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Courier services as a determinant for improving the „last mile" logistics in Poland

Usługi kurierskie w Polsce jako determinanta doskonalenia logistyki „ostatniej mili"

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Abstract. The article presents the results of research reflecting the essence and properties of courier services, as well as the premises for improving the „last mile" logistics in Poland. Undoubtedly, „last mile" logistics can be treated as a part of distribution logistics and in the era of turbulent development of e-commerce should be the subject of scientific research. There is some ambiguity related to the identification of the essence of courier services as part of the logistics services market. These services are provided by postal operators and significantly affect logistics solutions in the area of distribution and after-sales service. The purpose of the research was to determine the characteristics of courier services in Poland, including their drawbacks, and to indicate the possibility of implementing changes in the „last mile" logistics necessary to eliminate the identified imperfections. The research was focused on solving the following scientific research problem: What services are of key importance in the postal services market in Poland, and what fundamental errors in „last mile" logistics should be eliminated to improve the quality of customer service? The obtained research results allowed to positively verify the following research hypothesis: Courier services are of key importance among postal services, with domestic courier services continuing to dominate. The main drawbacks of current logistics solutions are: damage to parcels; delays in relation to the guaranteed delivery date and loss of parcels. As a result, the essence of courier services as one of the types of postal services was clarified, its essential characteristics were identified, and it was shown that domestic courier shipments will continue to dominate among postal services. The main shortcomings of the logistics solutions currently in use were also identified, namely damage to parcels; delays in relation to the guaranteed delivery date and loss of parcels at the last stage of delivery, which was the basis for pointing out opportunities to improve „last mile" logistics solutions.

Keywords: courier services, „last mile" logistics, distribution logistics, postal operator, logistics services market

Abstrakt. W artykule przedstawiono wyniki badań odzwierciedlające istotę i właściwości usług kurierskich, a także przesłanki do doskonalenia logistyki „ostatniej mili" w Polsce. Współczesne opracowania naukowe koncentrują się na identyfikacji specyfiki logistyki, którą postrzega się przez jej wielowymiarowość. Niewątpliwie logistyka „ostatniej mili" może być traktowana jako część logistyki dystrybucji i w dobie burzliwego rozwoju handlu elektronicznego powinna być przedmiotem badań naukowych. Istnieje pewna niejednoznaczność związana z identyfikacją istoty usług kurierskich jako elementu rynku usług logistycznych. Usługi te są świadczone przez operatorów pocztowych i istotnie wpływają na rozwiązania logistyczne w obszarze dystrybucji i obsługi posprzedażnej. Celem badań było określenie właściwości usług kurierskich w Polsce, w tym ich mankamentów, i wskazanie możliwości wdrożenia zmian w logistyce „ostatniej mili" koniecznych do wyeliminowania stwierdzonych niedoskonałości. Badania były skoncentrowane na rozwiązaniu następującego naukowego problemu badawczego: Jakie usługi posiadają kluczowe znaczenie na rynku usług pocztowych w Polsce i jakie zasadnicze błędy w zakresie logistyki „ostatniej mili" należy wyeliminować, aby poprawić jakość obsługi klientów? Uzyskane wyniki badań pozwoliły zweryfikować pozytywnie następującą hipotezę badawczą: Kluczowe znaczenie wśród usług pocztowych posiadają usługi kurierskie, przy czym nadal będą dominować krajowe przesyłki kurierskie. Głównymi mankamentami aktualnie stosowanych rozwiązań logistycznych są: uszkodzenia przesyłek; opóźnienia w stosunku do gwarantowanego terminu dostawy i utrata przesyłek.
W konsekwencji sprecyzowano istotę usług kurierskich, jako jednego z rodzajów usług pocztowych, określono zasadnicze ich właściwości i wykazano, że krajowe przesyłki kurierskie będą nadal dominować wśród usług pocztowych. Zidentyfikowane zostały także główne mankamenty aktualnie stosowanych rozwiązań logistycznych, a mianowicie uszkodzenia przesyłek, opóźnienia w stosunku do gwarantowanego terminu dostawy i utrata przesyłek na ostatnim etapie dostaw, co było podstawą do wskazania możliwości doskonalenia rozwiązań z zakresu logistyki „ostatniej mili".
Słowa kluczowe: usługi kurierskie, logistyka „ostatniej mili", logistyka dystrybucji, operator pocztowy, rynek usług logistycznych

Introduction

The Covid-19 pandemic was the cause of the exponential growth of courier services in Poland and caused significant changes in multichannel sales, where „last mile" logistics fundamentally determines the quality of logistical service to customers - consumers. It should be assumed that this upward trend will be sustainable, and therefore in the sphere of distribution and after-sales service there will be significant changes that are challenges for distribution logistics, including „last mile" logistics closely related to it. Thus, it is necessary to conduct research, on the one hand, reflecting customer preferences (expectations) for courier delivery, and on the other hand, justifying the recommendation of such solutions that would meet these expectations.

In the author's opinion, from the theoretical and practical point of view, it was important to achieve the goal of the research, that is: to identify the characteristics of courier services in Poland their shortcomings and to identify the possibility of implementing changes in "last mile" logistics. These changes, according to the author, are necessary to eliminate the identified shortcomings.

The essence of the problem situation is presented by the following research problem: What services are of key importance in the postal services market in Poland, and what fundamental flaws in "last mile" logistics should be eliminated to improve the quality of customer service?

