E-COMMERCE MOBILITIES

THE IMPACTS ON CITIES

WELCOME TO LOGISTICS CITY

№1 · 2020-2021

WELCOME TO

LOGISTICS CITY

Nº1 · 2020-2021

sogaris
La logistique urbaine du Grand Paris

Université Gustave Eiffel

POSTE IMMO

EDITORIAL

« It would be wrong to think of e-commerce as the source of all ills, just as it would be wrong to deny the impacts of such a rapid transformation of the mobility of goods. »

Are e-commerce and urban logistics two sides of the same coin or are we talking about two very different subjects? Confusion reigns, as logistics seems - at last - to be entering the public debate, thanks to the spotlight placed on this essential function of our global economy over the past year.

There is no doubt that e-commerce and urban logistics are linked: the boom in new distribution methods, whether in terms of the mobility of goods, the optimisation of the last kilometre, or the observed repositioning of warehouses in the heart of cities, owes a great deal to the revolution that the exponential development of e-commerce has represented for more than 10 years. What is a comfort for us consumers is however not without questions for the citizens that we must be: the environmental impact of delivery, the employment conditions of instant delivery workers, the increase in nuisances, the conflict of road use, the weakening of local commerce, etc. It would be wrong to think of e-commerce as the source of all ills, just as it would be wrong to deny the impacts of such a rapid transformation of the mobility of goods.

This is why we need to get back to the facts, to objective data, and this is the whole point of this new publication produced by the Logistics City chair directed by Laetitia Dablanc: we understand that e-commerce is in itself less carbon-intensive than traditional commerce, but that our behaviour - product returns, instant delivery, reallocation of free time, etc. - and the behaviour of retailers, distributors and other platforms lead to an overall increase in the carbon footprint of consumption. In this context, urban logistics plays the necessary role of shock absorber, by bringing warehouses closer to the final consumer and by helping mobility in the last few kilometres to evolve towards zero emission. A thorough review of the false evidence that needs to be fully understood in order to better anticipate what a truly virtuous urban logistics system can and should be in the service of our modern societies.

— ***Jonathan Sebbane***
General Director of Sogaris

— ***Rémi Feredj***
General Director of Poste Immo

« The paradox is that all these hopes and fears about the impacts of e-commerce in cities are expressed without robust data. »

E-commerce is contributing to contemporary urban transformations. Its role in the everyday lives of people, but also as a source of activity diversification of businesses and restaurants, has been confirmed since the pandemic. For their part, delivery workers are recognised as essential and the platforms employing them are increasingly being held accountable for the conditions under which this new profession is practised. Finally, cities applauded and facilitated the performance of logistics during the initial lockdown, but are now concerned about a potential explosion of parcel deliveries at all hours and in all neighbourhoods, threatening local commerce and exacerbating air polluting emissions and congestion.

In an interesting article in the New York Times on 4 March 2021, New York's private and public players point to another challenge posed by e-commerce, that of the place it will take in urban planning and real estate in our cities, as its need for efficiency inevitably translates into a growing demand for urban logistics spaces, from the smallest micro-hub to new vertical warehouse formats.

The paradox is that all these hopes and fears about the impacts of e-commerce in cities are expressed without robust data. While e-commerce is inherently digital, the data available to cities and researchers is surprisingly approximate. The unavailable data (on the number and location of deliveries, vehicles, jobs, etc.) is in fact at the very heart of the business model of e-retailers and their logistics service providers. The development of data sharing mechanisms is still in its infancy.

It is all these elements that this booklet has sought to highlight, the result of a year of academic work and intense exchanges with our sponsoring partners of the Logistics City Chair. It is here to stimulate debate and to help the urban management of all the logistics behind the considerable development of e-commerce today move in a more sustainable direction.

— ***Laetitia Dablanc***
Director of Research at the University Gustave Eiffel, Director of the Chair

SUMMARY

INTRODUCTION

HOW IS E-COMMERCE DISRUPTING THE URBAN LOGISTICS ECOSYSTEM?

With the growth of e-commerce, the "logistic intensity" of our commercial transactions in cities has increased and logistics is increasingly visible in the urban landscape. Delivery workers move around, park, unload, consult their smartphones, argue with motorists to justify their double parking, interact with shopkeepers and with the residents they have to deliver to. They are in trucks, vans, but also on motorbikes, cargo bikes, scooters, bicycles or even on foot. On their backs, large delivery bags, of all colours according to the brands that employ them. They are now part of the urban landscape.

This dynamic, perceived as unstoppable after a year of health crisis that is tightening the grip of traditional commerce, raises questions about the impact of e-commerce in the city and particularly about the emergence of a new form of logistics, resulting from e-commerce, as an object of permanent innovation and all the more unfamiliar as logistics sprawl and the digital revolution seemed to have pushed the flows of goods away from the cities. E-commerce is transforming the city as much as it is transforming mobilities. This first part looks at some of the definitions and understandings of e-commerce and the profound transformations it is bringing about in the logistics chain.

E-commerce frontiers

Online shopping is becoming more and more frequent and sales volumes are increasing. When we talk about e-commerce, we first think of transactions between businesses and consumers (**"business-to-consumer"** or "B2C"), but online commerce is mainly made up of transactions between businesses (**"business-to-business"** or "B2B"). According to the United Nations Conference on Trade and Development (UNCTAD, 2020), the global value of electronic commerce reached nearly $26 trillion in 2018, of which 83% represents business-to-business exchanges, including sales on market places and electronic data interchange.

However, in 2018, B2C generated no less than $4,400 billion in spending, of which approximately half involving an exchange of goods. This breakdown has changed in 2020: in France, the e-commerce federation FEVAD estimates show that the share of spending on services has decreased by 10.3% compared to 2019, while **consumption of goods has increased significantly by 32.3%.**

About 14% of all purchases worldwide are made on the web (Statista, 2020a). **The growth of e-commerce is mainly driven by B2C, with double-digit annual growth rates,** higher than those of B2B (Ecommerce Foundation, 2019b). In France, again according to the FEVAD, whilst in 2019 e-commerce accounted for 9.8% of all consumer purchases, this share reached 13.4% in 2020.

BUYER / SELLER	BUSINESS (company, professional)	CONSUMER (private individual)
BUSINESS (company, professional)	Business-to-business E.g. Amazon, Alibaba as well as many small merchants	Business-to-consumer E.g. Amazon, AliExpress, as well as many small merchants
CONSUMER (private individual)	Consumer-to-business E.g. Google AdSense, Adobe Stock, Jobster	Consumer-to-consumer E.g. eBay, Taobao, Le Bon Coin

Table 1. E-commerce categorisation and examples of businesses

Online stores have thus become an important alternative to the shopping street, a global trend that has been reinforced by the health crisis linked to COVID-19. A specific section in this booklet is devoted to the impact of the pandemic on e-commerce and its mobility.

Consumers also frequently use the Internet to buy and sell to other consumers, known as "consumer-to-consumer" or "C2C".

The landscape of e-commerce market players can thus be broken down into four transaction channels.

This booklet focuses on B2C (and to some extent C2C, which we will also explore in other research of the Chair), which is business-to-consumer goods, thus excluding services. Our aim is to highlight the importance of B2C as an economic activity and in its impacts on cities; to highlight the main innovations and developments in this field; to show the links between e-commerce and urban logistics in terms of mobility (of people and goods) and real estate; and to understand its environmental, urban and social impacts at the city level.

The growth of e-commerce is a global phenomenon. Internet penetration, the proportion of online consumers and average spending differ significantly from one country or region to another, but convergences seem to be prevailing in terms of consumer behaviour, technologies and e-commerce processes. Global internet penetration (its usage) has increased by more than 10% over the last five years, reaching an average of 61%. It is highest in Europe (85%) and North America (84%) and lowest in Africa (56%) and Asia and Oceania (53%). Online shopping, in terms of "proportion of consumers using the Internet and having made online purchases", varies overall from 13% to 89%. In Italy, for example, in 2019 only 48% of Internet users were shopping online, which is lower than countries such as China (59%), the United States (82%) and South Korea (89%). In Europe's biggest market, the UK, 87% of internet users shop online.

Europe has the highest online spending per e-consumer: an average of €1,586 in 2019 (Ecommerce Foundation, 2019b). **In France, 75% of the population makes online purchases, spending an average of €2,428 per year (Ecommerce Foundation, 2019a;**

Internet sales reached 112 billion euros in 2020 in France thanks to the accelerated digitalisation of the retail sector.

E-COMMERCE IN 2020 – FEVAD (2021)

Retailx, 2020a). These rates have increased as a result of periods of lockdown in 2020 (see section 4). 55% of French consumers make at least one online purchase per month (FEVAD, 2016) and **the average French e-consumer made 39 transactions per year, a significant increase from only seven transactions in 2006 (Beziat et al., 2020).** Figure 1 shows the share of the population making online purchases in the countries at the top of the list (Retailx, 2020b).

The online retail model does not cover all sectors and product categories. It mainly concerns clothing and sporting gear, media and computer software, and travel and holidays, which were purchased by more than 30% of European e-consumers. Tickets and events as well as household goods were purchased by more than 20%, while around 10% used e-commerce to buy electronic equipment, medicines, food and groceries (Ecommerce Europe, 2018). **Food is a particularly interesting e-commerce category, recent but growing (Econsultancy, 2019). This growth is particularly due to the maturation of "digital natives", consumers who have grown up with digital technology.** In France, before the first lockdown, 20% of Internet users had purchased food online and 12% had an experience of ordering prepared or restaurant meals (Retailx, 2020a). These rates increased following the pandemic.

Urban inhabitants account for the largest share of internet users and online shopping and tend to buy more online. A study by the research bureau 6t (2018) compared online consumption and mobility practices in the inner-city of Paris and Manhattan (New York). 97% of New Yorkers and 95% of Parisians made purchases online in 2017. These figures at the urban level are higher than at the national level: 80% for the United States and 68% for France in 2017 (Ecommerce Foundation, 2018). 73% of New Yorkers and 51% of Parisians had bought groceries online, while meal delivery was also a growing practice in 2017 (90% of New Yorkers and 67% of Parisians). Three-quarters of them used a smartphone application to do so.

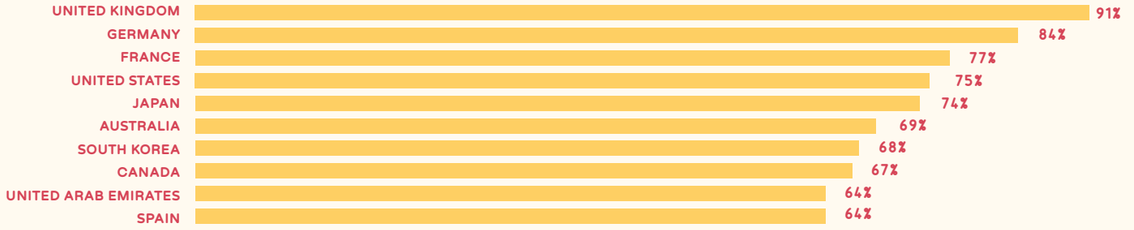


Figure 1. Leading countries in B2C online shopping (including services) in 2019 (Retailx, 2020b).

Online orders generate mobility: mobility of people (to go and collect their parcel at collection points, for example) and, with the strong demand for home delivery, mobility of goods. However, the data enabling the impact of e-commerce on mobility to be assessed is still lacking at national level and even more difficult to obtain at urban level. Although for 2017 the FEVAD (2018) estimates that 505 million B2C parcels were delivered in France, it would be between 700 and 800 million parcels in 2020. On an urban scale, La Poste reports 10 million collections and deliveries per day (B2B and B2C) in urban areas in France (Le Groupe La Poste, 2020). The study by Beziat et al. (2020) and that of Gardrat et al. (2016) present a broader approach to e-commerce. Their surveys of households in Lyon cover all "deferred purchase and reception" practices of households. In addition to e-commerce, examples of such practices include in-store purchases that are delivered instead of being taken home immediately (the so-called **"ship-from-store"**) and purchases by telephone or e-mail. Nevertheless, 95% of all deferred purchases registered concerned e-commerce. Each household in Lyon in 2016 generated an average of 19.2 orders per year (and this figure is certainly much higher in 2020, although detailed data is lacking). These purchases were generated by 73% of households, with variations according to socio-economic characteristics: from 57% for pensioners to 92% for professionals and executives. 60% of these purchases were delivered to the home. A good indicator to apprehend the impact of deliveries linked to e-commerce is the comparison of these flows with those generated by deliveries to establishments (e.g. stores, offices, industries, administrations), which are better known and modelled. Thus in 2016, **additional deliveries and pick-ups generated by e-commerce represented 17% of total deliveries and pick-ups in Lyon.**

E-commerce stakeholders

With the rise of e-commerce, the delivery points previously concentrated at the retail level are multiplying: the volumes previously limited by the storage capacity or shelving space are determined by consumer purchase volumes. Traditional logistical processes such as stock management and store replenishment, long the domain of retail management, are now placed in the hands of the end customer. **The direct entry of consumers into the logistics chain represents a real disruption.** Under their influence, what used to be "housekeeping" activities confined to the outskirts of the city and to delivery areas is now becoming a part of the city. In addition to consumers, e-commerce is contributing to the emergence of new players within the two other main links in the chain, i.e. retailers and logistics service providers.

COMBINING "BRICKS" AND "CLICKS"

Several types of online businesses are shaping today's e-commerce landscape. **At the beginning of the 2000s, "pure players" and electronic marketplaces created the online offer.** Both adopt an exclusively online approach. While pure players only run their own online store(s), e-marketplaces consolidate the online assortment of several businesses (e.g. Amazon for a large part of its activities). These e-retailers have disrupted retail sales. Their competitive prices, extensive assortment and delivery and return services call into question the relevance, resilience and longevity of physical shopping streets. Newspaper headlines talk about the "fall of the mall" and the "retail apocalypse", amplified by lockdown controversies over the definition of essential goods and authorised businesses.

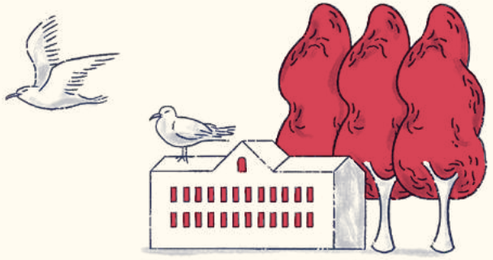
After more than a decade of widespread adoption of e-commerce, stores of all sizes have undergone major changes, now amplified by the health crisis. In small and medium-sized cities, there has been an increase in vacancies and a decrease in the number of independent retail businesses (Moriset, 2018). This is also confirmed by the most recent figures for the Paris metropolitan area by APUR (2020). Yet the changes are also reflected in a diversification of ways of selling and sales channels: **many traditional retailers with a (network of) physical shop(s) have been transformed into multichannel and omnichannel retailers.** These types of **"phygital"** retailers combine an online presence (e.g. website, app, social media) with offline stores. They are also referred to as "digitalised commerce" or **"bricks and clicks"**. The most striking example in France is that of the FNAC. While **multichannel retailers** adopt a partitioned approach, in which online and offline purchases are handled separately, **omnichannel retailers** integrate online and offline retail channels in a single process. In practice, omnichannel retailers enable consumers to make online purchases and pick them up in-store or return them to the store, order items in-store and receive them at home, and merge online and offline shopping. The strength of the "bricks and clicks" retail model is demonstrated by examples of large pure players launching and/or acquiring a network of physical stores, for example Amazon with its purchase of Whole Foods in the US.

