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Comparative analysis of study results on e-commerce customer preferences in last-mile delivery in Poland[1]

Analiza porównawcza wyników badania preferencji konsumenckich w zakresie dostaw ostatniej mili w e-handlu w Polsce

Abstract

The main aim of the paper is a comparative analysis of the research results presented in four research projects on e-customer preferences in last-mile delivery conducted recently on the Polish e-commerce market as: Gemius Poland, PostNord and Łukasiewicz Research Network – Institute of Logistics and Warehousing Network, and own research financed by Polish National Science Center under the title "Sustainable last-mile logistics and e-commerce returns. Perspective of various stakeholder groups". E-customers in Poland are mainly guided by price, safety and delivery service standards; trust in the supplier is also important. Interestingly, in the context of the development of pro-ecological trends, it is still of minor importance for Polish e-customers whether the delivery is environmentally-friendly, including whether it is possible to return the goods in an "environment-friendly" manner. A comparative analysis of research projects regarding e-customer preferences allows to identify similarities and differences in the scope of research results, identify a cognitive gap, and define directions and recommendations for further e-customer market research. The results obtained may also contribute to the formulation of recommendations for e-commerce and logistics companies regarding e-customer preferences for last-mile delivery to increase customer satisfaction, improve efficiency, and create competitiveness.

Keywords:
e-commerce, last-mile delivery, e-customer preferences, comparative analysis, meta-analysis

Streszczenie

Głównym celem artykułu jest analiza porównawcza wyników badań dotyczących rynku e-commerce przedstawionych w czterech projektach badawczych zrealizowanych przez takie instytucje, jak: Gemius Polska, PostNord oraz Sieć Badawcza Łukasiewicz – Instytut Logistyki i Magazynowania oraz badań własnych autorów finansowanych przez Narodowe Centrum Nauki w ramach projektu „Zrównoważona logistyka ostatniej mili a zwroty w e-commerce. Perspektywa różnych grup interesariuszy". E-klienci w Polsce kierują się głównie ceną, bezpieczeństwem i standardami obsługi dostawy, ważne jest także zaufanie do dostawcy. Co ciekawe, w kontekście rozwoju trendów proekologicznych dla polskich e-klientów wciąż niewielkie znaczenie ma to, czy dostawa jest przyjazna środowisku oraz czy istnieje możliwość zwrotu towaru w „ekologiczny" sposób. Analiza porównawcza projektów badawczych dotyczących preferencji e-klientów pozwala wskazać podobieństwa i różnice w zakresie wyników badań, zidentyfikować lukę poznawczą oraz określić kierunki i rekomendacje dla dalszych badań rynku e-klientów. Uzyskane wyniki mogą również przyczynić się do sformułowania rekomendacji dla firm e-commerce oraz logistycznych, dotyczących preferencji e-klientów w zakresie dostaw ostatniej mili w celu zwiększenia satysfakcji klientów, poprawy efektywności i budowania konkurencyjności.

Słowa kluczowe:
e-commerce, dostawy ostatniej mili, preferencje e-klientów, analiza porównawcza, metaanaliza

Introduction

Due to dynamic development of the e-commerce industry, the subject of e-commerce customer preferences in the field of last-mile deliveries and returns has become an interesting research topic, both from the point of view of theory and management practice. Based on the traditional business logistics concept, the term last-mile delivery is defined as a process of planning, implementing and controlling an efficient and effective flow of purchased goods and related information on the way from the nearest distribution hub to the final destination, in order to meet individual or institutional e-customer needs and expectations. Over the past decade, the number of scientific publications and research reports in this area has increased steadily. The attention of researchers (academics and research companies commissioned by various stakeholder groups) focuses on very different aspects and themes of that topic. Due to a large number of studies in the relevant literature, conducted from the perspective of various stakeholders, a cognitive gap has emerged in the comparative analysis of studies of the e-customers' preferences regarding last-mile deliveries – similar, although differentiated in terms of variables. Therefore, one of the main aims of the paper is a systemic literature review on e-customer preferences in the last mile delivery context. Furthermore, an additional aim, based on the findings of the project "Sustainable last-mile logistics and e-commerce returns. Perspective of various stakeholder groups" (further on abbreviated to "Sustainable last-mile logistics") the authors have carried out, is to identify factors most often taken into account by organisations conducting similar research in Poland, such as Gemius Poland, PostNord or Łukasiewicz Research Network – Institute of Logistics and Warehousing Network.

The paper is structured as follows: part one is dedicated to systemic literature review on e-commerce customer preferences in last-mile delivery context, based on VOSviewer software. Part two presents the e-customers survey results from own research project, "Sustainable last-mile logistics", in comparison to results of a similar survey, conducted over recent years in Poland. Part three contains a comparative analysis of methods and scopes of four research projects on e-customer preferences in last-mile delivery, carried out recently on the Polish e-commerce market. The results of the systemic literature review as well as the comparative analysis of research projects regarding e-customer preferences not only sum up similarities and differences in the scope of research results, but also identify a cognitive gap and define directions for further research, which are presented in the conclusions part.

