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## BEHAVIOR OF CUSTOMERS USING CEP INFRASTRUCTURE

### ABSTRACT

**Background:** One of important elements of a logistics infrastructure in the Courier, Express and Parcel (CEP) industry is a Pick-up and Drop-off Point, referred to PUDO. This is the point of relation between a customer and an operator. A dynamic evolution of e-commerce translates directly into the development of this type of infrastructure elements. However, it should be targeted enough to bring the intended effects, that is to increase the availability for the customers while rationally using already existing resources. Assuming that the efficiency of the use of infrastructure is a derivative of the behavior of customers for whom such infrastructure is created, it becomes crucial to recognize the typical behavior patterns of these customers. This aspect has become the main goal of the research undertaken by the authors of this chapter.

**Methods:** The research presented in this chapter is based on a multiple stage approach, including: 1) direct interviews with operators and users of PUDO, 2) preparation of the drafted questionnaire, 3) testing, 4) preparation of the final questionnaire, 5) conducting surveys, 6) analysis of the obtained results and exploration.

**Results:** The direct result of the research is in-deep recognition of the key behavioral aspects related to the use of logistics infrastructure, both in sending and receiving courier parcels. In the chapter some specific aspects are considered, such as: PUDO location, time of day of using PUDO, general travel motivations while visiting PUDO, applied means of transport to reach PUDO. A correlation between those aspects and customers' profile is also discovered.

**Conclusions:** The obtained results are the basis for shaping strategic directions of development and maintenance of the existing logistics infrastructure in the courier industry.

**Keywords:** Pick-up and Drop-off Point, Logistics Infrastructure, Users' Behavior

## INTRODUCTION

Constant changes on the market affect different sectors, including transport and logistics. One of the industries, which focuses attention of many researchers, is Courier, Express and Parcel (CEP). According to the PwC Advisory report [2018] in 4 years period time CEP solutions will affect an e-commerce market in a distinct level. The authors predict the development of services to more affordable and innovative form, enabling more convenience thanks to the spread of online shopping [PwC Advisory 2018].

One of important elements of a logistics infrastructure in the CEP industry is a Pick-up and Drop-off Point, referred to PUDO. This is the point of relation between a customer and an operator. Thus, it is also a type of e-commerce last mile delivery [Schewel and Schipper 2012]. Together with parcel lockers, PUDOs are categorized as out-of-home (OHD) delivery services [Kawa 2019]. The aforementioned dynamic evolution of the e-commerce translates directly into the development of this kind of infrastructure elements. Van Duin et al. [2019] state that the evolution of OHD infrastructure is one of the promising elements of success and they see the highest potential in delivery with a parcel locker. This point of view is also supported by Vakulenko et al. [2018]. The authors concentrate on the customers' opinions about this type of e-commerce last mile delivery, since it involves them in the service process. The results of their research, carried out on the group of 26 respondents, show the importance of the following elements: the location of parcel lockers, including the distance to the customers' residence and place of work; time access; service speed; ease of use. The authors also noted the disadvantages of the parcel lockers, including some technological aspect, among them [Vakulenko et al. 2018]: small display, missing buttons, silent door opening, unclear locker size scheme. These are the potential areas of CEP industry improvement, as well as tools for a competitive advantage on the market.

There are many companies that strive for this. The example of a parcel delivery company facing this problem is the Netherlands' PostNL. It is a leader on the national market [van Duin et al. 2019] and it operates on the one of the Europe's largest CEP markets [Salehi et al. 2017]. There are two main problems underlined, like operational costs' reduction and increasing customer satisfaction. The first one is solved by investments in the infrastructure, network expansion, introducing innovative solutions of parcel collection, sorting and delivery models. However, the second one requires more company involvement in its solution, because of decline in the customers' satisfaction [Ecommerce News Europe 2019a].