In turn, the research hypothesis, which was verified positively, was formulated as follows: Courier services are of key importance among postal services, with domestic courier services continuing to dominate. The main drawbacks of current logistics solutions are: damage to parcels; delays in relation to the guaranteed delivery date and loss of parcels.

The research methodology used included, among other things, a document survey and a diagnostic survey. The main limitations of the research were due to its subject and spatial scope (courier services provided in the territory of Poland) and temporal scope (2017-2021, with the diagnostic survey performed in 2021, in connection with the development of a master›s thesis by Katarzyna Sawicka under the scientific direction of the author. This thesis has been deposited in the archives of the War Studies University. A survey technique was applied using an online survey questionnaire with the Google Forms website. The respondents were people who use courier services in Poland [Sawicka, 2021, pp. 53-64]. The sampling was quasi--random with no minimum sample size estimate. Nominal, ordinal and interval scales were used to measure respondents' evaluations.

Consequently, final conclusions were formulated relating to the improvement of "last mile" logistics – the implementation of new solutions that could lead to the elimination of the identified shortcomings of courier services.

Study of the literature of the research subject

The nature and scope of the study is the basis for the extraction, analysis and critical evaluation of the literature on the subject of the research. The interdisciplinarity of logistics does not facilitate this endeavor, which is why the theoretical and practical aspects of distribution logistics, logistics services, including courier services, and logistical customer-consumer service were extracted. It should be agreed that the last mile, as the final stage of physical distribution of products (Smyk, 2017, p. 1529), is the most demanding stage of the flow of goods, and courier shipments mainly determine the future of e-commerce, which will require businesses to have, among other things, the ability to interact with customer expectations and organize cost-effective and environmentally friendly deliveries (Painting the Digital Future of Retail and Consumer Goods Companies, 2017, p. 8). As the last stage of transportation, it is a key success factor in achieving high levels of customer satisfaction and increasing the market share of service providers (Chen, Demir, Huang, Qiu, 2021, pp. 1-4). Last-mile logistics is considered the least efficient in the entire supply chain (Lin, Chen, Kawamura, 2016, p.3). This is caused, among other things, by spatially limited pick-up points or the demand for more frequent and smaller shipments (Slabinac, 2015, p. 111).

The literature is clear that last-mile logistics is beyond the scope of a single discipline, highlighting the complexity of the research area (Olsson, Hellstrom, Pallson, 2019, pp. 3-4). Rather, research focuses on operational and strategic ventures in distribution logistics, and contemporary distribution strategies increasingly take into account the role of multi-channel sales, including related logistics, in building competitive advantages in modern sales markets (Smyk, 2019, pp. 11-18). There is a certain paucity of publications that consider non-economic issues (Olsson, Hellstrom, Pallson, 2019, p. 417). The Polish literature is dominated by an efficiency approach to logistics tasks performed due to the nature of a particular logistics service (Pluta-Zaremba, Rutkowski, 2005, pp. 231-233). It is also possible to identify a current of research relating to the essence of logistic service and the role of standards in force in the industry of courier companies in shaping the quality of this service (Brdulak, 2012, pp. 40-42). The views of theoreticians and practitioners on the role of «last mile» logistics in e-business are changing (Wieczerzycki, 2012, p. 66-68). The globalization has led to a visible development of transport and the problem of "last mile" delivery is being solved thanks to technological, communication and industrial innovations (Ranieri, Digiesi, Silviestri, Roccotelli, 2018, 1-2). On the ground of practice, courier services are most fully described in the form of reports, the latest of which is on the practice of 2021 (Report on the state of the postal market in 2021; Raport o stanie rynku pocztowego w 2021 roku, 2022, pp. 15-41).

The context of logistics services is crucial in identifying the characteristics of courier services. The decisive quality factors of logistics service related to "last mile" logistics are "... first and foremost, delivery time, customer convenience, and reliability in delivery" (Książkiewicz, 2011, p. 91). Thus, the solution of the research problem involved the search for arguments proving that courier services dominate among postal services, and their provision significantly determines "last mile" logistics solutions. Therefore, the results of the evaluation of courier services, especially the identification of their shortcomings are at the same time premises for the search for opportunities to rationalize "last mile" logistics solutions.

Postal services versus courier services - common features and differences

Courier, express and postal services are often referred to as the "CEP services industry" and are part of the logistics services market (LSM) as a totality of relationships that occur between sellers who offer logistics services at a certain price and buyers who request the purchase of the services in question with the necessary means of payment. Thus, it can be said that the LSM consists of three integral elements:

– market players, which are sellers (service providers) and buyers of logistics services (service recipients);

– the object of the market, which are the logistics services offered;
– the mutual relations shaping the trade relations.

It is crucial to have a clear understanding of the essence of logistics services, which is most often a form of economic activity carried out on the basis of the forces and resources of enterprises operating in the logistics services market (mainly logistics enterprises), which profitably perform transportation, warehousing, forwarding and related and supporting services related to the process of movement of material goods and information in space and time (between links of supply chains). Thus, we can conclude that CEP services are part of logistics services (Rydzkowski, 2011, p. 43). CEP services mainly include express and courier parcel shipments, document shipments, and pallet shipments (Książkiewicz, 2011, pp. 92-93). It is sometimes difficult to discern the difference between CEP companies and logistics operators, whose offerings increasingly include the provision of logistics services attributed to the CEP service industry.

