature Review

2.1 The Last Mile Issue

The literature survey conducted reveals a number of issues related to the functioning of parcel machines in the modern economy. It is a topic inextricably linked to the development of e-commerce and parcel delivery forms. Of the basic models of e-commerce (B2B, B2C, C2C), it is the B2C relationship that raises particular challenges for online shop operators, who have to ensure the delivery of products to individual customers (Iwan, Kijewska and Lemke, 2016).

This is mainly due to their territorial dispersion and also the diversity of shipments in terms of size, shape and other characteristics. An additional challenge for logistics in e-commerce is the fact that recipients are not available around the clock at the destination (address) of the shipment (Moroz and Polkowski, 2016). As a result of these difficulties, the literature emphasises that finalising the sales process in the form of an appropriate delivery service (Sułkowski, Kolasińska-Morawska, Brzozowska, Morawski and Schroeder, 2022).

The delivery of products to final customers also raises a number of challenges, not least because a large proportion of them nowadays live in cities, and by 2030 this proportion is expected to reach 60% of the population (Deloison, Hannon, Huber, Heid, Klink, Sahay, and Wolff, 2020). Urbanised areas with a large number of dispersed consumers present a challenge due to the strict built environment and concentrated mobility.

Within the framework of e-commerce logistics in these areas, the so-called 'last mile' is recognised as a particularly important stage of operations and requiring special solutions. The last mile issue, as the final stage of delivery of a consignment to the consignee, is often addressed in the literature precisely in the context of urban logistics solutions applied here (Moroz and Polkowski, 2016).

The multitude of last mile delivery methods developed today and available to customers is undoubtedly a motivating factor for the use of e-commerce. The basic division includes home deliveries and collection points.

Within home deliveries, attended and unattended (e.g., repeat delivery and neighbours, family etc.) are indicated. For collection points, the following are specified, manned (post office and pick-up points (i.e., a shop)) and unmanned (package boxes and parcel machines) (Moroz and Polkowski, 2016).

Among the innovative approaches, crowdsourcing and crowdshipping are also cited as those involving people in last-mile delivery (Kiba-Janiak, Marcinkowski, Jagoda, Skowrońska, 2021; Ghaderi, Zhang, Tsai, and Woo, 2022.).

In this context, it should be added that the method of delivery chosen by the customer is undoubtedly influenced by a number of criteria, including the convenience of the recipient of the parcel, his or her place of residence, lifestyle or even age and state of health defining his or her mobility.

There are also external and sudden factors, such as the aforementioned coronavirus pandemic in recent years. It was then that the development of the OOH market gained momentum with the proposed solutions. The existing multitude of options would not have been possible without the accompanying technological developments. Hence, linking the two phenomena, it is emphasised that the SARS-CoV-2 virus pandemic had an impact on the technologisation of last-mile logistics services, leading to an improved level of "customer experience" (Sułkowski, Kolasińska-Morawska, Brzozowska, Morawski and Schroeder, 2022).

In view of the negative externalities arising from intensive logistics activities in urban areas, solutions are now being sought that strike a balance between meeting customers' expectations, their convenience in receiving parcels and also taking care to preserve the principles of sustainable urban development.

Hence, in the literature Kiba-Janiak, Marcinkowski, Jagoda and Skowrońska emphasise: "sustainable last mile delivery on e-commerce market in cities concerns the planning, implementing, coordinating and controlling of processes on urbanized areas related to the last mile delivery of goods purchased online with the accompanied information, in order to reduce costs, reduce environmental degradation and increase road safety, obtained as a result of a compromise developed among the diverse preferences of stakeholders" (Kiba-Janiak, Marcinkowski, Jagoda and Skowrońska, 2021).

The last mile issue is the focus of problems, challenges and trends for various stakeholders, including shippers, receivers, residents, government, logistics service providers and others (Kiba-Janiak, Marcinkowski, Jagoda, and Skowrońska, 2021).