The experiences of the other two companies operating on the Europe's largest CEP markets (according to [Salehi et al. 2017]), i.e. France and Germany, are presented by Morganti et al. [2014]. They compare alternative parcel delivery solutions, i.e. pick-up and drop-off points in stores and automated parcel lockers network. The authors present the key drivers of the development, including strategies of service providers and customers' preferences. Morganti et al. [2014] state that both solutions have advantages comparing to the home deliveries, like lower costs and a reduction of a missed deliveries' risk. Even though majority of customers in Germany asked for deliveries to their home. This is surprising because the network of PUDO was dense [Morganti et al. 2014].

The situation of e-commerce and last mile deliveries in Poland, the country with the one of the largest volume growth of CEP market in Europe [Salehi et al. 2017], is changing. In 2017 the growth was 11% [Ecommerce News Europe 2019b]. According to Ecommerce News Europe [2019b] a significant growth of 25% is predicted for Poland's e-commerce industry this year. The B2C segment is the largest in terms of volume of shipments [Kawa and Różycki 2018]. The networks of PUDO have also developed dynamically in recent years and with a few exceptions they have been counted in thousands in each of the largest CEP companies [Kawa 2019]. However, the growing number of parcels delivered cause more problems, such as over-packed parcel lockers. This issue may be mitigated by redirecting the parcel to another pickup point, or even directly to customer's car trunk.

There are many reports about Polish e-commerce presenting the problems and growing trends. However, they concentrate on the e-commerce companies and the opinions are selected from the managers, online store owners, marketers [Ideo Force, 2019]. There are also analyzed the technologies of the future, such as AI, payment methods, customer relationship techniques, trading platforms [Paucz 2019]. Majchrzak-Lepczyk [2015] states that for Polish modern companies, it is extremely important to communicate with customers exactly as they expect, e.g. setting up companies' accounts dedicated exclusively to customer service. This opinion is still vivid since most of the e-commerce users in Poland are young people, at the maximum age of 35 [Ecommerce News Europe 2019b].

Since the customers should be in the center of each company [Kotler and Lane 2012], including these of CEP industry, it is crucial to concentrate on their needs. Customers' perspective could cast a shadow on the industry and further steps of its development.

The main goal of the research is to recognize the typical behavior patterns of the Polish CEP industry’s customers, since it is assumed that the efficiency of the use of PUDO infrastructure is a derivative of their behavior.

The chapter is composed of four sections. The first one presents introduction to the chapter, including considerations about logistics infrastructure in the CEP industry, the functions of PUDO, as well as the role of customers and their behavior recognized and presented in the literature. In the second section the main steps of the proposed approach leading to the customers’ pattern behavior recognition are described. It is verified in the third section, where the general situation of the considered logistics infrastructure is introduced. There are also presented the results of each step of the research carried out, and their analysis, as well. Finally, in the fourth section of the chapter conclusions are drawn and the list of references is presented.

**PROPOSED APPROACH**

The research presented in this chapter is based on a multiple stage approach (see figure 1), including: 1) direct interviews with operators and users of PUDO, 2) preparation of the drafted questionnaire, 3) testing, 4) preparation of the final questionnaire, 5) conducting surveys, 6) analysis of the obtained results and exploration.

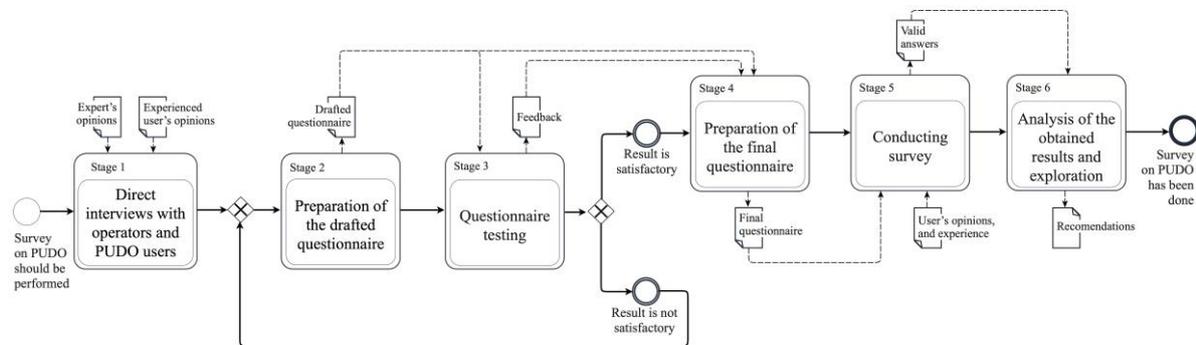


Figure 1. The key 6 stages of the proposed approach

Source: [own research]