A certain theoretical and practical problem is the definition of the essence of the courier service. On the ground of practice, the characteristic features of courier services can be identified, namely:

– services are provided at the last stage of physical flows in the supply chain (at the end of the distribution channel);
– there are a very large number of small shipments generating high delivery costs;
– a high level of delivery reliability is critical;
– existence of tracking capabilities for shipments;
– limited physical parameters of shipments;
– striving to reduce the delivery time of shipments as much as possible regardless of distance;
– use of low-capacity truck transportation (Książkiewicz, 2011, pp. 92-93).

The genesis of the concept can be traced to the postal services, where courier services were a response to the unsatisfactory level of service provided by the national postal companies in the 1990s. Consequently, the essence of the courier service can be defined based on the *Postal Law* (The Act of 23 November 2012, Postal Law; Ustawa z dnia 23 listopada 2012r. Prawo pocztowe, p. 3). According to the provisions of this legal act, the concept of courier service (service) should be understood as a letter mail item being a registered mail item or postal package, received, sorted, transported and delivered in a way that collectively provides:

– direct receipt of the postal item from the sender;
– tracking of the postal item from posting to delivery;
– delivery of the postal item within the guaranteed period of time specified in the regulations for the provision of postal services or in contracts for the provision of postal services;

- delivering the postal item directly into the hands of the addressee or person entitled to receive it;
- obtaining a receipt for receipt of the postal item in written or electronic form.

Courier services can be performed between businesses, companies and individual recipients (e-commerce), individual recipients (e-commerce and occasional mail). Formally, these services are classified in the *Polish Classification of Activities* in Division 53 and assigned the code 53.2 (*Other postal and courier services*) and 53.20.11.0 (*Courier services performed by various modes of transport*).

The terms courier services, transportation services, freight forwarding services should not be considered synonymous although the specific features of the courier service presented prove that it is also a transportation service and requires the performance of freight forwarding undertakings. It is reasonable to say that courier services combine transport and forwarding services, that is, they are a hybrid solution for the delivery of goods.

The aforementioned conceptual inaccuracy can be further exposed mainly on the basis of the Postal Law and its implementing acts. It should be noted that this Act implemented Directive 2008/6/EC of the European Parliament and of the Council of February 20, 2008 into the Polish legal order.

Adequately to the essence of the formal provisions in this Act, a division of the postal services market into the following main segments was introduced (Table 1):
- universal services;
- services included in the scope of universal services;
- courier services;
- other postal services.

It should be noted that CEP services refer to courier services twice - courier services; express services; postal services, which again include courier services (shipments). Therefore, the presented research results require some clarification, namely **courier services are treated as a segment of postal services.**

Data from the Reports on the State of the Postal Market in 2017-2021 make it possible to determine trends in the revenues of postal operators and the relative shares of these revenues from different types of postal services, namely letter mail, postal parcels, courier mail and other services (Table 1). It can be observed that revenues from courier and letter services dominate, with a decrease in revenues in the case of letter and parcel post between 2019 and 2021. There was an upward trend in the case of courier shipments, with courier-related revenues holding the highest share of operators' revenues in each year of the period under review, reaching 63.6% in 2021. This is another indication of the dominant role of courier mail and the high year-on-year revenue growth (the growth rate y/y 2021/2020 is 20.5%).

Table 1. Revenues from postal services

No.	Type of services	2017		2018		2019		2020		2021	
		[mln]	%	[mln]	%	[mln]	%	[mln]	%	[mln]	%
1.	Mail shipments	3334.9	39.6	3600.3	38.1	3776.1	36.9	3542.9	30.3	3419.6	26.5
2.	Postal parcels	441.8	5.2	442.8	4.7	472.1	4.6	454.9	3.9	412.9	3.2
3.	Courier shipments	3978.0	47.2	4644.9	49.2	5181.1	50.6	6802.8	58.8	8197.7	63.6
4.	Other services	669.6	7.9	758.8	8.0	813.0	7.9	820.7	7.0	860.5	6.7

Source: Report on the state of the postal market in 2018, 2019; Raport o stanie rynku pocztowego w 2018 roku, 2019, p. 18 [Accessed 1 March 2023]; Report on the state of the postal market in 2020, 2021; Raport o stanie rynku pocztowego w 2020 roku, 2021, p. 16 [Accessed 1 March 2023]; Report on the state of the postal market in 2021, 2022; Raport o stanie rynku pocztowego w 2021 roku, 2022, p. 17 [Accessed: 1 March 2023]

Courier services and their relationship to "last mile" logistics

"Last mile" logistics includes a number of logistics tasks carried out at the final stage of delivering shipments to institutional customers and customers-consumers, i.e. the provision of KEP services. The basic criteria for assessing the quality of the solutions used are derived from the essence of distribution logistics. In the case of "last-mile logistics" the balance between the level of reliability and flexibility of delivery expected by customers and the cost for a specific courier shipment is essential. Such defined criteria for evaluating "last mile logistics" solutions should be considered essential, but not the only ones, as evidenced by practical solutions used by companies in the KEP services industry.

According to A. Kawa, the scope of CEP services is driven by trends in the market, with the following identified as trends of this industry: investment in IT; e-commerce service; courier brokers; new sending and receiving locations; one-stop shopping; dedicated services; return logistics; investment in IT (Kawa, p. 112). It is reasonable to assume that these trends will be sustained in the coming years as well. Thus, it is possible to identify the tasks of CEP companies carried out within the framework of "last mile logistics", namely:

- achieving high operational efficiency of physical distribution;
- ensuring a high level of delivery reliability;
- tailoring the range of CEP services to individual customer expectations (providing comprehensive services - packages of "tailor-made" logistics services);

- striving to increase flexibility in the place and time of sending and receiving shipments;
- handling returns (Smyk, 2017, p. 1531).

