

Available online at www.sciencedirect.com**ScienceDirect**

Transportation Research Procedia 16 (2016) 378 – 393

**Transportation
Research
Procedia**

www.elsevier.com/locate/procedia

2nd International Conference "Green Cities - Green Logistics for Greener Cities",
2-3 March 2016, Szczecin, Poland

The last mile issue and urban logistics: choosing parcel machines in the context of the ecological attitudes of the Y generation consumers purchasing online

Mirosław Moroz^{a*}, Zdzisław Polkowski^b

^a *Wrocław University of Economics, 118/120 Komandorska Street, Wrocław PL53-345, Poland*

^b *The Lower Silesian University of Entrepreneurship and Technology, Skalniew Street 6b, Polkowice PL59-101, Poland*

Abstract

The dynamic development of electronic commerce is affecting the manner of the organization of urban logistics. The last mile issue, that is the problem of the final stage of delivery of a parcel to a recipient, appears in full in urban areas. The problem of the last mile can be solved for the benefit of the environment through solutions called parcel machines.

This paper aims to explore the relationship between environmental attitudes and behaviors of Generation Y and their propensity to make purchases over the internet and collect them using parcel machines.

The study found that Generation Y respondents in Poland do not perceive parcel machines as an environmentally friendly method of delivery of products purchased online. On the other hand, young people would be willing to pay a bit more for an item if it were a form of an environment-saving measure. It is true that this correlation is not strong ($r = 0.1785$), but through a campaign dedicated to Generation Y (social media) environmental attitudes could be affected. There was no relationship between the amount of disposable income and the propensity among Millennials to use green solutions.

© 2016 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee of Green Cities 2016.

Keywords: Urban logistics, the last mile issue, e-commerce, parcel machines, parcel lockers, Generation Y, ecological criterion of delivery method.

* Corresponding author. Tel.: +0-000-000-0000 ; fax: +0-000-000-0000 .
E-mail address: mkmoroz@o2.pl

1. Introduction

E-commerce is in a phase of continuous growth. According to the published studies, the estimated turnover of e-commerce in Poland in 2015 will exceed PLN 33 billion. This means a double-digit growth compared to the previous year. At least 55% of internet users make purchases online, although some estimates show that all internet users in Poland have done online shopping. In absolute numbers, this gives at least 13.5 million buyers.

However, the success of e-commerce in Poland has its price. Competition in the e-commerce sector is very fierce, due to the intangible value chain and the ease of comparison of the conditions of purchase (including price, delivery, opinions about e-shops). The internet sellers compete using a lot of instruments. One of the key factors to win against market competition is logistics. Efficiently organized delivery to the final consumer often prevails and determines the choice of the online store. However, it is not about the time and price of delivery. The specificity of internet trading is the territorial dispersion of customers. The retail customer (B2C - business to customer) usually orders small quantities of goods (often single pieces), but they do it relatively often. What is more, the customer in many cases remains outside of their permanent place of residence during the working hours of the courier company or post office. This is an additional feature in the characteristics of the logistics in e-commerce. Under these conditions, transport companies have proposed solutions that enable them to meet the requirements of the e-commerce market. One such solution is a parcel machine: an automated device allowing collection (and dispatch) of consignments around the clock. In Poland, the largest operator of this type of devices, called parcel lockers, is the company named InPost.

Cities are created by clusters of people, which, on the one hand, promotes the development of transport infrastructure and communication network. On the other hand, placing numerous residents with the entire "life" infrastructure (jobs, transportation, commerce etc.) within limited space causes air pollution, noise and other negative effects on the environment. The aforementioned development of e-commerce also contributes to increasing the burden on the natural environment. A delivery of a parcel to a recipient's address results in high costs of customer service (extended car route of a courier) and greater environmental pollution (higher emissions from the cars of transport companies). This problem is referred to as "the last mile issue".

This article aims to explore the relationship between pro-environmental attitudes and behaviors of Generation Y in Poland and their propensity to make purchases over the internet, using parcel machines to receive goods. The tests concerned Generation Y - a segment of young people born in the last two decades of the twentieth century, who use information and communication technologies (ICT) with great enthusiasm. There are numerous studies on Generation Y examining their behavior at the workplace, interacting with superiors or subordination to the prevailing organizational culture. At the same time, a review of the literature showed that few studies encompass the ecological attitudes of Generation Y. That is, however, the issue relevant to the growing economic importance of this part of the society. Generation Y already has a substantial budget, which translates into demand and buying behavior. In the near future, along with the ever increasing higher percentage of Millennials entering working age, their importance will only grow. The significance of this social group is particularly strongly felt in e-commerce. As a generation intensively using the internet, they just as much engage in online shopping.

2. Literature review

2.1. *The Urban logistics and e-commerce: the issue of last mile*

The economic and social life of the modern world is concentrated in cities. According to statistics from the United Nations, the percentage of the population living in cities increased from 29.55% in 1950 to 51.64% in 2010 (United Nations, 2014). Within 60 years, the percentage of urban residents in the whole population increased by almost 75%. It is estimated that cities generate about 85% of GDP (Gouldson *et al.*, 2015). Similar are the findings of a study conducted by the consulting company McKinsey (McKinsey & Company, 2011). This means that the concentration of manufacturing processes and trade is in urban areas. This concentration is the cause, and at the same time a consequence, of the development of the urban transport logistics system.

On the other hand, from an environmental point of view, the focus of logistics systems in cities has negative consequences for the residents' quality of life. Most accidents and traffic jams occur in cities, which leads to the accumulation of pollutants in the air and water (including greenhouse gas emissions), and the generation of noise. According to the European Commission's report, it is widely understood that urban transport is responsible for a quarter of the total emissions of CO₂ and 69% of traffic accidents take place in urban areas (European Commission, 2011). However, with the increasing intensification of traffic, the cost of traffic jams in 2050 may increase by 50% (European Commission, 2011). Based on the mentioned facts, the growing importance of city logistics may be noted. According to Taniguuchi *et al.*, city logistics is the process dealing with totally optimizing the logistics and transport activities by private companies with the support of advanced information systems in urban areas concerning the traffic environment, its congestion, safety and energy savings within the framework of a market economy (Taniguuchi *et al.*, 2001). People involved in activities related to urban logistics can see positive (necessary circulation of goods and movement of people) and negative (air and water pollution, noise, traffic jams, accidents) aspects of logistics systems in the city. On this basis, they try to introduce such rules and solutions that could minimize the impact of negative factors on the residents of the city.

