

THE LAST MILE TRANSPORT

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Purpose: The growing importance of e-commerce makes it necessary to look for new solutions in ways of delivering goods on the last delivery stretch from the last distribution warehouse to the final customer. The purpose of this article is to show the importance of last mile transport, to present problems connected with it and to show what modern solutions can be implemented, to solve these problems.

Design/methodology/approach: The document contains an analysis of the literature related to last mile transport. Based on the literature, the article describes the problem of last-mile transport in cities and proposes solutions that could improve the flow of goods.

Findings: During the literature research, a correlation was found between transport costs and the method of delivery of a parcel at the last mile stage.

Originality/value: Contemporary cities and metropolises are an area of dynamic social, cultural and economic changes. More and more crowded streets and increased CO₂ emissions are the effects of the development of goods flows inside the city and more people living in urban areas. The study presents modern methods of delivering shipments at the last mile and their impact on freight flows in the city.

Keywords: city logistic, last mile transport, innovations in last mile transport.

1. Introduction

Nowadays, electronic commerce is becoming more and more important. Sellers and distributors are being put under increasing pressure. The goal is for the goods to be delivered to city centres in the shortest possible time and at the lowest cost. It turns out that the last section of transport, the so-called last mile, has a major impact on the cost of delivery, but most of all on customer satisfaction. For this reason, there was also a need to create distribution centres near highly urbanised areas, whose task is to satisfy consumer demand. The last section of the supply chain for the customer's house or to the collection point requires the implementation of a number of optimisation solutions due to the size of challenges that logistic operators and suppliers face on this part of the road.

2. Last mile, and the city's logistics system

The last mile is the term used in the distribution, meaning the transport of goods from the distribution center located closest to the customer to the final recipient. The term is also commonly used in transport companies, supply chains and logistics. Although the name indicates a distance of exactly one mile between individual points, in fact it can be up to several dozen miles (Mantey, 2017). Due to the different nature of logistic services at the last stage of delivering shipments to consumers, last mile logistics covers a variety of different tasks (Pluta-Zaręba, and Rutkowski, 2005). It should be noted that the last mile logistics or logistics of the last kilometre is a part of the urban logistics. This is due to two closely related facts. First of all, difficulties in the last mile logistics are related to the extension in the population living in cities and green areas around them, which in result increases the number of delivery points in highly urbanised areas, makes supply logistics more complicated and requires more involvement from logistic operators. Secondly, urban areas, due to the increase in the intensity of transport traffic, play an extremely important role for the logistics sector. In addition, the population living in cities is a generator of a large number of orders in e-commerce, resulting in a dynamic increase in the demand for the transport of goods (Brach, 28.12.2018). Effective and efficient operating transport is an integral part of the economy and serves the public (Cichosz, 2015).

3. Ways of delivering parcels

The last mile is a key element in building a good image of the supplier. The e-commerce industry enforces constant changes in the ways of delivering ordered goods. The purpose of the changes is to increase customer satisfaction, minimise costs and reduce collection points. Vendors and online stores most often outsource transport services. For many years, Poczta Polska was the leader among companies delivering parcels. However, the increase in customer requirements for the quality of the delivery service caused that in 2009/2010 Poczta Polska lost its leading position and allowed the market to be taken over by the other transport and courier companies that offered better quality and flexibility of delivery at similar costs (Cichosz, and Pluta-Zaręba, 2011). Last-mile operators are usually letter and parcel suppliers, mailing sellers and food providers on the phone. The last mile transport can be carried out directly to the recipient or by means of (Allen, Thorne, and Browne, 2007):

- Delivery boxes located on the external wall of the client's house, to which only the recipient has access via a key or an access code. Delivery information is sent electronically to the e-mail address or mobile phone specified at the order.
- Delivery containers that are owned by a retailer or a delivery company, loaded in warehouses and distribution centres, temporarily attached to the customer's home by means of a closing device.
- Access systems that allow the supplier to enter the designated closed area for delivery.
- Collection points other than the recipient's house, most often characterised by long opening hours. The location of the collection point is determined by the customer when placing an order, e.g. the nearest gas station, a post office, a RUCH newsstand. The consumer is informed about the possibility of collecting the goods by a text message sent to the recipient's private phone number along with the access code, enabling the physical receipt of the goods. The result of this solution is to reduce the number of serviced locations and to minimise the number of shipments not picked-up by the consumer.
- Acceptance banks, which are sets of pick-boxes, performing a similar role to pick-up points, but not located in buildings and service premises, only using free space in parking lots, at railway stations and in places easily accessible and frequented by customers. The package is released automatically by opening a specific box. In contrast to collection points, the only participant in the pick-up procedure is the consumer. Customers are not permanently assigned to specific banks; the choice of pickup location takes place when ordering goods.