High operational efficiency of physical distribution can be achieved through the use of a properly designed operational network, consisting of sorting plants, branches, fleet, modern equipment, information technology and personnel. The expression of this efficiency is the delivery of shipments domestically within a day, and 48 to 72 hours for international shipments. Typical for achieving such high operational efficiency are distribution channels consisting of parcel sorting plants, multiple branches distributed fairly evenly across the country (around large population centers), a large number of sending and receiving points.

It can be concluded that the forms of physical distribution are differentiated by the parameters of logistical customer service. Fundamental among them is the timing of delivery. Thus, we observe the dominance of road transport, due to its spatial accessibility which turns out to be an important determinant of the concept of "last mile" logistics. It is evident that at the last stage of parcel delivery, traditional solutions of delivering parcels directly to customers by couriers at specific time intervals are used. It should be inferred that such a solution is used regardless of macro conditions (domestic shipments, international shipments). The observation about the size (weight) of shipments is also important. It should be assessed that the offers are attractive, from the point of view of institutional customers, if the individualization of services is applied, that is, the service provider is ready to design a specific package of components of the courier service "tailor-made". Noteworthy are solutions for customer communication and financial flows. Widely used information systems, telecommunications and technical means of couriers basically eliminate information barriers. Also important is the location of multiple points of shipment and return, ensuring door-to-door courier delivery; the use of applications to facilitate shipment and tracking, differentiation of delivery standards and associated prices.

Undoubtedly, it is also important to guarantee the possibility of choosing the most favorable location of the pickup point with a wide time range for its operation. The option of choosing an alternative recipient is also one of the solutions used in "last mile" logistics. In the case of the recipient's absence, the courier leaves a delivery advice with the recipient and automatically goes to the alternative recipient (neighbor). This solution promotes the realization of a successful delivery the first time, which is a significant convenience for the recipient and the sender.

The perspective of "last mile" logistics requires an analysis of the volume of individual postal services. (Table 2).

Table 2. Volume of postal services

No.	Type of services	2017		**2018**		**2019**		**2020**		**2021**	
		[mln pcs.]	%	[mln pcs.]	%	[mln pcs.]	%	[mln pcs.]	%	[mln pcs.]	%
1.	Mail shipments	1353.0	72.4	1372.2	71.2	1246.1	66.2	1054.7	56.2	975.7	50.4
2.	Postal parcels	26.4	1.4	23.0	1.2	25.2	1.3	30.0	1.6	29.2	1.5
3.	Courier shipments	308.1	16.5	368.8	19.2	440.9	23.3	635.6	33.9	776.0	40.1
4.	Other services	181.0	9.7	162.2	8.4	174.0	9.2	155.1	8.3	154.2	8.0
TOTAL		1868.5	100	1926.3	100	1886.2	100	1875.4	100	1935.1	100

Source: Report on the state of the postal market in 2018, 2019; Raport o stanie rynku pocztowego w 2018 roku, 2019, p. 22 [Accessed 1 March 2023]; Report on the state of the postal market in 2020, 2021; Raport o stanie rynku pocztowego w 2020 roku, 2021, p. 20 [Accessed 1 March 2023]; Report on the state of the postal market in 2021, 2022; Raport o stanie rynku pocztowego w 2021 roku, 2022, p. 21 [Accessed: 1 March 2023]

An important factor differentiating "last mile" logistics solutions (and their determinants) is the volume of domestic and foreign courier shipments. Domestic shipments dominated during the period under review (Table 3).

Table 3. Volume of domestic and foreign courier shipments

No.	Courier shipments	**2017**		**2018**		**2019**		**2020**		**2021**	
		[mln pcs.]	%	[mln pcs.]	%	[mln pcs.]	%	[mln pcs.]	%	[mln pcs.]	%
1.	Domestic	287.9	93.4	345.3	93.6	415.5	94.3	604.9	95.0	738.4	95.2
2.	Foreign	20.3	6.6	23.6	6.4	25.3	5.7	31.9	5.0	37.6	4.8
TOTAL		308.2	100	368.9	100	440.8	100	636.8	100	776.0	100

Source: Report on the state of the postal market in 2019, 2020; Raport o stanie rynku pocztowego w 2019 roku, 2020, p. 25 [Accessed: 1 March 2023]; Report on the state of the postal market in 2021, 2022; Raport o stanie rynku pocztowego w 2021 roku, 2022, p. 26 [Accessed: 1 March 2023]

Thus, the rationale behind this is that it is reasonable to assume reliance on the results of domestic studies when identifying opportunities for improving "last mile" logistics ventures. The drive to improve logistics solutions stems from the causes and number of complaints filed by customers (Table 4).