THE LAST MILE AND ITS DELIVERIES

In urban areas, the logistics market has adapted to changes in retail. Within the global parcel, courier and express delivery sector, a new segment specifically dedicated to the delivery of parcels in urban areas has emerged. **Accordingly, logistics service providers have specialised in the "last mile" of the retail supply chain, the final stage between the last warehouse where an item is stored and its destination, often the consumers' home.** The development of e-commerce has mainly contributed to the growth of last mile logistics service providers such as Colissimo, Chronopost, UPS and DHL, in exchange for fast and secure processing of the most visible and sensitive part of the retail supply chain. Their mission is described as "the battle against time and space" (Moriset, 2018). **The environmental and economic difficulties associated with the last mile, as well as its key importance for consumer satisfaction, are summarised as the "last mile challenge".**

Attracted by the explosive growth of e-commerce and determined to solve (part of) the last mile challenge, new innovative players have entered the market. These initiatives provide specific solutions for the business-to-consumer parcel market. They play on four determinants: **information systems** (organisation of delivery rounds); **hub organisation** (nearby storage); **the implementation of mobilities adapted to urban delivery** (e.g. cyclo-logistics); and **the insistence on human resources**. Examples include Colis Privé, which concentrates on collection points and ensures a new delivery in the event of home delivery failures, or Mr Pacha, which collects parcels from very active online shoppers and delivers them together on a predefined time slot. Another concept, which has enjoyed strong academic and media popularity, but without many concrete achievements close to its original concept, is that of **"crowd logistics"**. The original concept (similar to the UberPop ride-sharing service) transforms ordinary citizens into delivery workers, enlisting this "crowd" of people already travelling from point A to point B to pick up a parcel and making a stop along the way to drop it off. In doing so, crowd logistics combines algorithmic innovations in route organisation and human resource management. The initiatives of this "crowd" are very varied and diverge to varying degrees from their origins. **While the initial idea of optimising individual trips was not very successful, more professional crowds have developed:** UberEats, Deliveroo and Amazon Flex are examples of this. Several features of crowdsourced delivery or crowd-logistics are important to note (Buldeo Rai, 2019). Entirely oriented towards the digital economy, these players base their operations on platforms. They match the demand for logistics services with the supply of individuals whose logistics skills are amateur, self-assessed and uncertified (Carbone et al., 2017).

The environmental and economic difficulties associated with the last mile, as well as its key importance for consumer satisfaction, are summarised as the "last mile challenge".



"PROSUMERS" AND "LOGSUMERS"

By changing their consumption habits, **consumers are the driving force behind electronic, multichannel and omnichannel commerce.** The "prosumer" (proposed by the American sociologist Alvin Toffler) is defined as the fusion of producer and consumer, through the use of digital technologies: user-generated articles on Wikipedia, open source software via Linux, or purchase recommendations on Amazon based on buying habits, product reviews and site navigation. In e-commerce, consumers are increasingly responsible for defining the logistics service that suits them. **Becoming "logsumers", they can take an active part in making decisions about delivery times, price, quality and - still timidly but increasingly - the "green" or fair aspects of delivery services, and even about the logistics provider who delivers them.** H&M's sister brand, MONKI, offers the choice of slow ("standard") or fast ("express") delivery. Parisians can choose home delivery the day after purchase. In the Netherlands, it is even possible to receive products in a "climate-smart" way: by biogas trucks and bicycles. This trend improves the shopping experience for consumers, but for logistics service providers it is a "nightmare" (Savelsbergh & Van Woensel, 2016). It is much more difficult to organise efficient delivery routes when individualised time slots and multiple location types, for example, are added to the equation.

In the future, efficiency and sustainability in urban logistics will have to go hand in hand.

In the future, efficiency and sustainability in urban logistics will have to go hand in hand. **In the last mile challenge and for a more sustainable e-commerce model, consumers will be key players:** using collection points instead of home deliveries, collecting parcels on foot, by bicycle or within a chain of trips, accepting longer delivery times, grouping deliveries, preventing delivery failures and reducing excessive returns (Buldeo Rai, 2019). Moving towards a reduction in e-commerce mobility (or even towards "demobility", or a net reduction in purchase-related mobility) can play a role in favour of more sustainable e-commerce.

Increased scientific interest

As a research topic, e-commerce has received a great deal of attention over the last decade. European Union research funding under the "Framework" and "Horizon 2020" programmes has involved 231 projects in urban logistics or urban mobility related to e-commerce. This list includes completed or ongoing projects, which deal directly or indirectly with e-commerce. MOBYPOST (2011-2015) introduced an innovative concept of sustainable mobility for a more ecological postal delivery of mail and parcels by electric vehicles. Several projects have focused on specific solutions, such as urban consolidation centres (SUCCESS, 2015-2018), electric vehicles (RESOLVE, 2015-2018) and crowdsourced distribution (CROWD4ROADS, 2016-2019). Other projects have introduced a comprehensive approach, such as "living labs" to stimulate innovation in urban logistics (CITYLAB, 2015-2018, which has also set up an Observatory of e-commerce trends affecting mobility), cooperative business models (NOVELOG, 2015-2018) and carbon footprint assessment (SmartEnCity, 2016-2021).

E-commerce mobility is already present in the major conferences on urban logistics: "International Conference on City Logistics" (ICCL), "International Urban Freight Conference" (I-NUF) and VREF "Conference on Urban Freight". At the 11th ICCL in 2019, one third of the presentations were related to e-commerce, covering topics such as delivery robots, cargo bikes and electric vehicles; collection points and micro-hubs; consumer behaviour and preferences; and delivery routes. At the 8th edition of I-NUF in 2019, a fifth of the conference papers were related to e-commerce. Similar topics were discussed, including cargo bicycles, collection points and consumer behaviour, while also looking at methodological issues related to data, simulation and optimisation tools and impact measurement. At the 4th edition of the VREF conference in 2018, one out of eight topics was directly related to e-commerce, including impacts on logistics and urban distribution.

Projects on e-commerce mobility in cities are also being launched at national and regional level. In France, PUCA (Plan Urbanism, Construction, Architecture, an inter-ministerial agency) has funded the VIP project to examine the effects of online sales on access to goods, studying urban and metropolitan disparities. In its latest edition devoted to the productive city (2020), projects directly related to e-commerce and its logistics workers were selected. The French National Research Agency (ANR) recently approved a research programme (MOBS), in which the Logistics City Chair is participating, specifically dedicated to the analysis of consumer mobility and that of e-commerce players.

This non-comprehensive overview of the different research projects related to the mobility and logistics of e-commerce in cities demonstrates the growing attention of the scientific community to this topic. It also indicates the interest of public and private actors.

PRESENTATION OF THE CONTENTS OF THE BOOKLET

The Logistics City Chair builds on and contributes to this accumulated knowledge by linking it to logistics real estate, one of the most recent dimensions of this research stream. Its ambition is to include the issue of logistics locations and the analysis of the territorial impact of e-commerce mobility and digital transformations in the field of urban studies. As such, the Chair is dedicated to research on urban logistics with two scientific axes: a first axis dealing with urban and suburban logistics real estate; a second axis dealing with trends and new consumption practices and their impact on urban logistics and its real estate. Booklet n°1 of "Welcome to logistics City" proposes an analysis of the mobilities generated by e-commerce, both in terms of goods and personal transport, and studies the impact of these mobilities in all dimensions of urban logistics, its vehicles and its places. Particular attention is paid, in a dedicated chapter, to the consequences of the health crisis and the resulting perspectives. The booklet concludes with a discussion of the pressing need for data, which is perhaps the main obstacle to advancing this field of research and to understanding the logistics challenge for the cities of the future.

MOBILITIES GENERATED BY E-COMMERCE

B2C e-commerce is at the crossroads of both personal and goods mobility and this is even more true in cities. The city defines itself as a concentration of people and activities, and therefore also concentrates the demand and supply of goods. While the movement of goods is essential for maintaining urban life, the mainly road-based transport which e-commerce generates has negative local side-effects, such as congestion of the public space, noise nuisances, damage to infrastructure and air polluting emissions. The emission of greenhouse gasses has serious global repercussions.

Rising online orders and the resulting increase in deliveries undoubtedly contribute to these negative side-effects. However, to fully comprehend the impact of e-commerce on the urban environment and quality of life, we need to go beyond the conventional focus on delivery operations and the movement of commercial vehicles and recognise that online shopping affects both the mobility of people and goods and their respective contribution to externalities.

When buying goods online, the need for consumers to visit stores is theoretically eliminated and delivery operations are created instead. However, the relationship between personal and goods mobility in e-commerce is not at all clear. Online consumers still visit (or, in times of lockdown, feel the need to visit) physical stores for social interactions or for examining products.

When online orders are not delivered to the home or when another location has been chosen at checkout, consumers still travel to collect their purchases. And when online orders fail to live up to expectations, are faulty or damaged, consumers still go to stores or collection points to initiate a return procedure. These returns can in turn create additional goods movements. It is therefore essential to take into account both the mobility of consumers and that of logistics service providers. In the study already mentioned, research bureau 6t (2018) analysed consumer movements related to purchases and their preferences in terms of delivery options (Figure 2). This study also highlights disparities between online consumers in Paris and New York.

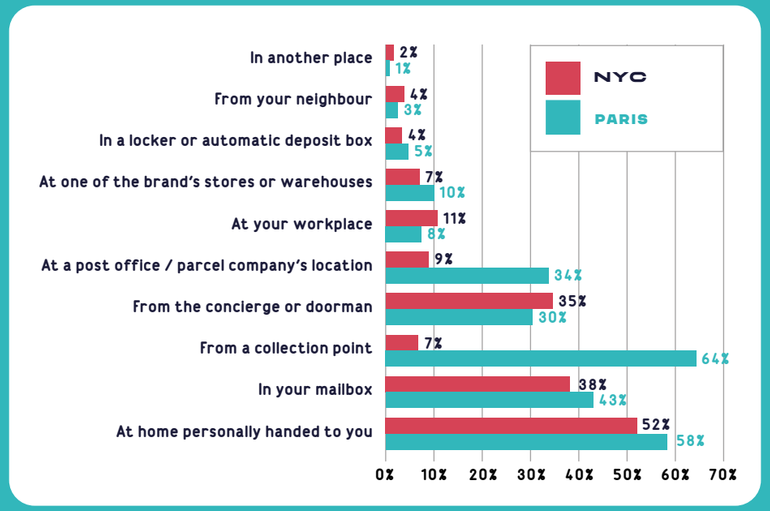


Figure 2. Parcel collection methods used in 2017 in Paris and New York (several answers possible) (6t, 2018).

PERSONAL MOBILITY: HOW DOES E-COMMERCE IMPACT OUR MOBILITIES?

In early research on e-commerce mobility, online orders were often considered direct replacements for purchases in physical shops. According to the **substitution principle**, it is more efficient for a few vehicles to make a couple of delivery rounds (in the case of e-commerce) than for a large number of vehicles to drive individually to and from stores (in the case of conventional retailing). As a result, these earlier studies (focusing on areas where consumers shop by car, which is not the case in city centres of large cities, for example) have shown substantial traffic savings and positive side effects on transport emissions.

Cairns (2005), for example, assessed international data on the shift from in-store grocery shopping to e-grocery shopping and estimated that vehicle-kilometre reductions of 70% were feasible. Much later, when e-commerce became widespread, Wygonik et Goodchild (2014) reached similar conclusions: for everyday purchases, personal travel generates more vehicle-kilometres than deliveries by truck. The latter, however, generate higher levels of pollution. Accordingly, the study concludes that e-commerce generates less traffic and congestion, but more pollution.

In Europe, however, vans rather than trucks are the most common type of vehicle for delivering online orders (Allen et al., 2018) and many purchases of urban consumers are made on foot, which changes the impact of substitution. **Different types of vehicles potentially produce different results, but variations can also be expected depending on the type of product, e.g. more substitution for food orders and less for non-food items.**

While internet use and mobile phone penetration increased significantly from 1984 to 2004, the number of annual kilometres driven per driver increased by 34% over the same period.

An earlier study by Mokhtarian (2009) showed that while internet use and mobile phone penetration increased significantly between 1984 and 2004, the annual number of kilometres travelled per driver increased by 34% over the same period. Although these statistics call into question the substitution hypothesis, more recent surveys **indicate a stabilisation of personal mobility for shopping.** In France, the share of trips to supermarkets increased until the early 2000s, but this trend ceased in favour of small and medium-sized stores closer to homes. **The renewed interest in small shops is partly explained by the investment of large retailers in proximity shopping, many of which belong to the same groups (Carrefour, Casino and other food supermarkets).**

It also undoubtedly reflects a change in consumer behaviour. In Île-de-France, shopping trips are down slightly, unlike other trips: from 5.5 million shopping trips per day in 2010 to 5.3 million shopping trips per day in 2018. One of the explanations for this is the reduction in occasional in-store purchases, which are now often made online. In the United States, the latest "National Household Travel Survey" shows a significant decrease in the number of trips for three purposes, including shopping. A reduction of about one-third in shopping and errands trips in 2017 compared to 1995 is observed (Mcguckin & Fucci, 2018).

The impact of e-commerce on consumer purchasing and travel behaviour is complex. Cullinane (2009) examines four potential links between e-commerce and mobility. **In addition to replacing or substituting for each other, e-commerce can change consumer travel behaviour, generate more purchase related travel or add non purchase related travel.** This is where **"omnichannel consumer behaviour"** comes into play, which refers to the simultaneous use by consumers of physical shops and online sales channels to make a single purchase. By viewing consumer shopping trips as a five-phase process, consumers can engage in product research, product testing, actual purchasing, product reception and product return (Buldeo Rai, 2019). **These different phases constitute the consumer "path to purchase"** and can be carried out at different times, in different ways or not at all (in the case of research, testing and return). In this way, the omnichannel model that retailers have developed is entirely grounded on consumers' behaviour patterns. However, consumers behaved omnichannel long before these new retail models came into existence: researching products online before making a purchase in-store or testing products in-store before buying them (at a lower price) online. International surveys show that 38% of American consumers (UPS, 2016) and 64% of Belgian consumers (bpost, 2017) actually make omnichannel purchases. Today, the figures are probably even higher.

Omnichannel consumer behaviour both changes and generates mobility. 57% of very small, small and medium-sized e-retailers in France sell both in traditional stores and online. What's more, 75% of French e-buyers think that local shops should provide an e-commerce offer (FEVAD, 2020). The modification of trips related to purchases is done in particular via **click-and-collect.** This process consists of searching for and purchasing items online, while in-store visits are only used to receive the purchase. Online browsing, where consumers study the assortment, compare product features and check reviews, followed by a purchase in the shop, can also change the shopping trip. For example, by encouraging visits to other, more specialised shops.

In addition to modification, e-commerce can also lead to trip generation, as consumers become aware of products they would like to buy that they would not otherwise have encountered. In another way, search behaviour can generate trips when several shops are visited before making a purchase, whether online or in-store.

Finally, the service called **ship-from-store** also generates trips because it allows in-store customers to receive their purchase at home instead of carrying it themselves. This system is particularly useful when items are bulky, heavy or out of stock. It can also be implemented to improve consumer comfort. In this way, ship-from-store generates delivery routes alongside consumer visits to stores, i.e. double mobility. A survey conducted by SprintProject and GS1 (2020) among 2,000 French consumers shows that they appreciate delivery services after an in-store purchase (Figure 3).

Omnichannel consumer behaviour both changes and generates mobility.

