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Working Paper

Parcel locker stations: A solution for the last mile?

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No. 2

Parcel locker stations: A solution for the last mile?

Antonia Niederprüm
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Abstract

Postal outlets and parcel shops are increasingly complemented by parcel locker stations. This paper explores the potential reasons for varying trends in the use of parcel locker stations in Europe and discusses the role of parcel locker stations in e-commerce delivery. The paper aims to identify challenges and key drivers for the development of networks of parcel locker stations based on case studies for a selection of countries. It analyses typical business models and discusses the economic reasons for the dominance of exclusively operated networks. The country studies show that establishing a parcel locker network requires significant investments and a dedicated digital strategy by the respective operators. We expect that the increased use of parcel locker stations in Germany will require significant incentives to motivate users (senders and recipients) in choosing this delivery method above home delivery.

Keywords: Parcel locker stations, e-commerce delivery, delivery options

JEL Classification: L20, L81, L87

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Summary

Parcel lockers present an alternative delivery option to the traditional delivery methods, i.e. home delivery or postal outlets / parcel shops, and have gained popularity in recent years largely due to growing e-commerce, especially during Covid-19 times. The attraction for parcel lockers is rooted in the flexibility it offers for both delivery and collection of parcels. It significantly improves first-time delivery success rates, lowers delivery costs and eases capacity constraints by providing a single drop-off point to carriers. For recipients, collection of parcels are still relatively convenient at locations that are close to home or on daily commute and typically accessible after hours. For online sellers, it offers an additional delivery option to their customers and delivery fees to parcel locker stations are generally lower compared to home delivery. Furthermore, by shortening the distance that carriers have to travel between delivery points thereby reducing their CO2 emissions, parcel locker stations could also present a more environmentally friendly delivery option.

The spread and use of parcel locker stations vary widely across Europe. In some countries, such as the Nordic countries, the Baltic States and Poland, there are large and dense networks of parcel locker stations that are widely accepted as the preferred delivery method. The operators have found innovative solutions for last mile delivery to improve access and operability, including the use of advanced technologies, e.g. integrating electronic systems and wireless transfer of information between online retailers, deliverers and recipients, as well as enabling contactless parcel pick-up through the use of mobile applications. In the majority of cases, these networks are operated exclusively by one operator (often national postal operators), as they are seen as a competitive advantage. In a few cases, open networks of parcel locker stations have been established, which are attractive for postal and parcel service providers whose B2C parcel volumes are not yet high enough to make it profitable to invest in their own network.

In Germany, there is a large network of parcel stations with the DHL Packstations, but, at the end of 2020, it had a significantly lower density than the networks in the comparator countries. Also, home delivery is still by far the preferred delivery method among consumers in Germany. The planned expansion of the network by Deutsche Post DHL is an indication that parcel locker stations are likely to play a greater role in last-mile delivery. However, as in the comparator countries with high usage, stronger price incentives for senders would be needed to encourage the use of the delivery method.

1 Introduction

It is a well-known fact that parcel volumes have been increasing in recent years largely due to growth in e-commerce, while letter volumes are declining. This presents new challenges to postal operators in terms of maintaining a high standard of service quality and addressing their capacity limitations in last-mile delivery of parcels. Parcel locker stations have emerged as one such solution enabling delivery vans to service a single delivery point for multiple parcels as well as improving the success rate of deliveries at the first attempt. Furthermore, fewer trips by delivery vans are expected to have a positive environmental impact as it reduces CO2 emissions of the carriers. From an online retailer's perspective, parcel locker stations offer an additional delivery option to their customers – perceived to improve service quality – and contribute to the convenience of parcel collection for recipients. Many online retailers also offer a free delivery service to parcel locker stations, making it an attractive option to buyers at the time of checkout. However, the use of parcel locker stations has not been as widely adopted or accepted in all countries across Europe.

This paper will explore and analyse the different reasons for varying trends in the use of parcel locker stations in Europe and discuss the future role of parcel locker stations in e-commerce delivery. In addition to the trends on the supply side, the paper will provide evidence on the usage of parcel locker stations by online shoppers. The paper aims to identify challenges and key drivers for the success (or failure) of parcel locker stations as an additional delivery option based on case studies for a selection of countries where parcel lockers play a prominent role in the last mile (including examples from the Nordic and Baltic countries, Poland, and Germany). Based on extensive desk research and interviews with stakeholders, the paper analyses the way in which parcel locker stations are organised and describes typical business models with special emphasis on the discussion of carrier-specific versus carrier-agnostic parcel locker networks. Based on international practice, we conclude with lessons learnt for the role of parcel locker networks in the German parcel market.

2 Typology of parcel locker networks

Parcel locker stations are automated machines consisting of compartments (lockers) that fulfil the role of providing a safe and reliable delivery point for packages that are too big to be delivered to a mail box. They are typically used for B2C deliveries, mainly due to the rise in e-commerce, and in some cases they can also be used for C2C deliveries or returns of goods that were ordered online. As a result, parcel lockers provide an alternative delivery option to home delivery, parcel shops, and post offices.

Parcel locker stations (terminals) come in different sizes in terms of the number of lockers they contain, ranging from compact terminals consisting of fewer than 15 lockers to large terminals that may contain in excess of 500 lockers (the largest parcel locker station in Europe was

Table 2.1: Technical specification of parcel locker stations

	Screen controlled	App-controlled (Bluetooth)	Smart Lock / IoT
Control interface	Touchscreen and Keypad Scanner (Bar-/Matrixcode)	Smartphone-App	Keypad
Connection	Electricity and internet connection required (mobile or fixed-line)	No connections required (battery operated and mobile data connection)	No connections required (battery operated and low frequency network, LPWAN)
Choice of location	Choice of location is limited (electricity and data connections required)	Flexible choice of location (mobile data network required)	Flexible choice of location (LPWAN required)
Usage	Usage by one person at a time	Usage by multiple persons simultaneously	Usage by multiple persons simultaneously
Important suppliers	KEBA (AT), InPost (PL), Cleveron (EE), Chinese suppliers (e.g. SNBC and Zhilai)		

introduced in Finland in March 2021 with 1,002 lockers).¹ The shape of the terminals is typically rectangular and made up of columns (modules) of variable-sized lockers stacked next to each other, depending on the requirements and the demand at a certain location. Generally, modules can be added or removed and the designs could in certain cases accommodate the installation of L-shape or U-shape terminals to optimise the space being used. Parcel locker stations typically stand between 150 cm and 220 cm tall and their depth ranges between 60 cm and 64 cm, while the total width is dependent on the number of parcel lockers (or modules) installed.

Accommodating for different sized parcels, the modules of parcel locker stations are configured to contain various sized lockers (compartments), i.e. variants of small, medium, and large compartments. The typical dimensions for the lockers may range between 8-75 cm x 35-40 cm x 60-64 cm (height x width x depth) depending on the supplier, and the configuration of the modules are generally adaptable to contain a specified number of certain locker sizes within the overall dimensions of the module. However, one limitation of parcel lockers is that not all parcels will fit within the specific dimensions of each parcel locker and, therefore, would require alternative delivery methods.

Parcel locker stations may also be found in various indoor and outdoor locations, contributing to the density of its network and making it convenient for consumers to collect a parcel at a place and time of their choosing. Indoor parcel locker stations are typically found in supermar-

¹ Posti (2021a).

kets and retail outlets or may also be available in shopping malls, hotels, and even inside some post offices or parcel shops. They are convenient to consumers who are then able to collect a parcel at the same location they use for shopping or located on a route they frequently use. Some of the downsides of indoor parcel lockers are that access to the lockers depends on the opening hours of the venue where they are installed, and the available space might restrict any expansion of the parcel locker station which in turn may lead to capacity constraints if the lockers are constantly full. In contrast, outdoor lockers that are typically located, inter alia, at train/bus stations, parking lots, or gas stations are typically accessible 24/7 providing even greater flexibility for consumers when collecting parcels, and are built to withstand extreme weather conditions. However, security risks may present itself, especially at night, in areas that may not be well lit or risk exposure to vandalism and possibly a greater risk of theft. Security cameras could be equipped on certain parcel locker stations to alleviate some of the security and safety concerns.

Access to lockers, for collection of a parcel by recipients or delivery by a carrier, can be provided in various ways. Traditionally, most parcel locker stations have a screen and/or keypad through which the recipient/carrier is able to enter a code that opens a specific locker. In some cases, a barcode scanner is equipped that will open a locker by scanning a label received by email or via a mobile app. Some parcel locker stations enable the use of both a screen / keypad and a mobile app for opening the lockers, while more modern machines use a screenless design and are solely operated by mobile technology (e.g. mobile app or Bluetooth). The screenless design of parcel lockers is steadily becoming more popular among users since they save space and costs by omitting a control module with a screen interface. Furthermore, in light of environmental consciousness, new parcel locker stations are starting to move away from fixed power supply and internet connection in favour of more eco-friendly solutions that use batteries to power the machines and rely on wireless broadband internet connections.

The general designs and features described above vary among the products and services offered by different suppliers of parcel lockers in Europe. In some cases, suppliers may only sell the hardware and software of their parcel lockers as products and services to postal service providers and parcel carriers. In other cases, suppliers may decide to operate their own parcel locker network and delivery services both nationally and abroad. The most prominent European suppliers of parcel locker stations identified in our research are Keba (Austria), Integer / InPost (Poland), and SwipBox (Denmark).

These suppliers of parcel locker stations use different approaches and business models depending on the country they are active in or the type of customer that uses their product as part of a parcel locker network. Parcel locker stations do not vary much in terms of their hardware designs and functionalities. The main differences stem from technological and eco-friendly innovations such as switching from fixed-line power and internet connections to machines that are battery-operated and use wireless broadband internet, or enabling contactless interaction

via the use of a mobile application or Bluetooth to open a parcel locker. These changes have largely improved the ease of installation and/or relocation of parcel locker stations and contributed to cutting costs in installation and maintenance. Furthermore, an integrated system enables all users (carriers, maintenance personnel, and consumers) to receive real-time information whether it is tracking of parcels, finding parcel locker locations with available slots, or reporting a defect of a parcel locker station.

The operation of parcel locker networks depends on different business models regarding the accessibility of lockers to parcel carriers for the delivery of parcels as well as the accessibility to recipients based on the location of the parcel lockers. Some parcel locker stations are used exclusively by the operator of the network (carrier-specific or closed network), whereas other parcel locker networks may be shared between multiple parcel carriers (carrier-agnostic or open network). Furthermore, some parcel lockers may be installed in the lobbies of residential and office buildings, thereby restricting its use to those residents / employees and are not publicly accessible. This type of solution is more typically found in densely populated urban areas. For the purpose of this study, the focus is only on those parcel locker stations that are publicly accessible to all recipients. A summary of the typology of parcel locker networks is provided in Table 2.2, and a more detailed description on the different business models of parcel locker networks is provided in Section 4.

Table 2.2: Typology of parcel locker networks

Criteria		Distinctions and Descriptions
Access	Exclusive access	Only the operator offers parcel locker stations as a send/receive station
	Open access	Multiple delivery companies (and other enterprises) are able to offer parcel locker stations as a send/receive station
Locations	Publicly accessible locations	No limitations to access Indoor: Inside buildings (Access dependent on opening hours) Outdoor: In open public spaces (24/7)
	Locations in residential buildings and office buildings	Access is limited to residents ("Residential parcel locker") or employees in office buildings ("Office parcel locker")

Notes: Focus of this study is restricted to the grey shaded areas

3 Parcel locker networks in Europe

3.1 Distribution of parcel locker stations

Diverging trends in letter and parcel volumes (including small packages containing merchandise) are driving the transformation of national postal operators into more parcel-oriented ser-

vices. Some national postal operators have distanced themselves from the daily delivery of letters to all households by switching to alternate-day (or even less frequent) delivery models. In contrast, quality of parcel delivery (particularly B2C) has improved with next-day delivery as the new standard in many countries. The European Regulators Group for Postal Services (ERGP) reported that, since 2015, the total number of parcels have increased from 5.07 billion to 7.15 billion, or by 9.2% p.a. on average, while letter post volume declined by 5.3% p.a. across the ERGP member countries (2015-2019).² The COVID-19 pandemic and resulting lockdowns have further boosted e-commerce sales as well as the number of online shoppers. Eurostat reports that the share of individuals with online purchases during the last 12 months increased from 60% to 65% between 2019 and 2020 in the European Union (EU-27).³ This jump in online purchases resulted in growing parcel volumes for national postal operators as well as parcel and express carriers in 2020.

- Many national postal operators (universal service providers) reported significant increases in parcel volumes: e.g. Deutsche Post DHL reported a 15% increase in 2020;⁴ PostNL's parcel volume increased by 19%;⁵ La Poste (colissimo),⁶ Royal Mail,⁷ and Austrian Post⁸ achieved growth rates around 30%; PostNord Sweden reported an increase of 23%, and PostNord Denmark had a growth rate of 37%.⁹
- The European parcel carriers DPD and GLS reported significant increases in their parcel volumes: at GLS, parcel volume increased by 23% to 614 million items (April-December 2020),¹⁰ and at DPD the number of parcels increased by 24% to 1.87 billion items. Moreover, DPD reported that the share of B2C parcels reached 55% of total parcel volume.¹¹

The jump in B2C parcel volume presented challenges to postal and parcel operators which resulted in the need for more capacity in sorting, transport and, not least, delivery ('the last mile'). Home delivery is particularly costly because of the increasing number of time-consuming stops associated with one-parcel-delivery and significant rates of unsuccessful first-time delivery attempts. Consequently, for years, parcel and postal operators have been extending the delivery (and return) options for parcels by increasing the number of alternative pick-up drop-off points ('PUDOs') such as parcel shops and parcel locker stations. "Out Of Home" (OOH) delivery, i.e. delivery to PUDOs, is seemingly becoming increasingly important.¹² Moreover,

² ERGP (2020b), p. 41.

³ Based on Eurostat, until [isoc_ec_buy] and 2020 [ISOC_EC_IB20]. In Germany, for example, the share increased by 4 percentage points from 79% to 83%.

⁴ Deutsche Post DHL (2021), p. 14.

⁵ See PostNL (2020, 2021).

⁶ CEP Research (2021a).

⁷ Royal Mail Group (2021).

⁸ Austrian Post (2021).

⁹ PostNord (2021a), p. 7-8.