Table 4. Complaints about courier shipments

Reasons for complaints	2017		2018		**2019**		**2020**		**2021**	
	[number]	%	[number]	%	[number]	%	[number]	%	[number]	%
Loss of shipment	69587	8.1	87,127	6.5	89,844	8.8	166,247	17.4	179,595	25.0
Loss of shipment contents	9649	1.1	13,154	1.0	14,054	1.4	24,570	2.6	27,203	3.8
Damage to the shipment	113,337	13.1	130,692	9.8	135,554	13.3	176,658	18.5	183,431	25.5
Delay in delivery	552,498	63.9	948,025	70.9	649,155	63.9	422,882	44.3	179,807	25.0
Errors in ZPO	551	0.1	807	0.1	418	0.04	2580	0.3	253	0.04
Untimely return of the shipment	1335	0.2	2285	0.2	2612	0.3	1167	0.1	851	0.1
Return of the shipment due to wrongly indicated reason for inability to deliver it	3665	0.4	8514	0.6	11,739	1.2	18,689	2.0	15,215	2.1
Other	114,327	13.2	146,653	11.0	112,810	11.1	141,037	14.8	132,175	18.4
TOTAL	864949	100	1,337 257	100	1016186	100	953830	100	718530	100

Legend:

RA – document acknowledging delivery receipt

Source: Report on the state of the postal market in 2017, 2018; Raport o stanie rynku pocztowego w 2017 roku, 2018, p. 28 [Accessed: 1 March 2023]; Report on the state of the postal market in 2018, 2019; Raport o stanie rynku pocztowego w 2018 roku, 2019, p. 30 [Accessed: 1 March 2023]; Raport o stanie rynku pocztowego w 2020 roku, 2021, p. 20 [Accessed: 1 March 2023]; Report on the state of the postal market in 2019, 2020; Raport o stanie rynku pocztowego w 2019 roku, 2020, p. 30 [Accessed: 1 March 2023]; Report on the state of the postal market in 2020, 2021; Raport o stanie rynku pocztowego w 2020 roku, 2021, p. 28 [Accessed: 1 March 2023]; Report on the state of the postal market in 2021, 2022; Raport o stanie rynku pocztowego w 2021 roku, 2022, p. 29 [Accessed: 1 March 2023]

Complaints filed due to delayed deliveries dominated, with the number of such complaints decreasing as of 2018. The increase in complaints due to lost shipments is puzzling. Between 2017 and 2019, the value did not exceed 9%, and in 2021 it reached 25% (in absolute numbers, there was an increase of 76,403 in 2020 compared to 2019, and another 13,348 shipments in 2021). From the point of view of improving "last mile" logistics solutions, it is also important to point out shipment damage as another reason for complaints. In 2021, these complaints accounted for 25.5% of the value of all complaints, with the rate of these complaints in each year placing them second among all indicators of the reasons for complaints filed.

Evaluation of courier services in Poland based on the results of a diagnostic survey

The results of the diagnostic survey are a collection of responses from those who chose to participate in the survey, using the technique of recruiting volunteers for online surveys. This technique is based on reaching out to users who hit the page or pages where the invitation to take part in the survey is posted. A certain shortcoming is the sample size – 167 people participated in the survey, 56% women and 44% men. By age, the following groups of respondents were distinguished: under 18 years – 2%, 18-26 years – 57%, 27-35 years – 11%, over 35 years – 30%.

The largest group (32%) were those living in a city with a population of 20,000 to 100,000. On the other hand, the smallest group (6%) was those living in a city of 100 to 500 thousand residents. In turn, rural residents accounted for 25% of respondents. From cities with more than 500 thousand residents, 27% of respondents took part in the survey. The last group was residents of cities with up to 20 thousand residents.

Respondents were most often recipients of courier shipments (87%), while the rest were senders (1%) or senders and receivers (12%).

The most common form of parcel delivery was pickup at parcel machines (68%). Home delivery was preferred by 30% of respondents. The remaining 2% used delivery to a pick-up point (kiosk, store) or other companies delivering parcels to the workplace. It is puzzling that no one indicated the post office.

The dominant postal operator was InPost (86% of indications). It should be noted that respondents were able to indicate the two operators whose services they use most often. DHL (44%) and DPD (32%) ranked second and third, respectively. No one indicated FedEx (Fig. 1.).

Respondents also indicated reasons for abandoning courier services. Seven types of answers were proposed, i.e. unattractive prices, untimely delivery, incompetence of employees, poor condition of shipments, difficult contact with the courier company, time of courier service and closure of the company (Fig. 2). However, many respondents took the opportunity to write their own answer. Among them, the most common reasons for cancellation included: the lack of choice of these companies when purchasing a particular product, and the company's failure to have pick-up points (e.g., parcel machine, store).

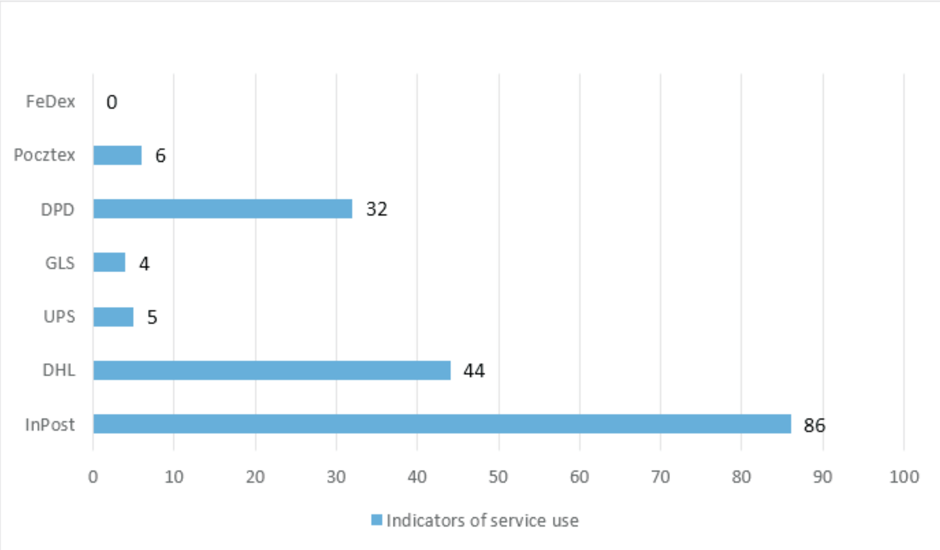

Fig. 1. Dominant postal operator
Source: Own study based on (Sawicka, 2021, p. 59)