E-commerce is the process of buying goods and services via the internet (Turban *et al.*, 2006, Laudon & Traver, 2007).

E-commerce is a result of popularizing transactions on the internet, thus of the possibility of concluding purchase contracts in the virtual environment. Among the most important benefits of e-commerce, perceived from the perspective of the customer, one should mention (E-commerce Poland & Gemius, 2014; Chiu *et al.*, 2014):

- 24/7 availability
- delivery to the house/ no need to travel to the shop
- the ease of comparing offers
- attractive prices
- the ease of finding rare / specialist products
- substantial amount of information about products
- larger assortment than in traditional shops
- the right to return any purchases made "at a distance"

E-commerce has been subject to growth processes of the scale of turnover and the number of online shops. Table 1 shows the dynamics of revenues of the American and Polish e-commerce.

Table 1. E-commerce revenues (\$ billion) - United States vs. Poland
(Source: UNCTAD, 2015, Polskie Badania Internetu, 2013)

Year	Revenues		Change	
	USA	Poland	USA	Poland
2002	1167	0.09	--	--
2003	1868	0.21	60.07%	124.24%
2004	2129	0.54	13.97%	156.76%
2005	2663	0.89	25.08%	63.16%
2006	2985	1.43	12.09%	61.29%
2007	3410	2.46	14.24%	72.00%
2008	3734	3.14	9.50%	27.91%
2009	3391	3.31	-9.19%	5.45%
2010	4368	4.43	28.81%	33.62%
2011	4936	5.00	13.00%	12.90%
2012	5371	6.14	8.81%	22.86%

The quoted data indicate some similarities to the growth dynamics: initial increases are the most significant, while in the end the dynamics are dropping. Also, a fall in the increase in the turnover is significant in 2009. On the other hand, higher accumulated growth dynamics are visible in Poland, representing the countries beginning the development of e-commerce, in comparison with the United States, a country of an established position in e-commerce.

E-commerce does not remain indifferent as far as the natural environment is concerned. The key feature of e-commerce is the home-delivery service. An increase in the scale of online shopping lead to an increase in the number of rides of courier and delivery company cars. Generally speaking, e-commerce enhances the tendency to increase the volume of parcels, along with a simultaneous fall in their weight and, as a consequence, to increase the frequency of rides (Edwards, McKinnon, Cullinane, 2010; Visser, Nemoto, Browne, 2014). On the other hand, there are positive effects on the environment triggered by the development of e-commerce. Table 2 contains a balanced attitude presenting the advantages and disadvantages of the logistic aspect of e-commerce.

Table 2. Factors of influence on freight traffic related to internet shopping (Source: Visser, Nemoto, Browne, 2014)

Attribute of logistics	Transport increasing factors	Transport reducing factors
Home delivery	higher freight mileage (replacing shopping trips) consumers might substitute former shopping trips by other (longer) journeys reverse logistics	replacement of individual shopping trips by bundled goods transport potential in overall traffic reduction depends on ability to bundle transports, set up efficient delivery trips and make full use of vehicle

Logistic problems of e-commerce directed towards retail recipients are concentrated on the last stage of the delivery, causing problems known as the problem of the last mile - *the last mile issue*. Geographical dispersion of recipients necessitates the need to organize supplies in practically every place of residence of the prospective customer. For the logistic operator it is related to the optimization of the place, the mode and the time of receipt of the parcel, the lead time, the average cost of delivery (Madlberger, 2005; de Souza *et al.*, 2014). Taking into consideration the growing expectations of recipients with regard to the time and delivery charges and, on the other hand, the economics of the logistic operator functioning, the practical service of retail clients constitutes the aforementioned problem.

The last mile issue is reflected in environmental protection. Repeated deliveries of small value, characteristic of e-commerce, in practice entail longer routes for the transportation means of the shipping companies. What is more, within the standard working hours of suppliers, customers are very often away from their place of residence. It creates the need for a repeat delivery to the same address and in some cases even the third visit of the courier is necessary. The problem of a repeat delivery concerns about 20 - 30 % recipients (Boyer, Prud'homme, Chung, 2009; de Souza *et al.*, 2014). In the process, the mileage of the cars of the logistic operator increase and greater emissions of pollutants occur. As concluded by Gevaers, Van de Voorde and Vanelslander: "The last miles is currently regarded as one of the more expensive, least efficient and most polluting sections of the entire logistics chain" (Gevaers, Van de Voorde and Vanelslander, 2011).

Increased traffic generated by e-commerce deteriorates the already difficult situation of cities because of the emission of air pollutants (CO₂, NO_x), the growing noise and the risk of accidents. The classic e-commerce formula of the home-delivery service turns out to be insufficient – both for sellers and customers. Therefore, solutions are sought to minimize the adverse effects of the growth of e-commerce. One of the solutions is the use of collection points. The logic of their functioning is based on the assumption that it is the recipient who comes to collect the parcel at a determined point: a shop, a stall or a parcel machine. Such a practice results in reduction of the mileage of the car of the courier who leaves a lot of parcels in one place. For the supplier, it leads to a decrease in the cost of each delivery. The recipient, in turn, is not limited by the working hours of the courier; they do not have to wait at home. Choosing the receipt in a collection point, they gain flexibility as far as the time of collecting the parcel is concerned.

A comparison of the ways to solve the last mile problem is presented in Figure 1.