The first stage is based on the direct interviews, which involves experts’ opinions as well as users’ and customers’ (including potential ones) responses. Their perspective should constitute the general overview of the CEP industry and its infrastructure. They could also express the CEP’s industry directions of changes, including customers’ needs. After a thorough analysis of collected data it is recommended to contain the respondents’ opinions in the further stages of the research. In the second stage the drafted questionnaire is prepared. It is composed of two parts. The first

one presents the major questions regarding the considered issue. This is also the part, where the experts', the users' and the customers' opinions are included. The second part contains additional information connected with respondents, like their age, gender, area of living and working. Next, the drafted questionnaire should be tested. There are two reasons of this third stage. The first one aims to check the level of understanding of the survey. There can also be confirmed its technical preparation, which is important for online surveys. It is suggested to direct the questionnaire to the most expected group of recipients of the analyzed services. Their opinions could improve the substantive level of the survey, which is the second reason of this stage. Thus, the drafted questionnaire should be carried out with the assistance of pollsters. Based on their experience and knowledge the respondents could be given a feedback for their further considerations. The survey researchers collect recipients' opinions and create the final version of the survey. This is the fourth stage of the presented approach. In the fifth stage, the major element of the research is carried out. This is the most time consuming part and the involvement of many experts is required. Their task is to reach the largest possible group of respondents, taking into account their diversity due to age, gender, social role, place of living and involvement in CEP's industry. There are advised different forms of collecting information, such as: online questionnaire, direct interviews and indirect contacts by e-mail. A time horizon and a total number of respondents depend on the research carried out. As a result, the responses are collected. Finally, they are clustered into different categories. Based on them the process of data analysis starts and this is the last stage of the proposed approach. Some groups of information can be interpreted directly, e.g. the age distribution of survey respondents, while the other can be combined with each other and their inter-dependence is checked, e.g. the number of respondents living in the city center and sending a parcel in the same area.

As a result, information regarding the current state and potential future steps of the CEP industry development can be learned. The proposed approach has been verified on the real-world example. It is presented in the next section.

## **STEPS OF THE RESEARCH**

The analyzed company operates on the Polish CEP market. Its infrastructure is spread all over the country. Most of the PUDO points is located in the cities with the number of citizens higher than 100 000. This infrastructure is still evolving. There is one main reason for this situation, i.e. the customers' needs, which are growing. The e-commerce branch is in a constant

development, too, and the technological solutions of sending and receiving courier parcels are still changing. Thus, an identification of key behavioral aspects related to the use of logistics infrastructure seems crucial to predict further steps of the company's development. To determine these features the approach presented in the previous section has been applied.

The initial interview, which is the first stage of the research carried out, has been conducted among 60 participants. They were CEP market experts (including scientists and entrepreneurs), users of PUDO infrastructure (including business users and/or owners), and customers (parcel senders, receivers) in the proportion of 10-10-40. The essence of the research was to determine the strengths and weaknesses of the analyzed PUDO network and the possible directions of its development, taking into account the expectations as well as anticipated threats. This part of the study was an interview and all the individually obtained opinions were collected into one common set. The most frequently appearing aspects were used to structure the next steps of the research.

One of the most frequently expressed opinions regarding strengths was the variety of forms of sending and receiving parcels, such as by courier or PUDO. The time flexibility and possibility to choose different places for sending and receiving parcels were also emphasized.