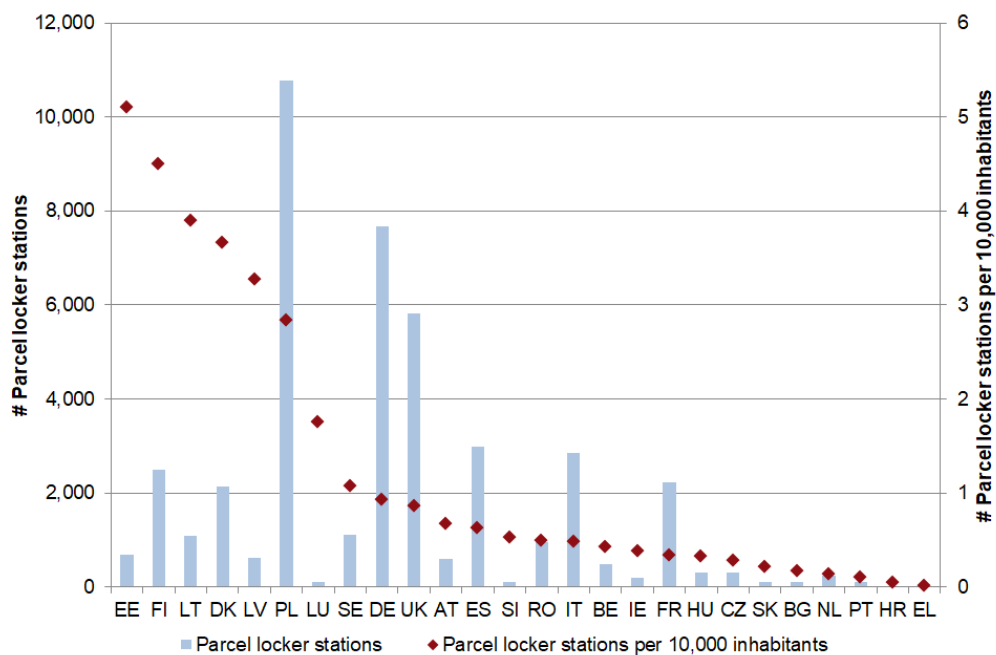
¹⁰ Royal Mail Group (2021).

¹¹ CEP Research (2021a).

¹² DPDgroup estimates OOH deliveries to rise to about 25% of total consumer deliveries by 2025, CEP Research (2021a).

the handling of returns requires simple and easily accessible collection points where parcels can be dropped off. These trends are confirmed by statistics on “postal establishments” and parcel lockers collected by the European Regulator Group for Postal Services (ERGP). They report that, between 2015 and 2019, their number increased by 16% to nearly 180,000 outlets driven by the increasing number of parcel shops.¹³ The number of parcel locker stations increased by 57% within one year from 19,344 (2018) to 30,338 (2019).¹⁴

Figure 3.1: Total number of parcel locker stations and density per 10,000 inhabitants by country (2020)



Source: Own calculation based on data collected from publications of operators and market studies of national regulatory authorities, complemented by Last Mile Experts (2021).

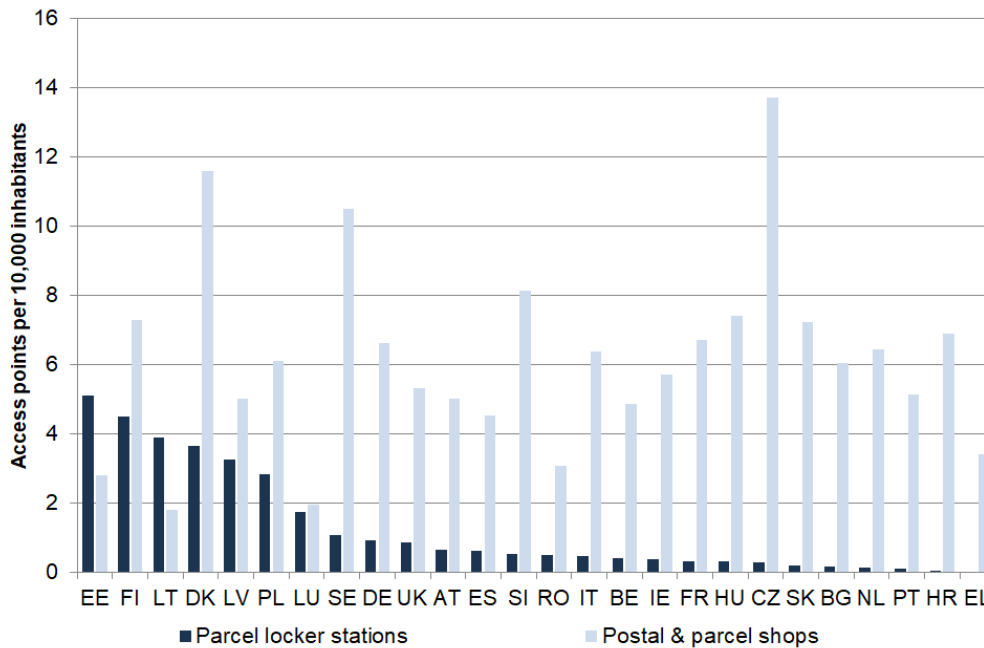
Figure 3.1 shows the number and density of parcel locker stations in the European Union¹⁵ and the UK in 2020. Based on extensive desk research complemented by information provided by a recently published report of Last Mile Experts (2021) we estimate that the total number of parcel locker stations exceed 44,000 in European Union and UK. In absolute terms, the largest numbers can be found in Poland, Germany and the UK. However, in relation to the country size (measured by the total population) the situation is different. The densest number of parcel locker stations can be found in the Baltic countries, Poland, and the Nordic countries Denmark and Finland.

¹³ ERGP (2020b), p. 60.

¹⁴ Ibid, p. 72.

¹⁵ Malta and Cyprus are excluded.

Figure 3.2: Density of parcel shops and parcel locker stations per 10,000 inhabitants by country (2020)



Source: Own calculation based on data collected from publications of operators and market studies of national regulatory authorities, complemented by Last Mile Experts (2021).

Notes: Extremely high figures in the density of parcel shops in some countries (e.g. in Denmark, Finland, Sweden and Czech Republic) indicate that parcel shops might be double-counted because retail outlets offer pick-up and drop-off services for more than one parcel service provider.

The density of parcel locker stations varies considerably among 26 European countries from more than five stations per 10,000 inhabitants in Estonia to less than one station in nearly two third of the countries (starting with Germany). In most countries, the number of parcel shops per 10,000 inhabitants is considerably higher than the number of parcel locker stations, see Figure 3.2.

During 2020, the networks of postal outlets and parcel shops were partly hit by the closure of stationary retail shops during the respective country lockdowns.¹⁶ Alongside social-distancing requirements, the lockdowns led to the increasing attractiveness of parcel locker stations as an alternative for home or parcel shop deliveries. Announcements of parcel carriers and national postal operators indicate that the number of parcel locker stations will increase in the next years:

- Deutsche Post DHL plans to raise the number of parcel locker stations (“Packstationen”) to 12,500 by 2023.¹⁷

¹⁶ See ERGP (2020a), p. 12-13.

¹⁷ Deutsche Post DHL (2020b).

- Polish InPost increased the number of parcel locker stations by more than 2,500 in 2020 and plans to expand the total number to 14,500-15,500 locker stations in the near future.¹⁸
- The Norwegian postal operator, Posten, plans to roll out 3,000 parcel locker stations at 1,000 locations during 2021.¹⁹
- Nærboks, managed by Nordic Infrastructure, a joint venture of PostNord Denmark and SwipBox (a manufacturer of parcel locker stations), rolled out more than 2,200 parcel locker stations in Denmark by March 2021.²⁰
- PostNord Sweden tested SwipBox parcel locker stations in Stockholm and decided to roll out 2,500 of these parcel locker stations by the end of 2022.²¹
- Finnish Posti significantly raised the number of parcel locker stations in 2020 and announced the expansion of its parcel locker network to 4,000 in the near future.²²
- DPDgroup announced that they plan to increase the number of parcel locker stations to 30,000 in Europe.²³ For 2020 they reportedly provided access to a total of 1,594 parcel locker stations in France, Denmark, Finland, the Baltic countries, Portugal, and Spain.²⁴ In many cases, they access existing carrier-agnostic networks of parcel locker stations.

These announcements fuel expectations that the density of parcel locker stations will significantly increase in many countries, including Poland, the Baltic and Nordic countries, and Germany. Moreover, the acquisition of Mondial Relay by InPost may further drive the establishment of parcel locker stations in France, Spain, and Belgium.²⁵

3.2 Demand for deliveries to parcel locker stations

Consumer surveys among online buyers provide some indications on the share of online buyers having used / preferred parcel locker stations as a delivery option among European countries. The most recent survey was conducted on behalf of PostNord among 12 European countries in the 2nd quarter of 2020.²⁶

¹⁸ InPost (2021a), p. 139.

¹⁹ CEP Research (2020b).

²⁰ Naerboks.dk, accessed 4 March 2021.

²¹ CEP Research (2021a).

²² Posti (2021a).

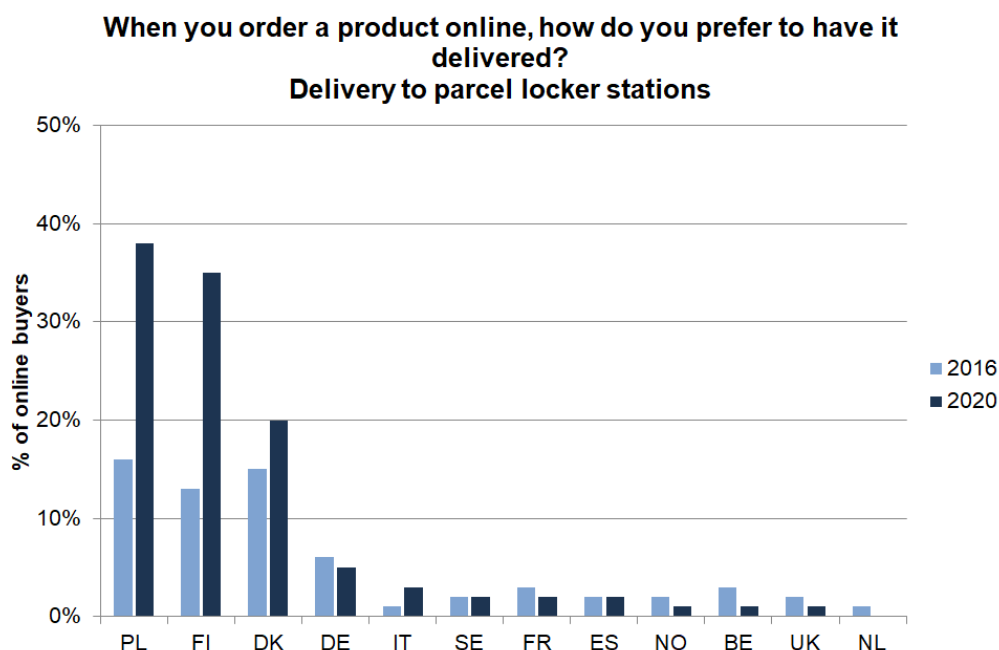
²³ Geopost DPDgroup (2021a), including Russia.

²⁴ Geopost DPDgroup (2021b), excluding Russia (with in total 3,394 parcel locker stations).

²⁵ See InPost (2021b).

²⁶ See PostNord (2020).

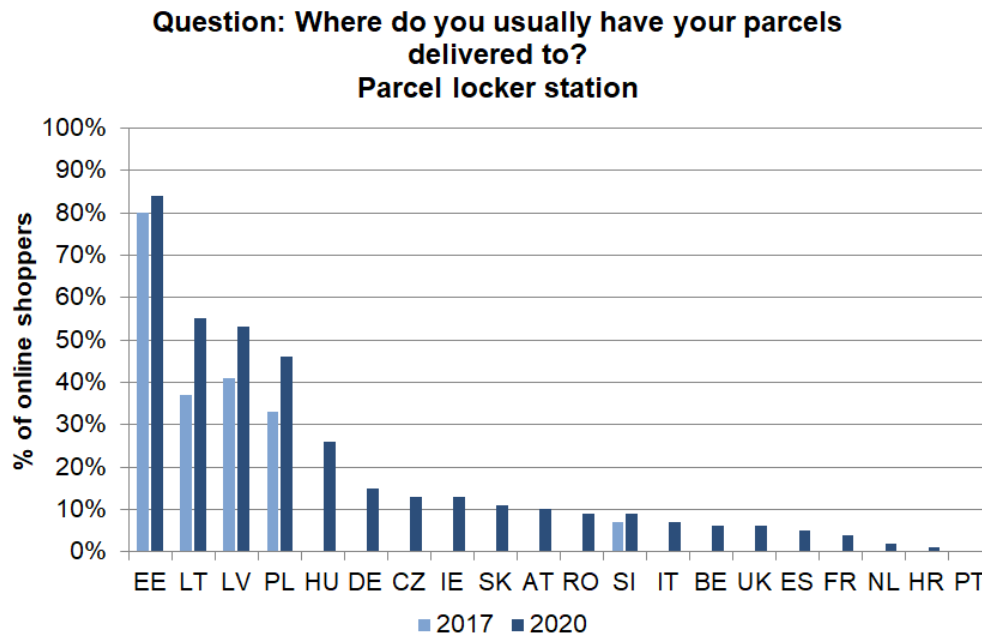
Figure 3.3: E-commerce in Europe: Preference for delivery to parcel locker stations (2016 and 2020)



Source: Based on PostNord (2016a, 2016b, and 2020). The 2020 consumer survey was performed in the 2nd quarter 2020.

The PostNord e-commerce surveys provide time series information for delivery preferences and usage. The results of the PostNord surveys show that the preference for parcel locker stations as delivery option by online buyers (1) considerably vary among European countries and (2) increased in recent years (see Figure 3.3). In Denmark, Finland, and Poland, the share of online buyers preferring parcel lockers increased significantly. In the remaining countries, preference for delivery to parcel locker stations appears low except for Germany with a share of 5%.

Figure 3.4: E-commerce in Europe: Preference for delivery to parcel locker stations (2016 and 2020)



Source: Based on Geopost DPDgroup (2017, 2021c). The online shopper survey was performed in 2019 before the outbreak of the Covid-19 pandemic. This survey does not include the Nordic countries (FI, SE, and DK).