They are also referred to as "ecosystem players", emphasising that given the scale of the challenges and the pace of change in this critical last-mile area, there is a need for them to act at once (Deloison, Hannon, Huber, Heid, Klink, Sahay and Wolff, 2020) - working together to ensure that the solutions introduced are successful.

A special role lies with Logistics Service Providers, including CEP operators and others, who, through the solutions they introduce, by providing support to numerous customers, have a significant impact on the scale of change taking place. The literature emphasises that it is the use of the aforementioned parcel machines that contributes to solving last mile problems, taking into account environmental challenges (Moroz and Polkowski, 2016) and therefore fits into the concept of sustainable last mile delivery.

2.2 Parcel Machines - Selected Aspects

Since their appearance on the market, parcel machines have represented a kind of new quality within logistics infrastructure facilities. Thanks to their attributes, they have recently become very popular with customers. This is resulting in an increase in their number worldwide, while the literature discusses the experience of the development of parcel machines in different countries (Leung, Lachapelle, Burke, 2023; Molin, Kosicki, van Duin, 2022; Lai, Jang, Fang and Peng, 2021).

Referring to the concept itself, the literature defines: "parcel machine: an automated device allowing collection (and dispatch) of consignments around the clock" (Moroz and Polkowski, 2016). These devices have lockers of different sizes, while their function is to receive, send or return the consignment.

Over time, these facilities have been equipped by operators with access to increasingly sophisticated IT solutions, including applications that allow parcels to be picked up without touching the panel. Such a possibility was particularly appreciated during the pandemic (Sułkowski, Kolasińska-Morawska, Brzozowska, Morawski and Schroeder, 2022), when contact with surfaces to which many people have access was avoided.

The practice of operating parcel machines in various countries indicates the emergence of specialised forms of these devices; the conditions and advantages of using mobile parcel machines are also increasingly discussed in the literature (Schwerdfeger and Boysen, 2020; Wang, Bi, Lai, and Chen, 2020).

An important issue in the literature related to vending machines concerns environmental aspects. In this context, two main approaches to this problem are clearly discernible. Firstly, attention should be paid to publications on the issue of how the use of parcel machines contributes to the reduction of negative externalities resulting from transport activities, thus, for example, reducing emissions of pollutants, noise and vibration or reducing congestion (Moroz and Polkowski, 2016; Iwan, Kijewska, and Lemke, 2016; Prandtstetter, Seragiotto, Braith, Eitler, Ennser, Hauger, Hohenecker, Schodl and Steinbauer, 2021).

Comparing courier deliveries to customers with those using parcel machines, it is indicated in the literature, (Bilik 2014, as pointed out in Moroz and Polkowski, 2016), that a courier during his working day in the first variant delivers about 60 parcels, while at the same time to parcel machines about 600. Moreover, during his daily working hours in the “traditional system” he drives about 150 km while in the case of parcel machine service about 70 km.

It is also worth noting that one parcel delivered by a courier to a customer's home contributes to the consumption of 0.23 l of fuel and the emission of 300g of CO_2; in the case of service using parcel machines, this is the consumption of 0.01 l of fuel

and the emission of 14g of CO_2 (Bilik 2014, as pointed out in Moroz and Polkowski, 2016).

Secondly, the environmental nuisance of parcel machines as a certain type of infrastructure facility is addressed in the literature. Consideration is given to solutions that can be introduced in the operation of these facilities to further reduce negative externalities. For example, in the context of their energy requirements, it is pointed out, among other things, that renewable energy should be used in their operation (Sułkowski, Kolasińska-Morawska, Brzozowska, Morawski and Schroeder, 2022).

3. Research Results and Discussion

3.1 Determinants for the Development of E-Commerce and Out of Home Deliveries in Poland

In order to achieve the aim of the article, it is necessary to address selected issues of the development of e-commerce in Poland and operators providing logistics services to online shops. These problems have a direct impact on the expansion of parcel machine networks in Poland.

