





## Comparative analysis of the parcel lockers market and its users in Italy, Poland, and Ukraine


Olga Kunytska<sup>1</sup>, Luca Persia<sup>2</sup>, Stanisław Iwan<sup>3</sup>, Diana Datsenko<sup>4</sup>  
Kinga Kijewska<sup>5</sup>, Adriano Gurrieri<sup>6</sup>

<sup>1</sup>  <https://orcid.org/0000-0001-5525-1315>

<sup>2</sup>  <https://orcid.org/0000-0002-6597-5285>

<sup>3</sup>  <https://orcid.org/0000-0002-5480-5475>

<sup>4</sup>  <https://orcid.org/0000-0003-0168-8778>

<sup>5</sup>  <https://orcid.org/0000-0003-4980-9372>


<sup>1,4</sup> National Transport University, M. Omelianovycha-Pavlenka St.1, Kyiv, 01001, Ukraine

<sup>2,6</sup> Sapienza University of Rome, Piazzale Aldo Moro 5, Rome, 00185, Italy

<sup>3,5</sup> Maritime University of Szczecin, 11 Pobożnego St., 70-507 Szczecin, Poland

e-mail: <sup>1</sup>[olga.kunytska@ntu.edu.ua](mailto:olga.kunytska@ntu.edu.ua), <sup>2</sup>[luca.persia@uniroma1.it](mailto:luca.persia@uniroma1.it), <sup>3</sup>[stan.ivan@wp.pl](mailto:stan.ivan@wp.pl),

<sup>4</sup>[diana11071994@gmail.com](mailto:diana11071994@gmail.com), <sup>5</sup>[k.kijewska@pm.pl](mailto:k.kijewska@pm.pl), <sup>6</sup>[gurrieri.1873626@studenti.uniroma1.it](mailto:gurrieri.1873626@studenti.uniroma1.it)

 corresponding author

**Keywords:** customer value, e-commerce, last-mile delivery, city logistics

**JEL Classification:** E61, F64, L91

### Abstract

Parcel lockers seem to be a very interesting and innovative solution for any type of city, beneficial to both customers and online stores. Accounting for the growing number of B2C e-commerce customers, this measure significantly meets their needs. Moreover, this solution solves the challenges of last-mile deliveries, which are one of the major effects of heavy traffic of commercial vehicles in the whole city area. Recipients and senders of parcels through parcel lockers are the main generators of demand for this service. Hence, assessing their satisfaction and requirements is a key indicator of the development of this area. This work focuses on the efficiency of user parcel lockers and compares the situation in Italy, Poland, and Ukraine. This paper also presents an analysis of the already existing data on the satisfaction of parcel locker users, as well as the results of a study conducted among Ukrainian consumers for this work.

### Introduction

Solving the challenges of last-mile delivery is one of the most interesting areas of today's city logistics, which is rapidly developing in European countries. Success in addressing this issue allows cities and regions to implement the principles of sustainable development. Parcel lockers (PLs) have proven to be a successful way to consolidate shipments and reduce transportation costs. They ensure customer privacy by providing fast and efficient service. In addition, this solution is the most environmentally friendly for implementing last-mile delivery.

Since consumers play an important role both as recipients and creators of PLs services, assessing consumer satisfaction and requirements is a crucial indicator of development. This paper analyzes the present situation of PLs services in Italy, Poland, and Ukraine and identifies differences in consumer evaluation and PLs market realization.

### Analysis of previous studies

According to the SOTI report 2020/2021, more than 61% of logistics companies consider the last mile to be the most inefficient process in their chain

(SOTI, 2021). One of the largest challenges facing courier companies today is that customers are not always available at the delivery location. This leads to an increase in the number of failed deliveries, which places an additional burden on last-mile operations not only in terms of cost but also with regard to environmental concerns. One of the effective methods to deal with this problem is the use of parcel lockers. Not only do they help logistics companies navigate their operations and costs, but they also provide customers the option to choose (Akdoğan & Özceylan, 2023).

