

DEVELOPMENT OF DELIVERY AND COLLECTION BOXES IN THE CONTEXT OF CITY LOGISTICS USING THE EXAMPLE OF INPOST COMPANY

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Purpose: The aim of this article was to examine the development of the use of delivery and collection boxes in the context of urban logistics, using the example of the company InPost.

Design/methodology/approach: The research on the development of sending/receiving points was divided into stages. First, a review of theoretical materials on the issue under study was conducted and the development of the InPost compartment was analyzed. Then a survey was created and posted on various social media. The survey targeted urban residents using online shopping. In the final stage, the results were collected and analyzed in the context of the development of sending and receiving points from the perspective of residents.

Findings: Undoubtedly, in recent years we can observe an increase in consumer interest in online shopping. Research confirms that the development of online shopping is closely linked to the development of various forms of delivery. Undoubtedly, in recent years, shipping and receiving boxes have been increasingly used, as the residents surveyed also noted.

Originality/value: The article presents the author's survey on the development of shipping/receiving boxes from the point of view of residents conducted in 2023.

Keywords: Development of vending/receiving machines, development of e-commerce, transportation of goods in town.

Category of the paper: Research paper.

Introduction

In recent years, except the traditional form of direct to customer delivery, the development of alternative methods such as the use of pick-up points or delivery and collection boxes has been observed. The crucial moment was the COVID-19 pandemic, which undoubtedly forced delivery companies to look for solutions for contactless delivery to the customer. Despite a number of global economic issues, online sales is still growing, which in result influences the higher demand for courier services. For online shoppers, buying a product can be as simple as

clicking a few buttons on a website and waiting for delivery. Thus for cities, dealing with traffic problems caused by e-commerce deliveries has become a complex problem requiring innovative solutions. Transport, which affects economic strength, product availability and the quality of life and attractiveness of urban areas, is an inherent element of online shopping (Wierzbicka, 2023). The delivery vehicles park and block pedestrian crosses. Grocery e-shops such as Walmart and Kroger, and food delivery services such as DoorDash, Uber Eats and Postmates, are increasing their online revenues by offering city centre home deliveries via vans, bikes and scooters in increasingly shorter time windows. As a result, demand for last-mile delivery is growing rapidly and is expected to increase by 78% globally by 2030. The World Economic Forum reports that by 2030 there will be 36% more delivery vehicles in city centres compared to 2020, increasing the external costs of road transport (World Economic Forum, 2020).

The aim of this article was to examine the development of the use of delivery and collection boxes in the context of urban logistics, using the example of the company InPost. An extensive literature review and a questionnaire survey targeting urban residents was carried out to identify changes in the area.

Literature review

The rapid development of the internet and an increase in the number of people with Internet access has made it possible to manage many economic, logistical and social processes remotely (Tarasiuk, Dłużniewska, 2021). The attractiveness of the use of the Internet has generated more and more new ways of using it. Nowadays, every company knows the huge importance of e-commerce in the market. Many people wonder whether we will still be using stationary shopping in the future, when we already have the possibility to see a product in a 3D view, try it on at home and send it back if necessary. Logistics is an important element in e-commerce, as it is used to deliver goods ordered by customers of online stores online (Kwiatkowski, Winnicka, 2018). According to Philip Kotler's definition, e-commerce is a general term used to describe buying and selling processes supported by electronic devices (Kotler, 2002). Another definition, provided by the Organisation for Economic Cooperation and Development (OECD) writes that it is a business conducted over computer networks, such as the Internet, including related infrastructure. E-commerce should be understood as a way of doing business using telecommunications and computer technology for the exchange of data between independent computer information systems for business transactions (Wawszczyk, 2003). With the development of the internet accessible on mobile devices, the concept of 'm-commerce' has also emerged, understood as purchases made using mobile devices. According to a report by ExpertSender, in 2020, more than 79% of Poles with internet access

(representing approximately 85% of the population) will have made an online purchase. One of the most important problems of online shopping in the context of city logistics has become the delivery of many small parcels to highly dispersed delivery points. This problem has been referred to in the literature as the 'last mile problem'. Direct deliveries in particular became an obstacle, as they could not be delivered due to a lack of collection. In result, this led to reduced customer satisfaction, which is why many companies started to use other solutions to enable customers to pick up their parcels at a time and place convenient to them. Such solutions include:

- Pickup at a selected point.
- A parcel in „Ruch” collection points.
- Inpost vending machines.
- DPD vending machines.
- DHL vending machines.

