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The Role of Last-Mile Delivery in the Future of E-commerce

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Abstract. Last-Mile delivery has attracted considerable interest from the logistics suppliers and retail industry in the last few years. New technologies and approaches are being discussed both professional and academic side. The trend of new technologies developed for transportation will not stop and the reason is not hard to explain: The increase of online commerce and app-based ordering of almost everything from books to food, requires a large capacity, speed, and flexibility. Following the importance of last-mile delivery, this paper intends to investigate the expectations of consumers and parcel logistics provides regarding last-mile delivery. To do so, we conducted a literature review of last-mile to identify the main gaps found in the literature so far, aiming to extend the current literature. Our results showed that advances in last-mile delivery will depend on the capacity of logistics parcel services and consumers to align their expectations.

Keywords: City Logistics · Urban Freight · Parcel Freight Distribution

1 Introduction

In the last few decades, the future of transportation has been revolving around science fiction ideas such as flying cars, floating bridges, teleportation. However, although our transport systems are a little bit far from this futuristic world, nowadays there is much more technology applied to the transport segment than ever before.

The most recent innovation in urban transportation is autonomy Drones. The first official tests with Drones started in 2013, performed by Amazon. According to the CEO company, the Drones could deliver packages weighing up to 2,3 kg to customers within 30 minutes of them placing order [1]. In the following year, DHL launched its initial operation for research purposes with Drones focused in remote areas with restricted access [2].

Currently, drone delivery is a reality. The “Prime Air” Amazon service is available in the U.S where drones cover up to 15 miles and delivery packages less than 30 minutes counting with the FAA (Federal Aviation Administration) approval and certification [3]. The German company DHL also launched in May

2019 their first regular service of Drones delivery in China, with a partnership with EHang an autonomous aerial vehicle company [4]. Another American parcel company – UPS – also performs Drone delivery for medical samples, but is going to expand the service for regular operations pushed by the competition and for the growth of online shopping [5]. Floreano and Wood [6] estimated that Drones will have an important socio-economic impact in society in many areas such as: Volumetric data collection; Inspection; Humanitarian Organizations, Transportation and others. In addition, they pointed out the Transport application affirming that Drones will also help developed countries to improve the quality of service in congested or remote areas and will enable rescue organizations to quickly deliver medical supplies in the field and on demand.

The trend of new technologies developed for transportation will not stop and the reason is the increase of online commerce and app-based ordering of almost everything from books to food, requires a large capacity, speed, and flexibility. In this context, last-mile delivery has grown exponentially in importance globally and is getting attention from the biggest companies around the world.

Besides drones, another trend for last-mile is shared mobility, Shaheen and Chan [7] explain that it will be possible in the future including the use of trip planning mobile apps, multi-modal integration, and potential opportunities with automation applied to last-mile delivery and not only for people mobility.

In this context, note that logistics service providers, who used to be almost invisible to final consumers, are now the first physical contact on the sales experience that consumers have. Moreover, more than ever, logistics and last-mile delivery are an active part of the whole customer experience journey. For Rai et al. [8] in the omnichannel environment, where products are delivered to the store and to the home, logistics service providers have become important links between retailers and their customers.

Indeed, the e-commerce sector was the first to realize the importance of last-mile delivery, nonetheless, the growth of sector create a gap between consumers and logistics parcel services companies. While the former are seeking alternatives to cost reduction and increase of the delivery efficiency, the latter are interested in more convenience to receive their products.

With those ideas in mind, this work intends to identify the expectations of logistics parcel providers and consumers and discuss the implications from e-commerce marketing. To this end, a literature review was conducted.

This paper is organized as follows. Section 2 represents the fundamental concepts for last-mile. Section 3 we delve into discussions considering expectations and implications of the last mile delivery in e-commerce. The last section closes with an initial conclusion and wonders for future researches.

2 Last-mile

In recent years, logistics evolve from supporting role to the protagonist in the management scenario, replacing the notion that transportation is a necessity following production. Logistics turns out a paradigm referring to the integrated

management of the whole supply chain, encompassing the entire cycle of production, circulation and, increasingly, consumption as something to be planned and analyzed [9].

Logistics always pursue the development from industry and market trends, emerging from a cost center to an innovative player, being crucial for the success of any retail company. Competitiveness can be improved through better management of logistics networks and can lead to the development of new models for different sectors [10].