Retailers and e-retailers experiment with several types of technologies throughout the purchasing process, which have substitution, modification or trip generation effects. While the web offers consumers unprecedented search possibilities, e-retailers aim to improve the in-store search process by introducing virtual screens, self-service kiosks and digital signage. On the contrary, stores (just think of bookshops) are outperforming online solutions when it comes to testing and trying out products and obtaining "humanised" information. To overcome this disadvantage, online retailers offer innovations at various levels of technological advancement to virtually try on clothes and accessories: from downloading digital images and avatars to fitting rooms equipped with augmented reality. Less technologically advanced solutions include home-delivered testers to try on various items before making a final choice and campaigns that encourage "fitting rooms at home", involving over-ordering and excessive returns. Digital home assistants and other distance retail technologies that use augmented reality, virtual reality and touch technology support out-of-store shopping. In-store purchase support is created by contactless payment technologies, allowing payment by mobile phone or automatically.

Irrespective of the different ways in which consumers combine physical and online shops for their purchases, **e-commerce profoundly affects mobility by facilitating the overall "fragmentation of purchases".** This concept describes the disaggregation of the shopping activity into a large number of different sub-activities, some of which are carried out physically and others electronically from various locations. In concrete terms, instead of going to shops once to buy a selection of items, e-commerce allows each

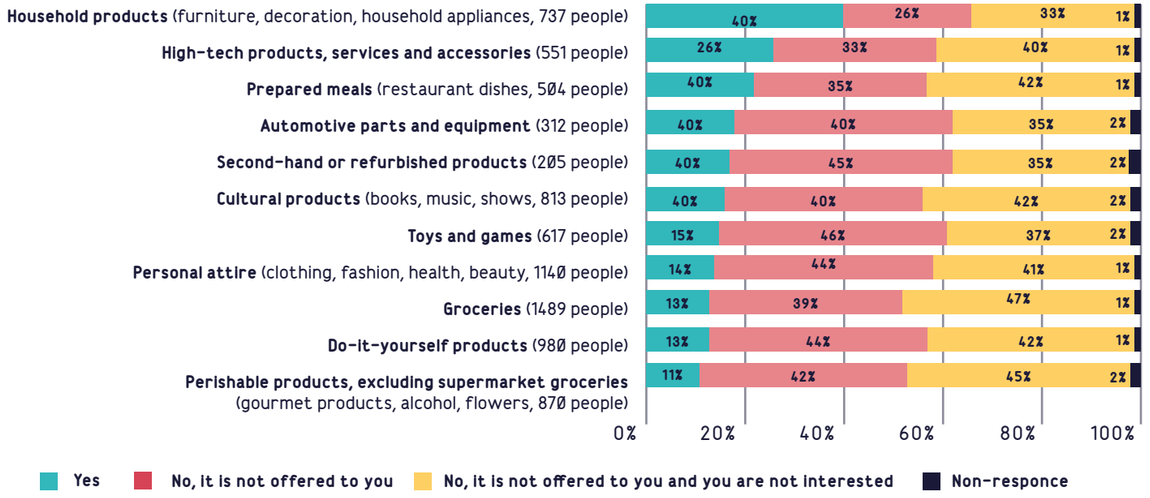


Figure 3.
The "ship-from-store" offer and consumer interest in France. Question asked to in-store shoppers in different categories: "Generally, are the following products delivered to you after an in-store purchase?" (SprintProject, 2020).

of these items to be purchased at different times of the day and from different companies. As a result, a single trip to the store is replaced by several deliveries (which does not prevent these deliveries from being consolidated and organised into rounds). **This fragmentation process has been further reinforced by the massive adoption of smartphones. Shopping is possible at any time of the day,** "including at work, on public transport, in airports and even in the mountains" (Cullinane, 2009). Research bureau 6t (2018) found that intensive online shopping goes hand in hand with frequent trips to the grocery shop.

Moreover, their survey found that only 3% of Parisians and New Yorkers no longer go to the grocery shop since they started shopping online. Evidently, **e-commerce has changed consumers' activity patterns, which are no longer solely polarised by specific locations, such as suburban supermarkets or convenience stores, but fragmented in space and time (6t, 2018).**

75% of French e-buyers think that local shops should provide an e-commerce offer.

Discussing e-commerce related mobility also requires a closer look at consumers' travel choices. When shopping, distance travelled, modal choice, type of vehicle and the number of activities combined in a trip are key elements. Simply put: walking or cycling are always preferred over delivery trips and in this case the substitution of traditional shopping by e-commerce is negative for the environment, whereas long journeys by combustion engine car for the sole purpose of shopping, are on the contrary worthwhile to be replaced by an online purchase, and in this case e-commerce is more preferable to traditional commerce.

Finally, in addition to the trips induced by a purchase, other indirect parameters come into play, such as trips generated over the time freed up by online shopping to carry out other activities.

E-commerce has changed consumers' activity patterns, which are no longer solely polarised by specific locations, but fragmented in space and time.

We need to place the mobility of B2C consumers in the broader debate on personal urban mobility and the profound changes it is undergoing. Reduction in the number of private cars and parking spaces in the city, urban aspirations to proximity (of the "fifteen-minute city") and implementation of eco-neighbourhoods promising more sustainable mobility have impacts on goods mobility as well, which are often ignored. In the development of cities with calmer mobility, it will be necessary to propose appropriate delivery solutions. The debate exists, but it is not sufficiently systematic when managing urban projects and transforming rules and regulations for the use of public spaces and roads.

MOBILITY OF GOODS IN THE E-COMMERCE ERA

Mobility data related to B2C deliveries are scattered and sometimes contradictory (Buldeo Rai & Dablanc, 2021, cf. section 5). This is paradoxical: data are overabundant simply because of the very high level of digitalisation in the sector, but fiercely guarded by e-retailers and their logistics service providers as they constitute one of the major resources of their business model.

E-commerce has considerably increased the number of new trips by logistics providers over short distances and the last mile (Hooper & Murray, 2019). The 2019 National Household Travel Survey shows that e-commerce generates 1 delivery per week per household in the US and 1.35 in New York. In Lyon, home deliveries represent approximately 130,000 movements (deliveries and shipments) per week, or just over 17% of all goods movements in the city (Gardrat et al., 2016).

The impact of e-commerce on the mobility of goods also lies in its effect of accelerating transformations. The way in which goods are transported is in fact the subject of considerable service innovations linked to speed, time, flexibility, information and the price of deliveries. Also jobs are being changed.

Speed of delivery

Very early on, fast delivery service was seen as one of the key factors in the success of e-commerce. Amazon is famous for building its business around quick and guaranteed delivery. In doing so, Amazon has set the bar high in terms of what consumers expect, forcing other e-retailers to follow suit. Whereas waiting a week (or more) was common in the early days of e-commerce, today's consumers expect to receive their orders within two days or even the day after their purchase. Consumer surveys in Belgium (Buldeo Rai, 2019), the Netherlands (Nguyen et al., 2019), France (SprintProject, 2020), China,

The impact of e-commerce on the mobility of goods also lies in its effect of accelerating transformations.

Bolivia and Brazil (Janjevic et al., 2019) highlight the importance of delivery times when online shoppers choose a delivery option. **However, they also indicate that speed is less sensitive than other aspects of delivery, such as cost.** Delivery within a few hours, or even "instantly" (within two hours), is becoming increasingly common. Same day delivery and instant delivery are required by younger consumers and **"millennials"**, born between 1980 and 1994, and are growing particularly in urban areas and for specific categories such as food (mainly prepared meals and groceries) and pharmaceuticals. Services such as Amazon Prime Now, which are only provided in very large cities, have increased the volume of instant deliveries in cities, although it is difficult to identify precise figures.

Ever faster deliveries make it more difficult to fully load vehicles and optimise delivery rounds, which in turn increases costs and nuisances such as congestion, noise and pollution. This also leads to an upsurge in the frequency of deliveries and an increase in the overall demand for transport. **All these reasons may encourage consumers to opt for longer waiting times where possible.** Research in Belgium (Buldeo Rai, 2019), the UK, France and the Netherlands (B2C Europe, 2018) has shown that consumers are willing to do so. These studies also highlight a lack of knowledge about the relationship between speed of delivery and environmental impact. **80% of online shoppers are not aware that fast delivery has a more negative impact on the environment than slower standard delivery** and 32% even think that slow delivery is more negative than fast delivery (B2C Europe, 2018).

However, not all fast deliveries are harmful for the environment. In urban areas, fast and instant deliveries are often dispatched from local shops, restaurants or **"dark kitchens"** (restaurants without customers, preparing

meals for delivery only). These locations are located closer to consumers than the average warehouse, allowing deliveries to be made by sustainable transport modes such as bicycles. Many initiatives have been launched to meet this new type of demand (and sometimes to create it), mostly based on platforms: Postmates (now owned by Uber), Deliveroo, UberEats, Meituan and Rappi are some of the well-known examples. There are also local providers, such as Frichti and Stuart in France.

The Logistics City Chair conducts regular surveys on **"instant delivery"** services (in less than two hours and via digital apps) in Paris. While in 2016, 87% of deliveries were made by bicycle, this share has gradually decreased over the years: to 73% in 2018 (Dablanc et al., 2019) and 47% in 2021 (Dablanc et al., 2021). The share of electrically assisted bicycles has increased as well as the use of bike-sharing scheme bicycles Velib (18% in 2021). A clause prohibiting the use of Velib "for regular commercial delivery purposes" was added to the Velib user contract in 2020, but it remains to be seen whether this prohibition has a legal basis.

80% of online shoppers are not aware that fast delivery has a more negative impact on the environment than slower standard delivery.

The use of mopeds has grown: used for 9% of deliveries in 2016 and 36% in 2021. The vast majority of moped-based deliveries are illegal, since French law requires a freight transport licence to deliver using a motorised vehicle. These developments undermine the environmental potential of instant deliveries: most mopeds in Paris are still combustion engines and generally very polluting.

The Belgian platform bringr (bpost) was counting on the environmental benefits of its crowd-delivery service, which have not materialised due to the predominant use of private cars (not bicycles) that are used for dedicated purposes rather than as part of a trip for other purposes (Buldeo Rai, 2019). In the United States, Amazon Flex, which is used by individuals making urban deliveries for Amazon to generate extra income, also adds a large number of car trips in large cities.

Time of delivery

Another service innovation is that e-commerce has changed the time of delivery, i.e. when consumers receive their deliveries. The standard service focuses on normal working days and office hours. During this period, consumers tend to be away from home and cannot receive deliveries at home. **In this "e-commerce paradox", the number of online shoppers increases, but the chance of receiving deliveries decreases** (what logistics service providers call **"delivery failure"**). One solution to remedy this paradox and improve consumer satisfaction is to adapt the delivery time. Schedules are diversified by offering evening and weekend deliveries, when consumers are actually at home, and delivery times are reduced to slots of one or two hours so that consumers can better organise themselves to receive their deliveries.

It is very common to offer tight delivery times for online grocery deliveries. Due to the perishable nature of the products and their sensitivity to temperature, the entire food logistics process up to delivery to the consumer's home must be guaranteed under optimal conditions. Food and groceries cannot be left with neighbours, taken to collection points or re-delivered the next day, which are common alternatives in the event of non-food deliveries failing. In order to solve the difficulties related to delivery

times, food retailers are experimenting with innovative solutions.

The two main innovations include boxes that guarantee temperature control for a certain period of time and "smart locks" where consumers use their smartphone remotely to allow delivery workers access to their homes and refrigerators. While reception boxes are installed at consumers' homes, delivery boxes are free-standing and must be returned to the retailer. The boxes can be customer-specific or shared between several households in the same neighbourhood. Pilot projects have been set up in Scandinavian countries, for example by SOK and Hollming in Finland.

"Smart locks" are more technologically advanced and rely on smartphones, security cameras and connected door locks. They have been successfully tested, for example in Sweden by the ICA supermarket chain and in the USA by Walmart. However, although boxes and locks are very different types of innovation, both raise concerns about their technical feasibility, business model and consumer acceptance.

For non-food items purchased online, evening and weekend deliveries are becoming more and more frequent, but time slots of one or two hours are not so common. An exception is provided by **"logistics-as-a-service"** initiatives, which function as alternative delivery address for their customers, collecting their deliveries, bundling them and delivering them within a predefined time slot. These providers obviously charge for their services and therefore target the most active online consumers. Most of the international examples have gone out of business, such as DROP in the Netherlands. In Belgium, Parcify experimented with logistics as a service, but found the business model unfeasible. In the Paris region, Mister Pasha (bought by Stuart) is continuing its activities.

In France, 20 million parcels have been delivered a second time in 2018.

From an economic and environmental point of view, the diversification of delivery and collection times can have both positive and negative impacts. The positive impact stems from the economic challenge for the actors in the chain to reduce delivery failures. Depending on the source, the year of publication and the geographical context, studies on the subject show that delivery failure rates vary from 2% to 60% (Buldeo Rai et al., 2019). **In France, 20 million parcels have been delivered a second time in 2018** (Haurillon, 2020). Delivery failure leads to a second (and sometimes even third) delivery in some cases and always requires handling and communication, which entails costs for logistics providers. According to the UK trade association for online commerce, IMRG (2016), these costs amount to between £1.90 and £3.40 (between 2 and 4 euros) per failure. For e-retailers too, this is a key concern. Improving performance on the first delivery run is de facto an environmental improvement.

In contrast, negative impacts of delivery time service innovations come from the reorganisation of routes, one of the major challenges for logistics service providers, who invest in route management and optimisation systems. **The redirection of parcels from regular daytime rounds to dedicated evening or weekend rounds and the rescheduling of rounds to meet delivery windows are all impediments to efficient delivery.** Innovative solutions to capture the benefits of tight delivery windows and avoid the pitfalls of inefficient routing, are introduced again by online supermarkets. Picnic, an online supermarket in the Netherlands, delivers by electric vehicle and offers its customers tight delivery windows for their weekly grocery deliveries. Different time slots are offered depending on the address of the consumers and pre-determined delivery rounds, scheduled at city and neighbourhood level. The UK online supermarket Ocado also offers different time slots and encourages consumers to choose a time when a delivery round is already scheduled in their neighbourhood, using green delivery van icons.

In France, 20 million parcels have been delivered a second time in 2018.

Diversification of delivery times requires ever greater flexibility from delivery staff in the B2C parcel sector, while shorter delivery times and concentration on certain preferred consumer schedules add constraints and pressure to meet expectations. Delivery companies are dependant as well on peak traffic situations, which are themselves increasingly volatile and difficult to predict.

Flexibility and information on delivery

Another service innovation concerns delivery flexibility: **logistics service providers implement dynamic re-programming or re-routing of parcels that are close to - or already in - the transport chain.** This

innovation allows consumers to change the date, time and/or place of delivery, a service to which consumers are increasingly receptive. This rescheduling of parcel delivery is important for half of online consumers in their decision to shop online, but this option was not offered at the time of their last purchase. In France, 24% of consumers are inclined to use this service when it is available (Chenevoy, 2019). As consumers are actively involved in the delivery process, allowing flexibility reduces the risk of delivery failure. **On a larger scale however, delivery flexibility complicates a volatile model**, in which the efficient planning, routing and loading of routes and vehicles becomes more difficult.

All innovations in delivery related services are accompanied by an exchange of information with consumers. In the early days of e-commerce, consumers were given little or no details about the expected delivery date and time for their online purchases, let alone the possibility to apply changes in-flight. From a retailer's perspective, improving the transparency and visibility of the delivery process improves the delivery experience. **From the perspective of logistics service providers, providing delivery details is a way to bridge the lack of a formal connection between them and consumers.** After all, it is retailers who order and pay for delivery services, leaving an information and communication gap between logistics service providers and the customers (i.e. consumers) of their customers (i.e. e-retailers), which does not facilitate the optimisation of the last mile.