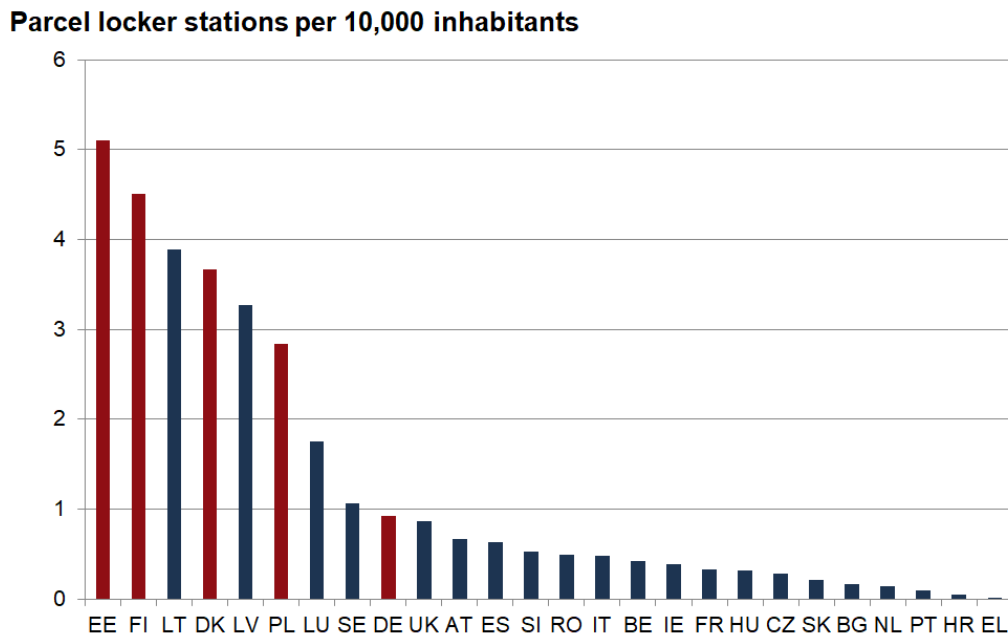
The most recent DPD E-shopper barometer confirms the picture on the role of parcel locker stations for online buyers and adds some information on the usage in smaller countries like the Baltics.

The analysis has shown that the supply of parcel locker stations and their usage for e-commerce deliveries significantly varies among European countries. For this reason we dive deeper into the eco-system of parcel locker networks in order to better understand the drivers and potential success factors for these networks.

3.3 Country studies

In this section, case studies are presented for five countries (Estonia, Finland, Denmark, Poland, and Germany) that have been selected based on four countries exhibiting some of the densest parcel locker networks in Europe (see Figure 3.5) and each country showcasing certain unique features and characteristics that are highlighted under each case study. The aim of the case studies is to provide a point of reference and comparison with the current situation in Germany from which lessons can be extracted that will be discussed later in the report.

Figure 3.5: Selection of countries for case studies



Source: Own research.

3.3.1 Estonia

Estonia is estimated to have the densest network of parcel locker stations by population in Europe, consisting of multiple competitive parcel carriers operating their own network of parcel lockers. The main parcel locker operators consist of Eesti Post (the national postal operator of Estonia and also known under its brand name Omniva), Itella (subsidiary of Posti from Finland), and DPD Estonia. DHL Express also has an independent network in Estonia, but on a smaller scale compared to the aforementioned players. The parcel locker situation in Estonia is found to relate closely to what is also evident in Lithuania and Latvia, and therefore it represents an example for parcel locker networks across the Baltic States.

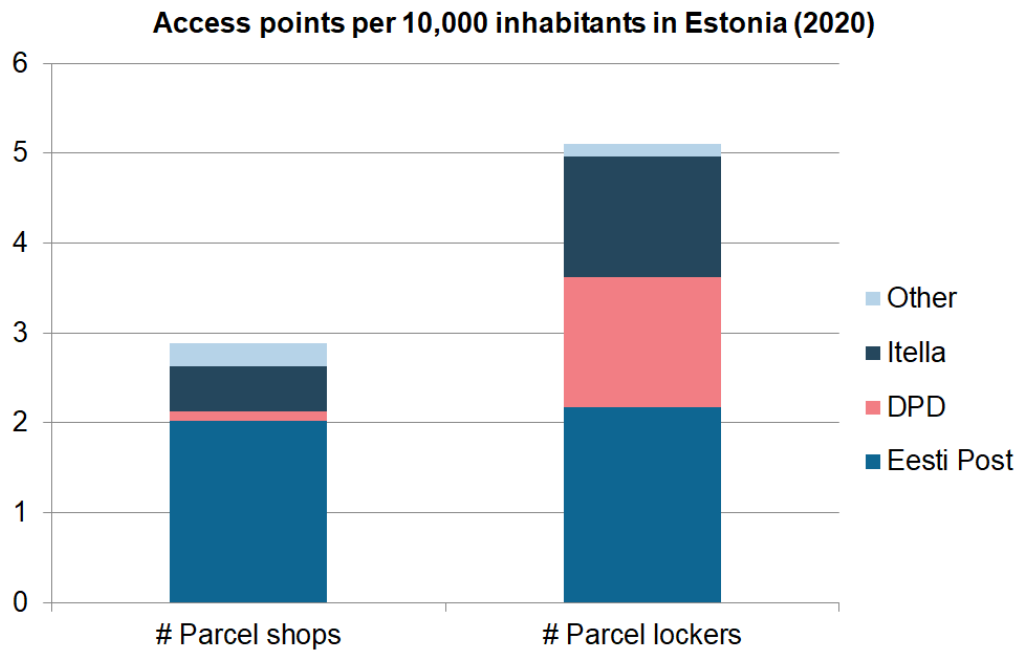
The individual parcel locker networks are operated exclusively by the respective carriers, with each carrier additionally operating their own networks of parcel shops. This implies that there is strong competition in the Estonian parcel market. It is worth noting that there are more parcel locker stations than the number of parcel shops present in Estonia (see Figure 3.6), which is unusual compared to other countries where parcel shops typically outnumber parcel locker stations by a significant margin. This may largely be a result of a high acceptance level by consumers and merchants of parcel lockers as a delivery option, or that the past infrastructure of parcel shops was not well developed (with exception EestiPost's network) leading to parcel lockers becoming a more viable delivery solution.

Table 3.1: Estonia: Key figures of parcel locker networks

	Omniva (Eesti Post)	Smartpost Itella	DPDgroup
Start	2011	2010	~ 2016
# of parcel locker stations (2020)	~290	~180	~190
Accessibility to carriers	Exclusive	Exclusive <i>Delivery partner of GLS and DHL parcel</i>	Exclusive
Location	Mostly outdoor	Indoor	Indoor and Outdoor
Control interface	Screen-controlled	Smart Lock (IoT)	Screen-controlled

Source: Own research.

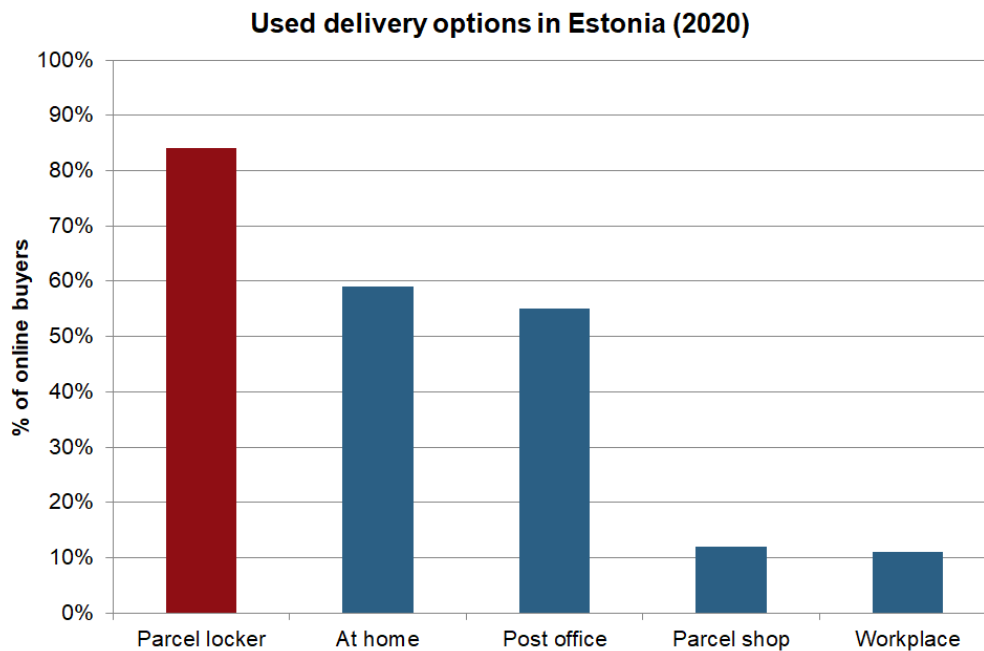
Figure 3.6: Access points per 10,000 inhabitants in Estonia (2020)



Source: Own Research.

Recent surveys have shown that parcel lockers are the most used delivery method by Estonian online shoppers, even more than home delivery (see Figure 3.7). Notably, parcel shops are even less used than the post office for the delivery of parcels, which further imply that parcel shop networks might not be well developed in Estonia. The evidence clearly suggests that parcel lockers are well accepted and that it is safe to assume that parcel lockers are the most preferred delivery method in Estonia.

Figure 3.7: Used delivery options in Estonia



Source: Based on Geopost DPDgroup (2021c).

Incentives for using parcel lockers may stem from it being the most affordable delivery option as many online merchants offer free delivery to parcel lockers above a certain value threshold.²⁷ For example, the listed prices for Omniva deliveries to parcel lockers are between 30-40% cheaper compared to home deliveries and roughly 5-20% cheaper than delivery to a post office, depending on the parcel size.²⁸ Parcels are also typically delivered sooner to parcel locker stations than to the home.²⁹ Furthermore, online merchants offer their customers a choice of their preferred carrier, thereby allowing them to choose the parcel locker station that is most convenient to them.

The parcel locker stations are generally screen controlled where recipients can enter or scan a code received by SMS or email to access the lockers; Itella Smartpost lockers use the same IoT / Smart lock technology as implemented by Posti in Finland (see Finland case study for a description). The parcel locker stations of all parcel locker carriers in Estonia are available to any user and do not require user registration, adding to the ease and convenience of its usability.

As a result of the popularity of parcel lockers in Estonia and the Baltic States, and ever increasing parcel volumes due to growing e-commerce, the named parcel carriers are planning

²⁷ Interview with the Estonian Regulator on 27 April 2021.

²⁸ Based on published price lists of Eesti Post.

²⁹ Interview with the Estonian Regulator on 27 April 2021.

further expansion of their parcel locker networks in all Baltic States, particularly focussing more on rural areas (Omniva).³⁰

3.3.2 Finland

Finland also presents one of the densest networks of parcel lockers and parcel shops by population in Europe. Consumers have exhibited a strong and growing preference for out-of-home delivery options (parcel lockers/shops) compared to home delivery, which sets it apart from the majority of countries where home delivery is still the preferred option. Furthermore, the use of Internet of Things (IoT) / Smart Lock technology and a '0G network' for the data transfer from parcel lockers as implemented by Posti also presents a unique and innovative case.³¹

Table 3.2: Finland: Key figures of parcel locker networks

	Posti	Lehtipiste/Pakettipiste	Smartmile
Start	~2010	2018	2018
# of parcel locker stations (2020)	2,062 <i>Planned: 4,000 (2023)</i>	~350	~70
Accessibility to carriers	Exclusive <i>Delivery partner of GLS and DHL Parcel</i>	Exclusive <i>Pakettipiste, DB Schenker, Matkahuolto, PostNord, DHL Express</i>	Open <i>DB Schenker, DHL Express, Matkahuolto</i>
Location	Indoor	Indoor	Indoor and Outdoor
Control interface	Smart Lock (IoT)	Screen-controlled	Screen-controlled

Source: Own research.

The majority of parcel lockers in Finland are operated by Posti (the national postal operator) as part of an exclusive network alongside its parcel shops and post offices. These parcel locker stations are primarily found indoors – due to the extreme weather conditions – in large retail chains (e.g. K-group, R-Kioski, and S-group stores) and at the same location as parcel shops on the premises of these stores. Since the retail chains in Finland typically have long opening hours (e.g. until 10pm or some are even open 24/7) it affords recipients plenty of flexibility to collect their parcels. It is also convenient for recipients who are able to collect parcels while doing their shopping. Posti recently announced that it has successfully tested the use of outdoor parcel locker stations which will be accessible 24/7, and plan to roll out more of them in areas where they do not receive space for indoor parcel lockers.³²

³⁰ See Omniva (2021).

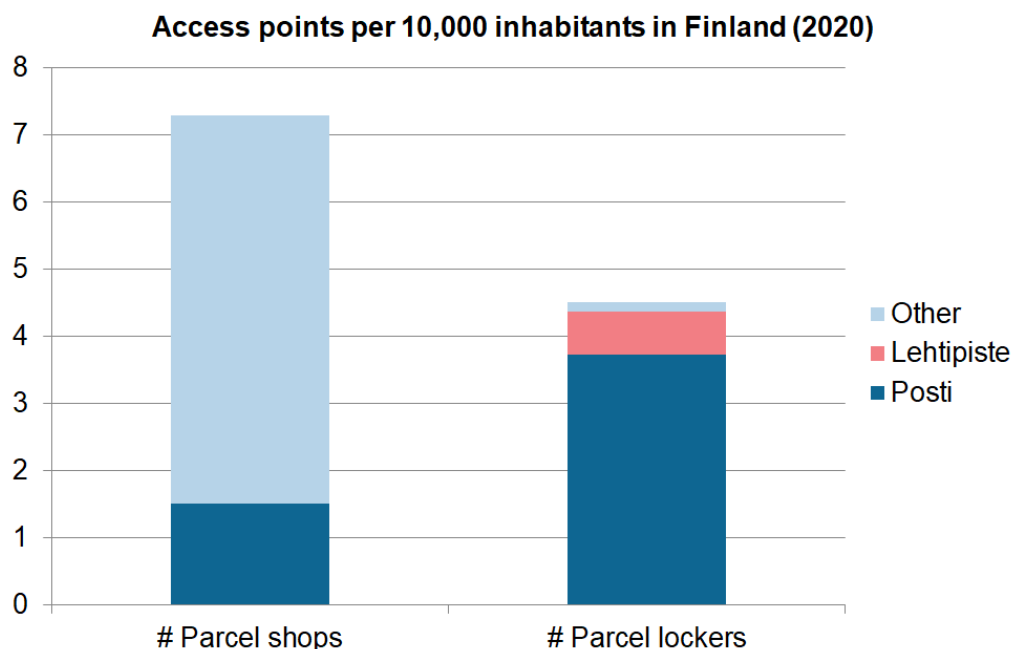
³¹ See Posti (2021b) and Sigfox (2020).