Systemic literature review on e-commerce customer preferences in the last-mile delivery context

In the paper, a multi-stage research procedure was used for an in-depth analysis of publications in the field of last-mile deliveries on the e-commerce market. In the first stage of the research, publications containing the keywords (or parts thereof) selected for the study were identified in the Web of Science database, which is indicated as one of the most important and extensive databases of publications in social sciences. Table 1 shows the publication identification results for different keyword combinations. The keywords were linked to a TS variable (TOPIC), including the variables Title, Abstract, Author Keywords, Keywords Plus. Logical operator combinations AND, OR, and a symbol to replace the string (*) were used when searching the database. Different formulas have been tested for consistency between the logical and substantive quality of the results obtained. A total of 36,200 different publications containing references to e-commerce or ecommerce from 1996 to 2023 were identified in the WoS database (of which 22,672 from the last 10 years). The database of publications from 2014 to 2023 (stage 2 of the adopted procedure) was used for text-mining analyses to identify publications that best fit the purpose of the study, i.e. those that allow searching for links between e-commerce (or ecommerce), last-mile delivery (stage 3). In the final step of the qualitative analysis, the results of four research projects on e-customer preferences in last-mile delivery conducted recently on the Polish e-commerce market were compared (stage 4).

Recognising research trends based on the analysis of the occurrence and co-occurrence of keywords is currently one of the basic methods used in the systematic literature review. Its popularity stems from greater availability of computer applications enabling such reviews. For this purpose, VOSviewer software was used to create clusters from keywords repeated in the analysed works. The clustering method, which belongs to data mining methods, is one of the exploratory techniques. Its purpose is to identify non-obvious relationships and patterns in data and internal similarities between data vectors and, based on these values, to determine the division of data into disjoint groups. As a result, elements within each group have strong mutual similarity, while objects from different groups show negligible similarity (van Eck & Waltman 2010; Waltman et al. 2010; Perianes-Rodriguez et al. 2016). However, like any form of scientific inquiry, it has limitations due to the subjectivity risk in the keywords selection and

Table 1

Number of papers identified in the WoS database in 2014–2023 according to the selected keywords

The combinations of topics	Number of papers
E-commerce OR ecommerce	22,672
"Last mile deliver*"	1,078
(E-commerce AND analys*) OR (ecommerce AND analys*)	9,170
(E-commerce AND "last-mile deliver*") OR (ecommerce AND "last- mile deliver*")	358
E-commerce AND "last mile deliver*" AND analys* OR ecommerce AND "last mile deliver*" AND analys*	149

(*) a symbol to replace the string.

Source: own elaboration based on WoS database (status at the end of November 2023).

the inherent instability of language systems. Also, there is no guarantee that the fields in which most papers have been published until recently will remain the priority fields in the future.

Study results (stages 1–3)

Analysing the results of this search, it is worth noting that among 22,672 publications in which the term e-commerce (or ecommerce) was used in the title, keywords, or abstract, only 358 refer to the last-mile delivery. A relatively small number of publications in this area may indicate potential existence of a research gap in the literature on the subject. The growing interest in research in this area may be evidenced by an increased number of recent publications that refer to this issue in the relevant literature. The number of publications referring to e-commerce and last-mile delivery in the last ten years (2014–2023) and its citations in the analysed period was presented in Figure 1.
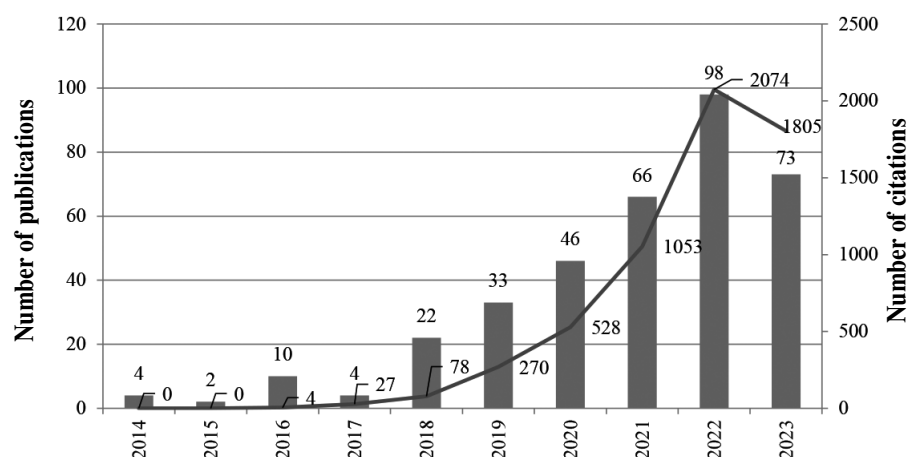
The first article referring to the indicated keywords was published in 2001 by Reich and Rosenbaum in "Mail technology: evolution to e-revolution". Between 2014 and 2017 only 16 papers in this field were published (most of them, 10 papers, in 2016). Since 2018, there has been a systematic increase in both the number of publications and their citations. Most of the works were published in 2022 (98 papers and 2074 citations). These are mainly publications concerning business economics (139 publications), engineering (96), and transportation (94).