The form of shipment most often chosen during online shopping is direct delivery by courier to customer's home or work (Figure 1). The second form of delivery is the collection of purchases at the acceptance banks, which includes, among others, parcel lockers, in which the possibility of picking up the parcel in the afternoon hours is not insignificant.

Assessment of the method of delivery of a shipment affects not only the opinion of a courier or transport company, but also the assessment of the seller himself, which is why the entrepreneurs strive to offer their customers the highest quality transport services. The most convenient form of delivery for the customers is a courier delivery. The disadvantage of this form of supply is fixed delivery hours. Many consumers are absent from home during courier delivery hours. The solution to this problem is to order the parcel to the workplace, or choose an alternative form of delivery with the possibility of pick-up the parcel in the evening.

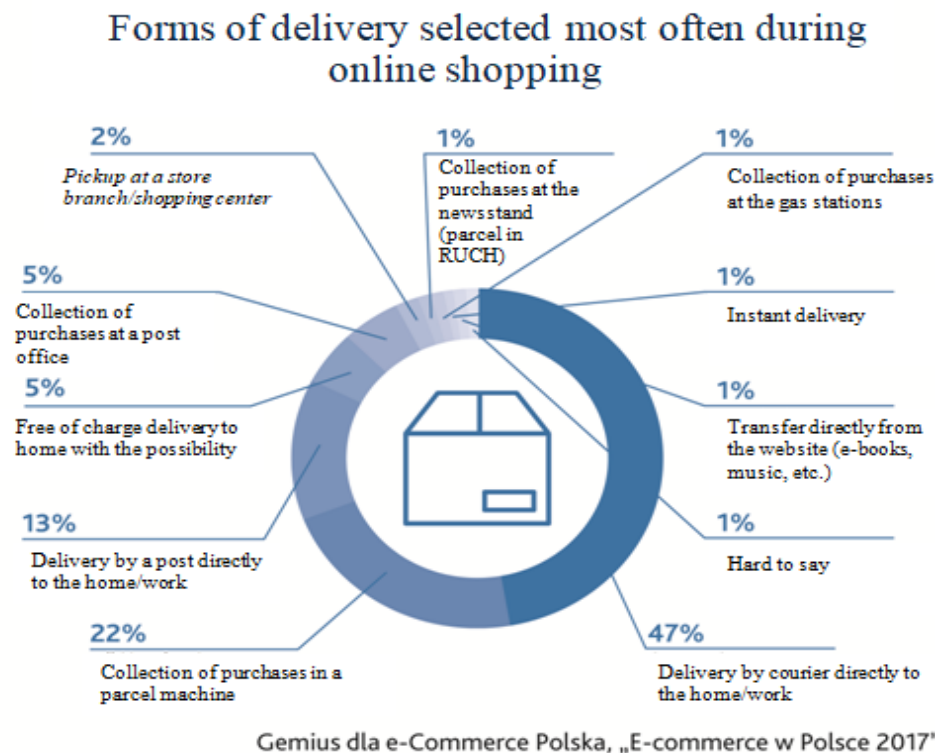


Figure 1. The most common forms of delivery of goods. Adapted from „Ostatnia mila. Dostawy do klienta ostatecznego” by Przemysław Klich, 2018 (access 28.12.2018).

4. The last mile problem

4.1. Causes of the last mile problem

The last mile transport problem usually involves the area of highly urbanised cities. However, in the countryside there are also issues related to the delivery of goods to recipients. The time of delivery is a measure of the efficiency of the transport of goods. In the city, the main reason of delays in deliveries is congestion. Although delivery points are usually located at a short distance from each other, the travel time depends on the conditions on the roads. The main defect of countryside is the large dispersion of collection points (Shelagh, 2018). The growing demand for transport of goods both in cities and in rural areas results mainly from the fact that in recent years an increase in sales in e-commerce has been observed, offering consumers a delivery directly to the home. Figure 2 shows the amount of money spent by customers for online shopping. The last mile concerns both B2C and C2C (Iwan, 28.12.2018). It should be noted that the B2C market has been growing in recent years. Only a few years ago it constituted 40% of the market, currently it covers over 50% of global transport markets, which means an increase of over 10 percentage points in a few years (McKinsey & Company, 2016). According to John D. Schultz, e-commerce sales were to reach

2.4 billion dollars in 2018. The demand for last mile logistics is constantly growing (Robinson, 28.12.2018). The expected increase concerns the transport of various types of products, including clothes, food, medicines, electronics, etc.