The experts and the users most often complained about the long waiting time for the parcel, especially during the holiday season. Thus, they confirmed the data presented in the literature regarding the longer waiting time for delivery from year to year, in particular before Christmas. They pointed out the time windows for picking up or sending the parcel, which is also considered as a weakness. Many negative opinions were also related to the lack of adjustment of couriers' working time to availability of senders and recipients of parcels.

The expectations coming from experts, users and customers were based on the reduction of major weaknesses, including more flexible couriers' working hours and higher level of PUDO availability. They were interested in the private parcel lockers, since it would increase their comfort of picking up or sending the parcel. They were not ready for the solutions available in the other countries, like sharing location data with couriers or sharing the trunk of a vehicle acting as a PUDO. The main reason is that it could violate their privacy.

All these opinions were used to determine the directions of further research. In the second stage of the study a test questionnaire had been constructed according to the general rules presented in the literature [Kotler and Lane 2011]. As a result, its structure had been composed of closed and open questions, with the total number 27. Questions had been divided due to sending parcels, receiving parcels, both sending and receiving parcels and regarding respondents. The

survey had been addressed to a group of 48 respondents. Testing, which constitutes the third stage of the study, had been conducted for over 2 weeks. A group of experts had made interviews with these respondents. They filled in and commented on the questionnaires. They had also the opportunity to submit comments to the survey questionnaire by e-mail. All these efforts made it possible to introduce substantive, technical and editorial corrections to the survey. Finally, in the fourth stage of the research, the basic version of the questionnaire has been developed [survey 2019]. It consists of 31 questions, including 23 closed and 8 open. The general structure of the questionnaire has not been changed, thus there have been questions regarding sending parcels (12 questions), receiving parcels (12 questions), both sending and receiving parcels (2 questions) and regarding respondents (5 questions).

Questionnaire surveys (fifth stage) had been conducted for 10 weeks of the year 2019. The survey is in an electronic and printed (paper) form. 404 respondents participated in the research. The sample was carried out on a group of Polish residents who were at least 14 years old. Among them were students of various universities, employees of companies operating in different industries and pensioners. Respondents were scattered throughout the country. Most of the responses were sent in an electronic version, including some sheets delivered by e-mail and occasionally in a paper version.

The obtained answers were collected in a previously prepared matrix composed of 38 columns and 404 rows. Information in columns represents answers to open and close questions. Each row of the matrix indicates the information presented by the next respondent. According to the approach introduced in the previous section, the analysis of the obtained answers (sixth stage) has been based on both direct and indirect inference, i.e. the former is based on recorded information, and the latter results from the combination of several responses.

The respondents have been grouped into 6 age categories, including 14-19 years old, 20-25, 26-35, 36-50, 51-65 and more than 65. The age distribution of survey respondents is shown in the figure 2. Adults between the ages of 20 and 25 are over-represented in this survey sample, while young and young adults ages 14-19 and adults over the age of 25 are under-represented. One of the possible reasons for the insufficient representation of seniors was indicated during interviews carried out at the first stage of the research. The possibility of seniors using the assistance of younger people, e.g. family members, during e-shopping was pointed out. Therefore, those people may not have felt the recipients of the survey and hence not responded. Alternatively, they passed the survey

to other family members. The distribution by gender is even, i.e. 49% are women and 49% are men, the remaining 2% of respondents refused to answer.

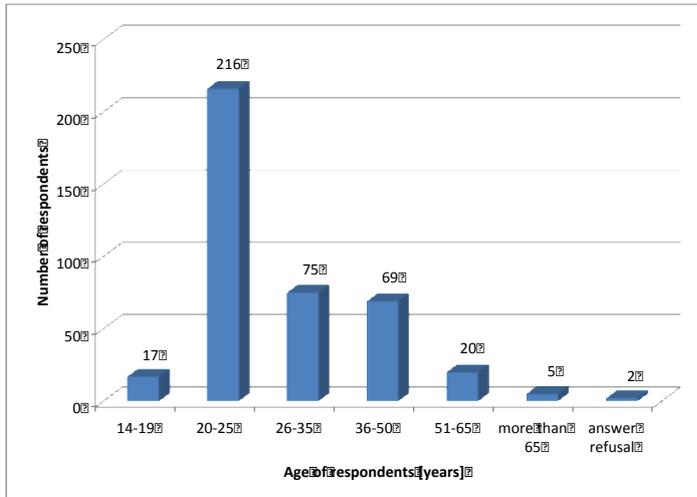


Figure 2. Age distribution of survey respondents

Source: [own research]