It should be noted that a prerequisite for the growth of e-commerce is high access to the Internet in a given country. In the case of Poland, in 2022, out of a population of approx. 37.6 million, the number of internet users has already reached approx. 30 million. Of this group, 77% made purchases online. It is worth mentioning that 75% of Polish Internet users bought in Polish online shops, and already 32% of web users in foreign shops (Gemius, 2022).

Logistics services of varying scope for e-commerce are provided by several groups of operators in Poland. Therefore, four main models of fulfilment services and their providers can be distinguished: fulfillment offered as a key service (e.g., operators: Omnipack, eCommerce Connections); fulfillment offered by a Logistics Service Provider (e.g., operators: Fiege, Rhenus Logistics, Raben and CEP operators); fulfillment offered by sales platforms (e.g., Amazon); fulfillment offered as an additional service (e.g., Traffica, Azymut) (Kawa, Łukasiewicz-Poznań Institute of Technology, GS1 Polska. 2020).

The specificity of the activities of these entities varies, some of them just undertake to serve the B2C model by providing last mile deliveries (including offering delivery services to parcel machines).

According to the Office of Electronic Communications, courier deliveries in Poland in 2022 were handled by by more than 70 CEP operators (UKE, 2023). It should be added that there are seven leading companies in the courier operator market: InPost sp. z o.o.; DPD Polska sp. z o.o.; Poczta Polska S.A., GLS Poland sp. z o.o., UPS

Polska sp. z o.o., FedExExpress Poland sp. z o.o. and DHL (UKE, 2023).

As mentioned, with the development of e-commerce, the number of courier consignments, which are the main object of service of these operators, has been significantly increasing in recent years, a fact illustrated in Table 1.

Table 1. *Courier consignments in national and cross-border traffic (in selected years) in million pieces*

Relation	**2015**	**2019**	**2020**	**2022**
in national traffic	204,8	415,5	604,9	862,0
in cross-border traffic	11,7	25,3	31,9	31,8

Source: *Elaborated based on (GUS, 2023).*

As can be seen, on the Polish market from 2015 to 2022, the number of courier consignments (national) quadrupled annually, while those in cross-border traffic have tripled. It is the courier services market segment that is growing in terms of volume of shipments in the wake of the development of e-commerce (UKE, 2023). This raises challenges for operators in terms of handling last mile operations and providing the right logistics infrastructure for this delivery stage.

3.2 Development of the Parcel Machines Market in Poland

The infrastructure for last-mile operations, as indicated, consists of post offices and pick-up points or parcel machines. On the Polish market, the operators had (at the end of 2022) a total of 30 237 post offices. 7 620 offices were operated by Poczta Polska, and in 22 617 services were provided by alternative operators (GUS, 2023; UKE, 2023).

It must be additionally noted that out of 30 237 offices functioning in 2022, 39.2% were offices owned by postal operators, and 60.8% were run by postal agents. It should be added that, along with the increasing number of courier deliveries, the number of post offices increased significantly over the years, with 24 295 in 2015 (GUS, 2023; UKE, 2023).

As mentioned earlier, other collection points are also important for OOH delivery. These are available to operators in Poland as well. For example, at the end of 2022, Poczta Polska had 11.888 external collection points dedicated to parcels with a "collection at point" option (UKE, 2023).

In the case of logistics facilities such as parcel machines, an even more significant development has taken place in Poland. Its beginnings date back to 2009, when the Integer.pl Capital Group started to launch devices called “Paczkomat® InPost”. These are defined as “self-service machines for receiving and sending parcels, open 24 hours a day, 7 days a week” (Integer.pl, 2023).

The city where the first parcel machine stood was Kraków (dataplace.ai, 2021). InPost's successive parcel machines have become a much requested solution for customers. The number of its machines in Poland grew dynamically. After a longer period of time, other operators, such as Poczta Polska, have also become interested in the parcel machines market. Networks of parcel machines are also being developed by e-commerce operators (sales platforms), e.g., Allegro, AliExpress, Logistics Servise Providers (DHL and DPD), Orlen (a multibranch entity) (Jędrak, Szwech and Gobcewicz, 2021).