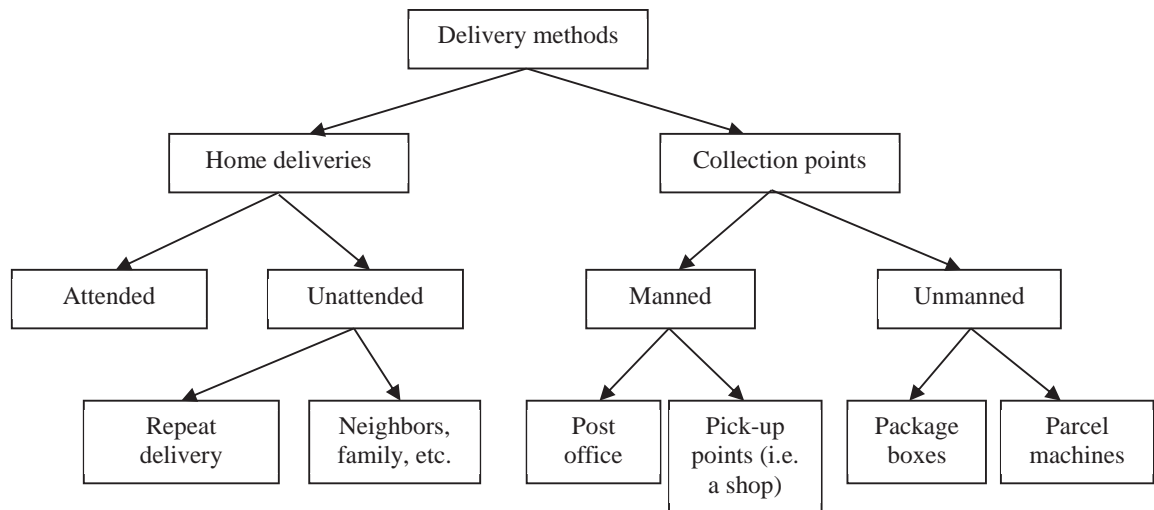


Fig. 1. The methods to overcome the problem of the last mile: classical solutions vs. collecting points (source: own work).

As for the classic way of the home-delivery service, an unclaimed parcel will be subject to a repeat delivery or will be left by the courier at the neighbors' place, by the door, etc. Collecting points, in turn, are divided into the ones served by people and the automated ones. In the latter type, the subdivision concerns the accessibility of the machine. In package boxes the access is limited to a specific circle of people. Parcel machines are located in public places and available to everybody. Collection points are becoming more and more popular, although they still do not pose a threat to classical home-delivery services. In 2012 there were 22 networks of parcel machines functioning in the European Union, the USA, Canada, Turkey or Russia (Ducret & Durand, 2012).

2.2. Automated Parcel Machines in Poland (InPost Parcel Lockers)

On 14 October 2009 the company InPost Ltd started, the first in Poland and one of the first in the world, network of parcel machines (Maj, 2009). 24/7 parcel lockers - as every other parcel machine – make it possible to collect the parcels at any time of day or night, on entering the mobile phone number and the access code. The devices are located in freely available places such as railway stations, shopping centers, petrol stations. According to the information published by InPost, parcel machines are not objects of acts of vandalism. A standard 24/7 parcel machine contains 3 types of lockers differing in size, the number of which is, depending on the type of the device, from 76 to 80. The monthly electrical power consumption is 90 kWh (Bilik, 2014). Picture 2 presents InPost parcel lockers.



Fig. 2. Paczkomaty 24/7 – an example of a parcel machine run by InPost company in Poland (source: own work).

According to the statistics available from InPost, recipients take advantage of around-the-clock collection possibility and on average they collect over 58 % parcels between 6:00 PM and 8:00 AM (Bilik, 2014). At the beginning, the service recipients could choose from 400 parcel machines all over the country. In mid-2015 the number of parcel machines was about 1300 (ISBnews, 2015). 98% of parcels are delivered to InPost parcel lockers the next day after dispatch (D+1) (InPost, 2015). The average price of parcel delivery via parcel machines is PLN 9.15 compared to PLN 10.81 paid on average for the delivery via Poczta Polska (Polish Post) and on average PLN 14.24 for the courier service (Iwan, 2015).

The above-mentioned factors translate into the strong market position of parcel machines on the market of logistic services. In 2014, the number of parcels delivered via the service increased by 90.5% compared to the previous year (Integer, 2015). At the end of 2014, InPost parcel lockers were used by 6,500 e-shops and nearly 30,000 sellers offering their products at Allegro (the biggest on-line auction site in Poland) (Ibidem). On the other hand, a weak point of the solution is the relatively small number of devices available outside bigger towns. Secondly, in spite of the dynamic growth, parcel machines are chosen as the fourth form of product delivery on the internet. Courier services are in the top position, next is the state post operator Poczta Polska and then personal collection (E-commerce Poland & Gemius, 2014).

The use of parcel machines contributes to limiting exhaust emissions, reducing the number of traffic jams and reducing the transportation-related noise. It happens because delivery trucks that serve the collecting points run a smaller mileage compared to courier company delivery trucks. In this perspective, a significant aspect is recipients travelling on foot to collect the parcel from the parcel machines, or collecting the consignment by car on the way to work or school, without covering additional distances. This aspect also translates into the environmentally friendly character of the discussed solutions for delivery of goods. With reference to parcel machines, benchmarking research has been conducted, comparing the service to a courier company, focusing on the question of reducing the amount of pollutants (Table 3).

Table 3. A comparison of ecological aspects of deliveries performed by a courier company and via InPost (parcel machines) (Source: Bilik, 2014)

Touchstone	Parcel delivery company	24/7 parcel lockers (InPost)
Parcels daily per one courier	60	600
Kilometers daily per one courier	150	70
CO ₂ emission per parcel	300g	14g
Fuel consumption per parcel	0.23 l	0.01 l

Placing parcels in bulk in one place and the smaller distance covered by the delivery truck contributes to a significant decrease in the individual fuel consumption, and thus to reducing the emissions of carbon dioxide. This aspect is the key benefit for the natural environment.

2.3. Generation Y's attitude to e-commerce and the environment

Generation Y is a collective name describing those born in the years of 1980 - 1999 (Hartman, McCambridge, 2011). The above range of dates defining the Y generation is accepted by mutual agreement, but there are exceptions to the accepted rule, for instance some authors prefer a shorter period, between 1982 and 1996 (Levenson, 2010). People of the Y generation are also called Millennials.

The classification distinguishing the Y generation is facilitated by specific characteristics, developed as a result of increasing globalization and of the dynamic development of the telecommunications technology (ICT). The Y generation is characterized by its specifics which manifest themselves on the labor market, in social contacts, the attitude towards parenthood, etc. The definition of the Millennials is based on their economic meaning. The people born in the last 20 years of the 20th century constitute a considerable reservoir of workforce. It is estimated that in 2014 the Y generation will constitute 47 % of the purchasing power of the Polish society (Sienkowska, 2009).