Among the articles identified, management, transport, and logistics topics dominate. Many of them present proposals for changes in the field of last-mile deliveries, which aim to minimise costs. In the research conducted various research methods were used. Wang et al. (2016) proposed an effective large-scale mobile crowd-tasking model in which a large pool of citizen workers are used to perform the last-mile delivery. They elaborated an effective large-scale mobile crowd-tasking model in which a large pool of citizen workers are used to perform the last-mile delivery. Allen et al. (2018) observed that the development of e-commerce led to an increasing use of light commercial vehicles for parcel deliveries in urban areas. In their article, main attention was paid to reasons of that increase. It also describes the problem of vehicles' poor loading capacity use during the last mile operation, which stems from repeated delivery services, and in turn entails an increase in the average cost of delivery. The study used a case study focusing on current parcel deliveries in central London. This method was also used by Leung et al. (2018). Iwan et al. (2018) aimed to analyse the usefulness and efficiency of parcel machines manufactured by the Polish company InPost as a solution used in the last mile delivery system. Their analyses used statistical data on deliveries carried out by InPost in Szczecin and presented the results of pilot surveys among people who took advantage of deliveries to InPost parcel machines. In turn, Castillo et al. (2017) described the use of so-called Crowdsourced Logistics (CSL) in the logistics strategy of enterprises to simulate same-day delivery services from a distribution centre to 1000 customer locations throughout New York City under dynamic market conditions. They compared these results to a traditional dedicated fleet of delivery drivers. Yuen et al. (2018) analysed the problem of last-mile deliveries from customers' perspectives. According to their research, made on a sample of 164 Singaporean consumers, customers willingness to innovate significantly reduces their interest in picking up parcels on their own. Similar analyses using survey results were also carried out by Vakulenko et al. (2018) and Wang et al. (2018). In the next stage to identify the tendencies in the
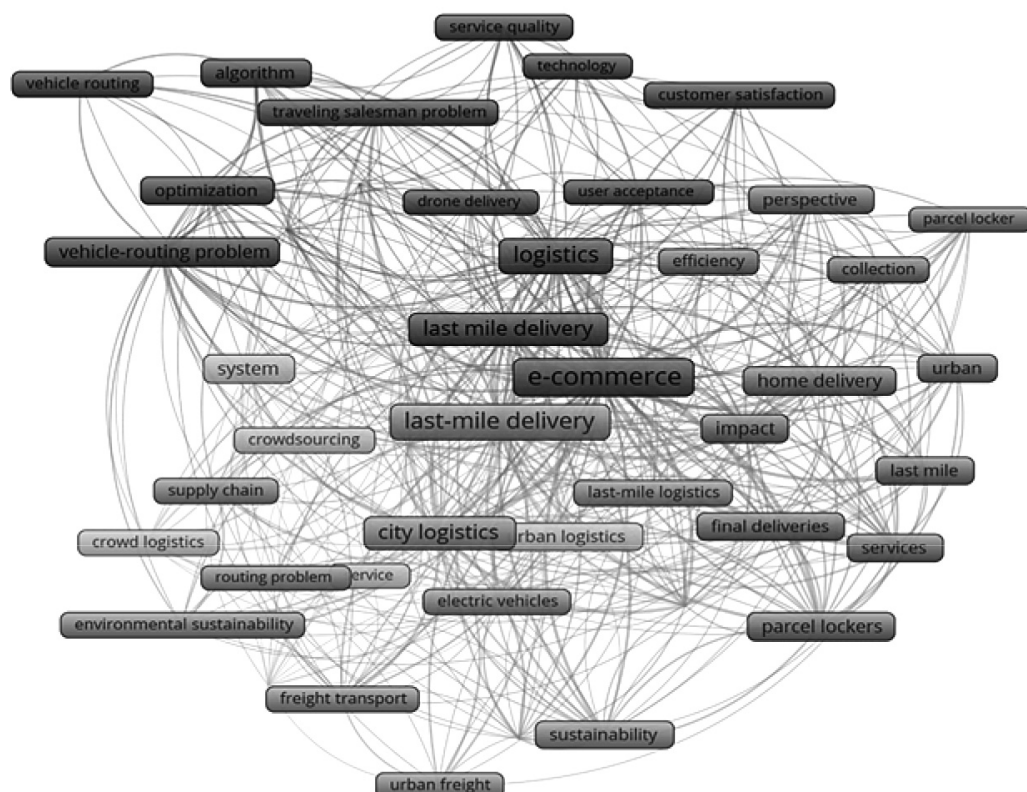
Figure 1

Total publications and citations by year – final database from 2014–2023

Source: own elaboration based on WoS database.

Figure 2

Clusters network

Source: own elaboration based on Vosviewer software.

literature, especially to answer the question of how research on this topic is divided into clusters, an analysis of co-citations of references was carried out, based on articles with at least five co-citations (see: Figure 2).