There have been distinguished 15 groups of employment, for example: pupils, students, students employed in a one-shift system, students employed in a two-shift system, persons employed in irregular working hours, persons employed in a multi-shift system. The obtained results are derived from the age structure of respondents. Students and persons employed in a one-shift system dominate. The respondents have also been grouped into 4 regions of living and working/ studying (figure 3), such as: a city center, suburbs, a town away from the main city and a village away from the city.

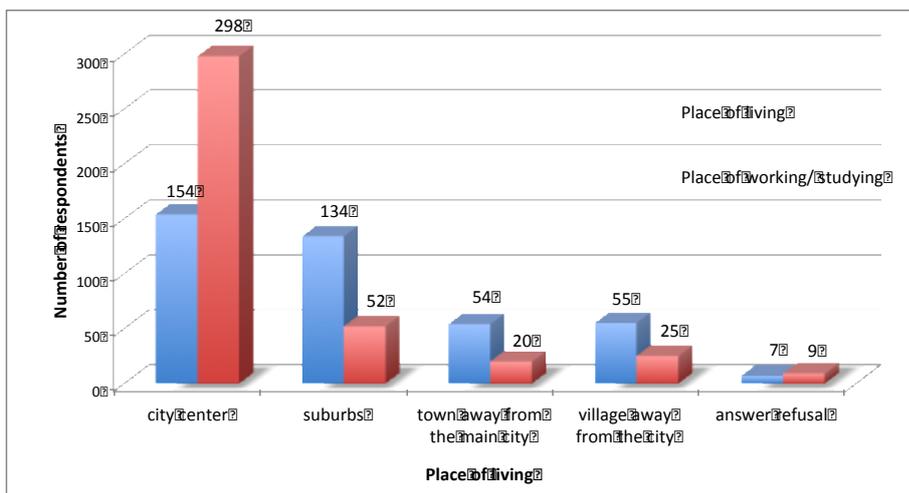


Figure 3. Place of living and working/studying distribution of survey respondents

Source: [own research]

Most of them declare that they live in the city center and its outskirts, while the workplace or university of 75% of the respondents is located in the city center. It should be noted that rural residents constitute about 40% of the population of Poland. This value results from the division into urban and rural communes. However, this division is not accurate from the availability of logistics infrastructure's perspective. Rural areas located near large agglomerations have different infrastructure accessibility than rural areas located away from the agglomerations. Indication of "suburbs" as a response to the place of residence or work can mean both the rural and the urban commune. Almost all persons who took part in the survey (98%) declare that they pick up parcels. 57% of respondents say that they pick them up often, i.e. at least once a month (figure 4).

Over half of the respondents (52%) sends parcels, while 45% of respondents declare that they send them rarely, i.e. less often than once a month. Generally, based on the most respondents' opinions (91%) parcels are more often picked up than sent.

Respondents sending parcels usually (44%) use the couriers' services and parcel lockers, while 56% of respondents pick up parcels delivered to parcel lockers (figure 5).