In recent years, numerous publications by scientists and researchers have been devoted to the study of parcel lockers. One of the first practical analyses of parcel lockers, in the context of their usability, was realized in 2011–2013 in the research project C-LIEGE (i.e., clean last mile transport and logistics management for smart and efficient local governments in Europe), founded under the Intelligent Energy Europe program. This work was focused on the efficiency of parcel lockers of the InPost Company and their proper location from the final user perspective (Lückenkötter et al., 2021). This research was undertaken at the Maritime University of Szczecin, Poland. Based on these results, some important conclusions have been considered that account for situations such as a location close to the market mall or transport junction. These analyses have been realized considering the influence of parcel lockers on pollution reduction. It has influenced the change of strategy in this context (previously, the parcel machines were primarily located at gas stations or parking areas).

In the period 2013–2016, the first wide-scale analysis of the usability of parcel lockers was accomplished in Poland under project GRASS (i.e., green and sustainable freight transport systems in cities), founded under the Polish-Norwegian Research Program. It was the first analysis that covered an area of one country with significant experience in parcel locker utilization. This research was focused on the usability of this system, as well as the pros and cons from the final user perspective (Iwan, 2015; Iwan, S., Kijewska & Lemke, 2016; Lemke, Iwan & Korczak, 2016). This work covered the 16 largest cities in Poland.

In ref. (Song et al., 2009), it is stated that the use of lockers provides savings at the last mile stage, mainly due to a reduction in repeated deliveries. A model for using parcel lockers for vehicle routing accounts for relevant aspects such as CO<sub>2</sub> emissions, customer time window, and congestion; this

is presented in ref. (Wen & Li, 2016). Faugere and Montreuil (Faugere & Montreuil, 2016) analyzed the business model of 12 companies that use parcel lockers and/or access points. The paper identifies trends and options for the design and operation of smart locker terminal networks.

The researchers' works also contain revolutionary solutions to the problems of last-mile delivery using parcel lockers. In ref. (Rolf et al., 2023), the use of mobile parcel lockers with changing locations depending on the regional parcel volume in the districts is considered. A pilot project evaluated the usefulness of mobile parcel lockers and cargo bikes in terms of delivery time, distance traveled, and emissions. An algorithm was developed to solve the problems of maximum coverage and vehicle routing in an integrated manner.

## Analyses of the present situation of delivery locker services in the studied countries

### Italy case study

According to a report by AGCOM (AGCOM, 2020), even if e-commerce is growing with such a trend, companies still have problems with last-mile deliveries. The number of parcel lockers in Italy increased, but their spread is not homogeneous. In particular, parcel lockers are concentrated mainly in the largest cities or province capitals, which are rare in rural areas. A map is provided by Figure 1.



Figure 1. Distribution of parcel lockers (AGCOM, 2020)

Analyzing the geo-localization data of parcel lockers, it was obtained that only 12% of Italian citizens live under 500 m away from the nearest locker (about 7.2 million inhabitants), 28% of citizens reside under 1 km away, and 46% of citizens live under 2 km away. This means that 54% of the population resides more than 2 km from the nearest locker, with a registered maximum of 222 km. The consequence is that half of the population still prefers home delivery.

In Italy, there are three different operators for deliveries. They compose a “closed network”. It means that only the owner of the lockers (i.e., Amazon, InPost, or Poste Italiane) can deliver parcels there. External operators who want to deliver parcels with lockers must pay a fee.

Amazon is the company that owns the highest number of parcel lockers in Italy. Their policy is a “closed system”. They also offer the possibility to return parcels that were bought with Amazon. InPost is another company that owns some of the lockers. Their policy, instead, is an “open system”. They also allow for the shipping of parcels.

Poste Italiane owns a few lockers, divided into public and private. While the first are “closed systems”, the second are “open systems”, both located in condominiums. Therefore, every operator is allowed to deliver parcels using lockers.

In 2020, the Politecnico di Torino and the Links Foundation published the results of their survey on the usage and the experiences with parcel lockers (Mitrea et al., 2020). They interviewed their students and workers, a total of over 30,000 potential people. From this sample, 1,140 respondents took part in the study, of which over 1,053 were online customers; all were asked their opinions about parcel lockers (the results are given in Table 1).