Most logistics service providers in the B2C parcel market today have implemented smartphone applications and dedicated web interfaces for two purposes: notification of delivery status and delivery preference selection. These two types of applications allow both the transmission of information to consumers through active alerts or links in text messages or emails, and the provision of information to consumers themselves. This information is both real-time, based on the driver's planned route, actual location and latest scans, as well as predictive, based on average route information. Although delivery staff may not always be comfortable with the real-time, public display of their location, this is an informative function that is largely driven by instant delivery platforms that allow delivery staff to be tracked at a glance. It is also highly sought-after by consumers: 61% of online consumers consider the tracking of shipments as one of the three main imperatives for good delivery (Econsultancy, 2019). Among French e-consumers in particular, 73% expect real-time delivery tracking (SprintProject, 2020).

Among French e-consumers in particular, 73% expect real-time delivery tracking.

When selecting delivery preferences, the interfaces and applications provided by logistics service providers allow consumers to entrust their delivery preferences: a neighbour or a safe place near their home in case of absence, or a specific collection point or locker location where they prefer to be delivered rather than at home. By giving consumers the opportunity to provide this information, logistics service providers are effectively less dependent on the options that e-retailers offer consumers and the information they collect. **However, these developments represent a challenge (and cost) for logistics service providers in terms of investment in information systems.**

Price of delivery

The most important characteristic of any delivery service remains its price. This has been repeatedly confirmed by consumer surveys: in Belgium (Buldeo Rai, 2019), the Netherlands (Nguyen et al., 2019), France (SprintProject, 2020), China, Bolivia and Brazil (Janjevic et al., 2019). **Despite its growing importance in consumers' purchasing decisions, consumers are unwilling to pay for delivery services.** Experiments with consumers and practical tests carried out by e-retailers have demonstrated the importance of free delivery. In an experiment in the United States where the product, retailer, delivery speed and return options remained constant, a first scenario offered the product at $130 with free delivery while a second scenario offered the product at $120 and charged $10 for delivery. Although the overall spending was the same in both scenarios, 66% of respondents chose scenario one (Gallino & Moreno-Garcia, 2018).

Not charging consumers for delivery implies that e-retailers cover these costs in another way, by raising product prices or covering them by marketing budgets. In some cases, generous delivery conditions (and by extension returns) have prevented major online retail platforms from making a profit. For Zalando (an e-retailer in the fashion industry), this has been the situation since its launch and years later. **The "free delivery paradigm" in particular leads to regular price negotiations between e-retailers and logistics service providers.** Although a Belgian study of a small sample of omnichannel retailers showed that switching service providers is infrequent, logistics service providers feel increasingly compelled to lower their rates and compete on price (Buldeo Rai, 2019). As margins in the logistics sector are low, this increases already existing phenomena of subcontracting or the use of independent workers, often to the disadvantage of employees in this sector.

Not only can 'free' delivery have a negative impact on the retail and logistics sector, but it also affects our consumption patterns and the nature and volume of flows. It encourages fragmented shopping, impulse buying (e.g. low-priced goods being shipped halfway around the world) and excessive returns (the home as a fitting room). Thus, consumers motivated by free delivery generate behaviours that can lead to inefficient delivery routes that amplify urban nuisances. New services are being deployed to remedy this situation, including flat-rate subscription delivery services, free delivery options coupled with a minimum purchase amount or price differentiation. Local logistics spaces in the form of neighbourhood hubs also make it possible to consolidate flows and organise the return or re-circulation of products.

With e-commerce subscription services, consumers pay a regular fee in exchange for benefits such as free delivery. A well-known example is Amazon Prime. **"There are more than 150 million Prime members worldwide and they spend twice as much as other customers"** (Grasland & Moutot, 2020). Research in Belgium (Buldeo Rai, 2019) and France (SprintProject, 2020) has shown that consumers are particularly open to this type of service. An example of alternative subscription-based services includes automatic replenishment, in which specific items are automatically delivered, such as boxes containing beauty products and meal preparation kits.

An alternative solution to meet the demand for free delivery is to link it to a minimum purchase amount. This encourages larger online shopping baskets and allows for more efficient purchasing practices and deliveries in turn.

Finally, the price of delivery services can be differentiated according to convenience. **Price differentiation is usually associated with delivery time and place of delivery.** For example, while a standard delivery to a local collection point during the week is free of charge, a price is charged for home delivery, next day delivery or evening delivery. Although the majority of consumers opt for the standard offer which reduces the extra expense, some consumers (or consumers in certain circumstances) are willing to accept an additional service at a higher cost (Buldeo Rai, 2019; Nguyen et al., 2019).

In conclusion, the growth of online shopping is transforming the characteristics of goods mobility, particularly urban mobility, in many ways. It generates service innovations by reducing delivery times, forcing more precise management of delivery slots, giving recipients (consumers) more power over the organisation of the times and places of delivery, and making delivery prices increasingly invisible. It is also an important force in the transformation of urban delivery jobs.

"There are more than 150 million Prime members worldwide and they spend twice as much as other customers"

INSTANT DELIVERY AND THE SOCIAL CHALLENGE OF LOGISTICS

The rapid development of "instant delivery" services by B2C platforms is disrupting logistics employment with the use of a **flexible workforce organised according to demand.** An arsenal of terms has emerged to deal with this new type of worker: in addition to the **"crowd"**, there are **"auto-entrepreneurial"** delivery workers and **"uberized"** delivery workers in France, **"riders"** in Italy and Spain, **"gig workers"** in the United States. The profiles of these new workers are varied: students, working people and taxi drivers who take deliveries during or after their trips, customers and store employees who make deliveries from the store on their way home (Buldeo Rai, 2019).

The number of full-time gig delivery workers is increasing, as shown in the 2020 survey of delivery gig workers in Paris, where they represent 73% of the workers surveyed (Dablanc et al., 2020). In theory, these platforms allow almost anyone to become an amateur, ad hoc, fast delivery provider. In reality, however, the irregular, flexible and poorly paid delivery activities of digital platforms now employ people on a full-time basis (Dablanc et al., 2017).

The platform economy is creating a new type of employment for self-employed workers who are highly economically dependent. These jobs are precarious and have lower or non-existent health insurance, accident compensation, unemployment benefits or retirement packages. In the delivery sector, they are also accused of encouraging dangerous behaviour on the road, as their income is strictly correlated to the number of delivery tasks performed. The latest survey of self-employed delivery workers in Paris showed that 29% of the respondents had had an accident at work (Dablanc et al., 2020). 37% of these workers were also "subcontracted", a euphemism for illegal account sharing. This high rate suggests the existence of networks of recruitment of undocumented workers in unlawful situations.

Legislation is gradually being put in place, often as a result of case law, to solve the associated problems, protect workers and ensure a greater tax contribution. Legislation at the European level is under debate. California's AB5 of January 2020 imposed the reclassification of platform workers as salaried employees: a referendum supported by Uber and other providers of the gig economy overturned it in the general elections of 3 November 2020.

The recent legal adventures of instant delivery have nevertheless forced platforms to take better account of the working conditions of delivery workers who depend on their algorithms, as shown by the recent decisions of Just Eat in France to recruit several thousand employees before the end of 2021, or of Uber in the UK to grant its workers the status of **"workers"**, halfway between salaried employment and self-employment.

2

E-COMMERCE IMPACTS ON PUBLIC AND LOGISTICS SPACES

E-commerce is reshaping cities, investing in new spaces and reinvesting or modifying others. Stores, for example, play the role of collection points in the professional parcel delivery chain; or they become places where orders are prepared then collected by consumers, as manifested during the lockdowns linked to the COVID-19 crisis. In recent years, shopping centres have seen an increase in internal flows linked to these new logistics store functions.

Here we approach the question of logistical locations for e-commerce from the point of view of their uses, bearing in mind that other work by the Logistics City Chair analyses warehouses and logistics facilities from the point of view of urban planning or spatial geography (we refer to the first booklet published in 2019 on this theme).

NEW LOGISTICS LOCATIONS AND USES

E-commerce has an impact on urban logistics locations of and on the geography of mobility: from a fairly predictable and concentrated presence in commercial and business areas, to a presence dispersed in space and time in all neighbourhoods, including residential ones. **E-commerce has not only changed transport patterns, but has also created new logistics spaces.** Collection points, for example: an old solution of distance selling (think of catalogue retailing), they have developed considerably and become professional, computerised and networked. They are the most visible alternatives to home delivery for consumers, particularly in France where they have acquired a significant market share as solution to delivery failure. Following the **"shop-in-shop"** concept, local stores organise collection for parcel deliveries and drop-off for parcel returns. Networks of collection points often rely on florists, bars, tobacco shops and newsstands (Morganti et al., 2014).

Collection points

Increased use of collection points enables logistics service providers to improve parcel consolidation and delivery round efficiency. Combined with a higher rate of successful deliveries, **they reduce the number of vehicle-kilometres, transport time, fuel consumption and operational costs per delivery.** For consumers, collection points provide reliable, flexible, convenient and secure parcel reception.

Owners of collection point benefit from increased traffic to their business and theoretically higher revenues. This positive impact is however increasingly being questioned: consumers who use pick up points do not necessarily buy other items or become customers, contrary to previous assumptions. An APUR (2020) report estimates that the share of customers returning to shop at their collection point varies from a few percentages for luxury or speciality shops, to 30% for small supermarkets and everyday shops. On its website, Relais Colis states that "33% of customers buy when collecting their parcels" (APUR, 2020). Also the fee that collection point owners receive for managing parcels, which varies from 30 cents to 3 euros per parcel (APUR, 2020), is criticised as too low. It makes it possible to compensate for the fall in revenue of certain types of business (e.g. press shops) and to renew their functions.

However, questions can be raised about the urban character of these networks, which sometimes bring to life low-quality shops (telephone or computer equipment shops, which represent 10% of the collection point network). Some stores see the logistics function taking precedence, particularly in terms of space occupation, over the main retail activity, raising the question of their longevity.

In any case, even if a differentiation according to zones is advisable, collection points enable to reduce the total number of delivery journeys by reducing the number of delivery trips to individual homes.

	ÎLE-DE-FRANCE	GREATER PARIS	PARIS
RELAIS COLIS	1406	790	291
PICKUP EXCLUDING LOCKERS	2685	1709	655
UPS	1620	936	421
MONDIAL RELAY	2317	1272	465
TOTAL	8028	4707	1823

Table 2.
Number of points in Île-de-France for the four major French pick-up-point networks (from APUR, 2020).

There are currently four main pick up point networks in France: Chronopost/La Poste via its Pickup subsidiary, Mondial Relay, UPS (formerly Kiala) and Relais Colis. Some post offices are also part of the Chronopost network and allow the collection of Colissimo parcels (APUR, 2020). Table 2 shows the number of collection points in Île-de-France, Greater Paris and Paris. Two-thirds of the population of the Greater Paris area is covered within a radius of 300 metres (APUR, 2020). Alongside these large networks, a recent development is provided by the Amazon Hub network. It offers two types of collection points: automatic lockers ("Amazon lockers") and the equivalent of regular collection points ("Amazon Counters").

In American, Asian and North European cities in particular, there is an increase in unattended collection points or **automated lockers**. Next to advantages as those of manned collection points, lockers also offer the possibility of picking up a parcel at any time. These sets of delivery boxes are often placed in public or semi-public spaces, such as railway stations and shopping centres. They are also placed on campuses and in apartment building lobbies.

Recent studies have examined in more detail the environmental benefits associated with the use of collection points (with or without human presence) as a home delivery alternative. While the benefits described above are generally valid, two nuances need to be made.

The first relates to consumers' collection trips. **A case study from Belgium shows that collection points are the most environmentally friendly way of receiving online orders, but only when consumers travel on foot, by bicycle or as part of another trip.** On the contrary, when collection trips are made by car or during a dedicated trip, the environmental impact of home delivery is lower (Buldeo Rai, 2019). A survey of collection point users in Brussels shows that about three quarters of consumers use these points after an unsuccessful home delivery. Half of them also travel by car. These findings call the true environmental potential of collection points into question (Buldeo Rai et al., 2020).

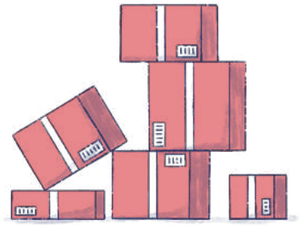
The second nuance concerns their spatial organisation. A study analysing the collection point network in Antwerp underlines that it is not optimised to produce economic nor environmental benefits (Cardenas & Beckers, 2018). **The majority of these outlets are exclusive to one particular logistics service provider, instead of providing logistics services to several actors, which means that a lot of space is needed to create a dense network for each logistics service provider.**

Nevertheless, some notable initiatives of a more collaborative nature are being developed. Examples include Bringme (points located in workplaces) and Cubee (located mainly in train stations or public transport stations), **which are open to several logistics providers.** Some platforms have also set up "crowdsourced" collection points. Platforms offering such services, such as ViaTim and Homerr in the Netherlands, use pensioners or people working from home and offer compensation for handling e-commerce orders from their neighbours who are absent at the time of delivery. The revenues for this type of parcel management are limited: for example 0.25 euros per deposit and 0.60 euros per collection at ViaTim (ViaTim, 2020). The platforms mainly focus on social (user-friendliness) and environmental benefits. However, the use of these services remains limited.

Click-and-collect & "drive"

Alongside collection points, another alternative delivery location is rapidly developing: the store, in the form of **click-and-collect**. Retailers with both a physical and online presence offer consumers the possibility to collect or return orders in-store. In the non-food retail sector, click-and-collect has made it possible to increase the range of in-store services. In commercial centres, increasing in-store collection flows generated by click-and-collect services even raises questions about the stores' spatial design, the traffic areas and the overall organisation of goods movements.

In the food retail sector, especially in France, this service has developed under the name of **"drive"** (an English word but mostly used in this form by the French). These drives are either located in or next to supermarkets or in a separate warehouse. A new type has been introduced, better suited to urban density and travel behaviour: **pedestrian drives.**



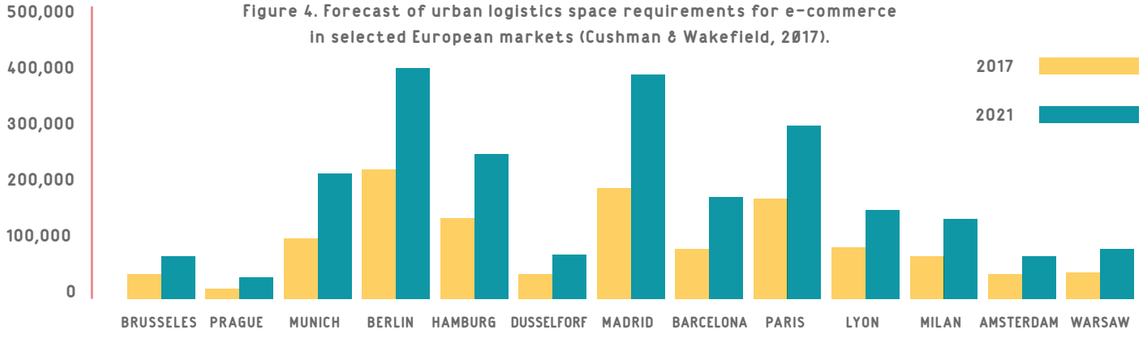


Figure 4. Forecast of urban logistics space requirements for e-commerce in selected European markets (Cushman & Wakefield, 2017).

For the moment, few click-and-collect networks have the density of regular collection point networks. **The primary motivation for introducing click-and-collect services was initially economic, as it reduces home delivery costs for retailers and facilitates cross-selling and up-selling opportunities (Buldeo Rai, 2019). However, this service is growing as its development has been accelerated by the COVID-19 crisis** (see section 5).