From the sociological and economic perspective, every generation differs from the previous one. The most important features of the Y generation include (Hanks *et al.*, 2008; Deal, Altman, & Rogelberg, 2010; Visser, Nemoto, Browne, 2014):

- Best educated generation in history (in terms of completing higher education)
- Proficiency at using ICT technologies
- High professional flexibility – they do not aspire to get a steady position
- Caring for maintaining a work-life balance
- Requiring not only well-paid work, but such work in which “something is happening”
- Millennials were brought up in the reality of the market economy
- Greater self-confidence is typical of this generation

In the context of the discussed issue, a significant aspect shows the Y generation as heavy users of ICT. Millennials are a group which most often uses the internet (US Census, 2014).

Using the internet manifests itself also through transaction applications (e-commerce), and this, in turn, is related to the manner of collection. According to the already mentioned research on e-commerce, Poland & the Y generation collects parcels from parcel machines in similar numbers to the ones typical of online buyers. For particular age categories, the percentage of those who use 24/7 parcel lockers is shown in Table 4.

Table 4. Percentage of people collecting consignments from 24/7 parcel lockers, broken down into age groups
(Source: E-commerce Poland & Gemius, 2014)

Age	Share	Classification into Gen Y
15-18	29%	+
19 -24	25%	+
25-34	36%	+
35-49	35%	-
50+	26%	-

The literature review revealed that the researchers attention with reference to the Y generation focused on their approach to work. Only a few scientific papers address the question of the Y generation's attitude towards ecology.

Some studies suggest that Millennials are ecologically sensitive (Lu, Bock, Joseph, 2013). It is, first of all, related to the wide knowledge possessed by the analyzed generation. On the other hand, studies show that the opposite trend exists. 51% of Millennials from the USA show little interest in global warming, while 25.5%, generally speaking, do not care (Hans *et al.*, 2008). Here, the question arises: does the declared attitude towards the environment translate itself into real action. It is possible to answer the question in the survey concerning the attitude of the Y generation conducted in Poland (TNS OBOP, 2012). 81% of the respondents stated that ecology was important (or very important) to them. On the other hand, only 23% of respondents pay attention to whether the process of producing goods is environmentally-friendly. It means that environmentally friendly attitudes are rather declarative only, however, when it comes to action, ecology fades into the background. In the example discussed above, the composition and the brand were a criterion for selecting a given product.

3. Research design and methodology

3.1. Research problem and objective

Defining the research problem is the starting point for conducting the study process (Cooper, 1982). For the purpose of this article, the research problem was formulated as follows: whether - and if so, to what degree – the choice of parcel machines as the method of delivering the product purchased on the internet, is connected with the environmental attitude of young people belonging to Generation Y.

To the authors' best knowledge, the issue of displaying environmentally friendly attitudes through the choice of the method of delivering the products purchased on the internet has not been explored in the literature so far. All the more, the above-mentioned scope of research has not been oriented towards the Y generation. As indicated in the Literature Review section, the research so far has concentrated on the characterization of the Y generation as far as their attitude to work is concerned, and to a lesser degree on their pro-ecological attitudes and behaviors. With reference to the methods of delivery through parcel machines, they were analyzed in the context of consumer choices (price, delivery time, etc.) The only study taking into account environmental aspects of the choice of parcel machines has been carried out by the InPost company (see Table 3). It has become the intention of the authors to fill this gap and conduct empirical examinations devoted to the matter of choosing parcel machines as the method of delivery in the context of the attitude and action taken to protect the natural environment.

The purpose of the article is to analyze the link between ecological attitudes and behavior of people belonging to the Y generation, and their tendency to do shopping via the internet and collect the purchased product through parcel machines.

In order to meet the goal, a positivist paradigm was adopted (Sułkowski, 2011). This paradigm is based on a quantitative attempt at examining the reality. As such, it allows a maximum solution of the assumed research problem and the purpose of research.

3.2. Research hypotheses

The review of the literature prompted the authors to formulate three hypotheses, focusing on the green practices of Generation Y in terms of delivery of products purchased online.

On the one hand, the presented data reveals that the choice of parcel machines as a means of delivery in e-commerce contributes to protecting the environment by reducing the emissions. On the other hand, the market reports quoted in the paper clearly show that the 24/7 parcel locker service is selected by Generation Y. Therefore, the question arises about the reasons for choosing delivery modes for products bought online by Generation Y. Do young people take into account environmental argument in their choices regarding the method of delivery? And if so - what is the proportion of people guided by environmental concerns among Generation Y in choosing the method of delivery? Given the lack of previous studies on how green practices are taken into account by Generation Y in their choice of parcel machines as a way of delivery of products purchased online, hypothesis No. 1 was formulated as follows:

H1: Environmental considerations constitute grounds for the selection of 24/7 parcel locker service by people of Generation Y shopping online

The second hypothesis deepens the first one. One of the methods for confirming environmentally friendly orientation is the tendency to pay higher prices for green products (Kubickova, Nusair, Parsa, 2014). In relation to the adopted research problem, thus it is necessary to examine the attitude of young people of Gen Y manifesting green behavior towards the idea of raising fees for delivery of products via 24/7 parcel lockers. Generally, people with higher environmental awareness are able to spend more to protect the environment (Kaiser *et al.*, 1999). Thus, those young people that save energy, conduct selective collection of waste, etc., would be the first ones willing to use parcel machines, and secondly, having more knowledge about the eco-friendly way of collecting the consignment, they would be willing to pay proportionally more for the delivery. As a result, the authors have adopted the following hypothesis No. 2:

H2: A person of Generation Y manifesting an environmentally friendly attitude is willing to pay more for an item purchased online.

The third hypothesis assumes as relationship between disposable income and a higher propensity to use environmentally friendly criteria in choosing the method of delivery. This hypothesis is rooted in the theory of motivation, more precisely, it is based on Maslow's hierarchy of needs (Koltko-Rivera, 2006). Environmental considerations are recognized and appreciated only in a situation when basic needs are met (Chiesure, 2004). Thus, people with relatively high incomes begin to include ecological reasons in their consumer choices. In relation to the subject discussed, it would mean the relationship between the amount of income and the desire for a more green method of product delivery. Thus, hypothesis No. 3 is as follows:

H3: Generation Y people with a higher disposable income tend to take into account environmental concerns when selecting the method of delivery of products purchased online.