This stage of the analysis resulted in distinguishing four following clusters: (a) cluster 1: e-commerce, last-mile delivery, logistics, algorithm, optimisation, service quality, supply chain management, technology, transportation, travelling salesman problem, user acceptance, vehicle routing and vehicle-routing problem, (b) cluster 2: last-mile delivery, last-mile logistics, city logistics, supply chain, parcel delivery, routing problem, electric vehicles, urban freight, urban freight transport, sustainability, (c) cluster 3: last mile, parcel locker(s), services, perspective, home delivery, final deliveries, efficiency, (d) cluster 4: crowd logistics, crowdsourcing, urban logistics, model, service, sharing economy, system. In a map made using VOSviewer software, the same shade of gray indicates clusters with related terms, characterised by strong relationships and co-existence. In terms of the number of labels with each keyword, it reflects the frequency of the word. The most common keywords are located in the centre of the map. Their co-existence determines the distance between words. When analysing the map, it is worth paying attention to the first three clusters, in which strong links between keywords selected for the study are visible. Basically, there are references to last-mile logistics modelling on the e-commerce market in all clusters (algorithm, optimisation, travelling salesman problem and vehicle-routing problem in cluster 1; routing problem in cluster 2; efficiency in cluster 3; and model in cluster 4). Table 2 presents

a list of research methods used for this purpose by various authors. A total of 149 papers were analysed. Most often, these are models for construction, which use various types of mathematical and statistical methods, focusing on the study of the preferences of customers using last-mile deliveries (e.g. cluster analysis, conjoint analysis and discrete choice modelling, logit model) and simulation methods used to solve specific research problems related to the organisation of transport (e.g. discrete choice modelling, fuzzy model and structural equation modelling). Literary analyses and heuristic models (or matheuristic) are also common in research in this field. The literature review also shows that references to sustainable development, environmental protection or the need to reduce harmful emissions related to transport are also common in works subject to in-depth analysis. A total of 81 works of this kind were identified in the created database. Sustainable logistics of the last mile is both the central theme (see: Caspersen & Navrud, 2021; Kiba-Janiak et al., 2021), as well as the added value of the conducted research, also focusing on other aspects, e.g. related to the reduction of delivery costs (see: Seghezzi & Mangiaracina 2021).

It is also worth noting that only few works focus on studying customer preferences for last-mile deliveries in the e-commerce market. These include research conducted by Vakulenko et al. (2018), which analyses consumer opinions regarding their level and acceptance for involvement in the last-mile supply process using technological solutions such as parcel machines. In turn, Hagen & Scheel-Kopeinig (2021) examine the opinions of residents of large German cities using last-mile deliveries in

Table 2

Research method

Test method	Author/authors
Systematic literature review	Kiba-Janiak et al. (2021), Mucowska (2021), Olsson et al. (2019), Chaberek (2021), Taylor et al. (2019),
Cluster analysis	Tanaka et al. (2018)
Conjoint analysis	Nguyen et al. (2019)
Discrete choice modelling	Caspersen & Navrud (2021), Gatta et al. (2021), Iannaccone et al. (2021)
Fuzzy model	Jiang et al. (2019), Jiang et al. (2020), Mehlawat et al. (2021), Wang et al. (2020)
Heuristic model/ matheuristic	Kitjacharoenchai et al. (2019), Zhang et al. (2020)/ Mancini et al. (2021), Dumez et al. (2021)
Multi-criteria models	Wang et al. (2021), Madlenak & Madlenakova (2020), He & Haasis (2019)
Structural equation modelling	Cai et al. (2021)
Logit model	Lin et al. (2020), Maltese et al. (2021)

Source: own elaboration.

terms of the possibility of launching a central last-mile microdeposit (CMD) on the market. The authors focus on studying the acceptance and readiness of residents to incur fees for such an alternative concept of last-mile deliveries. Whereas Wang et al. (2020) investigate consumers' behavioural responses to innovative last-mile delivery services (self-collection as an example) in the emerging e-commerce market of Singapore. 209 respondents participated in the survey, and Structural Equation Modelling (SEM) was used to analyse the collected answers. In each of the mentioned examples, however, the surveys of customers using last-mile deliveries on the e-commerce market focus on examining their opinions and preferences regarding the most often specific types of proposed solutions. In the literature on the subject, there are far fewer works examining customer expectations in a broader context taking into account, for example, the preferred delivery method, tendencies to use ecological delivery methods, or behaviour in the delivery of ordered goods.

Results of research on the preferences of Polish e-commerce customers in the scope of selected criteria from the area of last-mile delivery and returns (stage 4)

The research results conducted under the project "Sustainable last-mile logistics" were used primarily for analysis, evaluation and inference. The perspective of different stakeholder groups and research carried out by Gemius Polska (Gemius, 2020; 2021), NordPost (NordPost, 2021); Łukasiewicz Research Network – Institute of Logistics and Warehousing (Kawa & Pierański, 2021) were taken into account. The research also used the study on consumer behaviour and their preferences on the parcel machines market in Poland, conducted by Colliers (2022) at the turn of November and December 2021 on a sample of 400 people. The findings of the studies selected for analysis are based on a similar primary objective of analysing e-customers' preferences for last-mile delivery (although each study focuses on different aspects and specific dimensions). The variety of aspects covered by the studies makes them complementary rather than directly comparable. This complementarity of research results can be seen as a basic criterion for the selection of the four research projects.