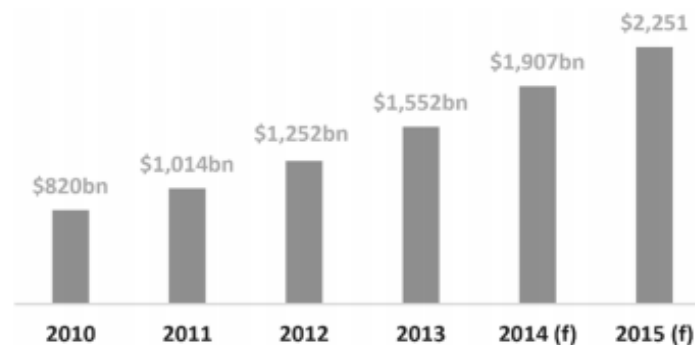


Figure 2. The increase in sales in e-commerce within the B2C market since 2010. Adapted from: Global B2C E-commerce Report, 2014. (access. 28.12.2018).

From the logistical point of view, the physical delivery of products purchased via the Internet is one of the most difficult distribution problems to solve. This is due to the variety and amount of shipments delivered to customers. The last mile is a challenge for logistics operators because e-consumers are increasingly buying online not only small items, but also products of larger sizes, e.g. furniture or home electronics/appliances, while expecting from sellers an inexpensive and efficient delivery as in the case of small shipments.

The last mile, apart from the fact that it is the key to customer satisfaction, is the most time-consuming and the most expensive part of the transport of goods. The last mile represents 53% of total shipping costs. With the increasing ubiquity of the so-called "free delivery", customers are looking for the cheapest form of delivery, which is the reason why logistics operators are looking for new solutions in the last mile transport (Shelagh, 2018). According to a study by McKinsey & Company in China, Germany and the United States on a group of 4700 respondents, 25-30% of consumers buying online would be able to pay more for delivery, only if it was made on the same day. The remaining 70% still prefer the cheapest delivery option. Despite lower and lower costs of delivery, the expectations of couriers are still growing. The standard is the ability of monitoring the product purchased online and the option of a free return in the event of dissatisfaction. The requirements of the recipients stimulate competition between transport companies about themselves (Brach, 2018).

4.2. Possible solutions to the last mile problem

Capital expenditures that should be borne by IT systems, infrastructure and people in order to improve or create a new distribution system that would allow entrepreneurs operating in virtual space to reach a distributed customer base would be huge. Therefore, many enterprises provide "last mile" service to specialised companies (Cichosz, and Pluta-Zaręba, 2011). Many of them, as a solution to the transport of last kilometre problem, offer delivery of products to the customer's chosen delivery points. An example of such enterprise is UPS, a company

which offers their consumers to send or receive a package at UPS Access Points, most of which are available 24 hours a day. Louis DeJianne, director of consumer goods, retail and marketing at UPS, says "Urbanisation of our population means that UPS and other carriers are looking for alternative ways of efficient delivery" (Mantey, 2017).

An innovative solution of the last mile transport, which is in the testing phase, is the use of drones. Mercedes-Benz together with Matternet has built a concept delivery vehicle that is a combination of autonomous drones on the roof of the vehicle with a robotised parcel sorting system. The invention debuted in January 2017 at the Consumer Electronics Show. Its purpose is not only to shorten the delivery time of packages, but also to sort them. Unlike a standard delivery van, packages are not loaded one after the other, but in groups. The interior space of the vehicle extends and is replaced by a new one, completely filled with parcels. During the ride, the packages are placed inside by a robotic arm in such way that the goods closest to the door are delivered first. After the driver reaches the place, the robotic arm loads the parcel to the drone located on the roof, which then delivers the goods to the address indicated. Each time the drone is on the roof of the vehicle, it is hooked up for loading, so it is always ready for use. Unfortunately, despite the high innovativeness of the delivery vehicle with the drone on the roof and the robot's hands inside, this technology will not be used in the nearest future due to the large number of obstacles accompanying the use of the drone. There are legal provisions that expressly stipulate that the drone should be in sight, which would make delivery of parcels very difficult. Another obstacle is the range of adhibition of this innovative technology and the spatial limit of the drone, which will not be able to serve flats in the blocks, but only detached houses and pickup points for shipments (Mantey, 2017).