The concept of “disposable income” is understood as a person’s income after paying all necessary expenses (taxes, the cost of food, housing, etc.) (Gottschalk, Smeeding, 2000). In other words, this is the income that a person can use for the needs of a higher level.

3.3. Data collection and sample characteristics

Due to the tangible nature of the problem contemplated in the research, a survey based on a questionnaire has been prepared. The research questionnaire consists of 10 questions. Prior to the collection of primary data, the questionnaire has been pre-tested among 5 people in the target group (Generation Y). The pre-test demonstrated the need to introduce a number of amendments; so that the questionnaire was fully understandable for the target group (e. g. the exact meaning of disposable income has been given). In the course of the study, prior to completion of the questionnaire, respondents were informed that the purpose of the study is to evaluate the use of InPost parcel lockers. The researchers did not emphasize environmental aspects of the study, so as to obtain a true picture of reality, undistorted by respondents adapting to the expectations of the researchers.

The judgment sampling method was used in the research. The reason for the selection of the sampling methods was the research structure and the relatively rare use of InPost parcel lockers among the target group (Aly, Duboff, 1971). Due to the nature of the research problem, the respondents involved in the researched were the ones who:

- will belong to Generation Y
- have collected at least once a product purchased online from a parcel machine.

The research conducted by Ecommerce Polish & Gemius mentioned above showed that about 28% of the internet users use InPost parcel lockers. However, in the course of the empirical research, it turned out that a lot of people

from Generation Y only had heard about InPost parcel lockers, but they had not used it. This problem was particularly evident in Ostrow Wielkopolski - a medium-sized city (about 80 thousand inhabitants).

The target group was young people from Generation Y. For the test, it was assumed that they are people who were born between 1980 and 1999. It is assumed that the Y Generation is best represented by students (Smith, Brower, 2012). Consequently, surveys were carried out at two universities: Wroclaw University of Economics and the University of Social Science, branch Ostrow Wielkopolski. Among the respondents there were people from the first and third year of bachelor's and the first and second year of master's degree studies. The respondents were both full-time and extramural students.

The research was conducted in November 2015. In total, the study involved 266 people. However, due to incompletely filled-in questionnaires or apparent inconsistencies in the answers, 32 of the surveys were rejected. In total, 234 survey were left for further analysis.

Table 5 shows the characteristics of the sample.

Table 5. Sample profile (Source: own research)

Category		Share
Gender	Female	84.6 %
	Male	15.4 %
Education Level	Undergraduate education	62.7%
	Graduate School	37.3%
Disposable income	0 – 100 PLN	6%
	101-300 PLN	13%
	301- 500 PLN	23%
	501- 1000 PLN	40%
	1001 – 1500 PLN	9%
	1500 PLN +	9%

The prevalence of women in the sample occurred due to the fact that women choose economic schools more often than men (MNiSW, 2013).

4. Results of the study

The first area of analysis concerns the selection of parcel machines by people of Generation Y as a method of receiving products purchased on the internet due to environmental reasons. The literature review did not reveal a single study that would concern the above-mentioned research problem. It is true that although there are a lot of market reports referring to the reasons for choosing the method of delivery, environmental reasons are not taken into account in them. On the other hand, there is a study showing the ecological advantages of the use of parcel machines (Bilik, 2014). Therefore, the survey first concentrated on the reasons for the selection of InPost parcel lockers. The listed reasons included the answer, “for environmental reasons”, stating the reason for considering the choice of parcel machines as “environmentally friendly” - lower emissions – the courier leaves the parcels in one place and does not drive to multiple recipients.

The range of reasons for using the 24/7 parcel locker service among the subjects of Generation Y is presented in Table 6.

Table 6. The reasons for choosing parcel machines by surveyed Millennials (Source: own research)

Reasons of the choice:	The percentage of respondents
lower delivery cost (compared to other methods of delivery)	32.05%
the ability to collect around the clock (easy for me to receive)	55.13%
speed of delivery (compared to other modes of delivery)	8.97%
environmental considerations (lower emissions - courier leaves parcels in one place and does not drive to multiple recipients)	1.28%
confidence in the brand (InPost parcel lockers is a proven way to collect)	2.56%

The data presented above do not leave any doubts as for the validity of the reasons to choose the method of delivery of products purchased online. The environmental reasons were chosen only by 3 people - almost 1% of respondents. Such a small number of responses opting for ecological reasons undermined the sense of testing the statistical hypothesis No. 1 (Aczel, 2000). At the beginning, the authors assumed that hypothesis No. 1 will be tested by the chi-square test of independence. However, given the above range of responses, without conducting formal tests of hypothesis, it may be stated that young people do not choose parcel machines for environmental reasons. The main reasons for the functional characteristics of the delivery are comfort, delivery time and cost.

The second hypothesis is that people from Generation Y who manifest an environmentally friendly attitude are willing to pay more for an item purchased online. Thus, the test requires the aggregation of ecological behavior performed by Generation Y. The questionnaire included the following positive types of real behavior:

- waste segregation (factor 1)
- energy saving (factor 2)
- throwing away the packaging of the goods received via the parcel locker to the appropriate container for waste paper or plastic (factor 3)

Lack of segregation of waste, including packaging, after receiving the consignment was considered as negative behavior towards the environment (factor 4).

Table 7 schematically shows the aggregation of the “green behavior” variable, together with the variability range of a given factor.

Table 7. Aggregation of factors in the “green behavior” variable (Source: own research)

					Total
Factor No.	1	2	3	4	
Variability range	(0.1)	(0.1)	(0.1)	(-1.0)	(-1.3)

The higher the value of the “green behavior” variable, the more environmentally friendly the activities carried out by the respondent are.

The second variable refers to the tendency to pay more for an item that would increase the level of environment protection. Respondents in the survey showed how much more they could pay. 2/3 of respondents did not express a desire to increase the supply costs to compensate for a more eco-friendly delivery. The others declared the possibility to raise the cost by 5% to 20%. For further calculations, the middle of scale was assumed, and thus respectively: 0%, 2.5%, 7.5%, 12%, 17.5%.