**Table 1. E-consumers’ attitude towards the parcel locker (research by PoliTO and Links)**

	N (total = 1,053)	% of total
<b>I have already used it</b>	<b>268</b>	<b>25.4</b>
I would like to use it again	257	24.4
I would not like to use it again	11	1.0
<b>I have never used it</b>	<b>785</b>	<b>74.6</b>
I would like to use it	731	69.4
I would not like to use it	54	5.1

Among those people who are not willing to use the parcel locker service, the reasons vary. For example, the main aversion is the non-perceived utility in carrying the parcel home, when the home delivery

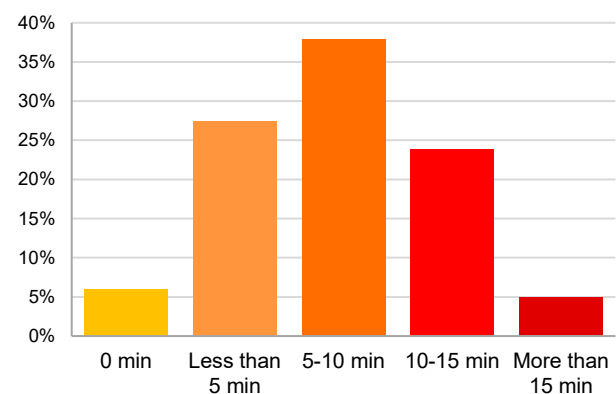
exists. Other reasons concern the showing of other people their personal habits in online shopping, the fear of being robbed while collecting the parcel, or not needing to use a parcel locker due to staying at home during the day.

It results that, almost obviously, people prefer to have a parcel locker near their habitual locations (i.e., home or workplace), but also would like to have parcel lockers in places where it is possible to complete more than one task (e.g., buying groceries at the supermarket or shopping at the mall in the same trip as collecting their parcels), which are also accessible by car. The exceptions to this assumption are gas stations and parking areas, where people might feel unsafe when collecting parcels. Another section of the survey asked about the preferred locations to position a parcel locker. The results are listed in Table 2.

Lastly, one section was dedicated to asking people if they were willing to change their daily routes to travel to a parcel locker and, if so, how much time they were willing to spend. The results are listed in Figure 2. It was found that 38.2% of potential adopters are available to deviate between 5 and 10 minutes from their daily routes to collect parcels, while 6% are not available to deviate at all.

**Table 2. Location preferences for parcel lockers (research by PoliTO and Links)**

	N (total = 988)	% of the total
Close to home	791	80.1
Close to the workplace	381	38.6
In front of a supermarket	366	37.0
At a gas station	56	5.7
In a parking area	38	3.8
In a shopping center	219	22.2
In a university campus	164	16.6
Other	19	1.9



**Figure 2. Maximum deviation (in minutes) to collect a parcel in a locker box for potential adopters (Mitrea et al., 2020)**

### Poland case study

Nowadays, Poland is the most experienced country in the world when considering the utilization of parcel lockers. The first successful business implementation was realized by InPost Company in 2009. From this time, the number of parcel machines significantly increased. Moreover, all the most important CEP (i.e., courier, express, and parcel) market actors considered this idea in their business models. Until now, the parcel lockers are utilized by InPost, DPD, Poczta Polska, DHL, Allegro, Orlen, and Alibaba. It is difficult to explain this phenomenon. The major reasons for the utilization of this system by e-commerce customers in Poland are shown in Figure 3.

The most important criterion when customers choose parcel lockers is their 24-hour availability. It makes this system very comfortable and independent. Additionally, the users underlined that the delivery price is highly crucial. It must also be mentioned that a significant increase in parcel locker utilization occurred when the cost of the delivery to the machines was reduced by the company.

According to the results of the analysis in Poland, the implementation and efficient utilization of parcel lockers requires the support of local residents, courier/delivery companies, and the owners of places where parcel lockers are located (Lemke, Iwan & Korczak, 2016). The crucial condition of their efficiency is the e-commerce stakeholders' willingness to deliver goods to the location of the machine, not to the final address of the customer. Based on the Polish example, this issue does not seem to be a problem for Internet retailers. From the business

stakeholder perspective, parcel lockers provide benefits such as (Iwan, Kijewska & Lemke, 2016):

- extra income from rent paid by the system operator,
- commercialization of the non-utilized outdoor space,
- extra revenue resulting from the increased footfall,
- a focal point for the community,
- opportunity to become part of international operations from cross-border deliveries,
- use of the reverse side of lockers for potential advertising space,
- building a reputation as a city that supports sustainable development.