From urban warehouses to micro-hubs

Urban warehouses represent a new type of real estate, required by the rise of e-commerce. In terms of logistics real estate, two distinct developments represent the geographical impact of e-commerce. On the one hand, the creation of "XXL" fulfilment centres (over 50,000 square metres or mega-fulfilment centres), which follow the historical trend of logistics facilities sited far from urban centres, and on the other hand, the search for space in dense urban areas to meet e-commerce delivery demands. This section focuses on the latter point. For large metropolitan warehouses, we refer to the spatial analyses of logistics buildings (theme 1 of the scientific program of the Chair), presented on the Chair's website as well as in the first booklet published in September 2019.

In order to meet consumer expectations, who generally state in surveys to appreciate ever faster delivery, goods must be located close to them. Urban warehouses have been introduced by major e-commerce players. Amazon for example has set up in several central locations in Los Angeles around ten urban warehouses, ranging from 5 to 20,000 m2. Amazon has also converted brownfield sites into warehouses (Moriset, 2018). Historically, Asian cities were the first to set up multi-story urban warehouses, such as in Tokyo, Hong Kong and Seoul (Dablanc et al., 2017), the number of floors of which can now exceed twenty. As early as 2017, a report by Cushman & Wakefield forecast the real estate needs in certain European markets for 2021 (Figure 4), with an increase of 102% for Madrid and 77% for German cities. An example of an urban warehouse used for e-commerce is the one built by Vailog/Segro on the port of Gennevilliers near Paris, on three levels, mainly occupied by Ikea to deliver to its customers in the west of Paris and its Parisian shop.

Because there is a potential for optimising the urban mobility of goods (i.e. delivering as much with fewer resources), **shared urban consolidation centres** have been developed to manage more collaboratively the operations of all the logistics service providers delivering in a given urban area (a city centre for example). **Shipments from different operators are centralised and delivered by a single operator, often using clean vehicles.** The consolidation centres are located in or just on the outskirts of the city, where they offer easy access to their customers who want to avoid city traffic but still have easy access to the consolidation centres themselves. The potential for reducing vehicle-kilometres and air pollution has been established (Verlinde, 2015).

Because of the operating costs and the reluctance to set up joint operations, the list of failed examples is long (e.g. the Citylogistics experiment in Lyon in 2015-2017) and only a few initiatives can be considered successful. However, the initial concept is not considered obsolete (Van Heeswijk et al., 2019). The Belgian company CityDepot, a subsidiary of the national postal operator bpost, operates in this way in several cities (mainly for B2B) (Buldeo Rai, 2019). The Binnenstadservice network is active in the Netherlands (https://binnenstadservice.nl/). In France, La Poste group has launched Urby, a subsidiary specialised in the pooling of urban logistics. Urby centres have been deployed from 2019 in 11 French metropolitan areas and further deployments are planned in the near future (Groupe La Poste, 2020).

E-commerce has accelerated the growth of so-called **urban logistics spaces** and **logistics micro-hubs**. **New models rely on small logistics facilities in dense urban spaces to break load and allow last mile, or last metre, deliveries with electric or non-motorised vehicles.** These hubs can be fixed or mobile, networked or single.

A network of micro-hubs has been developed by PostNL in the city centre of Amsterdam, in which seven former post offices and sixty electric cargo bicycles handle B2C parcels and B2B mail, receiving a total of more than 1,500 orders per day (van Rooijen, 2018). TNT tested a trailer with a loading dock and an office as a mobile logistics base in Brussels (Verlinde, 2015), while UPS uses mobile storage containers to supply Hamburg's pedestrian areas (UPS, 2017). The urban distribution space under the Porte de Pantin in Paris, completed in December 2020 (project P4, Sogaris, Syvil), represents the use of a "neglected urban area", a space with no use and at odds with the surrounding urban fabric.

For fixed and mobile bases, the search for an affordable location may in some cases require support from local authorities, which may be financial (e.g. a low-cost parking fee for a mobile hub) and non-financial (e.g. the identification of available urban logistics spaces) (Buldeo Rai, 2019).

Finally, **on-street delivery areas** are also part of the range of spaces dedicated to urban logistics, including for e-commerce. This is increasingly visible in residential areas. Their location, their design and way of enforcing them have remained fairly traditional. This can however be improved. The City of Paris, as part of the reorganisation of parking spaces, is rethinking the system to adapt it to the new challenges of urban deliveries. In Barcelona, the overall management of 5,000 delivery spaces on the city's roads has made it possible to increase their usefulness for freight operators. They must all be connected to an application (AreaDUM) that they must activate when they are at a delivery stop.

This approach, at first glance modest and minor, to the reorganisation of the public space based on the needs of the delivery providers and in particular the e-commerce delivery drivers in residential areas, should not be ignored

URBAN LOGISTICS FOR E-COMMERCE AS A SYSTEM

E-commerce logistics moves all lines. Not only does it impact on several fundamental dimensions of the logistics sector (including vehicles, warehouses, jobs, software), it also has systemic impacts on all these sectors at once, **in an urban environment that is itself constantly being transformed by public policies, energy transition requirements and consumer behaviour.**

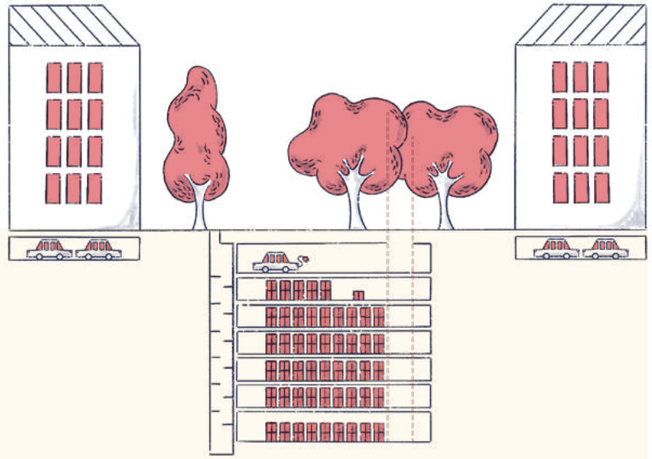
The impact of e-commerce logistics on public space, real estate and the urban environment must therefore be considered globally. **Failure to do so can lead to paradoxical situations and counterproductive results.** Taking a topical example: one of the most environmentally-friendly schemes for e-commerce logistics integrates an approach route by a large vehicle (such as trucks, trains, barges) and a shorter and cleaner last mile with an adapted vehicle (such as electric vans, cargo bikes, on foot, on foot with follower robots, etc.). This scheme enables to consolidate transport and reduce the total distances travelled by vehicles. However, the nature of the scheme is based on two conditions which may contradict new public policies on mobility and urban planning:

- **Heavy goods vehicles must be able to enter cities, in order to supply urban hubs and warehouses in a consolidated way.** Rail and waterway modes for urban logistics are being experimented with but are still expensive or complex to use. Then there are heavy goods vehicles, which may be prohibited from entering new low-emission or zero-emission zones. The transition to emission-free trucks (electric, hydrogen) will take longer than that of light commercial vehicles, due to their cost or the fact that there is still insufficient supply. In the meantime, care will have to be taken to allow Euro 6 trucks to enter the city and to support financially the acquisition of bioCNG, electric or clean hydrogen trucks.
- **Logistics hubs are needed within cities, in order to carry out the necessary transhipment of goods from a heavy vehicle to last mile modes.** Cities must accommodate these facilities in urban planning documents and in urban space management. With a few exceptions such as the identification of perimeters reserved for urban logistics in the current zooming plan of Paris, too often cities have allowed logistics facilities to move further and further away from the urban core, to the benefit of urban projects with predominantly residential, commercial or office uses.

Another example of the multiple interconnections of e-commerce logistics is its materialisation in the public space and the challenges of adapting it to policies for reclaiming public space in the city. The pedestrianisation of city centres, the elimination of car parking, the reduction of car space and the development of bike lanes are challenges for the e-commerce distribution chain. These paradoxes are pushed to the extreme in the case of eco-neighbourhoods, new city districts that are designed to minimise energy use and environmental impact: they promote environmentally friendly modes of transport and limit the use of cars, even going so far as to ban them altogether. **However, supplies and removals (waste in particular, including an increasing volume of e-commerce packages) must continue to be ensured. No special provisions have generally been planned for taking care of goods movement in such new developments.**

The impacts of e-commerce logistics on public space, real estate and the urban environment must be considered in a comprehensive way.

In conclusion, a new urbanism is needed, in which expertise and experience from different, often still separate, fields come together so that urban logistics can be brought to the centre of the way cities are planned, designed and developed.



NEW URBAN COMMONS? ISSUES AND PROSPECTS AS SEEN BY SOGARIS

Our mobility and consumption patterns are undergoing profound and accelerated changes, "consuming better", "travelling less", etc., which are combined with new urban relationships, highlighted by the model of the fifteen-minute city. The health crisis has only accentuated this aspiration to rediscover a quality of life "downstairs", in a calmer city, with a chosen demobility and a preference for local products, particularly in terms of food, as shown by the increased use of local stores and the growing success of short food circuits.

At the same time, as new players are positioning themselves to take up the challenge of the last mile around shared solutions, hybrid places are appearing, in the form of urban conciergeries, logistics shops or multi-service hubs, defining new **"urban commons"**. **These shared models, which are alternatives to collection points and lockers that are scattered throughout the city, are struggling to emerge due to a lack of suitable space and real estate to synergise these solutions in dedicated places.**

Places inherited from the automobile era, such as car parks, are progressively freeing up space in the heart of cities and are a source of potential for the long-term hosting of these new uses, reflecting the profound changes in urban mobility, by turning them towards local services. The call for projects around "reinventing the basements of Paris" has enabled Sogaris to design a new model for local logistics in the 3rd arrondissement of Paris. Instead of an old automated car park with six basement levels, this "inverted building" has been converted into an "urban attic" dedicated to storage, delivery and concierge services for local residents and professionals in a very dense area of central Paris. Following the example of the model developed by the cyclo-logistics cooperative Olvo, which offers its business-to-business customers space in their logistics hub located in eastern Paris, with the aim of promoting local production or the local economy, the **"local urban attic"** in the 3rd arrondissement is based on the synergy of players and offers (micro-storage, logistics, delivery by soft mobility, concierge services) and a resolutely local-oriented anchoring.

These new hyper-urban logistics spaces, still at the innovation stage, combine several ambitions:

- **Organising invisible neighbourhood logistics in a way that is different from the flows it generates, by focusing on soft mobility and the development of cycling lanes;**
- **Recreating centrality and activities and accompanying a movement to reclaim public space for the benefit of pedestrians;**
- **Providing a human presence and a local activity in place of "enclosed" service functions;**
- **Encouraging alternative modes of consumption and the local economy, by opening up the field to reverse logistics and collection;**
- **Creating value through the deployment of new urban services.**

E-COMMERCE MOBILITIES: INNOVATIONS IN VEHICLE TECHNOLOGY

E-commerce players and, more broadly, those involved in urban logistics are subject to various, often external, challenges, which lead them to adapt their mobility solutions and even to innovate in order to achieve their environmental transition. At the heart of this transition are developments and innovations in vehicles, engines and technologies.

CLEANER VEHICLES

Electrification of logistics

The growth of e-commerce has led to an increased use of light commercial vehicles for parcel delivery in urban areas (Allen et al., 2018). **There are several reasons for their popularity, including their flexibility and multi-functionality, well suited to the growing demand for more frequent deliveries and smaller volumes.** It is also important to note that the relative lack of regulation for light commercial vehicles compared to heavy trucks contributed to vehicle substitution. Several cities reported an absolute increase in the registration and use of vans, while passenger cars and trucks remained stable or even decreased. Researchers in Paris (Insee, 2020), London (Allen et al., 2018) and Brussels (Lebeau & Macharis, 2014), among others, have published statistics documenting this phenomenon. In Paris, there was a 19.7% increase in newly registered vans between 2018 and 2019 (Insee, 2020).

Cities are grasping the challenge of goods mobility. It consists mainly of conventional diesel-powered vehicles, which have a very significant impact, particularly on air quality. **While these flows account for only 6% of journeys and 8% of distance travelled by road in Île-de-France, they are responsible for 36% of pollutant emissions** (Coulombel et al., 2018) (these figures do not take e-commerce deliveries into account). This disproportionate impact has also been documented for other cities (Verlinde, 2015). This is due to older commercial vehicles that emit more emissions and the fact that they are more concentrated in the city centre than private vehicles, also affecting a larger population. The growing share of light commercial vehicles, to the detriment of trucks, actually increases the nuisances (PM, NOx, CO_2): if we take into account the load they carry (thus comparing tonne-kilometres instead of vehicle-kilometres), trucks pollute less than vans (Coulombel et al., 2018).

For urban delivery, electric vehicles, a solution which has reached technological maturity and which now represents a diversified offer for operators, are considered the main alternative.

Poor air quality, responsible for one in eight deaths in Europe (EEA, 2020), has led to policies of restriction on diesel and petrol-powered vehicles in European cities. **For urban delivery, electric vehicles, a solution which has reached technological maturity and which now represents a diversified offer for operators, are considered the main alternative** (Morganti & Browne, 2018). Other technologies have developed: natural gas vehicles and hydrogen, each raising specific issues.

Natural gas for vehicles has a less favourable environmental balance but it is a mature technology and rapidly adaptable to the heavy goods vehicle market. Refuelling solutions due to the lack of stations however remain a persistent problem. **Hydrogen** is emerging as a motorisation that cannot be ignored in the long term in the decarbonisation challenges, whatever the vehicle segment considered. This solution must become more mature, particularly with regard to the development of renewable or low-carbon hydrogen production and the deployment of a refuelling network.

The adoption of electric vehicles for delivery remains slow and low. Electric vehicles have gained popularity for personal mobility, amplified by eye-catching manufacturers such as Tesla, specific policies such as those implemented by Norway; or the Volkswagen "diesel-gate" scandal in 2015. As far as the mobility of goods is concerned, electrification remains limited. According to AVERE figures, for the first ten months of 2020, registrations of new electric vans in France fell by 3% while those of private cars increased by 132%.

Cost competitiveness (for purchase or long-term leasing) remains one of the main obstacles to the deployment of electric vehicles. These costs can be discussed in terms of the purchase price of a vehicle or its total cost of ownership, which includes all costs associated with owning, depreciating, operating and maintaining a vehicle (Lebeau et al., 2019). The results of a recent total cost of ownership (TCO) analysis conducted by Lebeau et al. (2019) indicate that the competitive position of electric light-duty vehicles is still difficult today. Small electric vans compete fairly well with their conventional alternatives because they weigh less and require smaller, less expensive batteries. However, the heavier an electric vehicle is, the more difficult its competitive position is (Lebeau et al., 2019).

Beyond the costs, the balance of advantages and disadvantages depends very much on the type of goods and the route model. Determining factors in the choices made by companies on all the alternatives to diesel and petrol balance vehicle autonomy, carrying capacity, easy access to refuelling and the cost of this refuelling. Morganti and Browne (2018) more specifically identify four types of concrete concerns that logistics service providers in Paris and London share: limited vehicle autonomy; the risk of queuing at the recharging station; payload restrictions caused by the size and weight of batteries; and unreliable local electricity supply.

With the supply of electric vehicles continuing to grow, financial and non-financial incentives are needed to support the potential of the technology and close the gap with environmental objectives. On the financial side, Lebeau et al. (2019) suggest more changes to the tax system and a mileage-based charge. On the non-financial side, Morganti et Browne (2018) refer to the need to raise awareness among policy makers, car manufacturers and actors involved in energy supply and local electricity distribution of existing barriers and ways to reduce them.