A parcel machine is a system of automatic post office boxes (or postal terminals) for sending and receiving parcels. The machines are distributed in public places, often close to supermarkets, petrol stations or university campuses. Most machines are available 24 hours a day. The report "Parcel vending machines and collection points in Poland - the new reality of the delivery world." presents a map, with parcel vending machines and pick-up points of the largest chains in Poland marked (Figure 1).

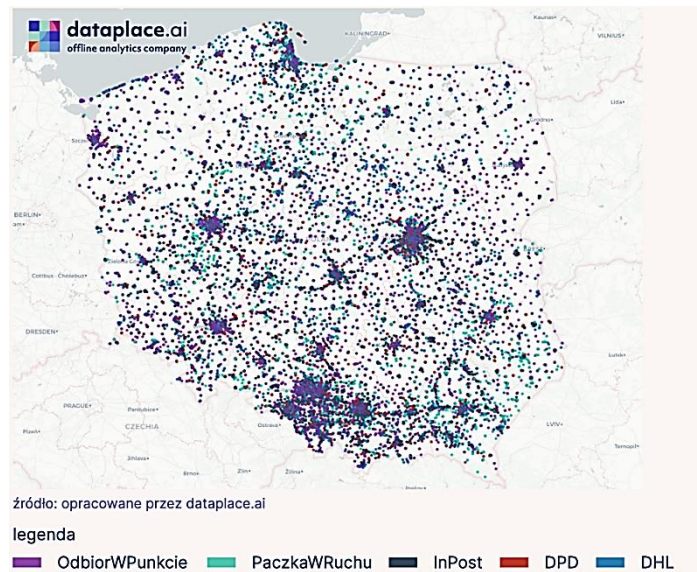


Figure 1: A Pickup in collection point.

Source: *Automaty paczkowe i punkty odbioru w Polsce- nowa rzeczywistość świata dostaw*. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.telepolis.pl/images/2021/08/raport-punkty-odbioru.pdf, s. 6. Access 17.09.2023r.

Looking at Figure 1, one can get the impression that there is practically ace left in Poland for new entrants into the parcel collection business. It should also be noted that the distribution of most points from different networks overlap, and are located near large cities. This is due, among other things, to the density of the population per 1m2. In addition, it is worth noting that the highest density of outlets, with the exception of the Warsaw area, is in southern Poland. Parcel vending machines are devices participating in e-commerce or mail-order sales, enabling self-pick-up of parcels at a time and place convenient for the customer. The promoter and pioneer of the idea of collection banks in the form of parcel vending machines is InPost, which is a company belonging to the Integer.pl S.A. capital group. In June 2021, according to the report 'Parcel vending machines and collection points in Poland - the new reality of the delivery world', Inpost's parcel machines occupied 45% of the country's area in relation to the analysed providers (Figure 2). The same report highlights that a total of 21,367,171 people in Poland have convenient access to pick-up points. The strategy of creating dense networks has both advantages and disadvantages. The advantage is undoubtedly accessibility, while the disadvantage is that the higher the percentage of shared traffic shared between points in the same network, the greater the chance that the point will not earn its own money.

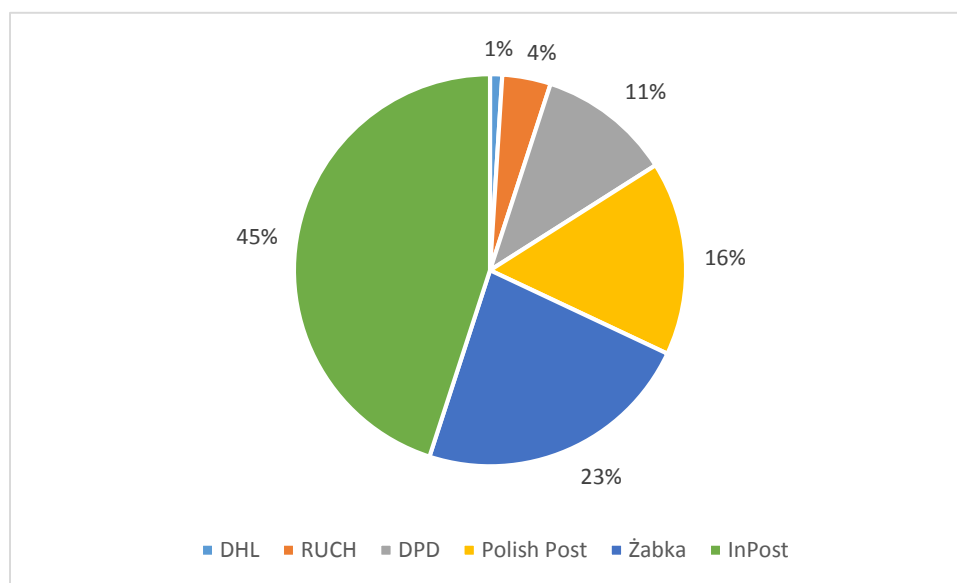


Figure 2: Percentage share of parcel collection points of the analyzed suppliers, in Poland.