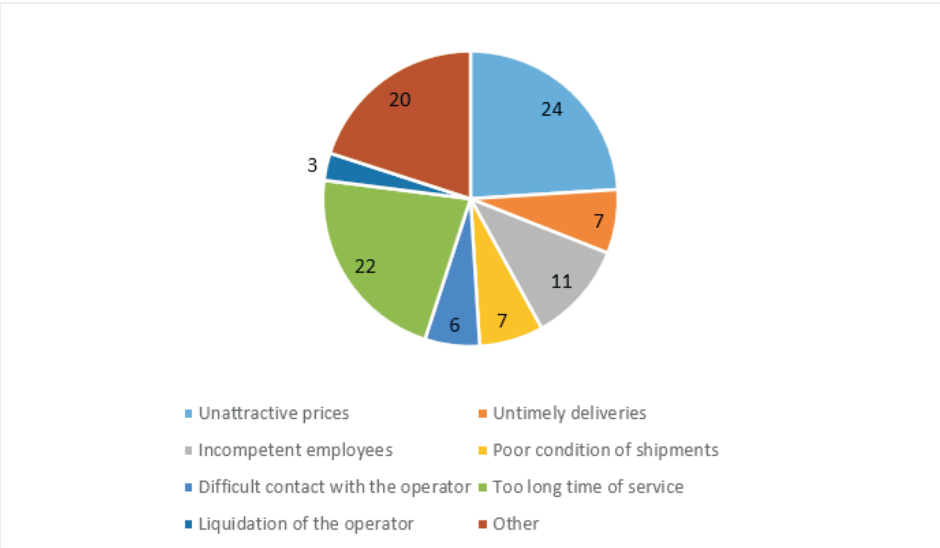

Fig. 2. Reasons for abandoning the services of a postal operator
Source: Own study based on (Sawicka, 2021, p. 60)

Some complementation of the reasons for dissatisfaction with the quality of courier services is an indication of the problems that respondents faced while using these services (Fig. 3).

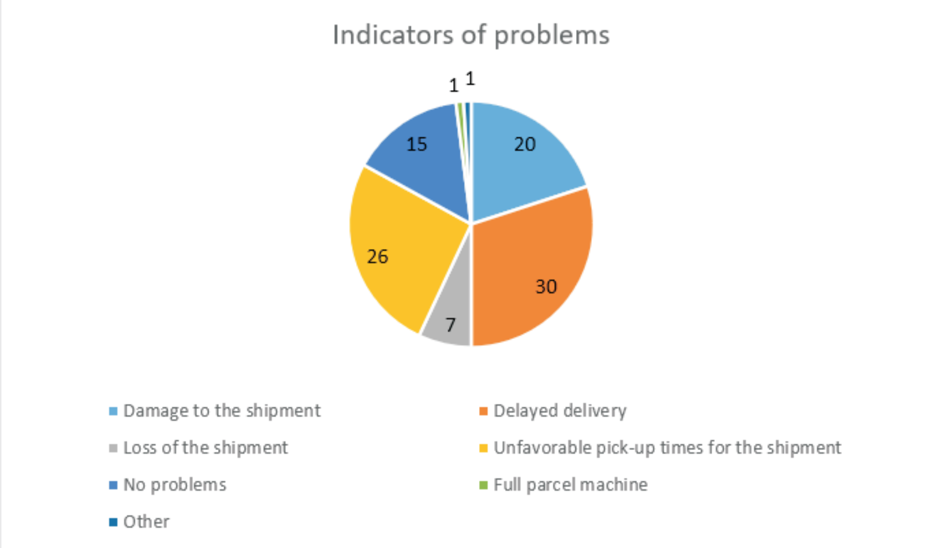

Fig. 3. Problems accompanying the provision of courier services
Source: Own study based on (Sawicka, 2021, p . 62)

The most common problem indicated by respondents was delayed delivery (30%), unfavorable pick-up times (26%) or damage (20%). Full parcel machine was the answer suggested by respondents.

Respondents also indicated their preference for the characteristics of a postal operator (Fig. 4).

Price of service (76%) and timeliness of delivery (74%) are the features most valued. This is followed by security of delivery (37%) and the ability to track the package (35%). A significant percentage of respondents also indicated the availability of the service (24%).

Respondents also indicated the main directions for improving courier services by the operators they currently worked with (Figure 5.). The majority chose extending shipment times (35%) and faster response to complaints (22%).