An important issue in the context of parcel locker efficiency is the willingness of Internet shop customers to receive their goods not at home but from parcel lockers. Due to this, the most significant topic is the proper location of the machine, considering that the final part of delivery (i.e., the very last mile) must be realized by them directly. It does not need to be located only close to the customer's house. However, it must be close to often visited places, like shopping centers, schools, or transport junctions (i.e., bus or train stops).

The Polish analysis showed that the special role in the proper development of parcel lockers is played by the local, regional, or national authorities. It is mostly related to (Iwan, Kijewska & Lemke, 2016):

- promoting the installation and development of parcel lockers based on strategies and policies shared with relevant local key stakeholders,
- sharing or renting the public space for the installation of parcel lockers,

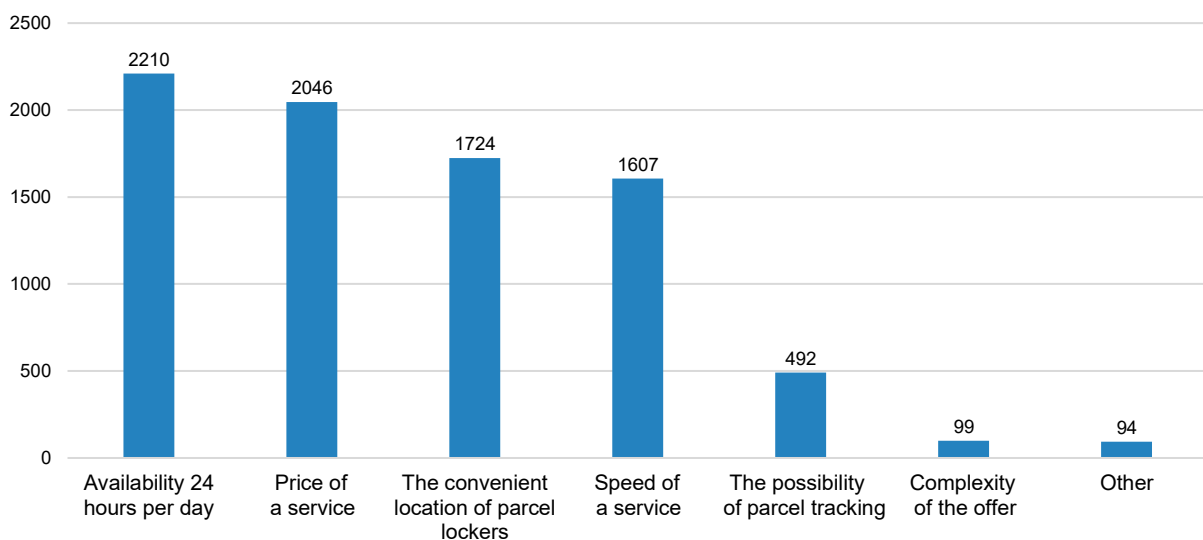


Figure 3. Criteria for choosing a parcel locker (Lemke, Iwan & Korczak, 2016)

- providing planning and building permission for pack station installations,
- supporting parcel lockers implementation by their involvement in transport planning and fleet monitoring systems.

An important aim of parcel lockers' implementation is to reduce the number of deliveries in the city area. It helps to reduce vehicle mileage with associated energy use and congestion impacts. The courier servicing parcel lockers is able to deliver 600 parcels in just one day with travel distances of about 70 km, in comparison to 60 parcels and 150 km in traditional delivery systems (Log4, 2023).

**Ukraine case study**

According to Statista (Statista, 2023), the e-commerce market in Ukraine showed steady growth in recent years before the start of the full-scale Russian invasion of Ukraine. In 2022, amid the war, e-commerce volumes decreased by almost 12 times and amounted to \$295.85 million. The decline was observed in all areas, especially in the segments of fashion, furniture, toys and hobbies, health and beauty, and electronics (Figure 4). Nevertheless, Statista makes optimistic forecasts for 2023. It is expected that, in 2023, the market volume will almost reach the level of 2020 and amount to \$2671,05 million. In 2025, it is expected to exceed the pre-war year of 2021.