Moreover, such activities are also planned by Furgonetka (a service that enables comparison of offers of courier companies). Intensification of the operators' activities is particularly observed from 2020 (Jędrak, Szwech and Gobcewicz, 2021). It should be added that, over the years, not all operators taking on this challenge have succeeded in launching parcel machines due to high market entry barriers.

As a result of the development discussed above, the number of parcel machines on the Polish market increased successively (Table 2), resulting in the fact that at the end of 2022 there were nearly 27 000 parcel machines under the control of 6 operators (UKE, 2023).

***Table 2**. Number of parcel machines on the Polish market in the years (2017-2022) in units*

	2017	**2018**	**2019**	**2020**	**2021**	**2022**
Parcel machines	2 718	4 468	7 205	10 926	18 419	26 914

***Source:** Elaborated based on (UKE, 2018 – UKE, 2023).*

Referring to the trends in the location of parcel machines in Poland, it should be noted that their highest density is found in large cities, including Warsaw (the capital) and in the south of the country, where many urban centres are concentrated. However, already in the surroundings (vicinity) of some cities (for example also Warsaw, Krakow, Bytom or Zabrze), as well as in many other places in the country, a large number of inhabitants do not have good access to parcel machines (dataplace.ai, 2021).

Despite the fact that the development of the parcel machines network is still taking place, according to Polish market research, in 2021, thanks to their use customers were already delivered approx. 450 million parcels, while it is forecast that this figure could double in 2024 (SwipBox, as pointed out in Jędrak, Szwech and Gobcewicz, 2021).

These data show how much interest there is in parcel machine deliveries in Poland and what network development can still be expected. Currently, referring to the shopping behaviour of e-commerce customers in the country, it is indicated that already 40% of deliveries are those to parcel machines, while approximately 50% of

parcels are delivered to the customer's home (SwipBox, as pointed out in Jędrak, Szwech and Gobcewicz, 2021).

Picking up a parcel from a parcel machine leaves customers free to choose it (e.g., near where they live or work). In this context, it should be emphasised that in Poland already approx. 16 million people have a parcel machine from InPost (the operator with the largest network of these machines in the country) within less than a 10-minute walk (as of June 2021) (dataplace.ai, 2021).

In addition, it is noteworthy that customers choose the delivery locations of parcel machines in such a way that they are able to pick up the parcel within a fairly short time after it arrives at the machine - approximately 70% of parcels from parcel machines are picked up from these devices within the first six hours (SwipBox, as pointed out in Jędrak, Szwech and Gobcewicz, 2021). The high turnover of parcels in parcel machines, and their lack of backlogging for long periods of time, undoubtedly allows for better utilisation of the available facilities in the country.

As mentioned above, last mile delivery, including the development of the parcel machine market, is influenced by various stakeholder groups. In addition to the already discussed operators of these machines on the Polish market and customers (their purchasing behaviour), reference should also be made to legislators and authorities at various levels. These actors, through the regulations and rules they introduce, play a significant role in creating last mile delivery solutions (Kiba-Janiak, Marcinkowski, Jagoda, and Skowrońska. 2021).

In Poland, legal regulations concerning parcel machines are contained, for example, in the Construction Act (Act of 7 July 1994) and the Postal Act (Act of 23 November 2012). Indirectly, the operation of parcel machines is influenced by a number of other regulations. As an example, the introduced Sunday trading prohibition (Sułkowski, Kolasińska-Morawska, Brzozowska, Morawski and Schroeder, 2022), which results in increased customer interest in online shopping and associated out-of-home deliveries.

It should be added that in some cities in Poland, in addition to national regulations, also decisions and documents of local authorities regulate the location, aesthetics, functionality, parcel machines, or even the fact of allowing advertising on the machines (Department of Urban Planning and Architecture, 2022).