Source: *Automaty paczkowe i punkty odbioru w Polsce- nowa rzeczywistość świata dostaw*. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.telepolis.pl/images/2021/08/raport-punkty-odbioru.pdf, s. 9. Access 17.09.2023r.

Analysing the above literature considerations, the question should be asked: is an even greater development of vending machines possible in Poland and how do city dwellers perceive this development?

Methodology of the study

The research on the development of sending and receiving points was carried out in three stages. The research process began with a literature search to determine the current state of development of the e-commerce industry and its impact on the development of delivery and collection points and parcel machines. Secondly, information made available by the currently most popular parcel delivery company InPost was examined. In the third stage, a questionnaire was constructed on the basis of the literature research, which was then administered to city residents in order to assess the development of sending and receiving points from their perspective. The survey questionnaire was created by using Google Forms and shared on social media and sent out via email. The traditional paper-based form of the questionnaire was abandoned due to the selection of the research group. The questionnaire was primarily intended to reach people who use a computer on a daily basis and are part of the e-commerce industry. The preparation of the questionnaire survey developed for residents included the determination of a minimum sample size for the research. In the end, 135 responses were obtained, which can serve as the residents' opinion on the development of the sending and receiving point. The questionnaire addressed issues relating to:

- Preferred delivery methods when shopping online.
- The main criteria for choosing delivery.
- Observing the development of sending and receiving points and parcel machines from a resident's perspective.

An important aspect of the survey was to determine the nuisance of indirect supply development from the public's perspective. The results of the survey are presented below.

Results

InPost is a Polish private logistics operator based in Kraków. The company belongs to the capital group Integer.pl S.A. In September 2009, the first InPost parcel machine was placed in Kraków. By the end of 2022, InPost already offered its customers around 22,000 parcel machines throughout Poland. InPost parcel machines also operate abroad. In addition to Poland, the company operates under its banner in the UK and Italy. InPost declares to support pro-ecological attitudes, especially in the context of reducing CO₂ emissions. According to a press release made available in March 2023. InPost, with its network of Paczkomat® devices, is steadily strengthening its position as the leader in logistics services for e-commerce in Poland. According to a survey conducted by Kantar in 2022. 92% of respondents chose Paczkomat as their preferred form of delivery when shopping online, while a year later this form of delivery

is already indicated by 94% of respondents. In addition, according to the survey, as many as 85% of Internet users consider Paczkomat® to be the most environmentally friendly form of delivery. In recent years, the InPost Group has become the leader among e-commerce delivery platforms in Europe, delivering 744.9m parcels, 40% more than the year before.

The results of a survey were analysed to determine residents' opinions on the development of delivery and collection points. The first question concerned the frequency of online shopping. It turns out that 63% of respondents use this form of shopping several times a month. The remaining respondents indicated that they shop online several times a week (18.5%) and about once a month (18.5%). The next question concerned the object of shopping. In this question, respondents could mark more than one answer. Chemicals and cosmetics (74.1%) and shoes and clothing (66.7%) were the most popular as the most frequently purchased item when shopping online. The results of the remaining responses are shown in Figure 3.