The aggregation of the first variable makes it possible to change the measurement scale, from a nominal scale to an interval scale (Michell, 1986). Since the declarations of increase were drawn on the ratio scale, the right way to examine the relationship formulated in hypothesis No. 2 is to use Pearson's correlation coefficient r . Let us define the null and alternative hypotheses number 2:

$$H_0: \rho = 0$$

$$H_1: \rho \neq 0$$

For the purposes of this study, it was assumed that the confidence level is 95%, thus an alpha value is 0.05. The calculations necessary to verify the hypothesis can be found in Table 8.

Table 8. Correlation coefficient analysis for hypothesis no. 2
(Source: own research)

Indicator	Value
df	232
t	2.764
p	0.006163
r	0.1785

In hypothesis No. 2 the p-value is very small, so the null hypothesis may be rejected (Babbie, 2013).

Therefore, people manifesting pro-ecological behavior are willing to pay more for delivery which is performed in a more pro-ecological way. However, the degree of relationship is weak - less than 18%. In practice, therefore, the alternative hypothesis must be accepted as more of a statement. Companies supporting parcel machines should not plan major increases in fees solely in relation with "green activities".

The third tested hypothesis concerns the relationship between the disposable income of Millennials and the tendency to represent an eco-friendly attitude in choosing methods of product delivery. As descriptors of the eco-attitude in the questionnaire, the following factors were included:

- Noise contributes to environmental degradation (factor 1)
- Recycling is desired (factor 2)
- Renewable energy is the future of energy (factor 3)

All the accepted factors have a positive impact on the environment. Their aggregation, made for testing hypothesis No. 3, is presented in Table 9.

Table 9. Aggregation of factors in the "environmental attitude" variable
(Source: own research)

				Total
Factor No.	1	2	3	
Variability range	(0.1)	(0.1)	(0.1)	(0.3)

The higher the value of the variable "environmental attitude" - the more developed the respondent's environmental awareness.

The second variable occurring in hypothesis No. 3 refers to the disposable income of the respondents from Generation Y. The questionnaire listed six levels of income:

- PLN 0 - 100
- PLN 101 - 300
- PLN 301 - 5000
- PLN 501 - 1000

- PLN 1001 - 1500
- PLN 1500 +

For further calculations, the amounts of middle values were used. The levels were, respectively, PLN 50, PLN 150, PLN 400, PLN 750, PLN 1,250 and PLN 1,750. The last level of income was unclosed upward, but due to the relatively low number of respondents receiving a disposable income of more than PLN 1,500, it was closed according to the instructions (Ostasiewicz, Rusnak, Siedlecka, 2006). As for the second hypothesis, the aggregation of the first variable makes it possible to change the scale of measurement, from the nominal scale into the interval scale, which in relation to the quotient scale of the second variable creates the possibility of using the Pearson coefficient r to test the described hypothesis. Let us define the null and alternative hypotheses number 3:

$$H_0: \rho = 0$$

$$H_1: \rho \neq 0$$

The calculations necessary to verify hypothesis No. 3 are presented in Table 10.

Table 10. Correlation coefficient analysis for hypothesis no. 3
(Source: own research)

Indicator	Value
df	232
t	-0.794
p	0.427927
r	-0.052

The calculated value of the p-value is relatively high. Thus, the adopted null hypothesis with lack of relation between variables may not be rejected. Therefore, the studies did not show a relation between the level of disposable income and the tendency of people from Generation Y to have an eco-friendly attitude. Such a result suggests that the interest in environmental protection stays the same, regardless of the income remaining after payment of necessary expenses.

5. Discussion and implications

The review of the literature shows that the attitude of Generation Y towards ecology is not clear. In the authors' opinion it does not shatter the legitimacy of formulating hypothesis 1. However, the results of the survey clearly show that when it comes to a conflict between utility values and ecology - financial benefits and the convenience of delivery definitely win among the Generation Y representatives. Ecological reasons are very poorly represented in the surveyed population (1.28% of respondents). Thus, it can be concluded that the motive of reducing the fleet of delivery vehicles on the streets of cities and towns is not a sufficient, or well-perceived argument in favor of parcel machines. Although the functioning of parcel machines actually contributes to the reduction of GHG emissions, it is not a strong enough argument for customers to use parcel lockers. Therefore, perhaps the time has come to reach for ecological motivation in the competitive struggle between different methods of delivery of products purchased online. It would be all about promoting parcel machines solutions as reducing exhaust emissions and the amount of traffic congestion in the city or traffic noise.

One factor should be pointed out, though that could influence the distribution of responses: namely, the authors of the questionnaire decided that the answer to the question about the reasons for the choice of using the parcel machines will be one-dimensional. In other words, respondents could select one reason for using parcel lockers at one time. The adoption of multi-variant response would probably result in a more frequent selection of the pro-ecological motives. However, it was decided to allow a univariate answer to first of all establish the dominant condition, and then secondly in a way to force the respondent to reflect on the importance of environmental reasons.

Research on the ecological aspects of using parcel lockers was the subject of studies carried by InPost (InPost, 2015b). In these studies, as a manifestation of environmental concern, it was shown that the recipient comes on foot to collect the consignment from parcel machines or stops to collect it on the way home or to work (i.e., without

driving any extra distance). On the other hand, as a factor causing a greater burden on the environment, the journey made solely to a parcel locker was shown. In the second case, environmental pollution increases, traffic jams on city streets increase, there is additional traffic noise. In a poll conducted for the purpose of this article a question was posed about accessing parcel machines - whether it is done on the way somewhere, or on foot, or the recipient goes only to collect the consignment from the device. The results obtained are as follows:

- Collecting the parcel on foot - 44%
- Collecting the parcel by car, but on the way to another place - 50%
- Collecting the parcel by car, where the destination was the parcel locker - 6%

Interviews with some respondents that took place after completing the survey indicate that the issue of using the car or going for a walk in the context of ecology is not clear. It turns out that for people living outside the city, the standard behavior involves driving a car. It is not a disregard for ecology, but rather the question of the possibility of communication and developed habits. Conversely, to go on foot to collect a consignment does not have to be a sign of greater ecological awareness. A walk to a parcel machine for one of the respondents was simultaneous with walking the dog. Undoubtedly, the method of access cannot be identified with ecological reasons.