Due to a limited framework of this study and the already mentioned diversity of the perspective of looking at e-customers preferences in the field of last-mile deliveries, the focus was mainly on three criteria: method and form of delivery preferred by customers, delivery time, and operators' readiness to adopt environment-friendly behaviours (especially in the implementation of deliveries and returns). The last criterion means that, as regards the results of the study by Łukasiewicz Research Network – Institute of Logistics and Warehousing, the authors of this publication pay attention exclusively to this element of the study which focuses on the logistical challenges associated with green e-commerce and diagnosing and determining the impact of green logistics solutions in e-commerce on customer satisfaction and loyalty. Other aspects defining the preferences of e-customers in the scope of last-mile deliveries in Poland were also indirectly addressed. The criteria are identified with variables that are repeated in all the studies mentioned.

The analysis of the research results and reports indicated above leads to several observations. As revealed by the analyses conducted as part of empirical research, an increase in the number and frequency of online purchases means that, currently, the so-called customer service is influenced by both the quality of online service and the quality of courier service. Therefore, the determinants related to time and convenience have become important, with which the following are closely correlated: on-time delivery, reliability of delivery, multifaceted delivery options, and the implementation of returns, which are closely related to the need to personalise deliveries. That confirms the assumptions that Rigby (2011) emphasised in 2011, indicating that customers would always choose services based on solutions that guarantee simultaneous optimisation of convenience, choice and price.

2021 was another year in which an increase in the number of people declaring online shopping was observed. According to the Gemius Report (2021), the increase amounts to 77% of the respondents (a growth of 4% compared to 2020, and 15% vs. 2019). The increase may have been caused, among others, by the COVID-19 pandemic which has also contributed to an increase in the number and frequency of purchases made via the Internet. 30% of respondents surveyed under the project "Sustainable last-mile logistics" indicated an increase in frequency; a report prepared by Gemius (2021) shows that 30% of e-customers buy more products online, and 33% shop online more often than before the pandemic. It turns out that almost 1/3 of e-customers in Poland buy more products online than before the pandemic.

According to the research carried out in 2021 as part of the project "Sustainable last-mile logistics", we can list the following among the products that are most often purchased via the Internet: consumer electronics equipment, household

appliances, computers, cosmetics, medical products and food products. The Gemius report (2020) lists the following industries as the most prominent beneficiaries: manufacturers of clothing and accessories (72% of respondents), footwear (61% of respondents), cosmetics and perfumes (51% of respondents). According to the PostNord report (2021), 52% of Polish e-customers order shoes, 40% cosmetics and perfumes, 37% computer and electronic equipment. Gemius's research confirms that the higher the value of purchases, the greater the pressure of e-customers for free deliveries. A trend is worth pointing out where men, more often than women, decide to make mass, collective or package purchases in the last decade to minimise the frequency of purchases. At the same time, men spend 65% more on their purchases, resulting from buying products in packages or sets and purchasing luxury goods or electronics.

The research conducted in 2018–2023 confirms that the fastest growing form of delivery in e-commerce is contactless delivery, mainly using parcel machines. This form of delivery is also exposed due to its ecological value and increasing safety, which turned out to be particularly important in the years of the COVID-19 pandemic. This conclusion is closely correlated with the systematically recorded increase in the number of parcel machines in Poland in 2018–2021. According to a study conducted by Colliers (2022), 85% of the 400 e-customers surveyed indicated they often, even regularly opted for parcel machines; 32% chose this form of collection whenever available. The same research shows that deliveries to parcel machines account for about 40% of all deliveries, and over 50% are shipments delivered directly to the place of residence/work. According to the Gemius report from 2021, deliveries to parcel machines are the most important criterion for people aged 15–24, and home delivery is the most popular form among people over 50. Colliers (2022) estimates that by 2024 the two forms of supply will achieve equal share of total supplies. Similar conclusions result from the considerations, research, and analyses within the Łukasiewicz Research Network – Institute of Logistics and Warehousing (Kawa & Pierański, 2021). It indicates the superiority of solutions enabling customers to collect in parcel machines, parcel boxes, and specially designated PUDO (pick up drop off) points, over the delivery service by the courier, due to lower cost, greater flexibility of the place and time of delivery and greater eco-friendliness. However, it is evident that PUDO solutions and parcel machines, with their limitations of weight and dimensions of the shipment, aren't useful for large-size shipments (e.g. gardening equipment, refrigerators, washing machines). Here, deliveries to the indicated address

are naturally preferred. Referring to the PostNord report (2021), the observed trend can only be confirmed (38% of the sample of 1056 respondents prefer parcel machines as a form of delivery, 35% – delivery on the same day to the destination and 7% – delivery on the next day to the destination).