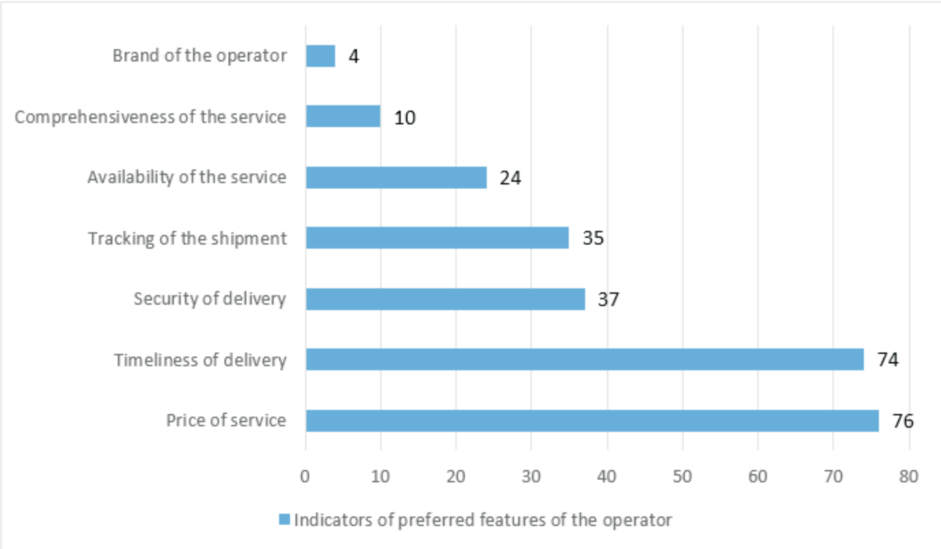

Fig. 4. Preferred characteristics of postal operators
Source: Own study based on (Sawicka, 2021, p. 61)

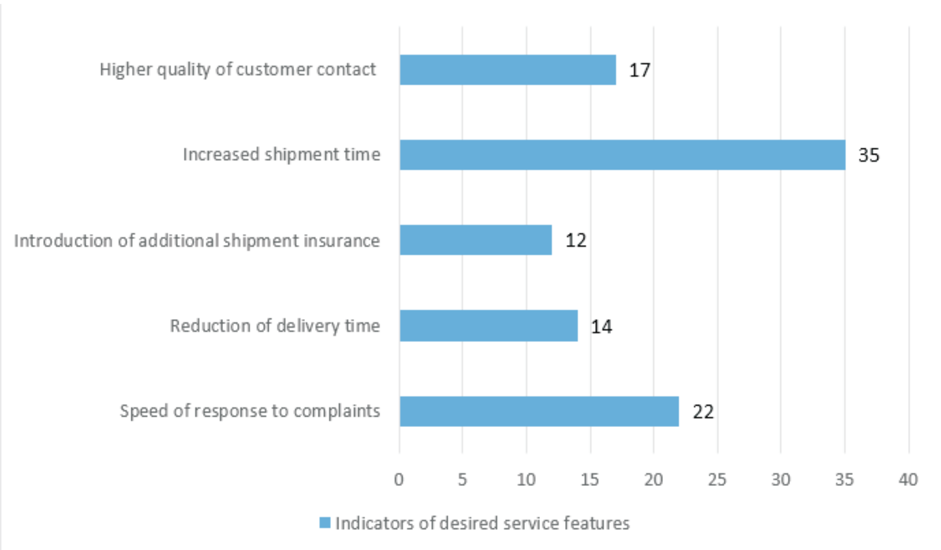

Fig. 5. Desired features of courier services
Source: Own study based on (Sawicka, 2021, p. 61)

In relation to the empirical results illustrated in Figures 4, 5 and 7, the chi-square test of independence was used to test whether there was a statistically significant relationship between the two qualitative variables. Statistica 13.3 software was used for this purpose, with a significance level of $\alpha = 0.05$. The calculated values of the statistical parameters are presented in Table 5.

Table 5. Results of the $\chi 2$ test

Variables and number of their variants	Value of the parameters			
	Pearson's Chi^2	Quota ratio	df	p
Gender (2) × Reasons for abandoning the services of a postal operator (8)	12.743	0.266	7	0.07861
Gender (2) × Problems accompanying the provision of courier services (7)	11.173	0.250	6	0.08315
Gender (2) × Desired features of courier services (5)	7.608	0.209	4	0.10704
Age (4) × Reasons for abandoning the services of a postal operator (8)	22.084	0.342	21	0.39470
Age (4) × Problems accompanying the provision of courier services (7)	38.917	0.435	18	0.00292
Age (4) × Desired features of courier services (5)	19.634	0.324	12	0.07433
Place of living (5) × Reasons for abandoning the services of a postal operator (8)	31.012	0.396	28	0.31657
Place of living (5) × Problems accompanying the provision of courier services (7)	2453472	0.358	24	0.43139
Place of living (5) × Desired features of courier services (5)	14.051	0.279	16	0.59494
Form of parcel delivery (3) × Reasons for abandoning the services of a postal operator (8)	15.920	0.295	14	0.31830
Form of parcel delivery (3) × Problems accompanying the provision of courier services (7)	11.090	0.250	12	0.52121
Form of parcel delivery (3) × Desired features of courier services (5)	7.671	0.210	8	0.46628

Legend:

df – number of degrees of freedom

p – value of statistical significance

Source: Own study

It should be concluded that most of the empirical results obtained are not statistically significant, thus there is no statistically significant relationship between the study variables. A weak statistical relationship exists only between the age of the respondents and the types of problems accompanying courier services (contingency coefficient = 0.435 at p = 0.00292). Perhaps due to their life experience, the respondents perceive the importance of the discomforts accompanying these services differently.

In the author›s opinion, this does not mean that the empirical findings are not valuable. They can provide a basis for further work on the issue, give or correct their direction, or verify existing knowledge.