³² See Posti (2021b).

Other parcel locker networks have also emerged in recent years, namely Pakettipiste (operated by Lehtipiste Oy and uses SwipBox Classic parcel lockers) and Smartmile. Both offer carrier-agnostic networks allowing multiple parcel carriers to make deliveries to these parcel locker networks. While Lehtipiste is a parcel operator with own transport and processing logistics (under the brand Pakettipiste), Smartmile is a technology start-up without own logistics and therefore dependent on the cooperation with logistics partners notably parcel and express operators. This has enabled competitors in the B2C parcel delivery market such as Matkahuolto, DHL Express, PostNord, and others to also offer parcel locker deliveries and not only rely on parcel shops and home deliveries. These networks have particularly experienced a significant increase in utilisation during the Covid-19 pandemic. Nevertheless, Posti is still reported to have the largest market share among parcel carriers in Finland, delivering more than half of domestic parcels.³³

It is worth noting in Figure 3.8, that Posti operates more parcel locker stations than parcel shops mainly due to them sharing the same location and there being more than one parcel locker station installed per location. In contrast, other parcel carriers mainly still use networks of parcel shops for out-of-home deliveries, many sharing the same parcel shop which might have led to double counting, which explains the high density of parcel shops in Finland.

Figure 3.8: Access points per 10,000 inhabitants in Finland (2020)



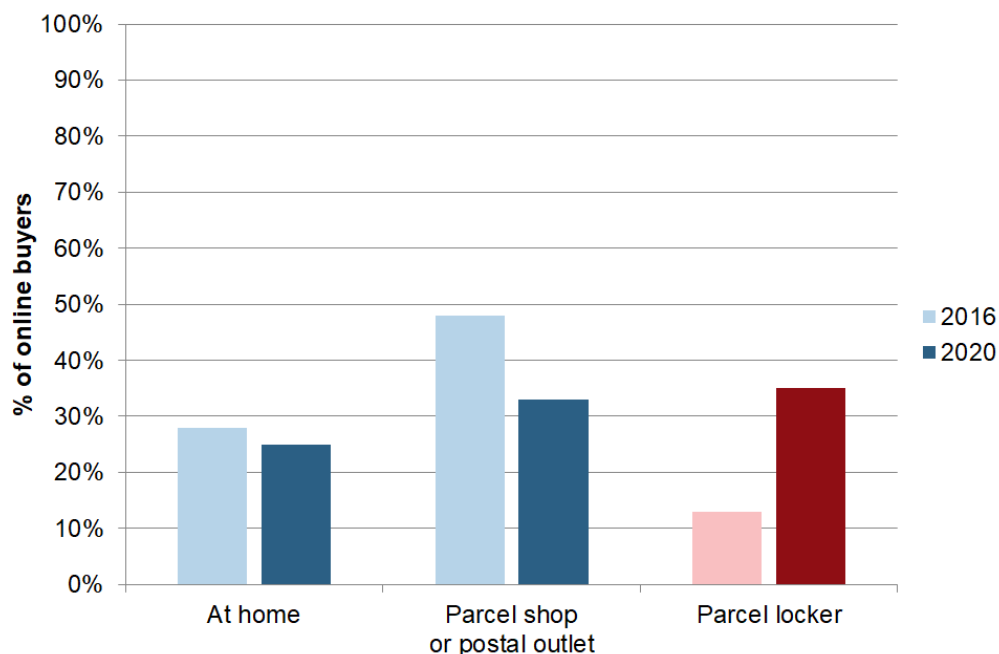
Source: Own Research.

³³ See WIK-Consult (2019) and PPTI (2019).

Finns have developed a strong culture for using and accepting parcel lockers / shops over the years with it becoming the preferred method of delivery (see Figure 3.9) – Posti reports that more than half its parcel volume is delivered to parcel lockers.³⁴ The following features play a significant part in contributing to the convenience of parcel lockers in Finland:

- Parcel locker stations are mostly located on the same premises as parcel shops and postal outlets affording recipients the freedom to choose where they want to collect a parcel – approximately 90% of Finns had collected at least one parcel from a parcel locker station in 2020.
- Parcel deliveries to parcel lockers are made more than five days a week – in large cities at least six days a week.
- Parcels that have been stored in parcel locker stations has to be collected within 7 days, whereas the storage time at parcel shops is limited to 14 days. Nevertheless, Finnish consumers typically collect their parcels, on average, approximately 24 hours after receiving the delivery notification. In fact, if a courier makes a delivery at 5 pm, 70% of parcels are picked up that same evening.³⁵
- Parcel lockers are also easy to access for all users since no registration is required.

Figure 3.9: Preferred delivery options in Finland



Source: Based on PostNord (2016, 2020).

³⁴ Interview with Posti on 21 May 2021.

³⁵ Interview with Posti on 21 May 2021.

Another contributing factor could be the considerable price incentives for out-of-home delivery with discounts between 22-35% compared to home delivery (according to Posti price lists), depending on the size and weight of a parcel. Similarly, price lists published by Matkahuolto indicated that out-of-home deliveries are offered at discounted prices ranging between 34-49% cheaper compared to home delivery depending on the parcel size and type of collection point.³⁶

Due to the popularity of parcel lockers in Finland, Posti reports that their parcel lockers are often at full capacity, especially during peak seasons, which may lead to an increased share of parcel volumes being delivered to parcel shops (including pop-up shops in peak times). In this regard, Posti analyses the utilisation rate of its parcel locker stations determining whether there is scope for an increase in the number of parcel lockers at specific locations. This analysis is made possible thanks to the Smart Lock (IoT) design developed by Posti and their software partners, which enables each locker to communicate with an innovative software system using 0G technology (Sigfox). The system receives real-time information on the status of each individual locker as well as when parcels are collected by recipients. Moreover, each locker runs on its own battery power. Hence, the parcel lockers require neither a fixed internet connection nor an external power supply. Given the success of parcel lockers in Finland, parcel locker networks are expected to grow even further in future, with Posti already planning to reach 4,000 parcel locker stations by 2023.³⁷

3.3.3 Denmark

In 2019, PostNord Denmark (the national postal operator) and SwipBox teamed up to form a joint venture (Nordic Infrastructure) which would provide a carrier-agnostic network of parcel lockers (Nærboks) in Denmark. This presented a unique case for such collaboration in the Nordic countries since national postal operators usually operate an exclusive and independent network. The Nærboks network had proven to be very well received among users and carriers alike as it aimed to provide a cost-effective parcel delivery solution and reach a larger share of the population by bringing parcel lockers closer to consumers.³⁸

However, in June 2021 PostNord had purchased the 50% share of SwipBox in Nordic Infrastructure to become the sole owner of the Nærboks network.³⁹ The overall impact of this buyout is still unclear, especially regarding whether the carrier-agnostic nature of the network would revert back to an exclusive network of PostNord. This would have significant ramifications for the delivery partners such as DHL Express, Bring, and Burd Delivery that have signed up to use the Nærboks network.

³⁶ Based on published price lists for 2021.

³⁷ Interview with Posti on 21 May 2021.

³⁸ CEP Research (2020a, 2021b).

³⁹ PostNord (2021b).

Table 3.3: Denmark: Key figures of parcel locker networks

	PostNord (Post Danmark)	SwipBox	Nordic Infrastructure (Nærboks)
Start	~2008	2015	2019
# of parcel locker stations (2020)	470	500	1,150 <i>(locations with around 2,000 locker banks)</i>
Accessibility to carriers	Exclusive <i>Delivery partner of GLS and DHL Parcel</i>	Open <i>DHL Express, Bring, TNT Express (FedEx)</i>	Open <i>PostNord, DHL Express, Bring, Burd Delivery</i>
Location	Indoor	Indoor	Outdoor
Control interface	Screen-controlled	Screen-controlled	App-controlled

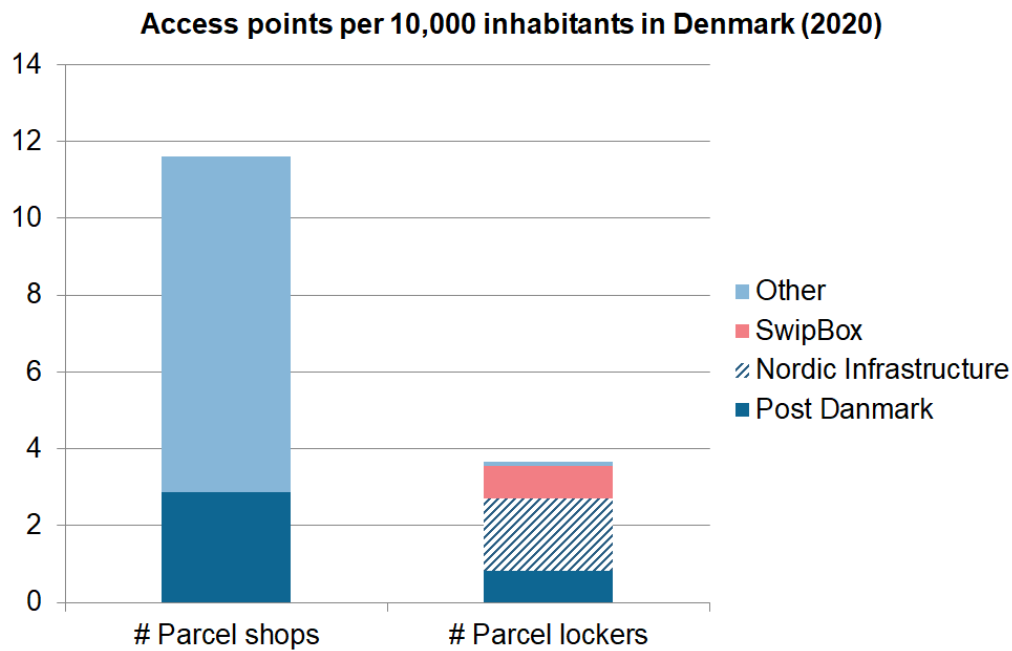
Source: Own research.

PostNord Denmark and SwipBox already had independent parcel locker networks before the joint venture which are still in operation. These stations are mainly located indoors at retail outlets and supermarkets. The SwipBox Classic parcel locker stations used at these locations typically consist of a base module with between 9-21 lockers which can be expanded by add-on modules containing between 11-22 lockers. In contrast, the Nærboks parcel lockers are located exclusively outdoors in public spaces and residential areas, making them 24/7 accessible and in closer proximity to recipients improving the convenience and flexibility of consumers for collecting parcels. SwipBox's Infinity parcel locker stations (used for Nærboks) are smaller in size, consisting of either 14 or 16 lockers, so that, depending on the demand at the location, more than one locker bank can be installed. This might help encourage parcels to be collected quickly, e.g. 90% of parcels in parcel lockers are collected, on average, within two days. Due to its app-controlled design, Nærboks became even more attractive as a contactless delivery option which saw its utilisation rate double under Covid-19 restrictions.

It is worth noting that the main competitors in B2C parcel deliveries in Denmark, namely GLS Denmark and DAO 365, do not have their own parcel locker networks, but rather focus on home delivery or use a wide network of parcel shops. This is evident in Figure 3.10 which illustrates the density of parcel locker stations and parcel shops in Denmark, observing that parcel shops still far outnumber parcel locker stations. This may be partly explained by Danes being accustomed to collecting parcels from parcel shops while doing their shopping.⁴⁰

⁴⁰ See FDIH (2020).

Figure 3.10: Access points per 10,000 inhabitants in Denmark (2020)



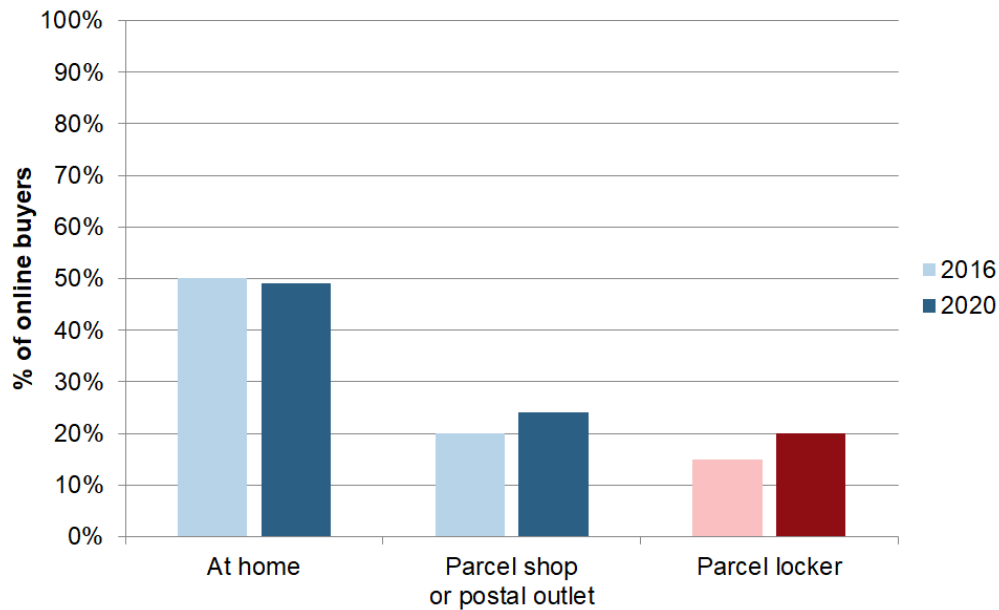
Source: Own research.