Analysing the forms of delivery, it is worth referring to the Gemius Report, which shows that 88% (mainly women) of 1360 respondents to online purchases are motivated mainly by free home delivery with the possibility of carrying the shopping into the flat, free of cost. The research carried out as part of the project "Sustainable last-mile logistics" shows that the most important criteria considered in choosing the delivery method remain the same and include: delivery price, free return option, trust in the supplier, and security (the above criteria are considered to be identical in all the studies taken into account). According to the research conducted by Nepan for PostNord (2021), the relevant criteria are: selection of the delivery date (37% of indications), the speed of delivery (50% of indications), possibility of choosing the place of delivery (61% of indications). Delivery time is also a significant factor. This criterion significantly impacts the number and frequency of purchases made by e-customers. The survey conducted by Gemius (2021) shows that the guaranteed delivery up to 8 hours from the acceptance of the order is preferred by 93% of e-customers, up to 12 hours is accepted by 85%, up to 24 hours by 29%, and up to 36 hours – 27%. Delivery time exceeding 72 hours is only selected by 4% of respondents. There is a clear influence of the speed of delivery on the decisions of e-customers. According to the PostNord report (2021), Polish e-customers have very high expectations regarding the speed of delivery (1/4, i.e. 25% expect delivery within 1–2 days). At the same time, according to the same report, much fewer e-customers were willing to pay for faster delivery (43% of respondents reported such preferences in 2019, and 37% in 2020). The cost of delivery, and the possibility of making free returns actually stand out as key criteria for e-customers in all studies and reports referred to in this publication. As returns are a natural part of the purchasing process, it is just as natural to facilitate access thereto (e.g. the "quick returns" service offered by InPost). According to the Gemius report (2021), 33% of e-customers prefer free return using a parcel machine, 11% – free return by a courier, 9% – free return to a brick-and-mortar store. The research carried out as part of the project "Sustainable last-mile logistics" shows that free return is also an important criterion considered by e-customers when choosing the delivery method (in addition to the distance from the place of collection, date, speed, safety, and the

cost of delivery). In addition, all studies included in the analysis confirm the assumption that modern technologies enabling the product to be matched to the customer reduce the number of returns. The analyses carried out within the Łukasiewicz Research Network – Institute of Logistics and Warehousing (Kawa & Pierański, 2021) highlight the importance of simple return procedures. Here, the significance of packaging is particularly strongly emphasised, which should be designed so that the return is possible in the same packaging in which it was delivered to the e-customer. It should be noted that packaging is not only important in returns to e-customers but also in deliveries themselves. Research results presented, among others, by Olah (Oláh et al., 2019) but also by the research of Łukasiewicz Research Network – Institute of Logistics and Warehousing (Kawa & Pierański, 2021), show that e-customers pay attention to the sub-optimal packaging of shipments, i.e. a packaging too large for the product size, wrapping the product with plastic film or bubble wrap, a large number of fillers. The result is non-degradable and non-segregated waste going to consumers' homes.

According to the research conducted as part of the project "Sustainable last-mile logistics", the least important factor was the environmentally-friendly delivery method. Slightly different conclusions are drawn from the report prepared by Gemius (2021). These studies show that environmentally-friendly delivery, i.e. one that uses, for example, electric vehicles, eco-packaging, eliminates the carbon footprint and motivates as many as 60% of respondents to buy online. The same report shows that the environmental friendliness of deliveries (but at the same time the "quick" delivery time) are more important criteria for people under 50 years of age. On the other hand, the research conducted by Łukasiewicz Research Network – Institute of Logistics and Warehousing (Kawa & Pierański, 2021) confirmed a relationship between solutions in the field of green logistics and the satisfaction and loyalty of e-customers. For e-consumers – in addition to a wide product range, price and fast delivery – environmental aspects matter. Therefore, these results are in line with global trends and tendencies related to the highest possible level of sustainability of e-customer service in the area of deliveries, returns, and packaging. At this point, one can refer to the Green Generations report, to which, among others, Hischier refers (Hischier, 2018). It shows that some e-customers are willing to wait longer for a shipment if this results from care being taken for ecological delivery, and to pay for deliveries that use ecological solutions (e.g. eco-packaging). According to the PostNord report, 32% of e-customers are willing to pay a higher delivery fee based on eco-friendly solutions. Where an

ecological form of delivery is already chosen (outside the place of residence), decisions are further motivated by: lower delivery price (72% share in all indications), proximity of the collection point (69.7%), the possibility of free return (51.7%) and shorter delivery time (51.2%). The least motivating factors that encourage e-customers to choose a more environmentally friendly delivery are pressure on pro-ecological behaviour and subsidies for non-ecological means of transport. The Łukasiewicz Research Network – Institute of Logistics and Warehousing study (Kawa & Pierański, 2021) clearly shows that e-customers prefer alternative delivery methods to courier services. However, the authors of this publication would like to emphasise that the logistics operators of the parcel machines network themselves show an increasing tendency to choose ecological solutions in their investments (e.g. Allegro branded parcel machines powered by renewable energy sources, including photovoltaic panels; in InPost, parcel machines equipped with air quality sensors, DPD – parcel machines powered by a built-in battery, one-boxes covered with plants to fit into the environment, etc.). Such investments are in line with global trends closely correlated with the concept of sustainable development. They are also dictated by spatial ones (the trend of caring for undisturbed urban landscapes).