Perhaps the real change in the electrification of goods mobility is not coming from traditional car manufacturers, but from young companies. Last year, Amazon invested more than 400 million euros in the start-up Rivian, while UPS made an undisclosed investment in Arrival, an emerging electric vehicle manufacturer (Brooks, 2020). In France, for example, it is worth mentioning the start-up XYT. These young companies collaborate directly with major players in the e-commerce market and build customised and affordable vehicles for urban deliveries.

Determining factors in the choices made by companies on all the alternatives to diesel and petrol balance vehicle autonomy, carrying capacity, easy access to refuelling and the cost of this refuelling.

As the electrification of fleets requires logistics service providers to change their operations and planning and to adopt new technological skills, **the challenge for these new companies will be to work with fleet managers, warehouse managers and logistics service providers to (partially) redesign delivery operations (Brooks, 2020).**

POST BIKE

Post bikes are two-wheelers with frame geometry for a conventional two-wheeled bicycle. They usually have cargo space in front of the steering wheel and / or behind the saddle. The maximum transport weight is usually 50 to 75 kg.

LONGTAIL

A two-wheeler variant equipped with an extended rear trunk, which is attached to each side of the rear triangle of the frame. At loads up to 50 kg, this construction can be operated in a similar way to conventional bicycles.

FRONTLOADER

The cargo space is located in front of the cyclist, as low as possible. The frontloaders are mainly two-wheelers: their low center of gravity and the geometry of the frame allow for maneuvering even at higher transport weights.

Bike with cargo space in the front also available in multi-axle version, with two front axle wheels. This allows for excellent stability

TRIKE

A multi-wheeler with the largest cargo space. Bicycles of this type are adapted to carry loads weighing up to 500 kg.

Figure 5. Classification of cycle-logistics, from bicycles to cargo bikes (Nürnberg, 2019).

Cycle-logistics

Logistics providers are impacted by road congestion. Their travel and parking space is also limited by current urban planning policies in favour of walking, cycling and public transport (Allen et al., 2018). One of the proposed solutions to bring freight mobility "back to the future" is cycling. **There is a diversification of cycle-logistics and delivery bike models: ordinary bicycles and cargo bikes, human-powered and electrically assisted** (Figure 5).

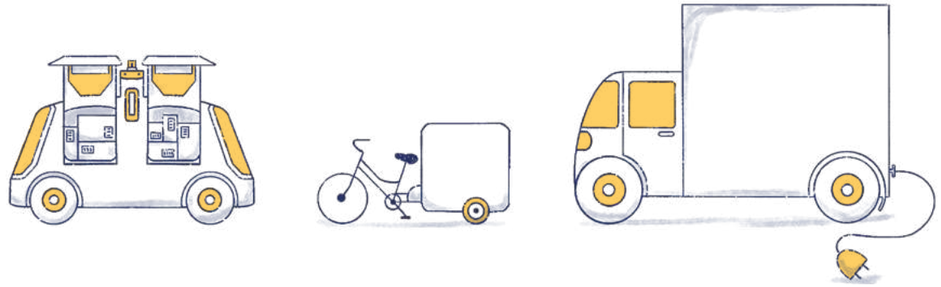
Cycle-logistics integrates non-motorised two- and three-wheelers that transport goods. They range from simple bicycles to electrically assisted tricycles and cargo bicycles.

Electric cargo bikes are the most mature technology in the last mile segment next to vans, with advantages in terms of emissions, versatility, ability to use bike lanes and to fit in despite traffic jams, noise and costs.

A case study in Paris shows that switching from commercial vehicles and mopeds to delivery bikes can significantly reduce local pollution and congestion (Koning & Conway, 2016). In addition, their need for parking spaces is limited and they present a solution that is widely accepted by the general public. They also have drawbacks, including the need for a driver who is prepared for all kinds of weather conditions and their limited loading capacity. Unlike electric vans, cargo bicycles are mainly limited to parcels and cannot replace conventional vans "one-to-one" (Jaller et al., 2020). They are limited in geographical radius.

As discussed in the previous section, **the use of bicycles or cargo bicycles for delivery requires a reconfigured spatial delivery model with a local infrastructure** (hub, urban logistics space) that serves as a starting point and allows for short delivery rounds, or short point-to-point journeys, as well as the storage and loading of vehicles. Two topics in particular will become increasingly important for the local infrastructure of cycle-logistics:

- **The development of bike lanes and the co-existence with passenger bikes,** due to the size of the cargo bicycles or the often higher road risk taken by bicycle delivery drivers compared to non-delivery cyclists (at a junction considered dangerous in Paris, an observation over two days revealed that 75% of delivery cyclists did not respect the red light, for "only" 50% of non-delivery cyclists) (Dablanc, 2018).
- **The design of suitable logistics facilities,** with special requirements (for example when using underground car parks, bicycles and even electrically assisted bicycles must be taken into account to design access ramps). Urban logistics facilities such as micro-hubs must be organized as a network of hubs in order to make transhipment of goods efficient. Route modelling must be rethought and adapted accordingly.



AUTONOMOUS DELIVERIES

Another potentially important innovation linked to the mobility of e-commerce is automation. Automation removes the need for human drivers, but the concept can cover very different things. For e-commerce deliveries, automation encompasses several types: 1) unmanned aerial vehicles or **drones**, 2) **autonomous mobile robots**, both those that run on sidewalks and those that run on roads, and 3) **autonomous light commercial vehicles and trucks** (Figure 6).

On paper, autonomous vehicles provide answers to some of the problems facing the e-commerce sector, including labour costs. For the last mile in particular, cost is a key element. **The current costs of these technologies remain high but have fallen significantly over the recent years.** McKinsey consulting firm estimated the potential savings in delivery costs in cities from 10 to 40% by using autonomous vehicles (Schröder et al., 2018). A significant reduction that is mainly attributed to labour costs. As labour costs rise, the technology becomes relatively even more affordable, accelerating the shift to automation.

Jennings and Figliozzi (2019) found that autonomous sidewalk robots used in combination with vans to transport them to service areas could be an economically viable alternative to standard delivery vehicles. This robot-van combination can serve 48 customers in less than half the usual average time. It is particularly efficient compared to standard vans when the average delivery time per customer is high and when customer density increases.

Other advantages of autonomous vehicles identified in literature include their efficiency, sustainability and safety (see Touami, 2020). In terms of efficiency, all other things being equal, autonomous vehicles allow for better vehicle loading, more flexible routing and theoretical availability 24 hours a day, 7 days a week. **As a result, they require fewer vehicles to carry out all delivery tasks and facilitate large-scale electrification, thus limiting local pollution.** Autonomous vehicles are also increasingly safe in terms of obstacle avoidance. The latter could be contrary to common concerns about autonomous vehicles, fuelled by newspaper headlines about test experiments that went wrong. Although autonomous vehicles can reduce or eliminate human error, which is estimated to be the cause of 90% of vehicle crashes, they introduce new risks and raise concerns about "crash algorithms", moral dilemmas and acceptable levels of safety. **Appropriate policies and regulations, as well as infrastructure developments, are imperative for the implementation of autonomous vehicles, as is public acceptance** (Touami, 2020).

A 2016 report by McKinsey speculated that autonomous delivery vehicles worldwide would deliver nearly 100% of parcels to consumers by 2025, while only 2% would be delivered by bicycle in the instant delivery segment (Joerss et al., 2016). Similarly, Fraunhofer researchers predicted that autonomously driven robots could make 400 million deliveries in Germany by 2030, in both urban and rural areas (Fraunhofer, 2016). Given the current situation of autonomous vehicles, these reports published five years ago, were overly optimistic.

Before these vehicles are deployed on a large scale, the next trend in the e-commerce sector is expected to be the introduction of semi-autonomous vehicles that track and support parcel delivery staff and increase productivity by reducing the time needed to drive and park the vans.

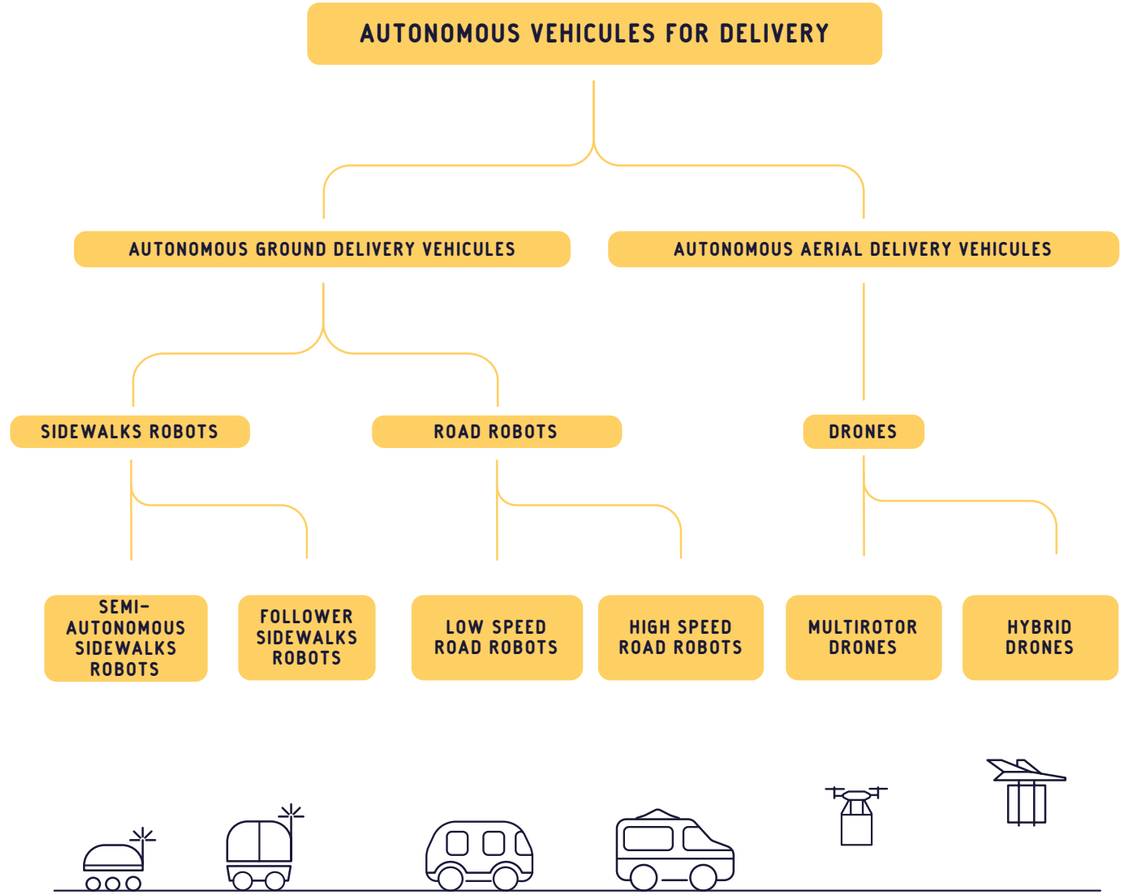


Figure 6. Typology of autonomous delivery vehicles (Touami, 2020).

Recent advances in automation technology have broadened the range and complexity of tasks that can be performed by delivery drones and robots. Experiments with drones have proven their usefulness in delivering medical equipment to hard-to-reach areas. Their use has developed strongly in China (in particular the network of the e-retailer JD). In these regions, drones are not a substitute for other transport solutions, but rather a means of penetrating new markets (rural and semi-rural). Swiss Post uses drones to distribute blood samples between hospitals, thus avoiding traffic jams (Swiss Post, 2018). Similarly, DHL carried out tests to deliver medicines to remote locations where weather or terrain conditions limit the use of ordinary vehicles (DHL, 2018).

Drones are also gaining popularity for e-retailer deliveries, as illustrated by trials such as Domino's pizza delivery. Other initiatives confirm that urban logistics services are taking a more serious look at this delivery solution. The French e-commerce platform Cdiscount has launched drone deliveries as part of a project called Pélican in 2017. The project aims to promote the delivery of parcels by drone in urban areas. Although initial test results have not been conclusive, the company continues to explore their potential. The Ukrainian postal service has been delivering small parcels using unmanned aerial vehicles in parts of the country since 2016 (d'Estries, 2016), while Iceland's largest e-retailer platform, AHA, has partnered with Flytrex for food delivery in the city of Reykjavik (Flytrex, 2020). Amazon has filed a patent for an execution centre designed to enable the landing and take-off of drones in densely populated areas, also known as "drone beehives" (Curlander et al., 2017). A study of European cities demonstrates the viability of beehives, supporting the hypothesis that this type of activity could develop (Aurambout et al., 2019).

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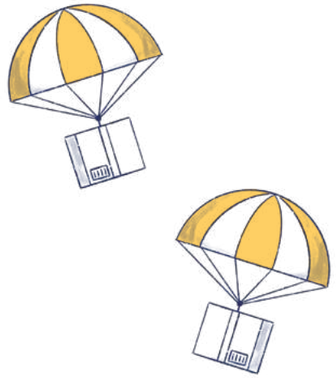
Delivery robots are also considered promising. Sidewalk delivery robots or **"droids"** circulate relatively slowly, between ten and twenty kilometres per hour, and carry about ten to seventy kilograms depending on the model (de Weerd, 2018). They travel back and forth between small facilities in the middle of the area they are delivering to and from their respective destinations. These facilities are either stationary, with small storage and transhipment areas that are also called "micro-hubs", or mobile, with vans that are equipped to transport the delivery robots called **"motherships"**. Motherships drop off a group of robots and bring them back to the central distribution centre after making all deliveries. Start-up Starship has teamed up with Mercedes for this type of "hyper-local delivery". Several companies have tested prototypes for food and non-food deliveries, such as DHL, Amazon, Kiwi, Yelp's Eat24 and FedEx' SameDay Bot, which can even climb stairs.

Road delivery robots were also tested. Walmart and Kroger in the USA have teamed up with Nuro to deliver groceries to suburban residential areas. In the context of the global pandemic, Chinese e-retailer JD has started testing autonomous road robots for daily needs in the city of Wuhan.

Few studies have been published on the profitability or viability of delivery robots, **but the succession of tests and the start of regular operations suggest that they will find a market for e-commerce delivery, rather suburban or in limited areas** (university, corporate or hospital campuses).

In conclusion, we can expect a diversification of delivery vehicles to distribute e-commerce parcels in the city of tomorrow. To meet the growing demand for more qualitative services from consumers, but also for a more qualitative urban environment from citizens, these vehicles will have to be increasingly clean.



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E-COMMERCE MOBILITY IN TIMES OF HEALTH CRISIS

The global COVID-19 pandemic led to the implementation of health measures of varying degrees and scales (total or partial lockdowns, social distancing, curfews, etc.). These measures have had a major impact on cities, especially the largest ones and their dense areas, transforming urban lifestyles and slowing down many economic and cultural activities. E-commerce has gradually acquired a very important economic - but also symbolic - role and has become a key element in the discussion on the future of cities.

THE FIRST LOCKDOWN

Lockdown measures implemented worldwide have resulted in the closure of workplaces and all non-essential businesses (except supermarkets). In France, a strict lockdown (the "first lockdown") was implemented from 16 March to 11 May 2020. It reduced personal mobility to a bare minimum. In Paris, a quarter of the population left the city in search of greener and more spacious environments (Insee, 2020). With the number of inhabitants decreased, visitors and tourists absent and several activities temporarily closed (restaurants, schools), the demand for goods mechanically decreased, reducing logistics mobility in the city. But consumption took other channels.