In Denmark, deliveries to parcel shops and parcel lockers are relatively popular alternatives to home delivery but the latter remains the most preferred (see Figure 3.11). Out-of-home (OOH) delivery options (parcel shop / parcel locker) are incentivised by prices being more affordable compared to home delivery, approximately 20-30% cheaper for parcels depending on weight and size.⁴¹ A recent consumer survey revealed that Danish online shoppers select delivery to parcel locker stations before delivery to the home or workplace because of convenience considerations while delivery to parcel shops is rather driven by the low price.⁴²

⁴¹ Based on public price lists of GLS Denmark and PostNord for 2021.

⁴² See FDIH (2020).

Figure 3.11: Preferred delivery options in Denmark



Source: Based on PostNord (2016a, 2020)

In the near future, it is expected that the parcel locker networks will continue to expand in Denmark as PostNord announced, after buying out SwipBox, that it plans to expand its parcel locker network from 2,950 SwipBox locker banks (June 2021) to 3,100 parcel locker stations in Denmark by the end of 2021.⁴³ It remains to be seen how SwipBox will respond and whether they will also look to find other opportunities to grow its carrier-agnostic network in Denmark.

3.3.4 Poland

The B2C parcel delivery market in Poland is unique in the sense that the market leader is not the national postal operator, Poczta Polska, but an independent parcel carrier, InPost, whose main focus is delivery to its parcel locker network. The Polish parcel market is highly competitive with InPost (including InPost Paczkomaty) as leading operator by volume and revenue.⁴⁴ InPost estimates their share of the Polish B2C parcel market more than 40% which is significantly higher than that of Poczta Polska with a market share of less than 20%. Moreover, InPost is leading in the deliveries to parcel locker stations, with 98% of deliveries going to parcel locker stations, making it by far the market leader in Poland. The home delivery segment is characterized by strong competition between InPost, DPD, GLS, DHL, Poczta Polska and UPS.⁴⁵

⁴³ PostNord (2021b). This number refers to the locker banks (with 14/16 lockers each). The total number of locations will be lower because there is often more than one bank per location.

⁴⁴ UKE (2021), p. 24.

⁴⁵ See InPost (2021a).

InPost boasts with a network in Poland containing the largest number of parcel locker stations in Europe and plans to further expand its network not only in Poland but also internationally (purchase of Mondial Relay in France in March 2021).⁴⁶ InPost's closed parcel locker network is used to serve online merchants that they have an agreement with – the largest online marketplace in Poland, Allegro, has a seven-year framework agreement as of November 2020 – for the delivery of parcels to parcel locker stations at much cheaper prices compared to home delivery.⁴⁷ Alternatively, Poczta Polska operates a small-scale carrier-agnostic network of parcel lockers (in cooperation with SwipBox) that is also used by DHL Parcel and DPD Poland.

Table 3.4: Poland: Key figures of parcel locker networks

	InPost	SwipBox / Poczta Polska
Start	2008	2018
# of parcel locker stations (2020)	10,776 <i>Planned: ~16,000 (end 2021)</i>	240 <i>Planned expansion by Polish Post</i>
Accessibility to carriers	Exclusive	Open <i>DHL Parcel, DHL Poland</i>
Location	Mostly outdoor	Indoor
Control interface	Screen-controlled	Screen-controlled

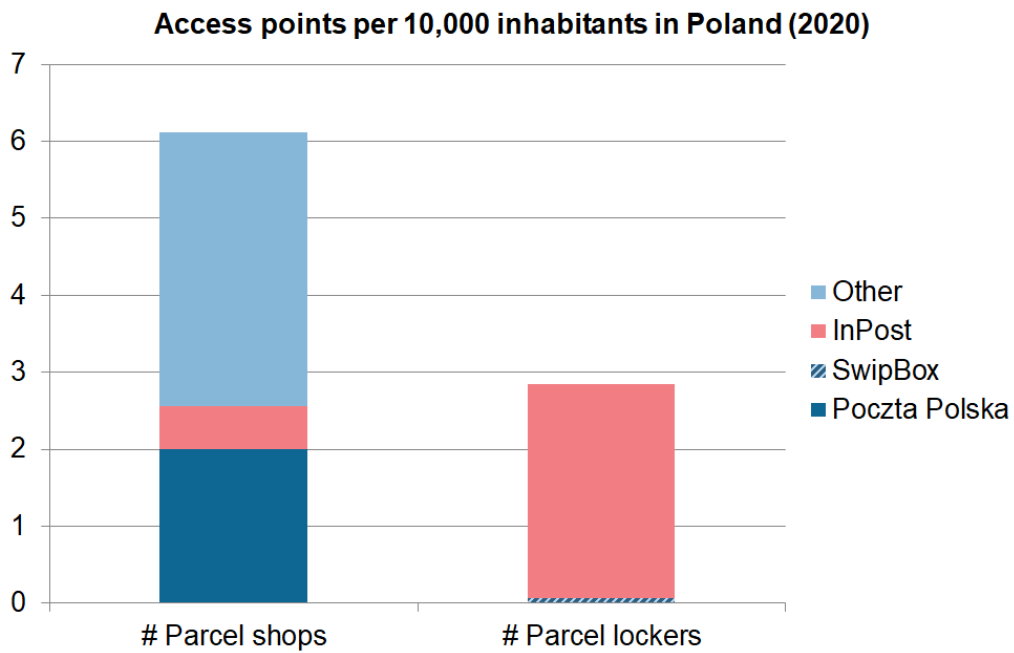
Source: Own research.

Other B2C parcel carriers, such as DPD Poland, GLS Poland, DHL, UPS, and FedEx, do not operate independent parcel locker networks. From Figure 3.12, one can observe that parcel carriers other than InPost mainly focus on parcel shops for out-of-home deliveries – for which Poczta Polska has a relatively weak market position – whereas InPost clearly has the dominant position in parcel lockers.

⁴⁶ See InPost (2021b).

⁴⁷ See InPost (2021a).

Figure 3.12: Access points per 10,000 inhabitants in Poland (2020)

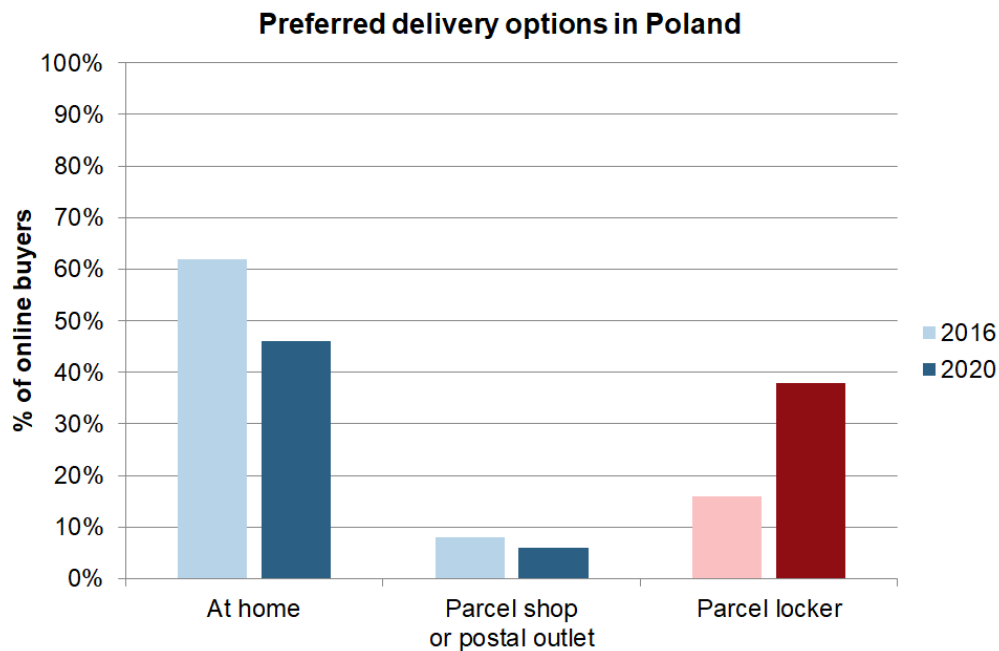


Source: Own research.

Covid-19 had led to an increase in the volume of parcel deliveries to parcel lockers as well as played a role in the demand for a contactless delivery method. In this regard, InPost parcel lockers provided a solution as they are easily accessible at all hours of the day, since they are mainly located outdoors. Recipients can collect the parcels within 48 hours.⁴⁸ The parcel lockers can be accessed using the InPost Mobile application, or via a touchscreen or code scanner and do not require prior registration to use this service. These features add to the convenience of recipients and allow them flexibility in collecting their parcels from parcel locker stations.

⁴⁸ InPost (2021a), p. 141.

Figure 3.13: Preferred delivery options in Poland



Source: Based on results of PostNord (2016b, 2020).

While home delivery remains to be the most preferred delivery method among Polish online shoppers, parcel lockers are the next most preferred delivery method and its share has been growing in recent years, from 16% (2016) to 38% (2020).⁴⁹ InPost estimates that by the end of 2020 approximately 35% of B2C parcels were delivered to parcel locker stations in Poland.⁵⁰

Out-of-home deliveries are overwhelmingly driven by online merchants and marketplaces offering lower delivery fees to buyers if they choose items to be delivered to parcel lockers or parcel shops, e.g. Allegro Smart!. In fact, delivery to a parcel shop is on average 20-30% cheaper compared to home delivery in Poland. Moreover, the fees charged by online retailers for parcel shop deliveries (especially to Ruchu Kiosks, Zabka stores, and Orlen gas stations) are seemingly, on average, even cheaper than deliveries to parcel locker stations.⁵¹ Additionally, InPost reports that parcels are usually delivered to parcel locker stations the next working day⁵², while the Polish universal service provider (Poczta Polska) delivers parcels within three days at the doorstep.⁵³ OOH-delivery, particularly to parcel locker stations, is therefore an affordable way for fast delivery of parcels in Poland.

⁴⁹ See Geopost DPDgroup (2017, 2021c). This trend is confirmed by PostNord surveys (see PostNord (2016b) and PostNord (2020)).

⁵⁰ InPost (2021a), p. 132.

⁵¹ See Furgonetka (2019).

⁵² InPost (2021a), p. 142.

⁵³ Poczta Polska website, <https://www.poczta-polska.pl/>, accessed 24 August 2021. Delivery times for standard parcel delivery services as part of the Package + and Postal Parcel services are indicated as D+3. Express or priority options can be delivered sooner at a significantly higher rate.

The parcel locker networks in Poland is expected to expand even further in future as InPost plans to have around 16,000 parcel locker stations by the end of 2021. Poczta Polska is also reportedly planning to expand its parcel locker network. Recently there have been developments of new market entrants in the Polish parcel delivery market in the form of Orlen gas stations acquiring the network of Ruchu Kiosks and announcing the launch of their own parcel delivery services (Orlen Paczka), including 2,000 parcel locker stations,⁵⁴ as well as Allegro is planning to launch their own parcel locker network of 1,500 parcel locker stations during the course of 2021.⁵⁵

3.3.5 Germany

Germany was one of the first European countries to introduce the concept of parcel locker stations as a delivery option for the national postal operator, Deutsche Post DHL (DPDHL), in the B2C parcel market back in 2001. It has since grown into one of the largest parcel locker networks in Europe by number, but given the size of the population it manages to rank just under the top 10 densest networks (see Figure 3.5).

Table 3.5: Germany: Key figures of parcel locker networks

	Deutsche Post DHL (DHL Packstation)	Amazon Amazon Locker	ParcelLock / Hochbahn / Deutsche Bahn (Hamburg Box)
Start	2003	2016	2020
# of parcel locker stations (2020)	6,650 <i>Planned: 12,500 (2023)</i>	~1,000 (2019)	23
Accessibility to carriers	Exclusive	Exclusive	Open <i>Hermes, GLS, DPD, Local retailers</i>
Location	Mostly outdoor	Indoor and Outdoor	Outdoor
Control interface	Screen-controlled App-controlled (Test)	Screen-controlled	Screen-controlled

Source: Own research. Amazon does not publish any data on the Amazon Lockers (see Supermarktblog (2021a) so that the number is only a very rough estimation based on Amazon Blog (2019). There are indications that Amazon has been expanding their network considerably since 2019.

⁵⁴ See WH (2021).

⁵⁵ See Allegro (2021), Marketplace Pulse (2021) and Notes from Poland (2020). Allegro's ambition to invest in own delivery logistics might be the result of Amazon's market entry into the Polish e-commerce market.

DPDHL operates the largest parcel locker network (DHL Packstation) in Germany. Amazon, which is the largest online marketplaces in Germany, has introduced their own parcel locker stations (Amazon Locker) in major cities where they have their own logistics and delivery operations (i.e. used exclusively by Amazon Logistics). Similarly, the DHL Packstation network is operated exclusively by DPDHL. Established in 2003, the number of parcel locker stations had slowly grown to 3,700 by the beginning of 2019. As part of the 'Strategy 2025' launched in 2019, DPDHL announced to nearly double the number of machines (7,000) by the end of 2021, thereby aspiring to meet customer demand for convenient delivery options, reduce delivery costs, and expand delivery capacity.⁵⁶ Deutsche Post DHL stated that around 3% of DHL parcel volumes were delivered to parcel locker stations at the the beginning of 2019.⁵⁷ In light of the experiences underwent during the pandemic, DPDHL decided to accelerate the implementation of parcel locker stations and to further expand the parcel locker network to 8,500 stations by 2021, and more than 12,000 stations by 2023. DPDHL is also in the process of testing the use of a screenless, app-controlled (Bluetooth) parcel locker station (Packstation Kompakt) that shall comprise around one-third of the 2023 parcel locker network.⁵⁸

In 2020, a small parcel locker network was introduced in Hamburg (Hamburg Box) by Parcel-Lock (in collaboration with Hochbahn and Deutsche Bahn).⁵⁹ This network is small-scale and localised, found at train and underground stations in Hamburg, that offers a carrier-agnostic network currently being used by Hermes, DPD, GLS, as well as local retailers for the handover of online and offline orders.