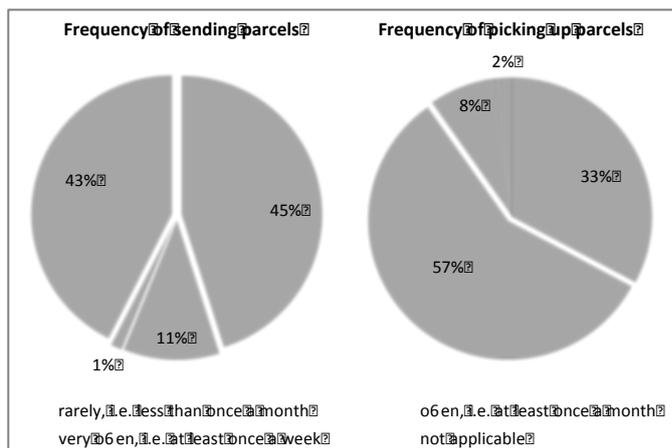


Figure 4. The frequency of sending and picking up parcels

Source: [own research]

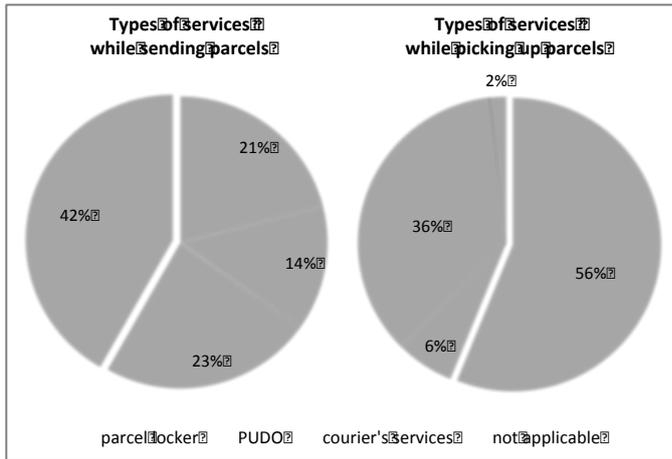


Figure 5. Types of services used by the respondents

Source: [own research]

The surveys carried out allowed the determination of time intervals (time windows), places and means of transport used by respondents when sending and receiving parcels. 18% of respondents declare that they can send parcels in the afternoon, i.e. between 3:00 p.m. and 6:00 p.m., and 17% at any time. 37% of respondents can pick parcels up between 3:00 p.m. and 6:00 p.m. Respondents most often send (48%) and pick up (84%) parcels near the house; less often in the area of work / study (7% of those sending parcels, and 8% of those picking up parcels). They usually send and pick up parcels while traveling on the route home-work-home, i.e. 22% of declarations for sent parcels and 36% of responses for picked up parcels. Respondents most often send and pick up parcels while traveling by car, i.e. 29% of respondents sending parcels and 35% of respondents picking up parcels.

Due to the goal of the research, i.e. determining typical behavior patterns of logistics infrastructure clients in the CEP industry, respondents have been asked about the importance of selected aspects when sending and picking up parcels. Among them were such as (figure 6): speed of delivery to the pickup point (e.g. home), timely collection of parcels by a courier, timely delivery of the parcel by a courier to a pickup point, parcel's security, convenient location of the place of origin (a drop-off point), convenient location of the place of destination (a pick-up point), aspects related to environmental protection.

Most respondents considered aspects related to the speed of delivery to the pick-up point as the most important, while those related to environmental protection were the least important. The attention of the respondents is also focused on timely delivery of the parcel by a courier to a pick-up point, as well as parcel's security.