While analysing the interest in new, environmentally friendly ways of delivery, it should be noted that one of the most important ones seems to be: mobile parcel machines and the use of electric cars in last-mile deliveries. The research conducted in 2021 as part of the project "Sustainable last-mile logistics" shows that 53.7% of e-customers are interested in the possibility of collecting a shipment from a mobile machine; 46.0% declare preferences in the scope of collecting a shipment delivered by an electric car. The following places included other, potentially new, methods of delivery (delivery by a cargo bike – 32.6%; crowdsourcing – 24.2%; deliveries using small autonomous vehicles – 24.2%; deliveries using drones – 23.9%; autonomous shop on wheels – 20.9%; possibility of collecting the parcel at a private person – 19.1%; using electric carts moving behind the courier – 16.7%; using vehicles equipped with drones – 16.5%). The results of the research conducted by Colliers (2022) in 2021 indicate that because, for example, free deliveries to parcel machines over weekends have become the standard, logistics operators have already introduced the "same-day delivery" service in most urban centres. One should expect the introduction of parcel machines in villages and all smaller towns in Poland within three years. Until 2024, it will be possible to observe intensification of new solutions regarding deliveries.

A critical aspect of research and analysis of e-commerce customers' preferences in the scope of last-mile delivery in Poland are those exhibited as part of Łukasiewicz Research Network – Institute of Logistics and Warehousing (Kawa & Pierański, 2021). They point to the growing importance of the freedom to switch between different sales and logistics channels and thus the growing importance of omnichannel. Attention is also drawn to the increased popularity of delivery and return channels such as parcel machines, click & collect, out of home (OOH). Out-of-home deliveries supplemented by PUDO (pick up drop off), i.e. collection and dispatch points, same-day deliveries, order handling and weekend deliveries, are also important. The development of marketplaces related to the creation of platforms independent of logistics companies, and the acquisition of key elements of the e-commerce value chain, are also observed – among others, by offering the fulfilment service, developing parcel collection points, and parcel machine networks.

Comparative analysis of last-mile research projects on methodology and scope of research

By analysing the organisation and methodology of research in the discussed research projects concerning the e-commerce market in Poland, one can notice similarities. Where the respondents are e-customers, the size of the respondent group exceeds 1000. The research method mostly used in the projects is a diagnostic survey using a questionnaire, and the data are most often obtained using the CAWI method. The similarity in the projects compared also applies to the subjective scope (e-customers in three out of four projects), and the geographic and temporal scope of the research. On the other hand, what differentiates projects are the conditions for undertaking research, their purpose, objective scope, and ways of presenting the results. Two of the four projects examined are scientific and result from the implementation of NCN grants. The other two are projects of commercial companies related to the e-commerce market provided by services. The nature of the projects determined the ways in which the results were presented. In the case of scientific projects, this took form of presentations at seminars or in scientific publications. The results of research of commercial companies were published on websites in the form of publicly available reports. The quality of research was communicated only in

projects of a scientific nature. A comparison of the characteristics of research projects is presented in Table 3.

Conclusions

Despite thousands of scientific publications published in 2011–2021 and many current reports on the growing e-commerce market, only a few papers focused on the last mile delivery analysis. In the first section of the paper, the systematic literature review proves the cognitive gap related to the knowledge on comparative analysis of e-customer preferences from the last mile delivery perspective.

Based on a review of the selected features of the four compared research projects and a review of the literature, it is possible to outline the profile of further research on last-mile delivery preferences in the e-commerce market, which would consider the most important advantages and disadvantages of the analysed research. The authors of the most important recommendations for e-commerce market research in Poland include: (a) considering the market (development of the e-commerce sector), social (shopping preferences) and technological (access to the Internet and mobile technologies) background, (b) accounting for the youngest e-commerce customers who independently make purchases (aged 15–24). As we read in the Gemius report, this group is a new type of consumer – using technology, mobile, using foreign websites and paying particular attention to the issue of environmental protection, (c) combining two ways of data collection, i.e. CAWI and CATI, which may prevent gaps in access to data in selected groups of respondents, (d) using expert analyses, especially for the construction of research tools.

A comparative analysis of the results of the Polish e-customers' preferences in the field of last-mile deliveries allows us to notice that the most important reasons for choosing the last mile delivery option include time and convenience, with which the following are closely correlated: on-time delivery, the reliability of delivery, the freedom to choose the delivery option, but also the organisation of returns. Increasing pressure to improve the quality of delivery service coincides with the expectation of reducing its costs. The higher the value of purchases, the greater the pressure from e-customers upon free delivery. The time of delivery and its return significantly impact the number and frequency of purchases made by e-customers. However, the share of customers who are willing to incur additional costs for express deliveries within 24 hours, or pay for the return of

Table 3

Comparison of the features of selected research projects concerning the e-commerce market in Poland

