

PARCEL LOCKERS: SUCCESS FACTORS AND CURRENT DISTRIBUTION IN 28 EUROPEAN COUNTRIES

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Abstract. COVID has pushed the growth in the share of online retailing to even higher levels than those seen before the pandemic. Last mile logistics faces specific problems related to delivery efficiency, customer service and sustainability, especially in urban areas. In this context, (white-label) parcel lockers have emerged as a solution. They generate numerous benefits for all stakeholders involved in the delivery process. This paper gives a comprehensive analysis of the scientific literature on parcel lockers (in the context of pick-up and shipment processes for B2C parcel shipments), highlighting the most important characteristics and success criteria for parcel lockers with a specific focus on environmental benefits. Based on extensive internet research, it also provides an overview of the distribution and density of lockers in 28 European countries.¹

Keywords: parcel lockers, last mile, sustainability

1 INTRODUCTION

Increasing urbanization worldwide and the sharp increase in online retail's share of total (retail) trade volumes are posing new challenges for logistics, especially in urban agglomerations. This is particularly true in terms of the "last mile" – the final step in the delivery chain, which is usually handled by courier, express and parcel (CEP) service companies. Innovative solutions are increasingly being sought here because this part of the delivery (or collection) process generates high costs. In addition, customers' needs are not yet being fully satisfied and there is a significant need for optimization regarding sustainability. One such innovative solution, parcel lockers have increasingly been used worldwide in recent years. The limited academic literature on this topic defines parcel lockers as unattended boxes that are used to drop off and pick up parcels and which can be accessed by consumers around the clock thanks to electronic encryption technology. [10] Lockers take two forms: closed systems, i.e. proprietary systems that are only used by one logistics provider (e.g. Amazon

¹ This research was conducted as part of the "Vienna out of the Box" project, with which the City of Vienna is currently seeking to implement a white label network. Go to www.wienbox.at for further information.

Locker and Post AT Box in Austria), primarily for internal efficiency reasons; and open, universal, neutral or operator-independent box systems (referred to as white-label boxes), where the principal focus is on technical integration of all CEP service providers into the respective system on the basis of a commercial agreement (in Austria: e.g. A1 Parcel Stations, Variocube and Myflexbox). White-label (universal) parcel lockers are a more efficient solution which can generate significant benefits for all stakeholders. Universal systems give online retailers and delivery service providers access to all parcel lockers in the network concerned, as well as enabling retailers, for example, to offer click-and-collect services. Universal parcel lockers can be operated by logistics companies, other private sector companies or the public sector. [9]

Methods

A comprehensive literature search was carried out using the most relevant databases, such as Ovid, Pro Quest, EBSCO, Emerald and Science Direct. 40 publications on the subject were identified and categorized by methodological approach. Most of the studies used purely quantitative approaches (22), while only a few chose a mixed method (qualitative and quantitative) approach (6). The number of papers that included surveys (15) or simulations or modelling (14) was almost identical. In contrast, only 12 purely qualitative approaches were found.² Based on extensive internet research, the distribution and density of lockers in 28 European countries was researched. For each of those countries, the e-commerce share of the total trade volume was added to clarify whether this could explain the different density of lockers. [1]

2 EVALUATION

2.1 THE DISTRIBUTION OF PARCEL LOCKERS

Despite the economic, cultural and social differences between residents of different cities in Europe, and between cities themselves, both parcel volumes and environmental awareness are developing uniformly across the continent. [10] We compared the total number of lockers, locker density per 10,000 inhabitants and possible connections to the share of e-commerce as a proportion of total trade volume for 28 European countries.³ A total of 62,886 lockers were identified, with the largest numbers in Poland (17,300), Germany (8,031) and Ukraine (7,065). On average there are 1.12 parcel lockers per 10,000 inhabitants in Europe. Estonia ranks first with a figure of 9.33, followed by Denmark with 5.48 and Poland with 4.57. Parcel lockers are particularly common in the Baltic and Scandinavian⁴ states (Estonia was

² A detailed tabular chart can be found in [1].