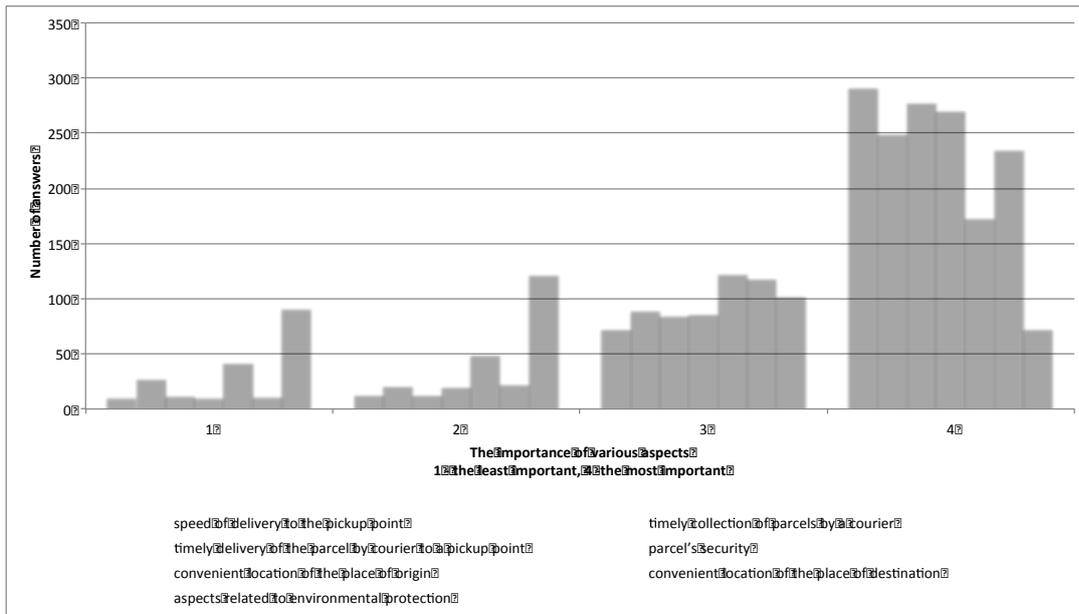


Figure 6. The importance of various aspects related to sending and picking up parcels

Source: [own research]

The last group of questions is connected with the relationship between the place of sending and picking up the package, the place of work / study and residence of the respondents. According to the received answers, parcels are usually sent by respondents living in the center and on the outskirts of the city and working in the city center; parcels are picked up by respondents living in the center or on the outskirts of the city and working in the city center.

Since the number of respondents using PUDO as place of origin (57 respondents) and place of destination (27 respondents) is relatively low, these points have been included in some of the further analysis as OHD services together with parcel lockers (83 and 224 respondents, respectively). It is worth noting that 91.4% of respondents who sent parcels using parcel lockers used them as pickup locations. 55.3% of respondents sending parcels by courier declared the collection of parcels from a courier, while 39.5% collected them in the parcel locker. Most of the users sending parcels in PUDO, used the pickup service by courier (50.0%) and parcel locker (32.7%).

Based on the results of Classification and Regression Tree (CART) [Breiman et al. 1984] and Chi-squared Automatic Interaction Detector (CHAID) [Kass 1980] analyses the method of collecting a parcel is strongly determined by the respondent's place of residence. Respondents who refused to answer and living in a village far from the city more often use courier services, while others prefer the parcel lockers and OHD. An exception are people, especially women, living in cities whose age is less than 19 years or more than 50 years. They use more often courier

services than parcel lockers (OHD). However, this subgroup was small - 17 respondents, of which 12 received parcels from a courier, and 7 used OHD services. Similar information was obtained for the separate analysis of PUDO and parcel lockers (as well as OHD). It results from the spatially diversified availability of OHD services, which is lower in the province. However, an analogous analysis carried out for sent parcels suggests that in this case users living in the countryside may still prefer sending parcels in PUDO. At the same time, the group sizes are small, i.e. 25-28 respondents and less than half of them prefers PUDO.

The Mann-Whitney U test [Mann and Whitney 1947] and the Kruskal-Wallis test [Kruskal and Wallis 1952] were also carried out for the data obtained. Based on them persons sending parcels attached more importance to timely collection of parcels by the courier (Mann-Whitney U test:  $Z = -3.17$ ,  $p = 0.002$ ) and convenient location of the place of origin ( $Z = -5.3$ ,  $p = .000$ ) than persons that did not send parcels. The Mann-Whitney U tests did not show significant differences in responses for the other analyzed aspects.