The developing use of parcel lockers has occurred in Ukraine since 2014 and, currently, their main implementers are four delivery services: Nova Poshta (since 2016), Ukrposhta (since 2021), Meest (since 2018), and ROZETKA online store (since 2018).

Nova Poshta, which is the leader in Ukraine in providing services through parcel lockers, is also the second-largest operator of PLs in Europe. Figure 5 shows how the number of the company's branches and PLs changed from January to July 2022. A sharp drop is explained by the first months of the full-scale invasion of Ukraine, but in May the company returned to pre-war levels; by the end of the second quarter, it had begun to increase again.

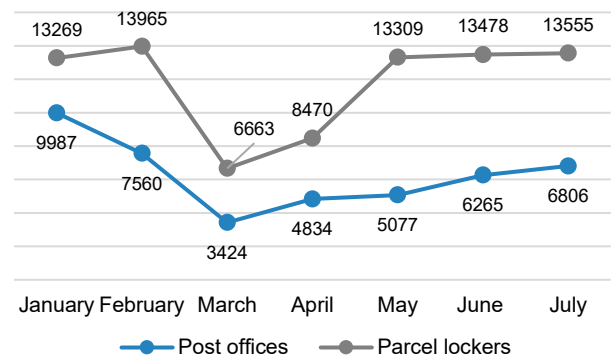


Figure 5. Dynamics of changes in the number of branches and parcel lockers of Nova Poshta in 2022

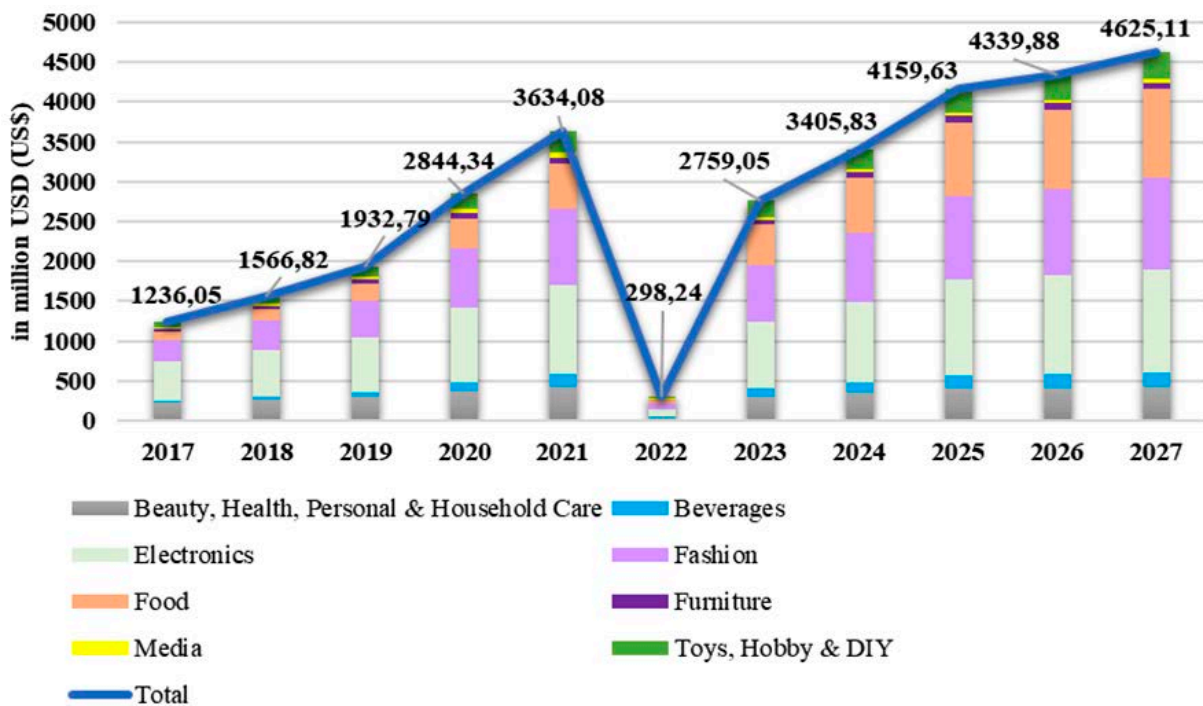


Figure 4. Dynamics and forecast of changes in e-commerce segments in Ukraine, 2017–2027 (Statista, 2023)

Recipients and senders of parcels through parcel lockers are the main generators of demand for this service, so assessing their satisfaction and requirements is a key indicator of the development of this area. Therefore, the Ukrainian customer survey of PLs was conducted for this study; 115 respondents took part in the survey (Table 3).