Features of the research project	Research projects			
	Sustainable last-mile logistics and returns in the e-commerce market. Different stakeholder groups' perspective	**Gemius project**	**PostNord Report**	**Łukasiewicz Research Network – Institute of Logistics and Warehousing**
Date of research	2021	2021	2021	2017–2018
Rationale for research	Scientific. Closing the cognitive gap about the rationale for making sustainable decisions in last-mile deliveries and returns. NCN Grant	Market. Cyclical (9 editions) presentation of trends on the e-commerce market carried out as part of the research and technology company's activities	Market. The results are used to prepare cyclical reports published since 2014 by PostNord – a company providing services for the e-commerce market	Scientific. Closing the cognitive gap on the impact of "green logistics" on loyalty and customer satisfaction. NCN Grant
Purpose of the research	Analysis of the preferences of different stakeholder groups for last-mile deliveries and returns (including sustainable deliveries and returns) and identification of factors that can motivate them to make last-mile sustainable choices and returns	Getting to know the attitudes, habits and motivations of e-consumers	Identification of e-customer preferences	Determining the impact of "green logistics" solutions on loyalty and customer satisfaction
Subject scope of the research	Last-mile delivery and returns solutions, e-customer and stakeholder preferences and factors determining ecological attitudes of e-customers	Behaviours, attitudes, motivations of e-customers	E-customer preferences	Green logistics solutions, loyalty and customer satisfaction
Geographical scope	Poland: the capital of voivodships	Poland	Countries of Europe, including Poland	Poland
Research methodology	A diagnostic survey using a questionnaire	A diagnostic survey using a questionnaire	A diagnostic survey using a questionnaire	Focused group interview using a questionnaire
Research technique	CAWI method	CAWI method	CAWI method	CATI and CAWI methods
Respondents	1100 respondents, over 19 years old	1769 respondents, over 15 years old	1056 respondents, over 15 years old	592 online stores

Source: own elaboration.

ordered goods, decreases. The fastest-growing mode of delivery in e-commerce are contactless forms, the most important of which rely upon parcel machines. Due to security reasons and growing environmental awareness, this delivery form gained even more popularity after the COVID-19 pandemic. Eco-friendly delivery choices are secondary to most e-customers regarding time, convenience and cost. However, there is a clear upward trend in the importance of sustainable last-mile deliveries and returns, especially among e-customers under 50. Mobile parcel machines and electric cars are the solutions preferred by e-customers in sustainable logistics and returns.

The importance of freedom of switching between the various sales and logistics channels of the last mile is increasing. Thus, the importance of solutions based on the omnichannel concept is growing. The identified preferences of e-customers create new challenges to strategic decisions of commercial and courier operators in the field of last-mile delivery logistics and indicate both the need and directions of further in-depth research in the dynamically developing e-commerce market.

Notes/Przypisy

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Monika Stelmaszczyk

ZDOLNOŚĆ ABSORPCYJNA PRZEDSIĘBIORSTWA W RELACJI DO DYNAMICZNYCH ZDOLNOŚCI MENEDŻERSKICH

Zdolność absorpcyjna wiedzy jest teoretyczną koncepcją, którą zajmują się badacze analizujący umiejętności organizacji związane z absorpcją wiedzy. W rozważaniach teoretycznych i badaniach empirycznych odnoszą ją do różnych zjawisk biznesowych. Prezentowana monografia jest głosem w tej dyskusji. Postanowiono dokonać retrospekcji dotychczasowych badań na temat zdolności absorpcyjnej. Odniesiono się do problemu interpretowania zdolności absorpcyjnej w kontekście zmian otoczenia, zwłaszcza w przypadku organizacji wykorzystujących technologie cyfrowe.

Praca składa się z pięciu rozdziałów. W rozdziale 1 opracowano definicję i model zdolności absorpcyjnej wynikający z rozwoju technologii cyfrowych. W rozdziale 2 uwzględniono w koncepcji mikrofundamentów zdolności absorpcyjnej dynamiczne zdolności menedżerskie. Rozdział 3 poświęcono metodyce badań. W rozdziale 4 przeprowadzono walidację nowo utworzonych skal pomiaru diagnostycznej, analitycznej i implementacyjnej zdolności absorpcyjnej. W rozdziale 5 wskazano, które dynamiczne zdolności menedżerskie bezpośrednio wpływają na diagnostyczną, analityczną i implementacyjną zdolność absorpcyjną, oraz oszacowano siłę tych zależności. Efektem dogłębnego rozpoznania kierunkowych zależności było stworzenie wiedzy na temat sposobów bezpośredniego oddziaływania menedżerskiego kapitału społecznego, menedżerskiego kapitału ludzkiego oraz menedżerskich zdolności poznawczych (poziom mikro) na poszczególne elementy zdolności absorpcyjnej przedsiębiorstwa (poziom makro). Zaprezentowano też wyniki badań empirycznych odnoszących się do testowania efektów mediacyjnych oraz efektów moderowanych mediacji. W zakończeniu sformułowano wnioski z przeprowadzonych badań, implikacje teoretyczne, menedżerskie, ograniczenia oraz kierunki przyszłych badań.