Women attached more importance than men to issues related to environmental protection ( $Z = -3.29$ ,  $p = .001$ ). This result is consistent with the other outcomes regarding consumer behavior, e.g. [Fisher et al., 2012]. Women more often declared that they send parcels (57.5% vs. 47%,  $\chi^2 = 4.42$ ,  $df = 1$ ). Women who sent parcels indicated a slightly higher importance of convenience for the location of the point of origin ( $Z = 2.13$ ,  $p = .033$ ) and the point of destination ( $Z = 2.08$ ,  $p = .027$ ). It can result from the fact that this group of respondents more often indicated traveling on foot (33.0% to 20.4%) than driving a car (43.5% to 52.7%) while sending parcels. Which in turn may be related to factors not studied in this work, such as having a driving license or a car. In addition, it is worth noting that both women and men declared more frequent use of OHD services than courier services while sending parcels (58.8% to 36.5% of men and women who declared sending parcels). Taking separately into account PUDOs, parcel lockers and courier services, the chi-squared test showed that the differences of sending parcels' preferences between men and women are not significant ( $\chi^2 = 2.05$ ,  $df = 2$ ). In the case of picking up parcel, this relationship is similar, but men more often than women declare that they use OHD services instead of courier services, i.e. 68.2% of men and 57.6% of women declare picking up parcels ( $\chi^2 = 5.24$ ,  $df = 1$ ). These differences are seen in the parcel lockers' users. In the case of PUDO, women and men pick up parcels equally often, which is 6.5% of respondents.

Pupils and students put more attention to the security of the parcel delivery ( $Z = -3.02$ ,  $p = .002$ ) and the convenient location of the place of destination ( $Z = 2.5$ ,  $p = .012$ ). The reason of the latter

may be the varied share of walking and car travels. This relationship also occurs in the case of employed persons. In addition, the structure of services used by students differed to the case of the other respondents ( $\chi^2 = 6.62$ ,  $df = 2$ ). Students less often declared the use of parcel lockers (50.1% to 63.6%), while more often courier services (40.7%, up to 31.2%) and PUDO (8.3% to 5.1%). On the other hand, employees insignificantly ( $\chi^2 = 5.94$ ,  $df = 2$ ) preferred parcel lockers.

Kruskal-Wallis test showed differences of the parcels' security for respondents using various types of services while picking up parcels ( $p = .034$ ). However, the Siegel-Castellan post hoc test [Siegel and Castellan 1988] did not show significant differences in comparing average ranks. After combining parcel lockers and PUDO services, it was found that more attention was paid to parcels' security by respondents using courier services than to those using OHD ( $Z = 2.59$ ,  $p = .009$ ). The results may be related to the fact that a group of students used courier services more often than the group of the other respondents (40% to 31%).

In case of the respondents' place of residence, set as independent variable, the Kruskal-Wallis test did not show significant differences in the answers to all 7 questions regarding the importance of various aspects related to sending and picking up parcels, for respondents' place. The results of the Mann-Whitney U test limited to "city-village" data also do not indicate any differentiation.

## CONCLUSIONS

In this chapter the typical behavior patterns of the CEP industry's customers in Poland has been investigated. It has also been the main goal of the research and to achieve it the multiple stage approach has been proposed. More than 460 respondents, including experts, users of the PUDO infrastructure and customers, have been interviewed.

The obtained results are the basis for shaping strategic directions of development and maintenance of the existing logistics infrastructure in the CEP industry, including the following aspects: the improvement of customers' satisfaction level by adjusting the time of couriers' deliveries to the availability of the receivers; the extension of PUDO infrastructure and opening hours, as well.

The obtained results suggest that in case of picking up parcels, the profile of PUDO's users is similar to the profile of parcel lockers' users and different from the profile of courier services' users. However, PUDOs are more willingly used by respondents declaring sending parcels than picking them up. It should be noted, that the share of PUDO users among all respondents was low. Moreover, results are limited to the dominating group of respondents, i.e. adults between 20 and

25, living in the city center and suburbs, as well as working in the city center. Thus, further research should be concentrated on the opinions' analysis of the wider group of respondents. It may also address the issue of possible differences between the perceived importance of environmental aspects and actual decisions regarding the choice of delivery method.

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