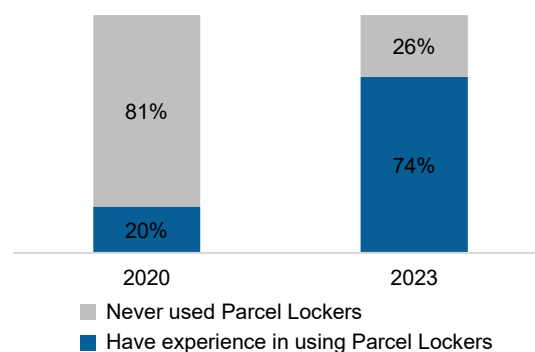
**Table 3. Description of the initial data used in the analysis**

Age	N	%
Less than 22	21	18
22–35	48	40
36–45	31	27
46–56	10	9
56 years and over	5	6
Gender	N	%
Male	42	37
Female	73	63
Main activity	N	%
Employed	78	67
Student	18	16
Pensioner	2	2
Not working	17	15
Residence	N	%
City of regional importance	74	63
City of district importance	18	16
Small town	4	4
Urban village	11	10
Village	8	7
Frequency of online shopping	N	%
Every week	18	16
Several times a month	47	40
Once every few months	38	33
Once every six months or less	8	7
Once a year or less	2	2
Do not do	2	2

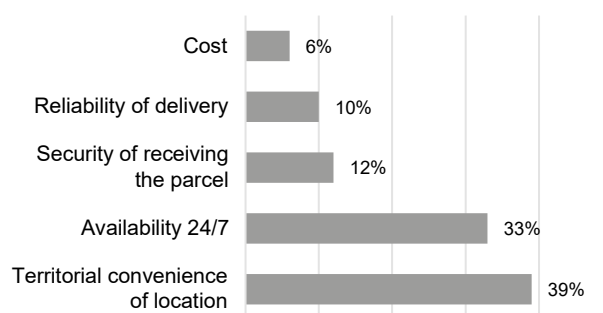
According to the results of the survey of respondents who make online purchases, 74% have experience using parcel lockers, which shows a significant increase in the popularity of this solution compared to the results of a similar study conducted by the authors in 2020 (Kunytska et al., 2021) (Figure 6).

The survey showed which characteristics of parcel lockers are key for consumers and what influences their choice for this particular delivery method (Figure 7), with respondents rating the available characteristics of parcel lockers on a 5-point scale (Figure 8).

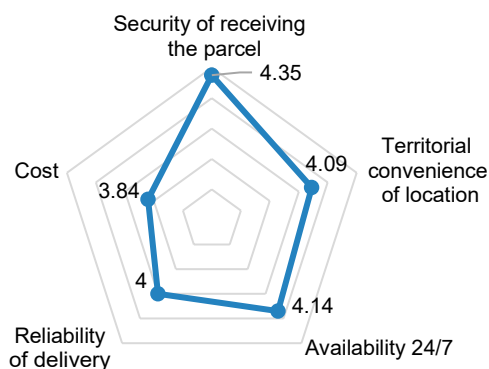
As can be seen from the results, the main factors of choice are the convenience of the location and



**Figure 6. Dynamics of parcel locker users among Ukrainian Internet consumers in 2020 and 2023**



**Figure 7. Ranking of criteria influencing the choice of a parcel locker as a method of delivery**



**Figure 8. Assessment of the characteristics of parcel lockers based on the existing experience of respondents**

the 24/7 accessibility to receive parcels. Consumers, according to their experience, provided these two characteristics a high rating – 4.04 and 4.19, respectively, on a 5-point scale for existing parcel lockers.