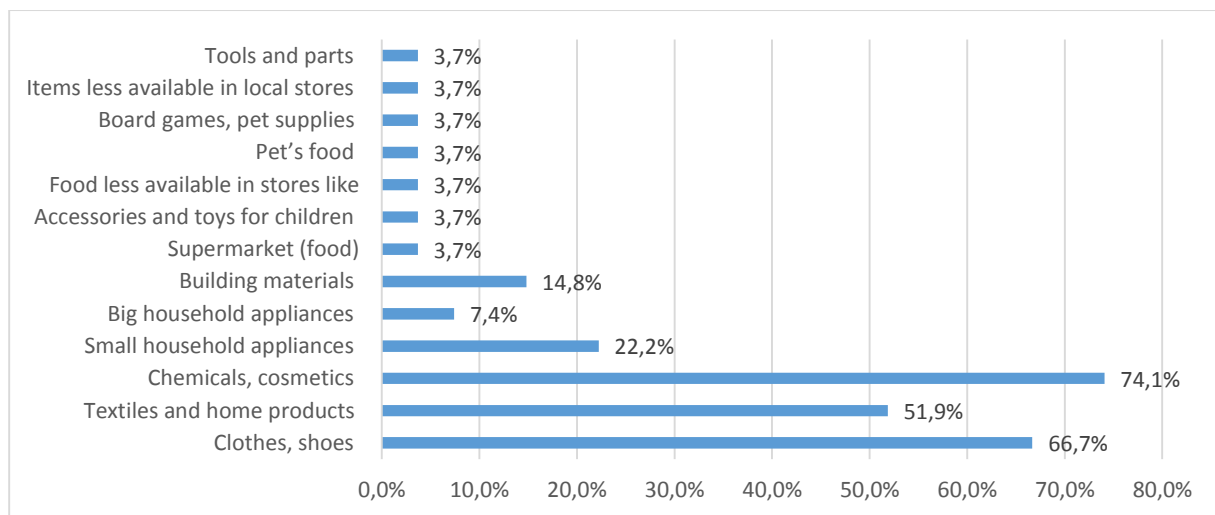


Figure 3. Products most frequently purchased online.

Source: own elaboration based on surveys conducted.

Respondents were then asked about the influence of individual criteria, selected on the basis of the literature review and their own experiences, on their choice of online shopping. Respondents were asked to rate each criterion on a scale of 0-3, where 3 meant that they were mainly guided by the criterion and 0- that it was unimportant. A weighted average was calculated for each criterion for an accurate analysis. The results are shown in Figure 4.

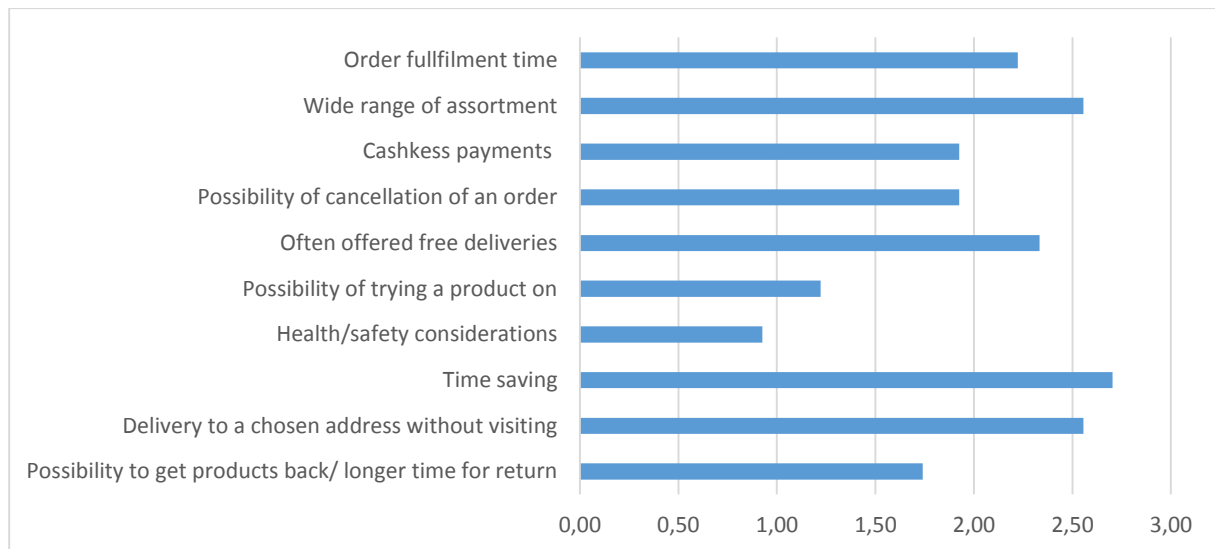


Figure 4. Criteria that influence the choice of online shopping.

As can be seen from Figure 4, the most important criterion according to respondents is time saving, followed by a wide assortment choice. The least important to respondents appeared to be security matters. The next questions concerned the choice of delivery method. Respondents were asked to rate on a scale of 0-3 the methods of delivery of products, where 0 meant "I do not use this type of delivery" and 3 meant "I use it practically always". As in the previous question, a weighted average was calculated for each form of delivery for accurate analysis. The results are shown in Figure 5.