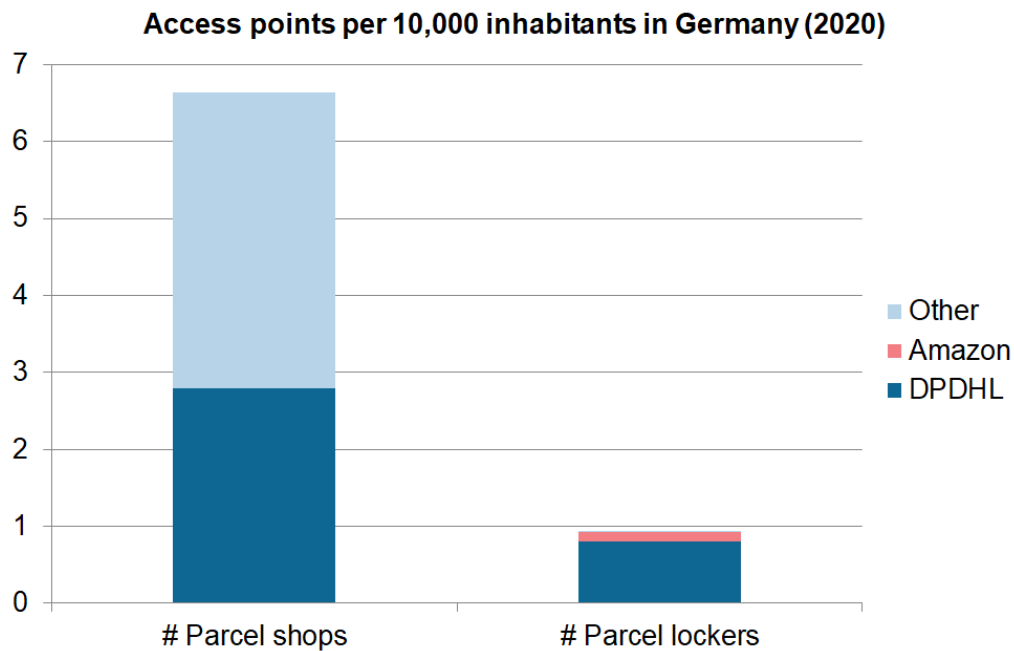
⁵⁶ Deutsche Post DHL (2019b), p. 66.

⁵⁷ Ibid.

⁵⁸ Deutsche Post DHL (2020a), There are reports that Amazon will also roll out app-controlled parcel locker stations in Germany, see Supermarktblog (2021b).

⁵⁹ See hamburgbox.de, accessed 23 August 2021.

Figure 3.14: Access points per 10,000 inhabitants in Germany (2020)

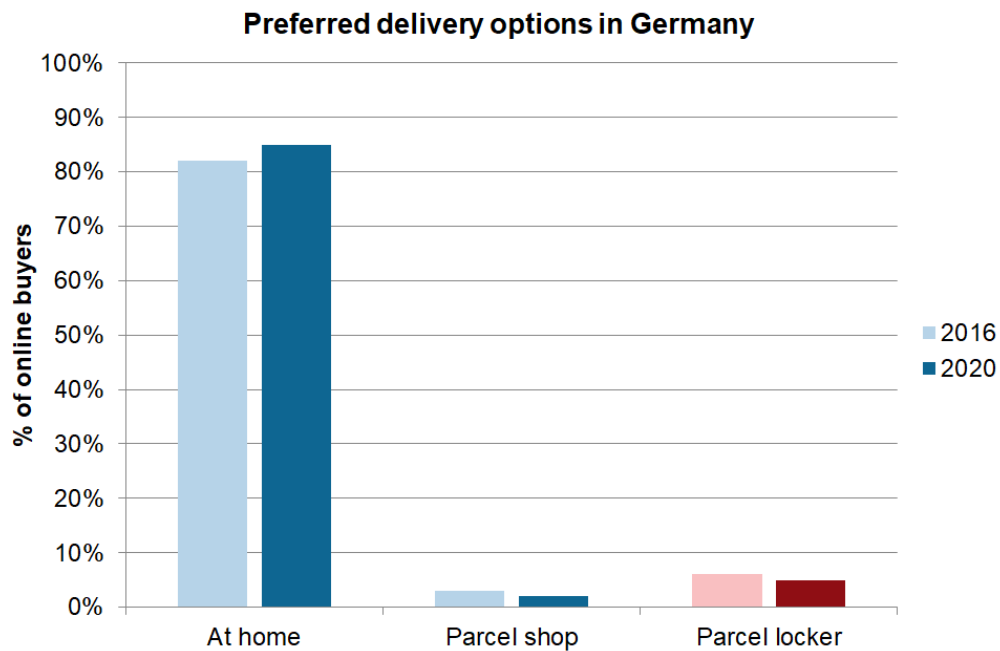


Source: Own Research.

From Figure 3.14, it is evident that DPDHL dominates the parcel locker market in Germany. However, its density is much lower compared to parcel shops. In contrast, the parcel market in Germany is fairly competitive with Hermes, DPD, and GLS as main competitors and an increasing (but unknown) share of Amazon Logistics. DPDHL is the market leader in B2C delivery, followed by Hermes.⁶⁰ All parcel carriers have established parcel shops (in partnership with local retailers) mainly as drop-off station for returns, resulting in a relatively high density of parcel shops in Germany. All players also offer the possibility to collect parcels from shops but with limited success (see Figure 3.15). Additionally, parcel shops are used as a fall-back solution for failed deliveries at the doorstep (mainly by DPDHL).

⁶⁰ See WIK-Consult (2019).

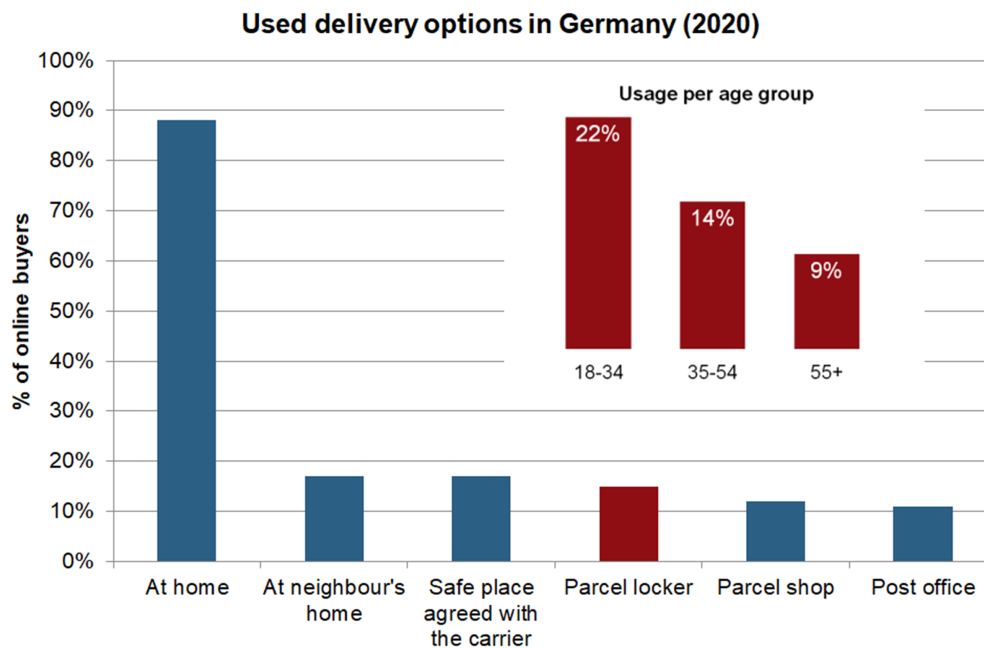
Figure 3.15: Preferred delivery options in Germany



Source: Based on PostNord (2016b, 2020).

Home delivery in Germany remains by far the most used and preferred parcel delivery method. Regarding the age profile of online buyers, younger generations are more inclined to choose parcel lockers as a delivery option. However, the acceptance of parcel locker stations remain low for all age groups (see Figure 3.16). Even more parcels are left with a neighbour or stored in a safe place agreed with the courier in the event that the recipient is not home, than the current share of parcels being delivered to parcel lockers and parcel shops (see Figure 3.16). This implies that recipients in Germany value the convenience of receiving a parcel at home much more highly than out-of-home delivery options.

Figure 3.16: Used delivery options in Germany (2019)



Source: Based on Geopost DPDgroup (2021c).

In Germany, there is no significant price differentiation in favour of out-of-home delivery options (parcel lockers / shops). Especially, DPDHL offer no discounts for deliveries to parcel lockers or shops compared to home delivery.⁶¹ Other parcel carriers tend to have only marginal discounts to retail customers, ranging between 4-15%, for delivery to parcel shops compared to home delivery.⁶² This would suggest that consumers' convenience is more important than any price incentive that e-retailers may be able to offer for out-of-home delivery options.

Nevertheless, the Covid-19 pandemic had resulted in substantially increased usage of parcel lockers due to increased parcel volumes and e-commerce, but also as people became more conscious of hygienic conditions and thus opting for contactless delivery methods – the number of registered users increased by double-digit percentages.⁶³ Another factor may be the flexibility that parcel lockers offer due to its 24/7 accessibility at outdoor locations. The pandemic might also have had the consequence of raising the awareness of parcel locker stations and could have convinced people of parcel lockers being a viable delivery alternative to home deliveries.

⁶¹ This does not exclude the possibility of lower delivery costs in individually negotiated contracts for large mailers. Amazon, for example, differentiate delivery costs for non-Prime members depending on delivery location (standard delivery to the home 3.99 € and to a pick-up point or locker (including Amazon Locker and DHL Packstation) for 2.99 € for basket values below 29 EUR, see Amazon (2021)).

⁶² Based on 2021 price lists for retail customers.

⁶³ See Supermarktblog (2021a).

4 Business models and cost structure of parcel locker networks

As mentioned earlier in the report, parcel locker networks are operated by a variety of operators using different business models. In this section, an analysis is provided on the different types of parcel locker network operators and the typical business models they implement, particularly focusing on the distinction between open (carrier-agnostic) and closed (carrier-specific) parcel locker networks. The cost structure of parcel locker networks is also discussed, including an example on the average cost per parcel for delivery to parcel locker stations, as well as mentioning the main price strategies being implemented by operators.

Among the most notable parcel locker network operators are national postal operators (usually universal service providers), e.g. DPDHL, Posti (Finland),⁶⁴ and Omniva/Eesti Post (Estonia),⁶⁵ that have an advantage of an existing nationwide network for collecting and delivering letters and parcels. Parcel operators have also been successful in deploying parcel locker networks, for example, DPD in the Baltics and Lehtipiste (Pakettipiste) in Finland, but they are generally less present than national postal operators in this field. Parcel locker networks operated by postal and parcel operators are mostly regarded as supplementary to home and parcel shop deliveries, which give them a competitive advantage by being able to offer more delivery choices to their customers. A major challenge (among others) faced by postal operators and parcel carriers are legacy problems with their existing IT platforms. These were originally developed to support their internal operations and less focussed on improving customer service (senders and recipients). However, there have been developments in IT platforms with emerging e-commerce having encouraged operators like Posti and DPDHL to set up dedicated digital strategies that shifted customers, senders (notably e-retailers) and recipients (online buyers) to the forefront of their efforts.

Parcel locker manufacturers such as SwipBox or InPost also operate their own parcel locker networks as stand-alone businesses in cooperation with local carriers. Therefore, they are responsible for managing the daily operations through their software solutions that are tailored for a specific parcel locker network. In other words, their incentives differ from traditional postal and parcel operators by finding innovative solutions that suit customers' (senders and buyers) needs, and not only providing a supplementary delivery service. These companies are more technology-based and have developed their own software solutions for operating a parcel locker network, thereby placing themselves in a much better position than postal / parcel operators. However, it is more common for parcel locker suppliers to sell or lease their parcel lockers to national postal operators or parcel carriers, and continue to offer hardware and software support relating to managing and operating the network. InPost presents a unique case because they started as a main competitor of Polish Post in the letter market and

⁶⁴ Posti also operates a parcel locker network under its Itella brand in the Baltic countries.

⁶⁵ While Omniva (Eesti Post) is the universal service provider in Estonia, it also operates its parcel locker network in Lithuania and Latvia.

only later entered the parcel market. The company was a ‘first mover’ in the segment of parcel locker deliveries and was quite successful in attracting online shops and, most importantly, the online marketplace Allegro as contract partners. In contrast to SwipBox, InPost built up their own logistics network to collect and deliver parcels either to parcel locker stations or at home.

Online marketplaces like Amazon have also deployed and operate their own parcel locker networks in certain countries (mainly in large cities in Austria, Germany, France, Italy, Spain, and the UK) as part of its last mile operations (Amazon Logistics). Similarly, Allegro in Poland are planning to roll out their own parcel locker network, thereby providing additional delivery options for parcels that do not fall under the agreement with InPost for the delivery of Allegro Smart! parcels to parcel lockers.⁶⁶

Finally, technology start-ups have emerged and entered the segment of parcel locker deliveries, like Smartmile in Finland. Another example outside the presented countries is Swedish Instabox.⁶⁷ In contrast to national postal operators and parcel carriers, these companies do not have to tackle any legacies faced by traditional postal and parcel operators. Instead, their focus is on reaching agreements with retailers and online merchants, or partnerships with parcel carriers, ensuring that they have sufficient parcel volumes being moved through the parcel locker network. This is a crucial requirement for start-up parcel locker network operators in order to cover their significant investment costs. Additionally, they are able to provide the necessary IT solutions for smooth integration with online merchants’ and parcel carriers’ existing systems and to encourage the use of their parcel lockers as a delivery option.

Table 4.1 summarises the typical business models we identified in our research. We distinguish the operation of open and closed parcel locker networks between operators with and without logistics operations. Logistics operations include collection and transport services, operation of logistics hubs (sorting facilities) as well as delivery of parcels to parcel locker stations.

In the majority of European countries where parcel lockers are being used as a delivery option, these networks tend to be exclusively used by a single operator (‘closed’ network). Open parcel locker networks are still in the minority and rather the exception to the rule as illustrated by the evidence from the countries selected for our case studies (Figure 4.1).

⁶⁶ See Allegro (2021).