Attention should also be paid to the cost factor. When asked what needs to be improved in the service of parcel lockers, the option “Reduce the cost of services” was ranked third, but only 6% of respondents mentioned cost as a key factor.

### Conclusions

Based on the above analysis, a comparison of the main characteristics of parcel locker markets in Italy, Poland, and Ukraine was made (Table 4).

**Table 4. Comparative analysis of the main indicators of the parcels locker services market in Italy, Poland, and Ukraine**

Country	Italy	Poland	Ukraine
Number of parcel lockers (PLs)	2,500 (October 2020)	36,685	15,183
First PLs, year	2014	2009	2014
Location of PLs	Supermarkets, gas stations, shopping centers, main subway and railway stations, and local shops	Supermarkets, shopping centers, business centers, gas stations, bus and train stations, and on the street	Supermarkets, gas stations, shopping centers, business centers, in entrances, and on the streets
Functions of PLs	<ul style="list-style-type: none"> <li>Parcel delivery</li> <li>Short-term storage (3 days)</li> <li>Parcel return</li> </ul>	<ul style="list-style-type: none"> <li>Parcel delivery</li> <li>Parcel sending</li> </ul>	<ul style="list-style-type: none"> <li>Parcel delivery</li> <li>Short-term storage</li> <li>Sending parcels</li> <li>Point of parcel transfer through the PLs registration for another recipient</li> <li>Packaging service from the delivery service</li> </ul>
Works without electricity	No	Yes*	Yes*
Forwarding, yes/no	No	No	Yes*
Shipping without packaging, yes/no	No	No	Yes*
Possibility to receive a parcel without the Internet, yes/no	No	No	Yes*
Free delivery to the PL from partner stores, yes/no	No	Yes*	Yes
Possibility to install a PL for business, yes/no	Yes*	Yes*	Yes*

\* Some operators have other conditions

The most important factor in the efficient utilization of parcel lockers is their proper localization in the city area. According to the analysis realized in the studied countries, it is possible to identify a few of the best locations for this kind of system:

- local hot spots within suburbs – next to convenience stores (high density of population living in the neighborhood),
- high-traffic pedestrian areas in city centers,
- shopping centers and supermarket car parks,
- bus/underground stations next to local commuting hubs,
- petrol station forecourts,
- service stations,
- business centers.

Parcel lockers located directly at the place of residence of recipients (at the entrance of the house) are also gaining popularity.

The analysis of consumer preferences for parcel lockers in Italy, Poland, and Ukraine showed that, in all the countries considered, the most important criterion for customers to choose parcel lockers is their convenient location. It is the distance from the place of residence that determines the final decision on their use.

Parcel lockers are one of the most efficient measures of city logistics. It must be underlined that a significant synergy effect can be achieved by the combined utilization of parcel lockers and other environmentally friendly city logistics measures, such as electric vehicles, cargo bikes, development of environmental zones, urban depots etc. Moreover, support by autonomous vehicles could add important value in the future (Figure 9) (Kerr & Różycki, 2023).



**Figure 9. Autonomous vehicle for delivering parcels to parcel lockers**

This kind of system seems to be a very promising solution for many cities. However, the crucial issue

of its efficiency is the proper business model, relating to the local specificity, established by business stakeholders as well as a general acceptance of these machines by users. The Polish experiences show that it can be fully accepted by e-commerce customers.