The second innovative solution in the testing phase proposed by Starship Technologies is the use of six-wheeled transport robots. Their main task is to deliver a package or groceries from the store to a specific recipient. The service is ordered via a mobile application. During transport, for safety reasons, the robot rack in which the shipment is located is closed. It can be opened only by the recipient with a special, previously generated access code. The way of delivery is monitored, so it is possible to check where the ordered item is at any time. A big limitation of robots is the range, which covers only three miles, and the capacity of the trunk, which prevents the transport of large shipments. However, producers believe that robots are perfect for urban space because they move safely and do not threaten residents and the environment. They could therefore be used as literally last mile deliveries. The aim of creating this innovative solution was the possibility to request delivery at any time of the day or night.

Another solution for the last mile transport is the usage of a traditional bicycle or a bicycle with additional electric drive. The solution will be suitable for the delivery of parcels with relatively small dimensions and limited weight. This is one of the most likely ways of delivery to implement. The usefulness of this method of transport is evidenced by the fact that many companies have been oriented to deliver in this way. Although the concept is not new, it has

gained its great supporters in recent years. Freight bicycles are already being used in many European cities, Denmark and the Netherlands are the leaders of such solution (Ivan, 2015).

A similar solution in Utrecht, Amsterdam and Frankfurt was introduced by DHL courier company. Delivery bikes used by them, so-called CubiCycles are a combination of four-wheel and a stable bike with a container base with a cubic meter capacity. One vehicle can hold up to 125 kg of shipments. In order to relieve the driver of the bicycle, an additional electric drive has been installed. The appearance of CubiCycle caused the necessity of creating new mobile distribution points located in city centres, thanks to which transport bicycles can be loaded even several times a day. The proposed solution reduces annual CO₂ emissions by 16 tons per year, which makes it environmentally friendly. Additionally, thanks to CubiCycle, the number of shipments delivered increased, from 6-7 pieces per hour transported by car, to even 10 delivered by bicycle. This is caused by the omission of congestion in crowded cities.

Another one option offered to enterprises in solving the last mile problem is the so-called sharing economy. It is a concept referring not only to urban logistics and transport, but also to the hotel industry or the cultural sphere. The solution consists in sharing unused resources. An example is Uber, which gives drivers the opportunity to earn money by allocating their unused resources - time and vehicle - to transport people where they need to go. Applying this solution in last mile logistics would enable delivery of the ordered parcel even on the same day, provided that the product would be available in stock. After confirming the order, the seller would send information to the carrier about the availability of the goods and the possibility of picking them up, which would then start looking for a free driver willing to transport the shipment. Unfortunately, the disadvantage of such a solution is spatial limitation.

The evolving internet services market has created the need to allow customers to pick up the shipment in the afternoons and on weekends. For this reason, in recent years, the popularity of the so-called parcel machines increased. In 2017, according to the report "E-commerce w Polsce 2017. Gemius dla e-Commerce Polska", the pick-up in the parcel machine was the second most-popular delivery form, just after the delivery by a courier. Currently, there are 3,000 InPost parcel machines with a total of 270,000 caches in Poland. Customers choosing this method of delivery do not have to worry about delivery times. The possibility of receiving a package is being informed by a text message in which there is a special code to open the locker. For a pick-up of a parcel, a customer has 48 hours after receiving the message. The customer chooses the parcel locker to which the goods are to be delivered, and its collection can take place even at night (InPost, 05.01.2019). In order to ensure sustainable development of cities, it is necessary to look for new solutions and business models regarding the design and use of the city's logistics infrastructure (Kauf, 2018).

5. Summary

The transport of the last mile is currently determined by traditional combustion cars, which adversely affects the urban environment. The last part of the delivery of the goods is the most expensive from the point of view of the total transport costs and the least effective. The development of e-commerce has contributed to the need of searching for new transport solutions by carriers. Traditionally, parcels are delivered by courier to the address indicated. However, consumers are increasingly choosing other methods of delivery. In recent years, so-called parcel lockers from InPost, offering the option of picking up the package at any time, have become popular. The problem of last mile transport is still current, which is why companies are looking for more and more revolutionary solutions. An example is the use of electric-assisted drones or bicycles. However, it should be noted that not all transport methods are acceptable by law, so each new solution requires a thorough check, and only later can it be applied in practice.

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