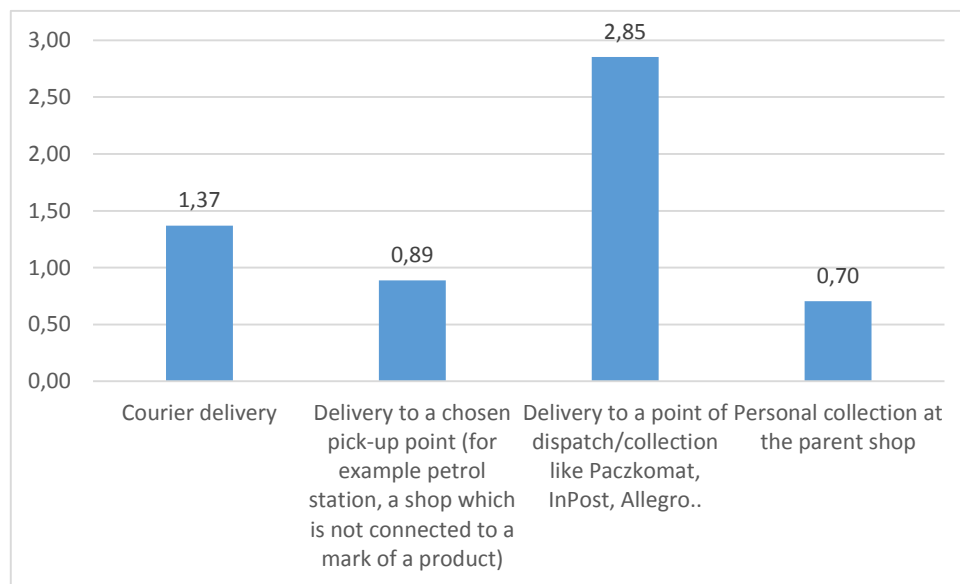


Figure 5. The most popular forms of delivery.

Source: own elaboration based on surveys conducted.

In Figure 5, it can be seen that delivery to InPost-type delivery and collection points has become the most popular among respondents. Only in second place was the once very popular courier delivery directly to the home. An explanation for this phenomenon can be found in the next question on the main motivation for choosing a delivery method. It turns out that for

63% of respondents, the most important factor is the ability to adjust the pick-up time to their own needs, only followed by the cost of delivery (22.2%). A further question asked which delivery method respondents felt was the most advantageous in terms of a particular determinant. The criteria used were delivery time, price, flexibility of delivery time, flexibility in terms of shipment size, damage to the shipment during transport and the posting of a possible return shipment. It turns out that in four out of the six determinants given, delivery to parcel machines was selected as the most favourable delivery method. The exact results are shown in Figure 6.

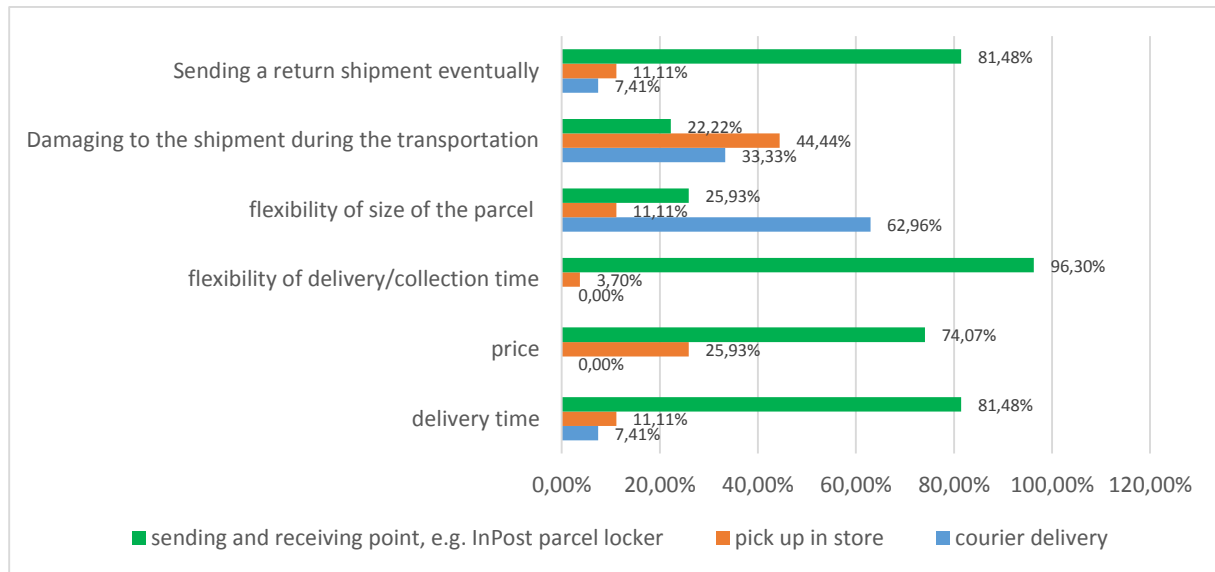


Figure 6. The most favourable forms of delivery according to different determinants.