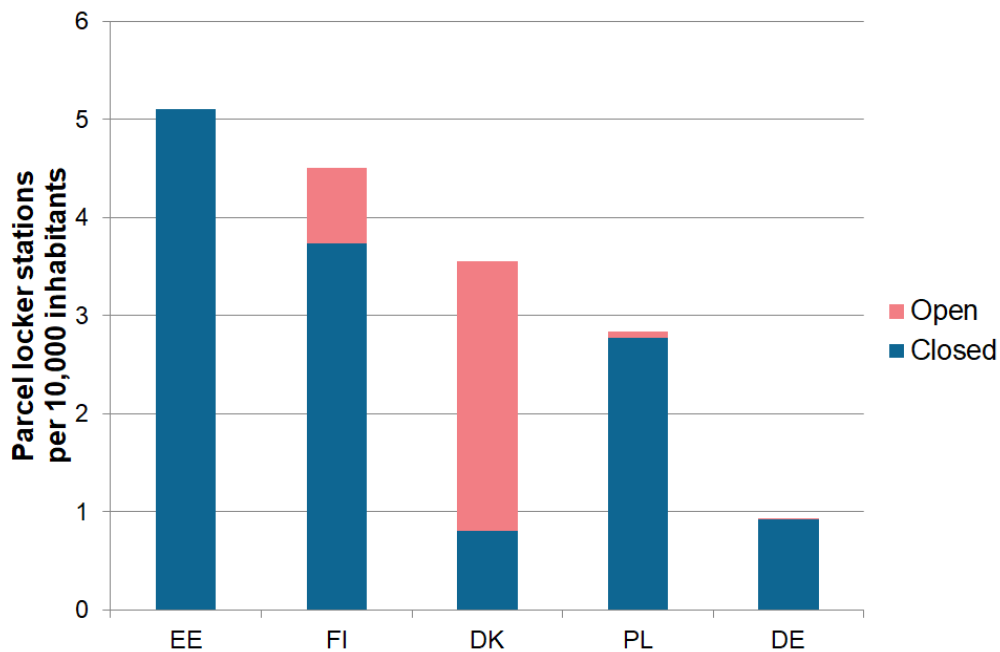
⁶⁷ Instabox operates one of the quickest growing parcel locker networks in Europe. PTS (2021) estimates that the market share in the B2C parcel delivery segment was between 3% and 5% in 2020. The company operates a closed parcel locker network and was quite successful in winning many Swedish online shops as customers, see Digital (2021). Their business model has some similarity to InPost in Poland.

Table 4.1: Business models with parcel locker network: Examples

Parcel Locker Network	Without logistics operation	With logistics operation
Open	Smartmile (Finland) SwipBox (Poland) Hamburg Box (Germany) Nordic Infrastructure (Denmark)	Lehtipiste (Finland)
Closed		InPost (Poland) National postal operators (DPDHL, Posti, Eesti Post) DPD, Itella (Baltic countries) Amazon Logistics (e.g. Germany) Instabox (Sweden)

Source: Own analysis.

Figure 4.1: Open versus closed parcel locker stations in selected countries (2020)



Source: Own research.

Parcel locker networks of significant size are mostly operated by a carrier, either by national postal operators, e.g. Omniva, Posti or DPDHL, or by parcel operators, e.g. InPost in Poland, DPD in the Baltics or Lehtipiste in Finland. Denmark is a unique case where the parcel locker network, Nærboks, was found by a joint venture between SwipBox and PostNord Denmark in 2019. However, the acquisition of SwipBox' shares by PostNord shows a change in PostNord's strategy with regard to the role of parcel locker stations in their delivery mix. So far, it appears that the network remains open for other carriers.

There are very few examples of other countries where open parcel locker networks are present. Open parcel locker networks are typically developed and operated by start-ups or suppliers that basically rely on a stand-alone business model, e.g. SwipBox (Poland), InPost (Italy and UK), and Smartmile (Finland). This decision involves a rather high-risk investment and may include speculation that a large carrier or a large online merchant would eventually acquire the network. Whether a national postal operator or parcel / express operator participates in an open parcel locker network seemingly occurs where they do not have a sufficiently large customer base and thus not enough volume (e.g. Poczta Polska in Poland, Lehtipiste in Finland) and / or do not wish to take the financial risk to invest in establishing their own parcel locker network.

That there are only few examples of (open) parcel locker networks, especially from independent providers, can also be explained by the cost structure of a parcel locker network.

Figure 4.2: Site factors and cost elements for parcel lockers

Sites	Site factors <ul style="list-style-type: none"> ▪ Accessibility ▪ Security ▪ User frequency („trip-chaining“) ▪ Connection facilities for power and data exchange ▪ Reliable and long-term contract partners (property owners) 	Usual sites <ul style="list-style-type: none"> ▪ Supermarkets, convenience stores, gas stations, shopping malls, and postal outlets ▪ Densely populated urban areas, with increasing demand expansion into suburbs and smaller cities ▪ Density KPI: average time needed / average distance to the nearest station
	Costs (Largely fixed i.e. costs do not vary with volume) <ul style="list-style-type: none"> ▪ Capital costs <ul style="list-style-type: none"> ▪ Parcel locker stations including installation (buy or lease) ▪ IT ecosystem to manage the network including apps to connect the parcel lockers with the users (senders and recipients, operator, other carriers) ▪ Operating costs <ul style="list-style-type: none"> ▪ Rental costs ▪ Connection charges (power, data exchange) ▪ Maintenance costs for the stations and the IT ecosystem 	

Launching a network of parcel locker stations requires significant investments and time (see Figure 4.2). Capital, operating, and other costs of such a network are largely fixed, i.e. independent from parcel volume. The identification of appropriate sites with high user frequency, the development of a smoothly running IT ecosystem, the purchase and installation of parcel locker stations, and promotional campaigns to increase awareness are necessary steps to establish a reasonably dense network. The country examples highlighted that the densest parcel locker networks were launched more than 10 years ago. Postal and parcel operators with well-established networks of parcel shops and postal outlets have a competitive advantage in identifying appropriate sites. Firstly, they can install a parcel locker station in or near parcel shops / postal outlets, and secondly, they already have experience in finding appropriate sites and negotiating with potential site owners.

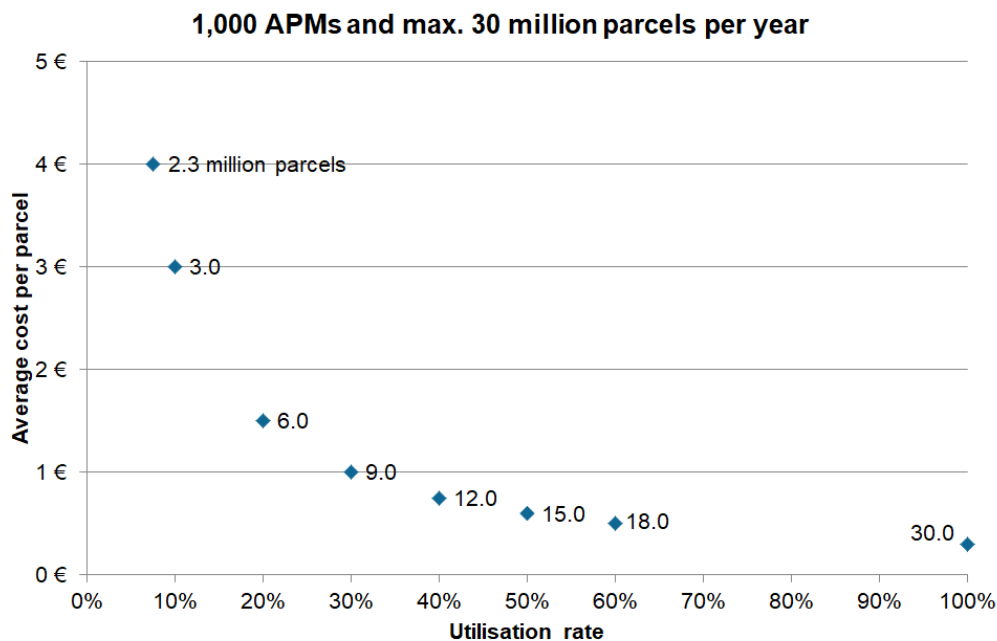
The additional average cost per parcel⁶⁸ born by a parcel locker network largely depends on the capacity of the network in relation to the number of parcels delivered through the network (utilisation rate).⁶⁹ The total capacity of a parcel locker network (per year) is the product of the average number of lockers per station, the total number of stations, the number of delivery days per year and the number of deliveries per day (i.e. how often a carrier drops off parcels at the parcel locker station per day), under the implicit assumption that recipients pick up their parcels within one day. The utilisation rate of a parcel locker network is the ratio of total parcels delivered to lockers and network capacity. The higher the utilisation rate, the lower the average cost per parcel delivered. Figure 4.3 illustrates this relation and highlights the impact of parcel volume and utilisation rate on the average cost per parcel resulting from the operation of a parcel locker network. The assumptions are summarised in the upper part of Figure 4.3 and the development of average costs per parcel is presented in the diagram.

⁶⁸ The additional cost does not include the cost for delivering parcels to parcel locker stations. We assume that the time needed for the drop-off process should be largely comparable to the time needed for handing over a parcel to a person (home delivery) or to a parcel shop owner. It should be noted, that the potential bundling effect depends on the number of lockers per station (i.e. the maximum number of parcels that can be delivered to one locker). The more lockers per station there are, the higher the potential bundling effect (and thus the lower the average delivery cost per parcel).

⁶⁹ The utilisation rate is a key performance indicator (KPI) for parcel locker networks, see InPost (2021a).

Figure 4.3: Illustrative example: Relationship between utilisation rate and average cost per parcel

Parcel locker networks & volume		Capex and Opex per station	
# Parcel locker stations	1,000	ø Capex	30,000 €
ø Lockers per station	100	Depreciation period	10 years
Parcels delivered /year	1-30m	ø Opex / year	6,000 €
Delivery days /year	300	Cost per station / year	9,000 €
Deliveries per day	1		



Source: The Capex include investment costs in parcel locker stations (tangible and intangible assets, i.e. hard- and software). The depreciation period implies that the cost of capital corresponds to 10% which appears reasonable given the financial risk.

This illustration highlights the importance of parcel volume in relation to the size of the parcel locker network (the utilisation rate) and provides an idea about the additional average cost per parcel delivered to a parcel locker. Therefore, it is not surprising that parcel locker stations are primarily placed in urban, densely-populated areas and at places with high user frequency. The average cost per parcel is a benchmark to assess the competitiveness of parcel locker delivery with alternative delivery options (home delivery with low drop-off rates and delivery to parcel shops). In this example the average cost per parcel of 1 € would be reached at an average utilisation rate of 30% (in this example 9 million parcels per year delivered to 100 thousand lockers on six days per week). The average cost should be at least the same level as the transaction fee for dropping off a parcel at a partner shop or equal the cost saved by foregoing home delivery. This example highlights only one aspect, although an important one, for the financial viability of a parcel locker network. However, the investment decision also depends on other aspects including, for example, using parcel lockers for collection services

as well as capacity buffer, or the role of parcel lockers as a potential unique selling point to attract users (senders and recipients).

Open parcel locker networks follow different pricing strategies which are dependent on its business model, especially whether the operator provides its own logistics. For parcel locker networks which rely either on one or multiple third-party parcel carriers for the delivery of parcels, the carriers, or local and online retailers, typically pay either a fee per locker or a subscription fee to the operator / supplier of the parcel locker network, (e.g. SwipBox (Poland), Quadient, and Smartmile) or a combination of subscription rate and fee per locker. The fee per locker is usually based on the actual number of lockers used for making deliveries, comparable to pay-as-you-go, and the price is likely to be higher compared to a subscription fee (usually combined with a longer contract period). Subscription fees are typically monthly or annual fees that determine a fixed number of lockers to be used by a specific carrier or retailer over the contract period. In some cases it may be possible to extend the number of lockers available to a carrier or retailer, when required, usually on a fee per parcel basis.⁷⁰ Similar payment models are most likely employed by open parcel locker network operators, with their own logistics operations, that share their network with other parcel carriers, e.g. InPost (UK and Italy) and Lehtipiste (Finland). Moreover, some costs may be transferred to recipients by means of delivery fees to parcel lockers and/or penalty fees for not collecting parcels within a predetermined timeframe.⁷¹

Alternatively, national postal operators or large parcel carriers buy parcel locker stations outright from suppliers for a one-off purchasing fee and independently operate the parcel locker network in addition to their other delivery services. Even in these cases there may be a subscription fee paid to the parcel locker supplier for software and hardware support, and maintenance services, e.g. KEBA, SwipBox, and Quadient all provide this type of payment model. The cost of the parcel locker network then has to be covered by the operator through cost-savings by avoiding home delivery, and hence depends heavily on large volumes being delivered via parcel locker stations. Generally, the identified pricing strategies of operators that offer a mix of delivery options reflect some of the cost-savings between home delivery and (bundled) delivery to pick-up points (with the exception of DPDHL). A lower price incentivises online shops to actively offer cheaper delivery options in the check-out process which

⁷⁰ See Quadient (2021), p. 101, provides an example of the different payment models they implement. They offer both a purchase model and a rental model of their parcel lockers, and distinguish the share of revenue that the subscription services generate under each model.

⁷¹ In China, HiveBox operates an open parcel locker network with around 264.000 stations (including the locker stations they acquired from China Post) in more than 100 cities. Since April 2020, recipients have to pay a charge to use a locker if they fail to pick up parcels from their lockers within 12 hours (see Technode (2020)). After protests they adapted the payment schedule and offer a membership program with a monthly fee and free-of-charge usage of their locker stations. Non-members have to pick-up their parcels within 18 hours before being charged (see Doddle (2021)). One major difference between the usage of Chinese and European parcel locker networks is that in China carriers use parcel lockers as a fall-back delivery option for failed home delivery while in Europe the online shopper / recipient usually decides whether an order shall be delivered to a parcel locker station.

could further promote the usage of parcel locker stations by online shoppers, especially in combination with a convenient way to select an appropriate parcel locker station in the check-out process (e.g. by clicking on a map).

From this perspective, it appears quite challenging to operate a parcel locker network on a stand-alone basis without logistics operations. Therefore, it is not surprising that many parcel locker networks are operated by large carriers and online merchants who already have a broad customer base and who are able to apply a combined cost calculation with other delivery and logistics services. Moreover, operators with a significant stake in the B2C delivery segment basically have no incentive to voluntarily share their parcel locker network with competing carriers as long as they have enough volume delivered through parcel locker stations to achieve financially acceptable utilisation rates. They consider their ability to offer online retailers and online buyers a mix of different delivery options and the flexibility to redirect parcels to alternative delivery locations as a competitive advantage. From an operational point of view, parcel locker stations help reduce delivery costs and provide easy-accessible spare capacity to handle peak demand amidst transport and labour shortages for home delivery and limited storage capacities in partner outlets. Finally, from an environmental point of view, parcel locker stations present an opportunity to reduce the operator's carbon footprint in the last mile.⁷² In this regard, open parcel locker networks are more likely to succeed in situations where the operator is not able to attract enough parcel volume in a short period of time to cover its costs.