Impact assessments have been carried out around the world to inform on developments in the logistics sector. For the Paris region, the Logistics City chair launched the "Barometer of urban logistics in times of lockdown", which surveyed a panel of transport companies on a daily basis and business organisations on a weekly basis, reporting on changes in delivery volumes, difficulties in obtaining sanitary equipment, recruitment problems and traffic conditions, access and traffic regulations. The analysis shows, as an example, how companies' perception of their level of activity has changed compared to a normal period (Figure 7). The synthesis reports published during the six weeks are available on the Chair's website.

Also benefiting from the input of professional transport and logistics organisations, these reports shed light on the evolution of the logistics situation during the six weeks of the first lockdown in France. **They document the extreme variability of orders faced by the logistics sector:** activity decrease and partial unemployment in some sectors (with the exception of supermarket supply), strong increases (but variable according to the days and weeks) in other sectors. **As the only means left to access non-food items and a "safer" alternative to in-store shopping, e-commerce has become one of the few economic activities to benefit from the global pandemic. "As travel becomes more expensive, difficult or dangerous, the substitution of information and communication technologies increases"** (Mokhtarian, 2009): a phenomenon that spread widely throughout the "locked-down" world.

The pandemic encouraged online sales among regular consumers, and also proved highly effective in accelerating e-commerce adoption among "laggards". These developments have occurred worldwide (McKinsey & Company, 2020). In Belgium, more than six out of ten consumers bought online during lockdown, with 12% reporting it was their first time (Defloor & Dekocker, 2020). In France, more than one in three consumers who made online food purchases during lockdown were also newcomers. 70% of them are baby boomers, born between 1940 and 1955 (FoxIntelligence, 2020). Online grocery shopping has increased to such an extent that retail professionals believe in its potential for lasting change (Econsultancy, 2020). In the UK, the online supermarket chain Ocado doubled its sales during lockdown, with 600,000 households trying it for the first time (Econsultancy, 2020). **In France, the supermarket chain Monoprix recorded a 974% increase in accounts opened on its site, to benefit from delivery or click-and-collect services, compared with the average for 2020 before lockdown (Cousin, 2020).**

In addition to increases in food shopping, other online product categories that benefited from the global pandemic include electronics (for teleworking); books and entertainment; medical, health and beauty articles; baby and pet food and products; fashion and clothing; and subscription services. Other categories of online products faced difficulties, such as travel accessories and event tickets; photographic items; furniture; luxury goods; and products related to weddings and parties. The type of items purchased online has changed over the weeks: sanitary items, teleworking assistance, sports equipment at the beginning; and DIY equipment (Defloor & Dekocker, 2020) and even fashion at the end of the period. Figure 8 gives a detailed sectoral overview of developments in e-commerce in France between 24 February and 29 March 2020 (Statista, 2020b), showing the immediate impact of the first lockdown. We see the rise in mass

Figure 7.
The evolution of the daily number of deliveries during the first lockdown, as perceived by transport companies in Paris compared to a "normal" period (Dablanc & Buldeo Rai, 2020).

retailing and the fall in online sales of cars, for example.

Logistics service providers responsible for delivering e-commerce orders faced considerable challenges to cope with the sudden increase in demand. These challenges, mainly related to the nature of

As the only means left to access non-food items and a "safer" alternative to in-store shopping, e-commerce has become one of the few economic activities to benefit from the global pandemic.

the demand for parcels, staffing restrictions and health regulations, caused a surge of parcels in warehouses and delivery delays. Declining delivery service was recorded in Europe and the United States, while delays were reported to be under more control in China and Korea (according to interviews with foreign colleagues). In France, during the sixth week of the first lockdown, the average delivery time increased to more than 10 days for 60% of items purchased online (FoxIntelligence, 2020). **The volumes of lockdown parcels were comparable to those during peak periods, such as Black Friday or the end-of-year holiday season.** Logistics providers needed some time to prepare and find sufficient staff.

Not only parcel volumes changed all at once, there was also a shift in their destinations and types. Temporary store closures (including collection points) and the new

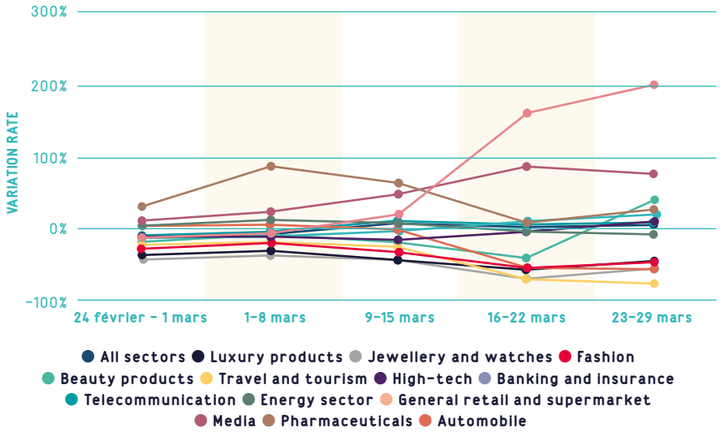


Figure 8. Sectoral evolution of e-commerce in France just before and just after the start of the first lockdown (Statista, 2020b).

reality of working from home led to a rapid increase in home deliveries in the strict sense, to the detriment of collection points, lockers and workplaces which until then had gradually captured significant market shares. **While the destinations for parcels became unified (all deliveries had to be made to homes), the types of parcels became more diverse:** large consignments, goods that are not usually delivered to private homes, etc. Bpost, the largest parcel distributor in Belgium, even created a visual for social media to explain the difficulties it was encountering (Figure 9). Oversized and under-packaged parcels require extra labour for processing, which was initially lacking and hampered further by absenteeism. Sanitary restrictions also (quite rightly) made operations more complex, requiring physical distances between warehouse workers and between deliverers and receivers, mandatory wearing of masks and gloves and repeated cleaning. A court decided that Amazon's inability to comply adequately with health regulations required it to temporarily close its warehouses in France (the company supplied French consumers from warehouses abroad) (Grasland & Moutot, 2020).

The sudden popularity of e-commerce pushed some e-retailers to explore online sales. In Belgium, local shops and major luxury brands such as Delvaux adapted to the new situation. A 15% increase in new online shops was recorded in the first lockdown wave compared with the previous year (Defloor & Dekocker, 2020). Retailers with existing online shops introduced new services such as discounted or free home deliveries. 35% of French retailers offered this type of promotion (Retailx, 2020a). Not only retailers, but also companies with a less obvious online presence launched

Figure 9. The challenges of loading delivery vans during lockdown, as seen by bpost, the Belgian postal operator.

e-commerce initiatives, including those normally focused on B2B such as local agricultural producers and those with a more traditional approach such as bakeries. Surfing on the wave of online grocery products while responding to delivery challenges, **partnerships formed between meal delivery platforms and grocery shops.** In France, Deliveroo teamed up with Casino to offer grocery products of its various brands, while UberEats started a collaboration with Carrefour.

2.
SINCE THE END OF THE FIRST LOCKDOWN

Gradually leaving lockdown, a certain resumption of activity, then the second wave of contaminations, curfews and the second lockdown: **what can be said about the last six months of the year 2020?** E-commerce has retained a key role and very high volumes. In France in September 2020 (Figure 10), it was at a 26% (non-food) and 27% (food) level higher than in January 2020, i.e. a pace of progression twice as fast as compared with the trends of previous years. The two curves show a very different pattern of growth (first a very rapid rise in non-food then a fall, and a more regular rise in non-food).

Several parcel service providers talk about the "switch" of their urban delivery operations: while they delivered 60 to 80% B2B, 40 to 20% B2C before 2020, at the end of 2020, the rates are reversed (it is true that many previous B2B operations were ultimately B2C operations, the so-called "B2B2C"). At the same time, the debate on traditional commerce has intensified. Under pressure from public opinion and the government, this even led to the postponement of "Black Friday" 2020 activities by major e-commerce players by a week. Independent shops, especially the smaller ones, are the hardest hit. The continued popularity of online shops and home delivery has already begun to cause the bankruptcy of some of them, as well as more powerful chains (the Gap chain in Europe, for example).

In France, some experts predict that 30% of fashion shops will eventually close, hampered by the rise in online sales and difficulties prior to the COVID crisis (including strikes and demonstrations) (Bertrand, 2020). The fall in physical trade is, however, far from being inevitable. The resilience of retail builds on omnichannel developments and orchestrating the last mile (BCG x Foxintelligence, 2020; Sanlaville, 2020).

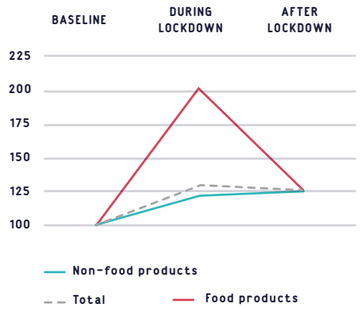


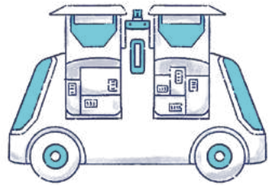
Figure 10. The two evolution curves of B2C (food and non-food) during and after the first lockdown (BCG x Foxintelligence, 2020).

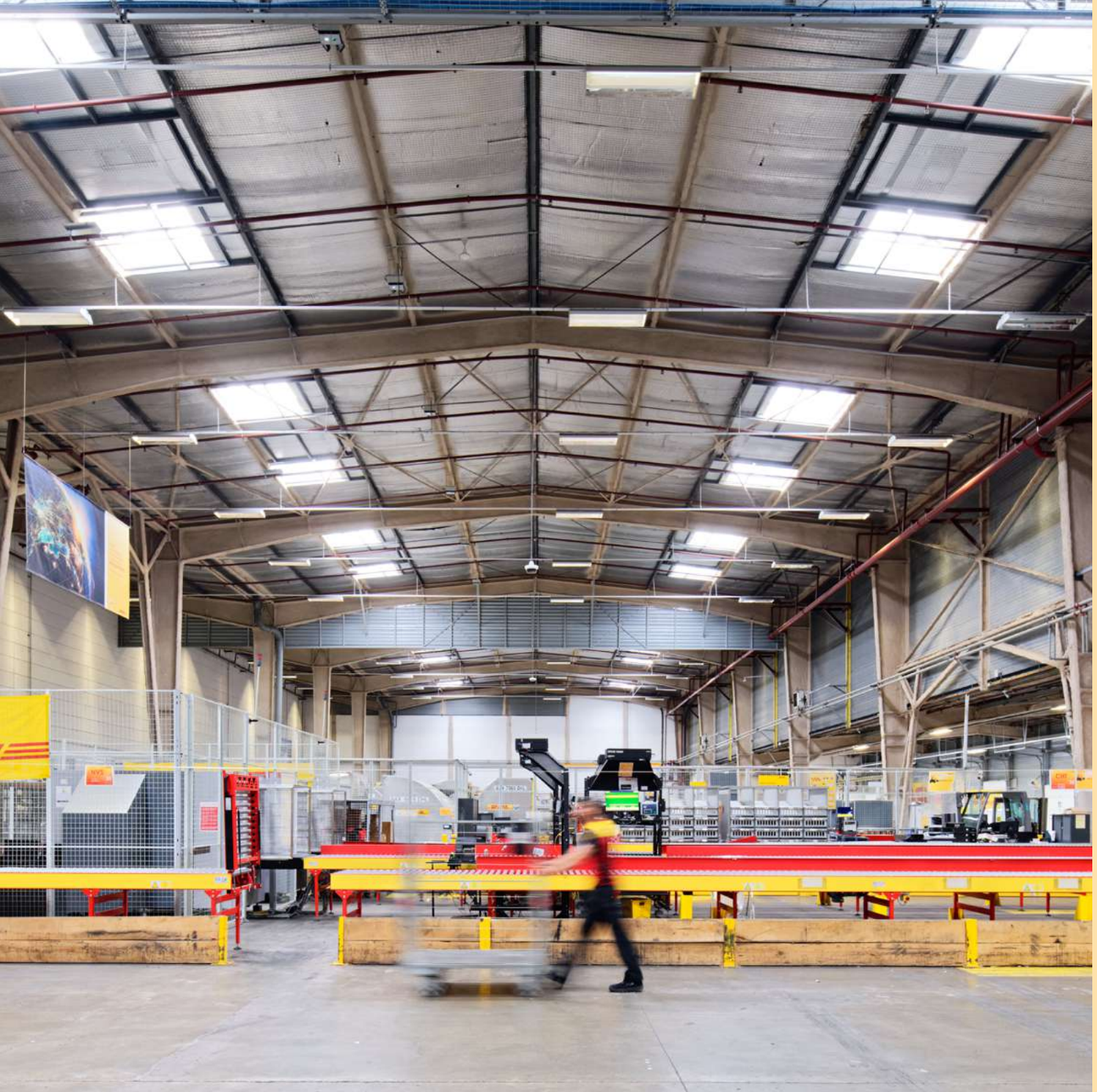
Today's e-commerce is evolving in urban spaces transformed by the pandemic and by other, more structural evolutions accelerated or made more visible by the pandemic. As people become accustomed to quieter, less congested and less polluted city streets, there is a need for solutions that can satisfy home delivery convenience while preserving quality of life in city. In this respect, **e-commerce has a double face: accelerator of nuisances as well as accelerator of solutions against these nuisances. A recent consultation from the City of Paris in September-October 2020 on the revision of the local zoning plan revealed a very strong desire on the part of the Parisians for actions in favour of sustainable mobility and against the noise of mopeds.** However, these mopeds are now very much in demand for e-commerce operations, particularly for instant deliveries in which a lot of very often old motorbikes are used, as discussed in section 2. E-commerce can also be a source of innovation in favour of a mobility that is more respectful towards quality of life. Such solutions include cargo bikes, electric vans and collaboration between supply chain operators to improve transport efficiency. In order to implement them, section 3 already argued that it is essential to allow warehousing and cargo transhipment to take place closer to urban centres, in a more sustainable "proximity logistics". New logistics models based on networks of logistics micro-hubs, deliveries made during off-peak hours, barge transport and publicly accessible lockers are examples of innovations that are more visible and increasingly supported by municipalities since the pandemic (Vazquez, 2020). Cities also developed temporary bike lanes, of which many are now being made permanent, and new uses of public space. E-commerce mobility will have to be integrated into this new urban environment.

The French Minister of Transport, speaking before the Parliament's Sustainable Development Commission in April 2020 during the lockdown, **indicated "that the crisis could be a catalyst for decarbonising the transport sector"**. France Logistique, for its part, has drawn up a recovery plan with seven immediate proposals to help the sector recover, notably by promoting the optimisation of urban logistics and the reduction of its carbon footprint (France Logistique, 2020).

In France, because of their presence in the public debate and their lasting impact on the environment, the economy, jobs and urban quality of life, **certain sectors of e-commerce logistics are the subject of dedicated government missions tasked with delivering their conclusions before the end of 2020** (Frouin mission on gig workers, "warehouses and e-commerce" mission of France Stratégie). Similar developments are noted abroad. President-elect Biden wants to reform the status and social protection of delivery and ride-hailing drivers; at the level of the European Commission, future legislation is being discussed. The COVID-19 pandemic accelerated the rise to the forefront of the logistics activity, one that had until then experienced strong growth but remained largely invisible in the eyes of decision-makers.

As we enter a third phase of lockdown and the uncertainty of a "back to normal" scenario persists, it is increasingly likely that the mobilities of e-commerce will have changed forever: online shopping habits are taking hold, omnichannel developments are transforming the functions of shopping streets and the need for efficient local logistics is more evident than ever.