Directions for improving the "last mile" logistics

Nowadays, the term *last mile* is a term referring to deliveries made as the last stage of physical distribution in the distribution channel, thus at the end of the supply chain. Most often, courier shipments are delivered from a warehouse or distribution center adequate to the essence of customer orders - e-commerce (B2C) sales, which projects the volume and physical characteristics of shipments. The results of the study confirmed that the volume of courier shipments is increasing intensively from year to year, and the observed development of the e-commerce industry reinforces the belief that this trend will continue in the coming years. It should also be taken into account that the presence of multiple postal operators on the market may induce customers to change service providers and even abandon future purchase offers of the company in the event of shortcomings during the provision of courier services.

In the author's opinion, it is legitimate to conclude that on the basis of the obtained research results the improvement of "last mile" logistics solutions can be directed. Modern companies of the CEP services industry offer courier services of national and international scope. A wide range of services makes it possible to meet the expectations of both business entities and individual customers. The results of the survey showed that customers are looking forward to the expansion of the service package offered by postal operators. At the same time, they pay attention to the price of services and reliability of delivery, which was the most common reason for abandoning the services of the existing provider. Both the results of the document survey and the opinions of respondents indicated that logistics solutions should be improved primarily in terms of reducing the number of damaged shipments, delays in relation to the declared delivery date and lost mail. In turn, the source literature and case studies complement the directions of change thus identified, and it can be assumed that in the near future the postal services market, and therefore mainly postal operators, will collide with even more complex conditions for carrying out logistics tasks, which may be related to the following challenges:

- a significant increase in the number of orders;
- intensification of urban traffic;

- seasonality of deliveries;
- a greater number of priority deliveries and an increased variety of goods with unfavorable natural and technical transport susceptibility;
- an increase in the number of delivery addresses, including to residents in small towns [https://www.mecalux.pl/blog/ostatnia-mila-czyli-dostawa-zamowien-do-klientow].

Due to customer preferences, the first priority should be to provide an attractive price for the service, which is directly related to the cost of "last mile" logistics. An increase in delivery reliability has also been advocated, particularly due to on-time delivery. Security of delivery and traceability of shipments should be further determinants of the development of "last mile" logistics.

The essential costs arise from the complexity of the transportation service, the handling of shipments at point logistics facilities and warehousing services. The conditions presented will prompt logistics managers to seek a compromise between increasing the number of vehicles, changing the location of logistics facilities to ensure shorter delivery routes, the need to implement environmentally friendly solutions and striving for an adequate price for services. It will become necessary to locate courier consolidation centers on the outskirts of cities and in places that guarantee high-quality logistical service to customers in small towns (e.g., determining locations using the method of least squares).

Reducing delivery times requires the use of optimization models to determine delivery routes between central (hub) and local sorting centers. Warehousing operations can also be a cause of longer delivery times and can contribute to imperfections in the process of providing logistics services due to damage, especially caused during the packaging of shipments. It is indispensable to use WMS-class information systems, which is already in practice in most warehouses.

Warehouse processes should be fully adapted to the needs of transportation. Typically, transport companies use transport management systems, so the aim should be to perform warehouse operations so that they complement transport standards in order to eliminate barriers at the interface between warehouse and transport companies. This is made possible by IT solutions (WMS, TMS - transport management systems), which are also conducive to the collection of data that can be used to rationalize managerial decisions based on the conclusions of their analysis, in accordance with the concept of big data. The results of the analysis (selection of adequate metrics and indicators) can help identify areas for improvement. A number of KPIs can be identified for use in «last mile» logistics, namely:

- percentage of shipments completed on time;
- fuel consumption rate;
- the percentage of utilization of available delivery trucks;
- the number of planned kilometers to be traveled for delivery, compared to the actual number of kilometers driven;

- delivery costs in relation to the order, kilometers traveled, delivery truck;
- number of stops;
- number of customer complaints;
- percentage of goods damaged in transit [https://www.mecalux.pl/blog/ostatnia-mila-czyli-dostawa-zamowien-do-klientow].

It is also reasonable to strive for personalization of the form, place and manner of courier delivery. Although respondents indicated that parcel deliveries dominate, but the individualization of logistics service will progress, so expanding the possibility of leaving the shipment in locations as close to customers as possible, with the ability to pick up shipments as long as possible, providing specific storage conditions for specific products (medicines, frozen food, plants) is also a desirable direction for the development of «last mile» logistics.

Conclusions

In the author's opinion, the research results obtained can be used as a basis for the following final conclusions.

Firstly, courier services are of key importance in the CEP services market and should be considered as one of the segments of the postal services market.

Secondly, it should be assumed that domestic courier services will still dominate in the future, so it is advisable to favor "last mile" logistics solutions used in the Polish postal services market and identified in the diagnostic survey as desirable.

Furthermore, the main shortcomings of the logistics solutions currently in use are damage to parcels; delays in relation to the guaranteed delivery date and loss of parcels. Efforts should be made to improve the quality of operations performed at point logistics facilities as part of the physical distribution of courier shipments.

Moreover, improvements in delivery reliability can be achieved by: increasing the number of courier collection points, especially in smaller towns; increasing the frequency of deliveries by enriching the number of vehicles and adjusting their capacity to accommodate a greater variety of cargo (small and large).

Finally, modern information exchange technologies, applications that enable tracking and advising of shipments immediately before delivery to the customer, and consequently more precise determination of delivery times should be considered as tools for improving the distribution of physical "last mile" logistics.

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