Source: own elaboration based on surveys conducted.

As can be seen from Figure 6, respondents found the drop-off/pick-up points, e.g. InPost parcel machines, to be convenient in terms of delivery time, flexibility of pick-up time, price and sending a possible return shipment. Courier deliveries, on the other hand, proved to be the most advantageous for customers in terms of parcel security. In-store collection, on the other hand, offers the greatest flexibility in terms of the size of the goods ordered. The survey also shows that the most inconvenient for residents are courier home delivery (48.1%) and personal collection in a shop (44.4%). It appears that only parcel post and pick-up points are inconvenient for a small group of respondents (7.4%). In order to investigate the extent to which the network of sending and receiving points was expanded, two further questions were asked of respondents. The first asked: at what distance from the place of residence is the nearest sending and receiving point. As many as 63% of respondents indicated that the distance was no more than 500 m. The results of the remaining responses are shown in Figure 7.

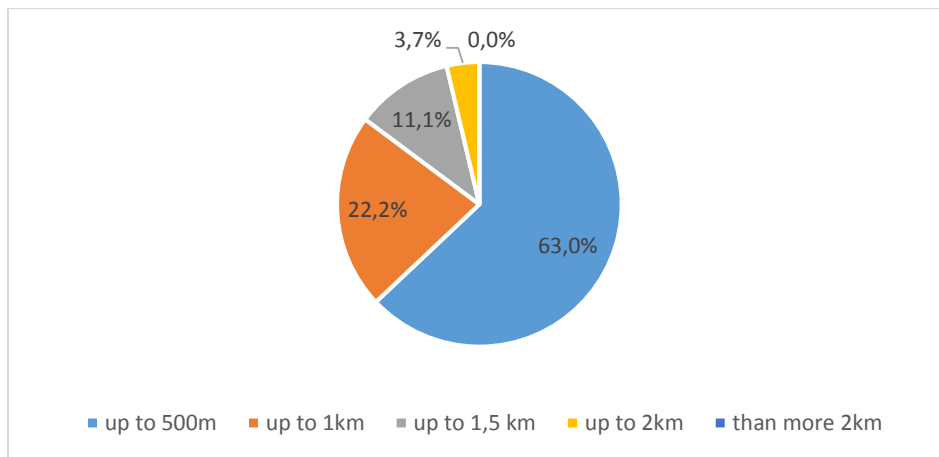


Figure 7. Distance from the nearest delivery point.

Source: own elaboration based on surveys conducted.

The second question, on the other hand, asked respondents whether any new transmission and reception boxes had been set up recently in the vicinity of their place of residence. This was answered in the affirmative by 77.8% of respondents, of whom at the same time 95.2% indicated that the new boxes did not cause any inconvenience and therefore did not have a negative impact on their quality of life.

Respondents were also able to rate the benefit of the new drop-off points on a scale of 1-5, where 1- a small benefit and 5- a huge benefit. Taking into account the weighted average of the answers obtained (4.41), it can be concluded that residents consider the creation of new points to be a great benefit, which only confirms the previous survey results.

Next, the respondents assessed the influence of the individual factors, determined from the literature review, on the development of transmission and reception boxes. The results of the study are shown in Figure 8. 44.4% of the respondents rated the alignment of reception times with the pace of society as a very strong influence on this development.