Regarding last-mile delivery, it is necessary an overview of City Logistics topic. Taniguchi and Shimamoto [11] define city logistics as the process for totally optimizing the logistics and transport activities by private companies with the support of advanced information systems in urban areas considering the traffic environment, its congestion, safety, and energy savings within the framework of a market economy. In addition, Savelsbergh and Woensel [12] explain there are many definitions of city logistics, but common to all of them is that city logistics is about finding efficient and effective ways to transport goods in urban areas while taking into account the negative effects on congestion, safety, and environment.

Another important aspect of city logistics, it has been coined to emphasize the need for an optimized consolidation of loads of different shippers and carriers within the same delivery vehicle and coordination of freight transportation activities within the city [13].

Part of city Logistics' concerns is last-mile delivery. Lim and Srari [14] explains that the term "last-mile" originated in the telecommunications industry and refers to the final leg of a network. Today, last-mile logistics denotes the last segment of a delivery process, which is often regarded as the most expensive, least efficient aspect of a supply chain and with the most pressing environmental concerns.

Last-mile deliveries are one of the major effectors of heavy traffic on commercial vehicles in the whole city area. Their essential features, significantly lowering the rational functioning of the transport system, include a high degree of fragmentation and a low range of use of the cargo load compartment of vehicles [15]. Boysen et.al [16] brings to light that traditional last-mile delivery by trucks faces several problems, due of the human driver and the large fraction of unproductive work (e.g., due to absent customers or traffic holdups), truck deliveries are costly and, furthermore, seen as a major source of negative effects on congestion, safety, and environment in large city centers. However, according to Mackinnon [17] the amount and efficiency of freight movement in urban areas will be influenced more strongly by wider technological and business trends than by the localized actions of government agencies. One such trend is the growth of online retailing.

In the environment of e-commerce, Irakleous [18] says that although the provision of delivery service for e-shopping is an issue between e-retailer and transport service provider, the services to be developed need to identify consumers'

demand and especially under what conditions a customer is willing to pay for these services.

It is a complex chain, to meet expectations from different stakeholders, such as consumers, retailers, parcel service companies among others. According to Irakleous [18], e-shopping can be fulfilled by a delivery system that can satisfy both consumers' and retailers' needs.

Consumers care about last-mile delivery because it offers convenience and flexibility. For those reasons, same-day and on-demand delivery services are gaining traction for groceries (e.g. Deliv Fresh, Instacart), pre-prepared meals (e.g. Sun Basket).

3 Results and Discussion

3.1 Last-mile expectations

Based on the literature review was possible to identify five aspects of interest from the e-commerce consumer perspective: (1) Delivery point; (2) Delivery time and speed; (3) Track and trace; (4) Value-added services and (5) Delivery Price:

- **Delivery point:** is the first thing that consumers will determine after purchase something online. There are two main obvious options: at home or at the workplace or if available pick-up in a point provided by the e-retailer.
- **Delivery time and speed:** are regarding the total time between order confirmation and final delivery, as mentioned previously is the main factor that impacts on the choice of delivery services attribute.
- **Track and trace:** are services based automatic communication between parcel providers and e-shoppers, thought RFID bar codes or number of orders, guarantee end-to-end tracker is very important for the final consumer has the feeling of control of their package.
- **Value-added:** is difficult to measure, because depends on consumer perception, can be a different package, an electric vehicle, a bike delivery, a call from provider among others. The price of delivery is the most sensitive aspect of this relationship, preferably should be lower than product price, but also cover all transportation and information costs, some companies still offering “free shipment” sometimes absorbing part of freight cost, sometimes embedding in the final cost [18].

Each one of those five attributes above are connected more to the consumer perspective, but online retailers are striving to offer consumers evermore responsive (and costly) last-mile delivery services in their efforts to increase sales and gain market share from their competitors, and as a result, often fail to cover the costs of these operations. The most significant impact of e-commerce on freight transportation is the increase in direct home delivery of smaller shipments, which may stimulate greater complexity in distribution system management, potentially causing higher costs in carrier's fleet operations [19,20].

On the other hand, three aspects from parcel service providers were also identified, being: (1) the “not at home” problem; (2) Unattended delivery and (3) Last-mile collection. From the last-mile provider side, we can summarize those three aspects in one unique concern: Operational Cost.