## References

1. AGCOM (2020) Allegato B Alla Delibera n. 629/20/CONS. *Documento per La Consultazione Pubblica Sulle Misure per Incentivare l'utilizzo Degli Armadietti Automatici per La Consegna e La Raccolta Dei Pacchi*. Available online: [www.agcom.it](http://www.agcom.it) [Accessed: December 01, 2020].
2. AKDOĞAN, K. & ÖZCEYLAN, E. (2023) Parcel Locker Applications in Turkey. *Beykent Üniversitesi Fen ve Mühendislik Bilimleri Dergisi* 16 (1), pp. 43–54, doi: 10.20854/bujse.1219275.
3. FAUGERE, L. & MONTREUIL, B. (2016) Hyperconnected city logistics: Smart lockers terminals & last mile delivery networks. In Proceedings of the 3rd International Physical Internet Conference, 29 June – 1 July, 2016, Atlanta, GA, USA.
4. IWAN, S. (2015) Parcel Lockers as a solution to support last mile delivery management in e-commerce. *Logistyka* (2), pp. 36–39.
5. IWAN, S., KIJEWSKA, K. & LEMKE, J. (2016) Analysis of parcel lockers' efficiency as the last mile delivery solution – the results of the research in Poland. *Transportation Research Procedia* 12, pp. 644–655.
6. KERR, I. & RÓŻYCKI, M. (2023) *Cleveron takes on Starship in robot delivery*. [Online]. Available from: <https://www.parcelandpostaltechnologyinternational.com/analysis/cleveron-takes-on-starship-in-robot-delivery.html> [Accessed: June 25, 2023].
7. KUNYTSKA, O., COMI, A., DANCHUK, V., VAKULENKO, K. & YANISHEVSKYI, S. (2021) Optimizing last mile delivering through the analysis of shoppers' behaviour. In: Sierpiński, G., Macioszek, E. (eds) *Decision Support Methods in Modern Transportation Systems and Networks. Lecture Notes in Networks and Systems* 208, pp. 129–147, Springer, Cham, doi: 10.1007/978-3-030-71771-1\_9.
8. LEMKE, J., IWAN, S. & KORCZAK, J. (2016) Usability of the parcel lockers from the customer perspective – the research in Polish Cities. *Transportation Research Procedia* 16, pp. 272–287.
9. Log4 (2023) *InPost parcel lockers: survey report*. [Online]. Available from: [www.log4.pl/aktualnosci-2609-Paczkomaty\\_InPost\\_\\_ekspertyza\\_AGH.html](http://www.log4.pl/aktualnosci-2609-Paczkomaty_InPost__ekspertyza_AGH.html) [Accessed: April 10, 2023].
10. LÜCKENKÖTTER, J. et al. (2021) *Final Evaluation. C-LIEGE Deliverable 6.3. 2013*. Available online: [www.c-liege.eu](http://www.c-liege.eu) [Accessed: December 21, 2021].
11. MITREA, I.A., ZENEZINI, G., DE MARCO, A., OTTAVIANI, F.M., DELMASTRO, T. & BOTTA, C. (2020) Estimating e-consumers' attitude towards parcel locker usage. *IEEE 44th Annual Computers, Software, and Applications Conference (COMPSAC)*, pp. 1731–1736, doi: 10.1109/COMPSAC48688.2020.000-5.
12. ROLF, B., KURTZ, G., HEMPEL, K. & ZADEK, H. (2023) Optimizing the Route and Location Planning for Cargo Bikes and Mobile Parcel Lockers. In: Nathanail, E.G., Gavanas, N., Adamos, G. (eds) *Smart Energy for Smart Transport. CSUM 2022. Lecture Notes in Intelligent Transportation and Infrastructure*. Springer, Cham, pp. 1343–1357, doi: 10.1007/978-3-031-23721-8\_108.
13. SONG, L., CHERRETT, T., MCLEOD, F. & GUAN, W. (2009) Addressing the last mile problem: transport impacts of collection and delivery points. *Transportation Research Record* 2097(1), pp. 9–18.
14. SOTI (2021) *Mobility report*. [Online]. Available from: <https://soti.net/industries/transportation-and-logistics/mobility-report/> [Accessed: December 15, 2021].
15. Statista (2023) *Ukraine's Economy & Society. Statista Country Report*. [Online]. Available from: <https://www.statista.com/study/48494/ukraine> [Accessed: January 15, 2023].
16. WEN, J. & LI, Y. (2016) *Vehicle routing optimization of urban distribution with self-pick-up lockers*. International Conference on Logistics, Informatics and Service Sciences, 24–27 July 2016, Sydney, NSW, Australia, doi: 10.1109/LISS.2016.7854384.

**Cite as:** Kunytska, O., Persia, L., Iwan, S., Datsenko, D., Kijewska, K., Gurrieri, A. (2023) Comparative analysis of the parcel lockers market and its users in Italy, Poland, and Ukraine. *Scientific Journals of the Maritime University of Szczecin, Zeszyty Naukowe Akademii Morskiej w Szczecinie* 75 (147), 89–96.