The research results indicate that representatives of Generation Y are willing to pay more for a greener way of delivering to them the products purchased on the internet. Testing hypothesis No. 2 showed a weak connection between the ecological character of supply and the possibility of raising the price. However, the scale of rising delivery charges resulting from its ecological character is not large. According to the survey, the increase of delivery costs should not exceed 5%. The necessary condition is informing Generation Y more effectively that the parcel machines are an example of green solutions. This would require the companies handling the parcel machines to run promotional campaigns highlighting their ecological character. Due to the profile of Generation Y such a campaign could be run on social media sites. The study indicates that there is no relationship between the level of disposable income and the tendency of people from Generation Y to show an eco-friendly attitude. For parcel machines companies this is a neutral message. An eco-friendly attitude remains average (the average aggregate factors that make up the attitude is 1.4, on a scale from 0 to 3). It does not allow relying on the visibility factor of environmental protection as an important instrument to compete with other methods of delivery. The tendency to take into account pro-ecological factors is not growing along with revenues which remain at somebody's disposal or their purchasing power.

The test results lead to the conclusion that Generation Y does not see the role of the parcel machine in general and InPost parcel lockers in particular, as a means of rescuing urban logistics. This follows directly from the facts guided by other conditions when selecting InPost parcel lockers. Meanwhile, popularizing this method of receipt of goods purchased on the internet could contribute in some way to improve the situation on the roads (traffic jams) and to improve air quality (lower emissions). Also, the tendency to incur higher charges for an environmentally friendly mode of delivery, as well as the lack of a significant relationship between the amount of disposable income and an eco-friendly attitude, does not facilitate the conclusion that there is strong motivation for ecological improvement among the Generation Y representatives. Thus, it seems that parcel machines will be developed on the basis of other factors taken into consideration by consumers.

6. Limitations and future research

The conducted studies concern the issues of externalizing environmental attitudes by choosing InPost parcel lockers as a means of delivery of products purchased online. To the best of the authors' knowledge, the research problem is of a pioneering nature. This involves certain limitations. The adopted research concept is based on an unrepresentative sample of students selected from two universities in Poland. The study was designed on the basis of the judgment sampling method, which is justified by the relatively small number of people who meet the conditions for participation in the survey. However, in the future it would be worthwhile to carry out research representative on a larger numerical test. Secondly, the survey covered only students. Although students are a large part of Generation Y, it is reasonable to conduct research among other segments of the Y Generation - young people who do not study.

Thirdly, research should be carried out in other countries, so as to get rid of the context of the national / regional levels.

A threat to the legitimacy of the results of the research is to adapt to the expectations of the investigator's social desirability bias. During the data collection actions were taken to minimize this problem, by the order of questioning and hiding the main purpose of the study. However, in any future research it would be helpful to consider this threat to a greater extent.

Any future research should take into account the above aspects involving primarily an increase in the base of respondents. What is more, a research sample of a greater size will make it possible to obtain the answers that in this study were only outlined. For example, an important issue is the reasons for choosing to go on foot or by car to the parcel machine. In this context it would be good to examine real reasons for the use of parcel machines by Generation Y.

References

- Acel, A. D. (2000). *Statistics in management*. Warsaw: PWN.
- Aly, H. F., & Duboff, J. I. (1971). Statistical vs. judgment sampling: An empirical study of auditing the accounts receivable of a small retail store. *Accounting Review* 46, 119-128.
- Babbie, E. (2015). *The practice of social research*. Wadsworth: Cengage Learning.
- Bilik J. (2014). Parcel machines - green solution for green cities, 1st International Conference Green Logistics for Greener Cities. Szczecin, Poland.
- Boyer, KK, AM Prud'homme and W. Chung (2009), 'The last-mile challenge: evaluating the effects of customer density and delivery window patterns', *Journal of Business Logistics* 30 (1), 185–201.
- Chiesura, A. (2004). The role of urban parks for the sustainable city. *Landscape and urban planning* 68(1), 129-138.
- Chiu, C. M., Wang, E. T., Fang, Y. H., & Huang, H. Y. (2014). Understanding customers' repeat purchase intentions in B2C e-commerce: the roles of utilitarian value, hedonic value and perceived risk. *Information Systems Journal* 24(1), 85-114.
- Cooper, H. M. (1982). Scientific guidelines for conducting integrative research reviews. *Review of educational research*, 52(2), 291-302.
- Deal, J. J., Altman, D. G., & Rogelberg, S. G. (2010). Millennials at work: What we know and what we need to do (if anything). *Journal of Business and Psychology*, 25(2), 191-199.
- Ducret, R., & Durand, B. (2012). e-Commerce et logistique urbaine: la consigne automatique, une alternative d'avenir?. *Rencontres Internationales de la Recherche en Logistique (RIRL)* 9, 1-28.
- E-commerce Polska & Gemius (2014). E-commerce w Polsce 2014. Gemius dla e-Commerce Polska, E-commerce Polska Izba Gospodarki Elektronicznej, Gemius. Available from: http://www.ecommercepolska.pl/index.php/download_file/847/793/
- Edwards, J. B., McKinnon, A. C., & Cullinane, S. L. (2010). Comparative analysis of the carbon footprints of conventional and online retailing: A "last mile" perspective. *International Journal of Physical Distribution & Logistics Management* 40(1/2), 103-123.
- European Commission (2011). WHITE PAPER Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, Brussels, COM(2011) 144.
- Gevaers, R., Van de Voorde, E., & Vanelslander, T. (2011). Characteristics and typology of last-mile logistics from an innovation perspective in an urban context. In C. Macharis, S. MeloCity (Eds.), *Distribution and urban freight transport: multiples perspectives*, (pp. 56-71). Northampton: Edward Elgar.
- Gouldson, A., Colenbrander, S., Sudmant, A., Godfrey, N., Millward-Hopkins, J., Fang, W. and Zhao, X. (2015), *Accelerating Low-Carbon Development in the World's Cities, 2015*, London and Washington, DC. Available from: <http://newclimateconomy.report/misc/>
- Gottschalk, P., & Smeeding, T. M. (2000). Empirical evidence on income inequality in industrialized countries. *Handbook of income distribution*, 1, 261-307.
- Hanks, K., Odom, W., Roedel, D., & Blevins, E. (2008). Sustainable millennials: attitudes towards sustainability and the material effects of interactive technologies. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 333-342). ACM.
- Hartman, J. L., & McCambridge, J. (2011). Optimizing millennials' communication styles. *Business Communication Quarterly*, 74(1), 22-44.
- InPost (2015a). Paczkomaty, InPost. Available from: <https://twoj.inpost.pl/pl/przesylki/paczkomaty>
- InPost (2015b). Czy Paczkomaty są EKO? Raport z badań internetowych, luty 2015. Available from: https://paczkomaty.pl/pliki/EKO_Paczkomaty_broszura.pdf?_ga=1.205922202.865005393.1448043804
- Integer (2015). Paczkomaty InPost: rekordowy 2014 rok, InPost. Available from: <https://integer.pl/pl/aktualnosci/paczkomaty-inpost-rekordowy-2014-rok>
- ISBNews (2015). InPost zwiększył liczbę Paczkomatów w Polsce do 1300, Wirtualna Polska. Available from: <http://finanse.wp.pl/kat,1033731,title,InPost-zwiekszyliczbe-Paczkomatow-w-Polsce-do-1-300,wid,17456170,wiadomosc.html?tid=1160ad>
- Iwan S. (2015). Parcel Lockers as a Solution to Support Last Mile Delivery Management in E-Commerce. *Logistyka* 2, 36-39.
- Laudon, K. C., & Traver, C. G. (2007). *E-Commerce: business, technology, society*. Upper Saddle River: Pearson Prentice Hall.
- Kaiser, F. G., Ranney, M., Hartig, T., & Bowler, P. A. (1999). Ecological behavior, environmental attitude, and feelings of responsibility for the environment. *European psychologist* 4(2), 59.