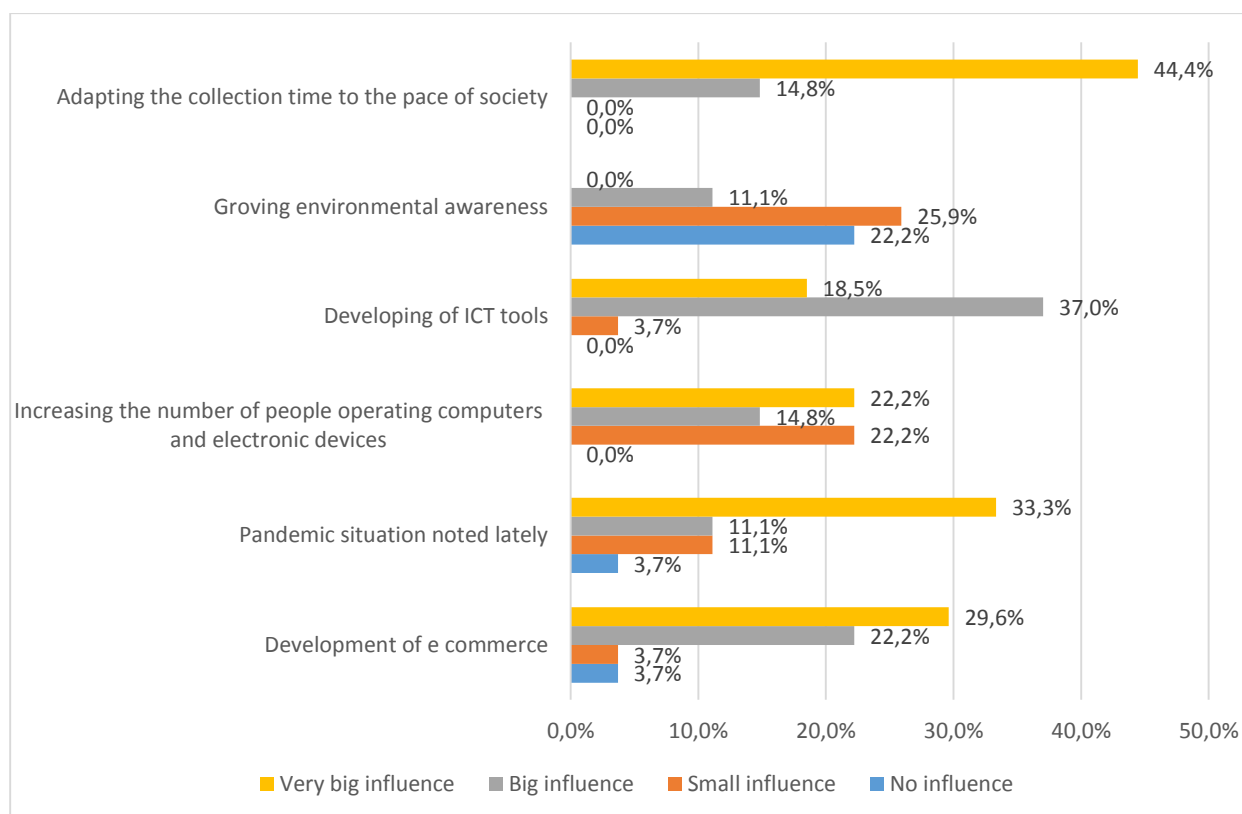


Figure 8. Influence of individual factors on the choice of vending machines.

Source: own elaboration based on surveys conducted

In order to analyse the results of the study in detail, a weighted average was calculated for each factor, assigning weights according to the degree of influence. The results of the calculations are presented in Table 1. The values obtained were then compared, identifying the factors that residents believe have the greatest impact on the development of the transmission and reception boxes.

Table 1.

Influence of individual factors on the choice of vending machines

	no impact	low impact	high impact	very high impact	Weighted average
Weight →	0	1	2	3	
Factor ↓	Number of responses received				
Developments in the e-commerce industry	5	5	30	40	2,31
Pandemic situation noted in recent times	5	15	15	45	2,25
Increase in the number of people using computers and mobile devices	0	30	20	30	2
Development of ICT tools	0	5	50	25	2,25
Increasing environmental awareness of society	30	35	15	0	0,81
Adaptation of reception times to the pace of society	0	0	20	60	2,75

Source: own elaboration based on surveys conducted.

The study using a weighted average only confirms that the greatest influence on the development of sending and receiving points is the alignment of collection times with the pace of society. In second place with a score of 2.31 was the development of the e-commerce industry. According to the respondents, the escalation of parcel points was not influenced by the increasing environmental awareness of society. However, at the same time, 81.5 per cent of respondents said that delivery to a pick-up point was more environmentally friendly than direct delivery to the home, which was considered in the next question. Then, in another open-ended question, respondents were able to comment on why they thought delivery to a collection point was greener. Responses varied, but most focused on three key benefits:

- reducing the number of destination pick-up points, which minimises fuel consumption and kilometres travelled,
- reducing the length of routes for delivered goods while minimising external transport costs,
- saving time.