5 Conclusions and Outlook for Germany

The Covid-19 pandemic has pushed growth rates in e-commerce and parcel volume several years ahead and is a harbinger of the challenges for the last mile. Parcel locker stations are considered as one solution for capacity bottlenecks in the last mile. Postal operators in some European countries increasingly invest in parcel locker networks with the consequence that supply and usage of parcel lockers for B2C delivery vary considerably within Europe (see Chapter 3). The evidence suggests that some market leaders in B2C parcel delivery have shifted their mindset and started investing in parcel locker stations in 2021, e.g. PostNord in Sweden and PostNL in the Netherlands.

The country studies present key parameters of the most important parcel locker networks in each country. They show that the roll-out of these parcel locker networks required several years. Moreover, establishing a parcel locker network requires significant investments and a dedicated digital strategy by the respective operators. In ensuring the economic viability of such a network it is necessary that as many parcels as possible are delivered through parcel lockers. In order to increase parcel volume, e-retailers and consumers increasingly offer/use parcel locker stations as a delivery option. Based on the country studies we identified four

⁷² The environmental impact of parcel locker deliveries (e.g. in combination with a broader city logistics concept) is another important topic that is not discussed in this paper.

important drivers for the success of parcel locker stations:

- Delivery to postal outlets as an existing and functioning parcel delivery option;
- Lower prices for delivery to parcel shops and parcel locker stations;
- High density of parcel locker stations;
- Easy access to parcel locker stations – dedicated digital strategies.

(1) Delivery to postal outlets as an existing and functioning parcel delivery option

In Europe, parcel delivery standards vary among countries. In the Nordics (like Denmark and Finland) and many Eastern European countries (including Estonia), people are accustomed to pick up parcels in post offices or parcel shops. In these countries, home delivery of parcels is usually a more expensive value-added service. In Eastern European countries, next-day delivery of parcels, ideally at the doorstep, is therefore considered as an express service. With growing e-commerce new delivery companies emerged that mainly rely on delivery to parcel shops (in supermarkets and convenience stores) or parcel locker stations (e.g. Inpost in Poland). We identify two reasons for these developments: (1) delivery to shops/parcel locker stations is less costly and thus lower priced than home delivery (see the next argument), and (2) delivery to shops or lockers is faster than home delivery. For example, InPost reports that parcels are usually delivered to parcel locker stations the next working day⁷³, while the Polish universal service provider (Poczta Polska) delivers parcels within three days.⁷⁴ In Germany, parcels have traditionally been delivered at the doorstep and, with growing e-commerce, usually by the next working day.

For consumers, the switch from parcel shop delivery to parcel locker delivery is less burdensome than the switch from home delivery to parcel locker delivery.

- In the first case, the recipient's effort is basically the same with the advantage that parcel locker stations are often accessible 24/7. From this perspective, consumers switch from a more traditional pick-up point to a technically more sophisticated pick-up point which is more a matter of convenience and accessibility. However, in Eastern European countries, home delivery is often linked with long delivery times. In these countries, delivery to parcel locker stations actually results in an amelioration of service quality in terms of delivery time.
- In the second case, additional effort from the recipient is needed to collect the parcel. From this perspective, delivery to a parcel locker station or a parcel shop might be

⁷³ InPost (2021a), p. 142.

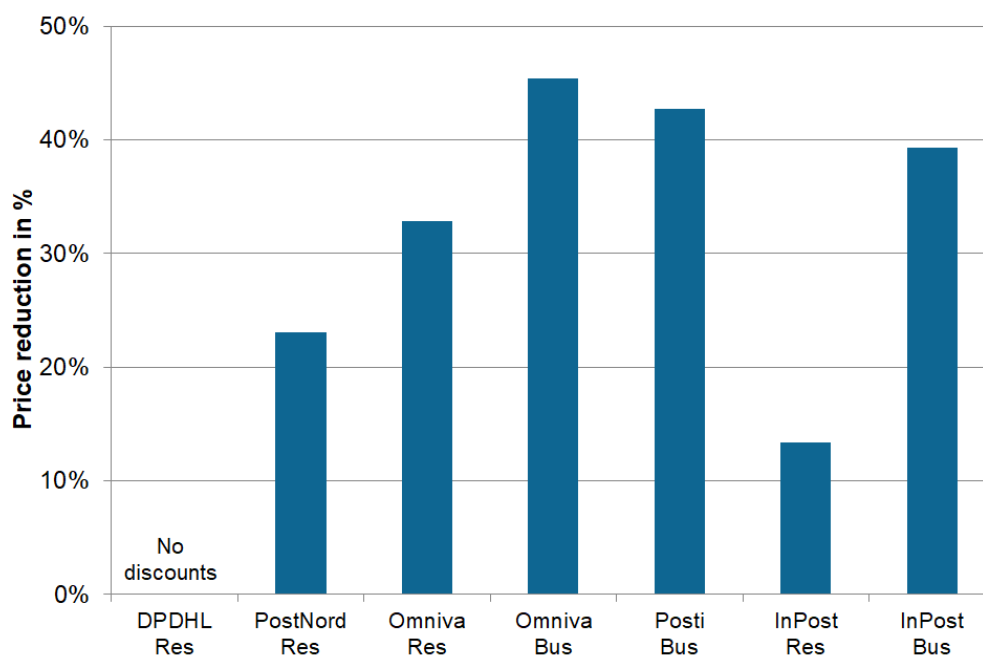
⁷⁴ Poczta Polska website, <https://www.poczta-polska.pl/>, accessed 24 August 2021. Delivery times for standard parcel delivery services as part of the Package + and Postal Parcel services are indicated as D+3. Express or priority options can be delivered sooner at a significantly higher rate.

considered as a deterioration in service quality. If this extra effort is not remunerated with lower delivery costs (and/or better quality of service) the switch merely depends on the recipients' delivery preferences.

(2) Lower prices for delivery to parcel shops and parcel locker stations

The good news is that the use of parcel locker stations is generally free of charge for recipients in each country case study. We consider this as a necessary condition to promote consumer acceptance of parcel locker stations. Bundled delivery of parcels at a single stop, either a parcel shop or a parcel locker station, is generally less costly than home delivery (as long as there is a sufficiently large bundling effect, i.e. enough parcels delivered to a locker station). This is reflected in the tariff structure of the postal / parcel operators in the four comparator countries.

Figure 5.1: Discounts for delivery to parcel locker stations compared to home delivery (S Parcel, June 2021)



Source: Own calculations based on published price lists.

Notes: S Parcel: Small-sized parcel (different definitions applied, does not fit into the letter box)
 Res: Prices for residential customers (consumers);
 Bus: Prices for business customers
 DPDHL – Business prices not available
 PostNord – Business prices not available
 Posti – The product 'home delivery parcel' is only available for business senders.

Figure 5.1 presents the discounts of a selection of operators for the delivery to parcel locker

stations. PostNord Denmark⁷⁵ and Posti offer the delivery to shops and parcel lockers at the same discount. At Omniva, delivery to parcel lockers is the cheapest delivery method for senders followed by delivery to shops. This price difference might reflect the competitive situation in the Estonian parcel market with three independent players, especially in the segment of parcel locker deliveries. InPost applies high discounts for business and low discounts for residential customers. In Germany, DPDHL does not differentiate retail parcel tariffs dependent on delivery locations (PUDO or home) unlike their competitors Hermes, DPD, and GLS who offer parcel delivery to shops at lower prices (apparently with limited success as reflected by the delivery preferences of online shoppers). Home delivery of parcels is the standard delivery service in Germany. It used to be a relatively low-priced service due to the competitive situation in the German parcel market. However, in the last two years parcel tariffs have been increasing particularly for business customers (i.e. online retailers). According to DPDHL, the higher prices are the result of increasing labour and transport costs (in addition to increased investment costs in the expansion of postal infrastructure, including parcel locker stations).⁷⁶

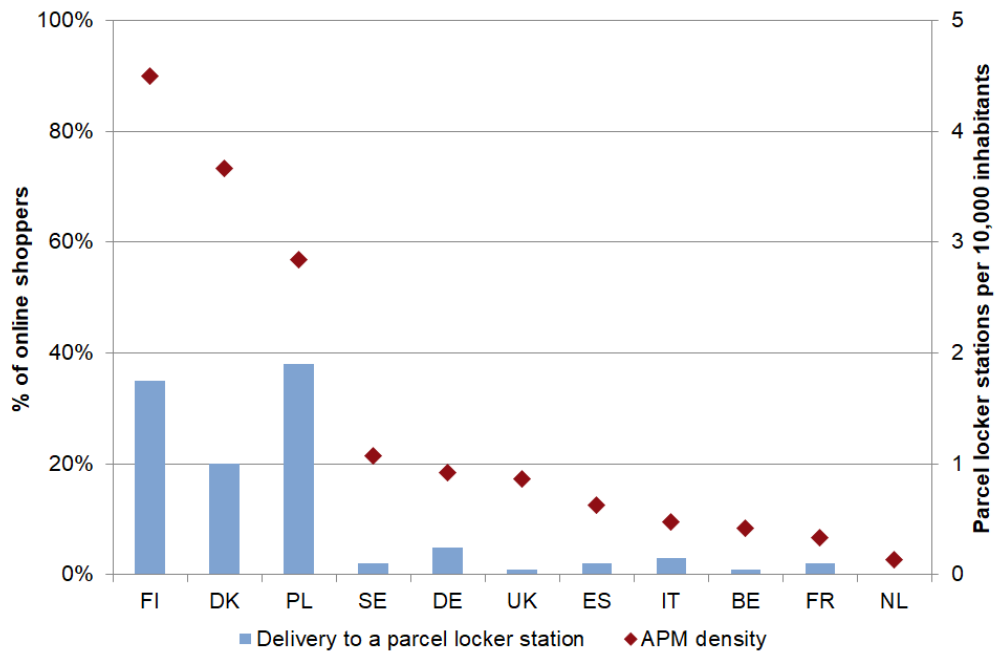
(3) High density of parcel locker stations

There is a positive correlation between consumer preference for parcel locker deliveries and the density of the network.

⁷⁵ According to FDIH surveys, delivery to parcel shops is considered to be the cheapest available delivery option (see FDIH (2020)).

⁷⁶ See for example Deutsche Post DHL (2019a) and Deutsche Post DHL (2020b).

Figure 5.2: Share of online buyers preferring delivery to parcel locker stations and parcel locker station density (2020)



Source: Based on PostNord (2020a and 2020b) and WIK research on parcel locker stations (see Figure 3.1 for more detail).

Figure 5.2 presents the reported share of online buyers preferring parcel locker stations for delivery in relation to the density of parcel locker stations. The share of consumers preferring parcel locker deliveries increases with the density of the parcel locker network. In countries with high density of parcel locker stations, the share of online buyers are considerably higher than in countries with low density. It appears that two locker stations per 10,000 people are accompanied by a relatively high level of acceptance. A high density also means a high level of visibility and publicity. In Germany, even after DPDHL's announced expansion to 12,500 parcel locker stations, the density would still remain below two per 10,000 people, and thus remain lower than in the reference countries today.

(4) Easy access to parcel locker stations – dedicated digital strategies

Easy access in combination with digital affinity of recipients play an important role for the success of parcel locker stations. Its success largely depends on the 'IT ecosystem' that organises the data flows; visibility (real-time locker availability, parcel tracking); and the integration of senders (online shops), recipients (online shoppers), and operator(s) via appropriate user-friendly (mobile) applications and interfaces. In this context, convenience means that the usage of parcel locker stations is easy and transparent for all users (senders and recipients). In Germany as well as in the four reference countries, the operators have been investing in

their digital capabilities. National postal operators like Eesti Post, Posti, and DPDHL have launched digital strategies with the step-by-step objective to establish a unified IT platform and appropriate digital applications. This is a huge task as national postal operators as well as 'traditional' parcel & express service providers have to deal with legacies in their IT systems that have been primarily developed for operational purposes.

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Outlook for Germany: Can delivery to parcel locker stations in Germany be as successful as in the comparator countries?

The planned expansion of the parcel locker network by DPDHL by 2023 to more than double its current size, is a positive indication that parcel lockers will continue to play a role in last-mile parcel delivery in Germany in the future. The increased number of parcel locker stations will by implication improve its network density and alleviate capacity constraints of home deliveries amidst growing e-commerce, increasing labour and transport costs, as well as growing environmental considerations. The introduction of a digital strategy and the testing of new screenless parcel locker stations by DPDHL further imply that they have made a switch to a more customer-oriented approach. This is likely to improve the ease of use of parcel locker stations and become more technologically integrated.

However, much will depend on the willingness of German online buyers to accept and adopt parcel locker stations as a preferred delivery method. This may potentially be a considerable obstacle since Germans have become accustomed to the convenience of home deliveries which is typically offered free of charge to the recipient and there is currently no price incentives offered by DPDHL for online merchants opting for parcel locker deliveries. Consequently, the necessity may arise that delivery to parcel locker stations be offered to online merchants at lower delivery fees than home delivery, encouraging them to promote the use of parcel locker delivery among online buyers. Furthermore, a larger network of parcel locker stations would require sufficient volume of parcels to be delivered by this method in order to justify the

investment in the network expansion.

The emergence of growing localised parcel locker networks, especially Amazon Lockers in large cities, might also contribute to greater awareness of parcel locker stations as a delivery option, which in turn could encourage online buyers to opt for this delivery method for their broader national and even international online purchases. The introduction of an open parcel locker network may additionally motivate other larger parcel carriers to participate in the network, e.g. Hamburg Box. In our view, the paramount market position of DPDHL in the German B2C delivery market in combination with the growing number of Amazon Lockers make it less likely that competing additional networks of parcel locker stations will emerge in Germany.

In summary, the increased use of parcel locker stations in Germany will require significant incentives to motivate users (senders and buyers) in choosing this delivery method above home delivery. As we have seen, convenience plays a key role in recipients choice of delivery method, therefore it is imperative that parcel lockers be regarded as just as convenient or compensate for any loss of convenience, possibly through price incentives. Nonetheless, the evidence has shown that parcel locker stations received a boost in usage thanks to Covid-19 lockdowns and it is reasonable to conclude that its attraction could continue improving under the right conditions and that it can have a successful future in Germany.

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