³ The complete list of all 28 countries can be found in [1], as of 09.2021

⁴ With the exception of Sweden, which has a lower average locker density than the European countries analyzed.

mentioned above). Lithuania has 982 lockers, which is equivalent to a density of 3.51, followed closely by Latvia with 624 lockers (density: 3.30). Finland (2,200) operates nearly 700 more lockers than Norway (1,560), but both have a far higher density than the European average: Finland's is 3.97 and Norway's 2.88. [1] E-commerce's share as a percentage of total trade volume in 2020 puts the spread of parcel lockers into context. The European average is approx. 18%. Belgium (31%), the Czech Republic (30%) and Denmark (29%) are the European leaders in e-commerce distribution. The correlation between the share of e-commerce and the number of parcel lockers per 10,000 inhabitants was tested using a linear regression analysis. No significant effect for the size of the share of e-commerce ($\beta=0.013$) can be determined, nor is there a variance clarification ($R^2=-0.038$; $p=0.83$) that could suggest a correlation. Therefore, we can conclude that the density of lockers in the countries studied cannot be explained by the share of e-commerce. [1]

2.2 CRITICAL SUCCESS FACTORS FOR PARCEL LOCKERS

Basically, we can identify four critical success factors: location, costs, environment and customer satisfaction. Location is the most important factor because it has a decisive impact on the other three. A poor location results in extra costs, lower customer satisfaction and no environmental benefits. Although the importance of location is obvious, there is no universal approach to siting parcel lockers. [9] With regard to the environmental benefits, however, the distance between the consumer and the locker must be no more than 0.94 km, otherwise the environmental benefit of parcel lockers compared to doorstep delivery in terms of CO₂ savings is lost, due to the use of cars as a form of individual transport, which is supposed to be avoided as environmentally harmful. [5] Basically, the introduction of a (universal) parcel locker system without existing infrastructure entails the highest costs, although this means that the maintenance of individual parcel lockers can be kept within limits. [6] The literature therefore refers to public private partnerships. [8] At this point, it should be mentioned that white-label systems are not only the most effective solution, but also the cheapest, especially when it comes to implementation costs in large areas. The time savings and resulting reductions in delivery costs represent the key cost advantage for delivery service providers. With optimal use of resources potential savings of 50% in terms of time and 24% in terms of distance travelled can be estimated. [2], Therefore a fully implemented universal system of parcel lockers can reduce the distribution costs for parcel delivery on average according to the literature by 40%. [9] Provided a suitable location is selected, parcel lockers also have positive effects on the environment mainly due to the reduction of the delivery distance and the overall increase in efficiency of delivery. [12] The highest potential cut in emissions at the parcel service provider level is two-thirds in urban areas⁵. [5] The estimated average potential

⁵ In extra-urban areas, the potential reduction depends even more closely on the location of the parcel locker, but it is around 90% of the total amount (kg) of CO₂ emitted per parcel due to the lower settlement density. [5]

CO₂ savings vary between 35% [3] and a maximum of 40% [12]. The introduction of parcel lockers in a city the size of Graz (approx. 637,000 inhabitants) would not only save 263,289 vehicle kilometers per year, but also 44 tons of CO₂, 130kg of nitrogen oxides and 2kg of PM10 (particulate matter). [7] Customer satisfaction is a complex and barely researched sub-area. But we can state that a) 38.2% of customers are willing to spend 5 to 10 minutes more in order to be able to use a parcel locker service, while only 6% would not accept any additional time expenditure [10], and b) younger sections of the population are even willing to pay more for the delivery service if it is a more environmentally friendly type of parcel locker service. This observation remains constant across different income groups. [11]

3 CONCLUSION

Parcel lockers are a new city logistics trend that is now firmly established in Europe, especially in the Baltic and Scandinavian states and Poland. But there is no connection between locker density and e-commerce's share of total trade across the 28 European countries examined. However, the City of Vienna's "Vienna out of the Box" project aimed at implementing a white-label network must be viewed as a pioneering initiative, because most of the European networks currently in place are specific networks (often implemented by the national postal services) that (more or less) integrate other CEP service providers. White-label parcel lockers can be seen as an innovative solution in the context of the last-mile problem, which creates benefits for all stakeholders and the environment. In order to realize the positive environmental effects, critical network density and, above all, location selection are crucial. In the future, city logistics networks will use parcel lockers not only as delivery and collection points, but also as alternative transshipment points for platform transactions (e.g. goods deliveries for transactions conducted on sites such as willhaben.at) and for click-and-collect purposes.

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