5

MOVING FORWARD: BUILDING MORE AND BETTER DATA

Both city and logistics management are based on solid knowledge. The validity of a public policy option, as well as the validity of a reorganisation of operations of a logistics company, are highly dependent on the quantity and quality of available data. These data are particularly essential for predicting the challenges that cities will face due to the exponential growth of e-commerce. We present here a synthesis of the results of a comprehensive review of the scientific literature on the subject of e-commerce mobility data.

In order to better understand and deal with the urban challenges of e-commerce, five types of metrics are necessary:

- **socio-demographic indicators,** such as changes in population and its characteristics, densities and housing locations;
- **logistics indicators,** such as the number of collection points and the location of warehouses and urban logistics spaces;
- **consumer indicators,** their use of online sales and their delivery and collection preferences;
- **volume indicators,** on orders and parcels;
- **goods movement indicators,** such as the number of deliveries and returns, vehicle type, and changes in the types of jobs involved in delivering e-commerce.

Some of these data are available at the national level but are largely lacking at the urban level. This is a paradox because, as mentioned above, online shopping generates a large amount of data due to its digital nature that is theoretically easier to collect and process. But these data are entirely owned by e-retailers or logistics service providers and are largely inaccessible to researchers and municipalities.

We undertook a comprehensive review of the scientific literature on the theme of e-commerce mobility data to identify and compare the types of data that are currently known, applied and presented in research and the data sources that provide access to them. This review found that knowledge is focused on consumer preferences and behaviour on the one hand, and on daily parcel volumes on the other hand. In-depth surveys have made it possible to measure the impact of consumers' socio-demographic characteristics on their online purchasing behaviour. Some inconsistencies have emerged, particularly in the volumes ordered and the profiles of the most active online consumers (e.g. male or female?). Research also converges on certain points, such as the limited influence of regional conditions. In other words, **whether we live in an urban or rural environment does not determine whether and how often we shop online (Beckers et al., 2018; Wang & Zhou, 2015).** Numerous other surveys have been conducted to determine consumer preferences for delivery and purchasing behaviour, for example on the use of lockers and e-grocery. However, as they rarely represent the urban population as a whole and are based on non-standardised and very varied data collection methods, their results are difficult to compare.

Let's take the parcel volume indicator. Estimates can be made from secondary sources such as research reports and government documents, as well as calculations based on company information and survey data. Data comparability is also hampered by the mixture of data units that are used interchangeably and without clear definitions: “deliveries”, “orders”, “shipments” and “parcels”. In terms of number of orders, parcels and daily deliveries per urban inhabitant in different cities around the world, Chinese cities represented by Shanghai and Beijing stand out, while South American cities such as São Paulo (Brazil) and Belo Horizonte (Brazil) generate far fewer deliveries (Figure 11).

These results confirm the general trends known at the country level (Ecommerce Foundation, 2019b). **The graph also highlights large differences in methodologies and data collection sources.** For example, how can we explain the low levels of e-commerce orders in the 12th arrondissement of Paris compared to the Belgian cities of Antwerp and Brussels or the Portuguese district of Lisbon-Barreiro, when the national reports indicate that e-commerce is more important in France than in Belgium or Portugal (Ecommerce Europe, 2019)?

If we consider delivery density expressed as the number of deliveries per square kilometre, some cities stand out (Figure 12). Because of its population density, Manhattan (New York, United States) seems to receive approximately double the number of parcels distributed in Shanghai (China). Its parcel volume per square kilometre multiplies the volume of other cities considered as high-density areas (e.g. Paris 12th). This unit of data is also questionable, as it is so difficult to compare cities according to their size, ignoring the specificities linked to urban form, spatial activity and sprawl phenomena. In two cases (marked with an asterisk), the maximum number of parcels delivered in a square kilometre is indicated, instead of the urban average. The study on São Paulo includes both: with an average delivery density of 6.5 and a maximum delivery density of 93, it provides more elements for taking into account intra-urban delivery differences.

The most obvious gaps seem to be in information on delivery routes on the one hand and in the logistics infrastructure for urban e-commerce on the other hand. Information on delivery routes, in particular the number of deliveries and pick-ups per online order (Dablanc, 2018), information on vehicle size (Conway, 2020) and delivery trip patterns (Wang & Zhou, 2015), is not well assessed. Two questions seem crucial in this respect: how to define an online order and how many goods movements does an order generate? As regards the definition of online orders, Gardrat et al. (2016) rightly point out

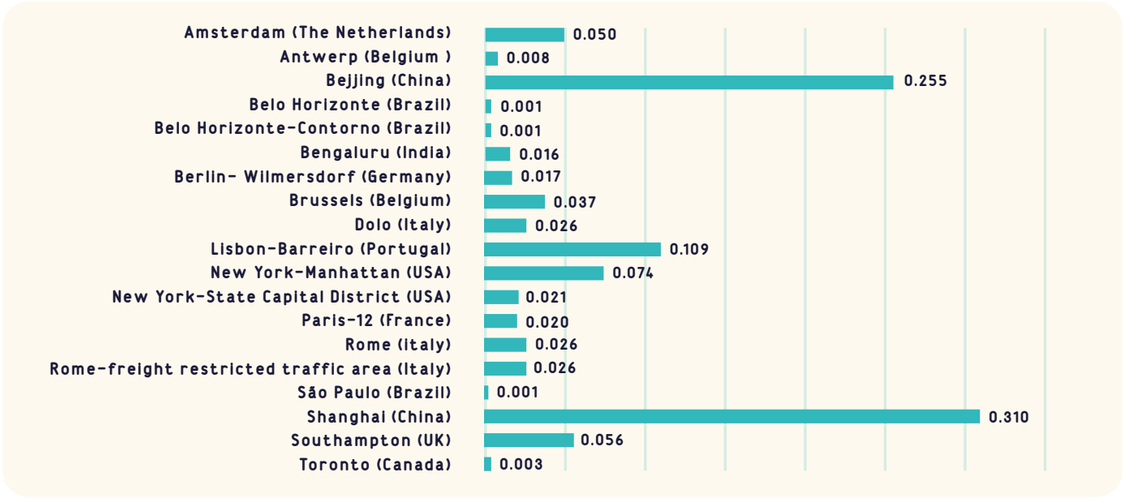


Figure 11. Daily B2C deliveries per capita (sources: various, in Buldeo Rai & Dablanc, 2021).

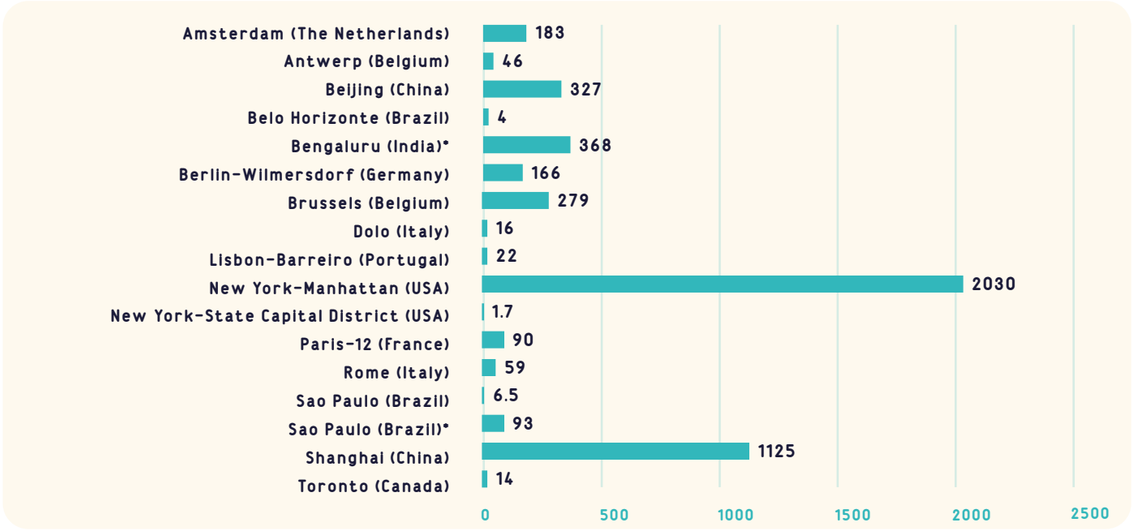


Figure 12. Average daily B2C deliveries (*maximum deliveries) per km2 (sources: various, in Buldeo Rai & Dablanc, 2021).

that e-commerce is not the only channel that generates deliveries for individuals. By introducing the concept of "deferred purchase and reception" from households and developing a survey to quantify it at the household level, the authors manage to include other types of purchases as well, including increasingly popular in-store purchases that are shipped for delivery rather than being taken home immediately. Regarding the conversion of online orders into the number of delivery trips, Wang and Zhou (2015) calculate the conversion factor on the basis of housing structures (i.e. single-family house versus multi-unit flats) and Holguín-Veras et al. (2019) use the assumption that seven B2C deliveries are equivalent to one freight trip.

In addition, there is a growing diversification in urban logistics: delivery vehicles (from vans of various sizes and motorisation to two-wheelers, motorised or not, or even to private cars or the use of public transport), delivery people (employees, temporary workers, self-employed, private individuals), logistics locations (from multi-storey warehouses, logistics hotels, to neighbourhood micro-hubs), purchasing behaviour (varying sizes of order baskets in response to free delivery) and e-commerce delivery operations (e.g. consolidation and fragmentation of orders). **Specialised indicators do not respond to this increasingly complex reality.** For example, with regard to the infrastructure related to e-commerce logistics, data on the locations of logistics facilities are missing (Heitz et al., 2019). A crucial issue is the heterogeneity of logistics facilities, which is not fully documented or understood. Here too, several trends complicate the collection of accurate data, such as fluctuations in the network of collection points, the strong increase in collection points (especially lockers), the development of mixed-use logistics facilities (e.g. ship-from-store) and the emergence of micro-logistics hubs.

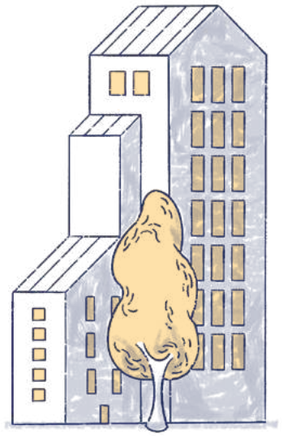
Several recommendations and best practices can be formulated for a common research data agenda on urban e-commerce logistics.

Firstly, the most urgent data gaps need to be filled, especially on delivery operations and logistics infrastructure indicators. There is also a need to improve the data quality that currently exists, on consumption and parcel volume indicators.

Second, to make progress in comparing knowledge across different cities and at different times, **standardisation of data collection needs to be pursued:** by being more explicit about the data collection instruments used, by sharing survey questionnaires and observation protocols, and by building on past efforts and tools to collect new data. Another way to improve comparability is to explicitly and systematically disclose the methodologies that were applied to collect, compile and calculate the data, the sources that were used to provide access to the data presented, the temporal and spatial information to which the methodologies, sources and data refer, and the precise units in which the data are expressed. Too often, it is difficult to find this basic information.

Thirdly, articles reporting on modelling research should increase and improve their data-related information on parameters and assumptions used to feed the models. However, as this type of research often relies on proprietary information from businesses, it is likely that dissemination issues need to be addressed. At a larger scale, company-level data may provide only a partial view of urban reality. For this reason, interview-based research is recommended, which often generates information from several parties. In addition to capturing a rich qualitative content, the interviewers could also look for certain quantitative facts and figures, thus highlighting multiple aspects of the evolution of urban e-commerce logistics.

To improve this area of research in the future, several fields can be further explored. Various data collection efforts already exist using the following sources:



- **Data from logistics service providers and e-retailers, in potential win-win partnerships** with municipalities. See the example of the municipality of Amsterdam, The Netherlands, which gets the location of the delivery points of the 80 largest logistics service providers operating in the city every week.
- **Data recorded by automated license plate reading cameras** set up to enforce low-emission zones or city tolls. Rotterdam reserves the right to analyse a month's worth of detailed data each year to find out about changes in personal and professional mobility and vehicle types.
- **Data from telecom operators.** These do not yet make it possible to distinguish between the profiles of goods transport vehicles, let alone those specifically related to e-retailers, and those of other vehicles in circulation.

Technological developments certainly open the way to new methods. But how can we use these solutions to improve knowledge of B2C mobility in urban areas, while at the same time managing the problems of ownership of private (e.g. navigation applications) and public (e.g. cameras) data? Data accessibility and the future availability of open-access data sharing platforms remain a major challenge.

THE LOGISTICS CITY CHAIR

The *Logistics City* chair was launched in 2019 in partnership between the University Gustave Eiffel (merger of the University of Paris-Est Marne-la-Vallée (UPEM) and IFSTTAR) and the real estate group Sogaris. In April 2020, the chair was joined by Poste Immo, a subsidiary of La Poste Group. The ambition of the Chair is to bring the issue of logistics locations and the analysis of the territorial impact of e-commerce mobility and digital transformations into the field of urban studies.

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The Gustave Eiffel University is a French university specialised in the study of smart and sustainable cities, with a strong focus on transportation. Its main location is in the Cité Descartes campus in Marne la Vallée in the Eastern part of the Paris region. The University Gustave Eiffel results from the merger of the University of Paris-Est Marne-la-Vallée and IFSTTAR, the national transportation research institute, together with the close association of three engineering schools and a school of architecture.

SOGARIS

A long-term investor, Sogaris is a real estate company specialising in urban logistics. Sogaris is deploying a coordinated network of sites for the Paris metropolitan area that meets the new needs of e-commerce and the explosion of distribution flows in the city. As a private company with public capital, Sogaris intends to invest €300 million by 2021 to promote the emergence of new, more sustainable and innovative modes of distribution in cities, at the service of its private customers and public stakeholders. Committed to the fight against climate change, Sogaris has made reducing the environmental impact of freight transport an essential objective of its strategy.

POSTE IMMO

Poste Immo, a subsidiary of La Poste Group, is the Group's property developer and service provider. Poste Immo manages, develops, maintains and enhances the value of a portfolio of approximately 6 million square metres of land, comprising more than 10,000 commercial, industrial and retail properties throughout France. It assists the Group's business sectors (Services-Courier-Colis, La Poste network, digital branch, Geopost and La Banque Postale) in implementing their projects in order to provide them with property that meets their needs, complies with the latest environmental standards and contributes to the objective of controlling costs. Poste Immo also offers a range of services to local authorities and businesses. With nearly 900 employees working at its regional offices and head office, it maintains a close and trusting relationship with its partners.

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LA RÉGION ÎLE-DE-FRANCE

Logistics is an essential dimension of the organisation of the territories and the economy of the Ile-de-France region, the leading French region with 12 million inhabitants and the largest European region in terms of GDP. Today, it represents 10% of the regional GDP and employs more than 375,000 people. Due to its geographical location and the large number of consumers, the Île-de-France region is a strategic area for logistics activities and the organisation of goods flows. In the field of transport, the Region is investing massively (30% of its budget) to modernise and expand infrastructures, support the development of new modes of transport and accelerate the implementation of new solutions to meet the mobility needs of people and goods. By adopting its regional strategy for freight and logistics in March 2018, the Region wished to reconcile economic attractiveness and environmental excellence to promote controlled, efficient and innovative logistics, in a context of strong growth in flows, particularly by road.

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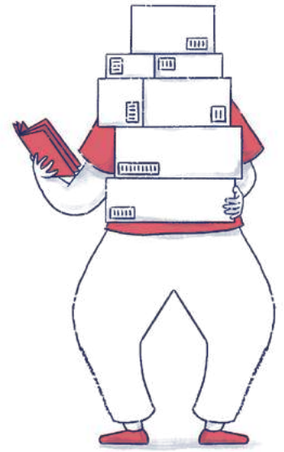

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