- **The not at home:** issue is a growing concern for logistics providers, the rise of home deliveries of very small packages, increases the freight cost and makes the flow more complex. When the customer is not at home at the time of delivery, it generates a future attempt and a lower satisfaction from the consumer as well.
- **Unattended delivery** may offer an option for not at home situation, is cheaper and no need a person to receive the package, leaving the package in the doorstep, garden shed, concierge; but it can cause some security implications mostly when are high-value packages.
- **last-mile collection** consists in giving the consumer the option to pick-up their package at some convenient location, such as retail shops, petrol stations, etc., but this option is only reasonable if the pick-up point concentrates a certain number of orders to justify the cost transportation, even though is the same cost as home delivery [20]. Endorsing those challenges Wang et al. [21] argues that in urban logistics, the last-mile delivery from the warehouse to the consumer’s home has become more and more challenging with the continuous growth of E-commerce. It requires elaborate planning and scheduling to minimize the global traveling cost but often results in unattended delivery as most consumers are away from home.

Figure 1 summarizes the disproportional scale between parcel service providers and final consumers, in the middle is the online companies that must administrate and balance the operational costs of delivery with the final price of their products.

3.2 Last-mile implications

According to our research is possible to infer that there is a saturation of urban centers in terms of logistics flows, but there is a lack of an efficient and sustainable framework to deal with many challenges and expectations from different stakeholders along the last-mile in e-commerce supply chains.

Altenried [9] argues that the rise of logistics to a position in which it has become a central discipline of contemporary capitalism and sketches its digitally-driven saturation of urban spaces as the expression of new logistical urbanism.

Lim and Srai [14] endorse this idea saying that the development of these experimental last-mile logistics models, not surprisingly, created uncertainty within increasingly complicated and fragmented distribution networks. Without sustainable delivery economics, last-mile service provision will struggle to survive retailers increasingly challenged to find an optimal balance between pricing, consumer expectations for innovative new channels, and service levels.

Furthermore, is important to note that last-mile itself is a challenge for the majority of urban territories nowadays. Altenried [9] brings a reflection that with

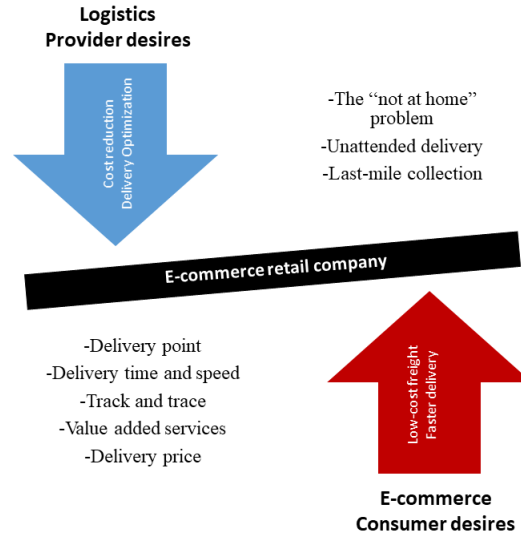


Fig. 1: Logistics Desires x Consumer Desires

a glance at the streets of most cities brings to light the ubiquity of logistical operations: These streets are swarming with delivery vans of all sorts, bicycle messengers, food delivery drivers on scooters and many others trying to deliver all kinds of products to customers with maximum speed. Contemporary cities can no longer be understood primarily in relation to static objects, but increasingly through their logistical systems and procedural flows, claiming that time is now ‘the most critical attribute of city making’.

In this sense logistics, cannot be apart from city development, must be an essential part of any discussions among stakeholders. To endorse this complexity Bjerkan et.al [22] conclude that so far research on e-commerce and transport can be characterized as diverse and inconsistent, both in terms of theoretical approaches, definitions, data, methodologies and findings. It is difficult to identify an obvious, overall direction, and existing research does not allow a definitive conclusion on the relationship between e-commerce and transport.

4 Conclusions

The research allow us to initially conclude that there is a gap among logistics parcel providers, e-Shops and e-Consumers expectations.

The limited delivery options and affordable technologies are dominated by standard home delivery methods.

Solutions such as autonomous drones and sharing mobility are embryonic; still, need a clear regulation and investments to make it feasible for most parcel delivery companies in last-mile logistics.

Finally, this study is relevant to the e-commerce sector, first because brings light that last-mile delivery is becoming a more significant factor that may affect online sales expansion in the future.