The survey was concluded with a question on the possible risks posed by delivery and collection boxes. 66.7 per cent of respondents indicated that, in their opinion, existing and newly established points do not pose a threat to the environment.

Discussion

Undoubtedly, in recent years we can observe an increase in consumer interest in online shopping. As transport, and in particular the transport of goods, is strongly linked to the e-commerce industry, companies are looking every day for new delivery solutions to attract new customers. The first questions of the survey confirm that online shopping is becoming more and more popular, due to the variety of assortments and time savings. The research presented in this article confirms several important points. First, delivery using parcel vending machines has recently become the most popular form of delivery, which is due to its convenience in terms of delivery time, flexibility of pickup times, pricing, and simple posting of a possible return shipment. This is also confirmed by research conducted by Kantar, according to which 92% of those surveyed in 2022 (Kantar, 2023) chose Parcel Post as their preferred form of delivery when shopping online. Secondly, the biggest influence on the development of sending and receiving points is the alignment of pickup times with the pace of society and the development of e-commerce. Similar research results were obtained by Szewczyk and Trajder in 2017. According to their research, the two most frequently chosen determinants of parcel vending machine selection turned out to be flexible pickup times and parcel convenience. The questionnaire surveys conducted in this article also have their limitations. They can only serve as an opinion of residents with regard to the development of

transmission and reception boxes. This is evidenced by the incomplete survey sample, which was only 135 people, while, with an estimated fraction size of 0.5, and an acceptable error of 0.05 (5%), and $\alpha = 5\%$, the survey sample size should be a minimum of 384 people. In addition, the research was limited to the opinions of local residents, and the development of parcel vending machines has also been influenced by businesses that have quickly adapted to the new delivery strategy. The author intends to expand the research with questionnaires to additional stakeholders in the future. It should also be noted that the number of people of all ages using computers is increasing year on year, which I believe is also not insignificant for the development of both e-commerce and various forms of delivery. In 2009, the idea of Paczkomats was born in Poland, so modern devices resembling post office boxes, which make it possible to independently collect and send parcels 24 hours a day, 7 days a week. Initially, few people believed in the success of the idea. It seemed abstract to leave ordered products in a place other than the customer's home. The surveys conducted show that according to residents, parcel vending machines are a very good solution, making it easier to receive parcels and thus improving their quality of life. The research carried out brings another argument to management science, showing that appropriate logistics solutions combined with the use of modern technology have a positive impact on the lives of residents and smooth the flow of goods in cities. So why have drop boxes been so successful over the years? According to Szewczyk and Trajer, parcel machines are an innovative tool in the courier industry developed by the independent logistics operator InPost (Szewczyk, Trajer, 2017). Ciepaj E., on the other hand, describes parcel machines as a revolutionary system "tailor-made" for the customer (Ciepaj, 2012). According to the author, they perfectly meet the needs of customers while keeping up with the dynamic development of the e-commerce industry. Recipients do not have to wait for a courier or stand in lines to pick up a package at specific times. In addition, the costs of deliveries using outboxes are comparable to, and often lower than, those to be incurred by choosing a courier. Shipper-receiver boxes are, in the author's opinion, a good solution in the context of urban logistics. Placing multiple parcels in one place reduces the number of courier transport routes, which in turn reduces the external cost of transporting goods, and also reduces the number of delivery trucks traveling through cities.

Conclusions

There is no doubt that in recent years there has been an upsurge in the development of broadcast boxes. This is due to a number of factors, including the growth of the e-commerce industry, the COVID-19 pandemic and the increasing use of computers and mobile devices by increasingly older people. The pioneer among companies currently offering parcel machine delivery is InPost. It is InPost that initiated this form of delivery in Poland by implementing the

so-called Paczkomaty. The use of parcel boxes in the context of urban logistics has many advantages. Firstly, it reduces the number of delivery points, which undoubtedly affects car traffic in the city. Secondly, it reduces the external costs of transport by reducing emissions, urban congestion and noise. A disadvantage of vending machines is considered by some to be the appearance of metal boxes in the city landscape, which are not always in the right places and are currently not regulated in any way. The survey carried out showed that the development of vending boxes is not only noticeable in number, but also by the public. Many people use this form of delivery because of the time savings as many of these machines are open 24 hours a day and the cost, which is usually lower than home delivery by courier. Parcel vending machines are a modern solution that adapts the timing of delivery to the pace of society. In the future, it could be a delivery method used not only by individual customers but also by small businesses.

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