As further stakeholders, the previously mentioned local residents should also be referred to, as they are not always the customers of parcel machines, but are affected by the negative effects associated with their operation, for example in the form of land occupation by the machine, increased pedestrian and vehicular traffic around the facility or deterioration of the landscape.

It should be noted that there have been cases of dissatisfaction among local

communities in Poland and the occurrence of protests or even dismantling of facilities as a result (Jędrak, Szwech and Gobcewicz, 2021).

In the context of the aforementioned problems, in order to reduce the nuisance of parcel machines for the local environment, sustainable solutions are being used by operators. For example, in 2021. InPost launched a parcel machine powered by photovoltaic panels; operator DPD launched screenless machines; and Allegro introduced machines powered by renewable energy and equipped with air quality sensors, in addition, the operator plans to cover the walls of parcel machines with plants (Jędrak, Szwech and Gobcewicz, 2021; dataplace.ai, 2021).

Regarding the social aspects of parcel machines, it should be noted that many people indicate that by picking up a parcel they go for an extra walk (Jędrak, Szwech and Gobcewicz, 2021), which has health benefits. In addition, social expectations are also driving the introduction of special types of these machines into the market; these include book vending machines, fridge vending machines and furniture vending machines, while research by Colliers shows that customers also mention the development of vending machines for diet catering (Jędrak, Szwech and Gobcewicz, 2021; Department of Urban Planning and Architecture, 2022).

4. Conclusions

Over the years, the development of various forms of retailing has influenced the development of accompanying infrastructure. E-commerce, as discussed in this article, was primarily associated with the delivery of products directly to customers. Over time, however, innovative solutions have emerged at the last mile stage - out of home delivery - collection points.

Here, parcel machines deserve special attention. They represent an optimal variant, responding, firstly, to the expectations of customers who collect their parcels from a machine located, for example, near their place of residence, and secondly, they are a solution that reduces the negative effects resulting from logistics activities.

In Poland, the parcel machines market has recently been developing dynamically. A significant factor is the high customer interest in e-commerce shopping and the accompanying development of the market for e-commerce logistics services. Thanks to the first operator - InPost, which introduced parcel machines to the Polish market, a significant part of the country's population (living in the largest cities) now has good access to such devices.

The success of the first parcel machines in Poland has also encouraged other operators to develop their networks. There are currently six operators on the market, while the total number of machines is around 27,000 (UKE, 2023). From the point of view of market development, further expansion of the market's entity structure is to be expected. Already today, alongside CEP operators, other actors

are developing their networks.

The perspectives for further development of the market are good, as there are still many places in the country with poor access to parcel machines, especially outside the large cities. This is where the location of these machines seems reasonable. A noticeable trend is to locate these machines in a variety of facilities, including shopping centres or office complexes and even convienience shops, and these solutions may become more attractive due to the comfort for customers.

It is also important to note that clients are showing interest in parcel machines tailored to handle selected product groups, for example food with reduced storage temperatures and therefore parcel machines may also become an attractive last mile delivery solution for cold supply chains, or other supply chains.

Research conducted by Colliers also shows that customers, in connection with the use of parcel machine services, count on facilitation and innovation in forms of payment (Jędrak, Szwech and Gobcewicz, 2021). The development of financial tools and technology in this regard can support the further evolution of the parcel machine market.

The use of parcel machines in last-mile logistics, compared to traditional courier deliveries, contributes to reducing negative externalities. One parcel delivered in this way leads to significantly lower CO_2 emissions and less fuel consumption. The positive impact of the use of parcel machines on balancing the last mile stage, as indicated by researchers, is therefore likely to be realised on a larger scale in Poland.

It is important for every customer to be aware that through their purchasing decisions they have an impact on reducing the negative externalities of the logistics services provided to e-commerce. Furthermore, in view of the negative externalities resulting from the location of parcel machines near housing estates, further efforts should be made to reduce the resulting nuisance for residents.

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