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References

1. BBC: Amazon testing drones for deliveries, <https://www.bbc.com/news/technology-25180906>
2. DHL: DHL | press release | english, https://www.dhl.com/en/press/releases/releases_2014/group/dhl_parcelcopter_launches_initial_operations_for_research_purposes.html
3. D'onofrio, J.: Amazon's new delivery drone will start shipping packages 'in a matter of months', <https://www.forbes.com/sites/jilliandonfro/2019/06/05/amazon-new-delivery-drone-remarks-warehouse-robots-alexa-prediction/#44921c7f145f>
4. E-commerce: quantas lojas virtuais existem por aí?, <https://www.ecommercebrasil.com.br/artigos/quantos-e-commerce-existem-por-ai/>
5. UPS: UPS plans to expand drone deliveries - CBS news, <https://www.cbsnews.com/news/ups-plans-to-expand-drone-deliveries/>
6. Floreano, D., Wood, R.J.: Science, technology and the future of small autonomous drones 521(7553), 460–466, <http://www.nature.com/articles/nature14542>
7. Shaheen, S., Chan, N.: Mobility and the sharing economy: Potential to facilitate the first- and last-mile public transit connections 42(4), 573–588, <http://www.ingentaconnect.com/content/10.2148/benv.42.4.573>
8. Rai, H.B., Verlinde, S., Macharis, C.: How are logistics service providers adapting to omnichannel retail? 51(11), 588–593, <https://linkinghub.elsevier.com/retrieve/pii/S2405896318315076>
9. Altenried: On the last mile: logistical urbanism and the transformation of labour 13(1), 114, <https://www.jstor.org/stable/10.13169/workorgalaboglob.13.1.0114>
10. Juhász, J., Bányai, T.: Last mile logistics: an integrated view 448, 012026, <http://stacks.iop.org/1757-899X/448/i=1/a=012026?key=crossref.c07a3066cca27eeb30a245e85c4aa373>
11. Taniguchi, E., Shimamoto, H.: Intelligent transportation system based dynamic vehicle routing and scheduling with variable travel times 12(3), 235 – 250, <http://www.sciencedirect.com/science/article/pii/S0968090X04000221>
12. Savelsbergh, M., Van Woensel, T.: 50th anniversary invited article—city logistics: Challenges and opportunities 50(2), 579–590, <http://pubsonline.informs.org/doi/10.1287/trsc.2016.0675>
13. Crainic, T.G., Ricciardi, N., Storchi, G.: Models for evaluating and planning city logistics systems 43(4), 432–454, <https://doi.org/10.1287/trsc.1090.0279>, place: Linthicum, MD, USA Publisher: INFORMS

14. Lim, S.F.W., Jin, X., Srari, J.S.: Consumer-driven e-commerce: A literature review, design framework, and research agenda on last-mile logistics models 48(3), 308–332, <https://www.emerald.com/insight/content/doi/10.1108/IJPDLM-02-2017-0081/full/html>
15. Iwan, S., Kijewska, K., Lemke, J.: Analysis of parcel lockers' efficiency as the last mile delivery solution – the results of the research in poland 12, 644 – 655, <http://www.sciencedirect.com/science/article/pii/S2352146516000193>
16. Boysen, N., Briskorn, D., Fedtke, S., Schwerdfeger, S.: Drone delivery from trucks: Drone scheduling for given truck routes 72(4), 506–527, <http://doi.wiley.com/10.1002/net.21847>
17. Mckinnon, A.: The possible impact of 3d printing and drones on last-mile logistics: An exploratory study 42(4), 617–629, <http://www.ingentaconnect.com/content/10.2148/benv.42.4.617>
18. Irakleous, A.: Modeling framework for last-mile logistics services
19. Allen, J., Piecyk, M., Piotrowska, M., McLeod, F., Cherrett, T., Ghali, K., Nguyen, T., Bektas, T., Bates, O., Friday, A., Wise, S., Austwick, M.: Understanding the impact of e-commerce on last-mile light goods vehicle activity in urban areas: The case of london 61, 325–338, <https://linkinghub.elsevier.com/retrieve/pii/S136192091730305X>
20. Xu, M., Ferrand, B., Roberts, M.: The last mile of e-commerce – unattended delivery from the consumers and eTailers' perspectives 2(1), 20, <http://www.inderscience.com/link.php?id=16815>
21. Wang, Y., Zhang, D., Liu, Q., Shen, F., Lee, L.H.: Towards enhancing the last-mile delivery: An effective crowd-tasking model with scalable solutions 93, 279–293, <https://linkinghub.elsevier.com/retrieve/pii/S1366554516300783>
22. Bjerkan, K.Y., Bjørgen, A., Hjelkrem, O.A.: E-commerce and prevalence of last mile practices 46, 293–300, <https://linkinghub.elsevier.com/retrieve/pii/S235214652030394X>