- Koltko-Rivera, M. E. (2006). Rediscovering the later version of Maslow's hierarchy of needs: Self-transcendence and opportunities for theory, research, and unification. *Review of general psychology* 10(4), 302.
- Kubickova, M., Nusair, K., & Parsa, H. G. (2014). Does Green Hotel Image Influence Guests' Behavior; the Case of Generation Y. *Journal of Services Research* 14(2), 9.
- Levenson, A. R. (2010). Millennials and the world of work: An economist's perspective. *Journal of Business and Psychology* 25(2), 257-264.
- Lu, L., Bock, D., & Joseph, M. (2013). Green marketing: what the Millennials buy. *Journal of Business Strategy* 34(6), 3-10.
- Madlberger M., (2005). The last mile in an electronic commerce business model - service expectations of austrian online shoppers, *Proceedings of the 13th European Conference on Information Systems, Information Systems in a Rapidly Changing Economy*. Regensburg, Germany.
- Maj M.(2009). InPost: Paczkomaty wystartowały!, available from: http://di.com.pl/news/29086,0,InPost_Paczkomaty_wystartowaly.html
- McKinsey&company (2011). Urban world:Mapping the economic power of cities, 2011, The McKinsey Global Institute. Available from: http://www.mckinsey.com/~media/McKinsey/dotcom/Insights%20and%20pubs/MGI/Research/Urbanization/Urban%20world%20mapping%20economic%20power%20of%20cities/MGI_urban_world_mapping_economic_power_of_cities_full_report.ashx
- Michell, J. (1986). Measurement scales and statistics: A clash of paradigms. *Psychological bulletin*, 100(3), 398-407.
- MNiSW (2013). Raport Szkolnictwo wyższe w Polsce – 2013, Ministerstwo Nauki i Szkolnictwa Wyższego, Warszawa 2013. Available from: https://www.nauka.gov.pl/g2/oryginal/2013_07/0695136d37bd577c8ab03acc5c59a1f6.pdf
- Ostasiewicz, S., Rusnak, Z., & Siedlecka, U. (2006). *Statystyka: elementy teorii i zadania*. Wrocław: Wydawnictwo Akademii Ekonomicznej im. Oskara Langego.
- Polskie Badania Internetu (2013). E-Commerce w Polsce, Rynek, Nabywcy, Trendy; Polskie Badania Internetu. Available from: http://www.slideshare.net/P_B_I/e-commerce-w-polsce
- Sienkowska, E. (2009). Pokolenie Y – śmierć tradycyjnej reklamy?, 22.05.2009, <http://blog.momentum.pl/2009/05/22/pokolenie-y-smierc-tradycyjnej-reklamy/>
- Smith, K.T. and Brower, T.R. (2012). Longitudinal study of green marketing strategies that influence Millennials. *Journal of Strategic Marketing* 20(6), 535-551.
- de Souza, R., Goh, M., Lau, H. C., Ng, W. S., & Tan, P. S. (2014). Collaborative urban logistics—synchronizing the last mile a Singapore research perspective. *Procedia-Social and Behavioral Sciences* 125, 422-431.
- Sułkowski, Ł. (2011). Natura poznania w naukach o zarządzaniu. *Przegląd Organizacji*, (10), 6-8.
- Taniguchi, E., Thompson, R. G., Yamada, T., & Van Duin, R. (2001). *City Logistics. Network modelling and intelligent transport systems*. Amsterdam: Pergamon.
- TNS OBOP (2012). Młodzi 2012 o ekologii i odpowiedzialności społecznej biznesu, TNS OBOP, Warszawa 2012. Available from: http://www.tnsglobal.pl/wp-content/uploads/2012/10/Mlodzi-2012_Raport_TNS-Polska.pdf
- Turban, E., King, D., Viehland, D., Lee, J. K. (2006). *Electronic commerce: A managerial perspective*. Upper Saddle River: Pearson Higher Education.
- UNCTAD (2015). *Information Economy Report 2015.Unlocking the Potential of E-commerce for Developing Countries*, UNCTAD Division on Technology and Logistics. Available from: http://unctad.org/en/PublicationsLibrary/ier2015_en.pdf
- United Nations (2014). *World Urbanization Prospects, 2014*, United Nations, Department of Economic and Social Affairs. Available from: <http://esa.un.org/unpd/wup/highlights/wup2014-highlights.pdf>
- US Census, 2014. *Computer & Internet Trends*, United States Census Bureau. Available from: https://www.census.gov/hhes/computer/files/2012/Computer_Use_Infographic_FINAL.pdf
- Wesner, M. S., & Miller, T. (2008). Boomers and millennials have much in common. *Organization Development Journal* 26(3), 89-96.
- Visser, J., Nemoto, T., & Browne, M. (2014). Home delivery and the impacts on urban freight transport: A review. *Procedia-social and behavioral sciences* 125, 15-27.