Last mile practices in e-commerce: framework development and empirical analysis of Swedish firms

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Abstract

Purpose – In light of the recent dynamics, this paper aims to explore the last mile (LM) of e-commerce retailers. Two research questions are developed (1) What firm characteristics are critical in LM practices? and (2) How do LM practices differ based on the identified critical firm characteristics?

Design/methodology/approach – Data were collected via 10 interviews with e-commerce executives, as well as a survey on 200 e-commerce firms in different retail sectors in Sweden.

Findings – "Firm Size" and "Sales Channel-Mix" appear to be the top critical firm characteristics in LM practices. While last mile delivery (LMDe) was found to vary more based on sales channel mix than firm size, the opposite occurs for last mile back-end fulfilment (LMBF). Moreover, last mile consumer steering (LMCS) was found to vary only with sales channel-mix. Unexpectedly, primarily store-based retailers capitalize on their stores while offering competitive remote services; they hence compete indirectly with their existing store network.

Originality/value – While most prior work has focused on LMBF and LMDe for strategizing, the consumer-steering aspect seems to have been a missing link. This study develops an integrated framework for LM strategy planning, incorporating LMCS, LMBF and LMDe. New aspects such as the environment, specialization and inventory management are included. The findings provide insights for executives when strategizing, undertaking competition analysis and positioning the firm.

Keywords Omni-channel, e-commerce, Last mile, Strategy planning, Logistics

Paper type Research paper

1. Introduction

The retail landscape is transforming in light of the pandemic, as well as through digitalization and prevalence of omni-channel approaches to distribution (Frasquet *et al.*, 2021; Verhoef *et al.*, 2015; Halan, 2021). These shifts entail complexities in pricing, services, human resources, know-how, as well as last mile (LM) logistics practices (Hübner *et al.*, 2016a). Managing LM logistics is, arguably, most critical in e-commerce (Mangiaracina *et al.*, 2019). Given the expected boom in e-commerce reception and adoption, omni-channel logistics will arguably be challenging in the coming years, exacerbated by being relatively under-researched (Marchet *et al.*, 2018; Cai and Lo, 2020). For instance, consumer savviness and

concerns regarding environmental sustainability further constrain retailers in their LM practices (Cai and Lo, 2020), especially if Logistics Service Providers (LSP's) are involved (Mangiaracina *et al.*, 2015). Such a dynamic environment not only affects business strategies but also raises the need for innovative logistics practices and flexibility (Cao, 2014; Jeanpert and Paché, 2016; Jocevski *et al.*, 2019; Lim and Winkenbach, 2018; Sandberg, 2021), notably because firm characteristics evolve over time (Davis-Sramek *et al.*, 2020). For instance, during the COVID-19 pandemic, increased consumer demand for contactless shopping (Halan, 2021) and home deliveries (HD) has prompted retailers and LSPs to explore autonomous delivery robots (Pani *et al.*, 2020). Given the inconsistencies among firms, there does not exist one magic LM practice fitting all retailers, given its importance in differentiation and positioning (Ishfaq *et al.*, 2016). Therefore, understanding whether and how LM practices differ based on firm characteristics could be of interest for research and practice (Kembro and Norrman, 2021), especially given that empirical studies on LM practices are relatively scant (Mangiaracina *et al.*, 2019).

While configurational approaches could be beneficial in disentangling complex systems, they are still scarce in the omni-channel literature (Chandra and Grabis, 2007; Marchet *et al.*, 2018; Lim and Srai, 2018). *Firstly*, although the few attempts on elucidating LM practices help understand some key logistics parameters in strategizing, they either do not clearly underline the critical firm characteristics or do not provide an industry-wide picture, mainly due to focusing on certain sectors or firm sizes (see Galipoglu *et al.*, 2018). For instance, Kembro and Norrman (2020, 2021) explore how certain contextual factors are critical in last mile back-end fulfilment (LMBF); specifically, in select cases in fashion, consumer electronics and construction materials retailing. *Secondly*, the existing frameworks for LM strategy planning appear to suffer from neglecting important logistics parameters in LMBF and last mile delivery (LMDe) (see Hübner *et al.*, 2016c; Marchet *et al.*, 2018), such as those steering shopper decisions or sustainability (Mangiaracina *et al.*, 2019); this is especially important given that sustainability impacts shoppers' choice of delivery mode (Ignat and Chankov, 2020; Cai and Lo, 2020). Furthermore, according to Wollenburg *et al.* (2018a, 2019), last mile consumer steering (LMCS) might lead to improved firm performance. LMCS involves guiding consumers through channels and delivery options, which can be accomplished via logistics parameters such as cross-channel inventory information, delivery speed differentiation, consumer delivery and return fees. *Thirdly*, to date, no large-scale quantitative study has been reported to shed light on LMCS, LMBF and LMDe in an integrated way and to elaborate the differences in the LM practices of both omni-channel retailers as well as e-tailers (cf. Hübner *et al.*, 2016c; Marchet *et al.*, 2018 which only focus on the former).

This paper sets to address those gaps *by exploring the LM practices of e-commerce retailers*. Specifically, we revisit and build upon existing frameworks for LM strategy planning, mainly by incorporating consumer steering, and provide insight via a large empirical sample of Swedish e-commerce firms. We propose the following research questions (RQ's):

RQ1. What firm characteristics are critical to LM practices?

RQ2. How do LM practices differ, based on the identified critical firm characteristics?

Sweden has repeatedly been ranked as a pioneer in e-commerce, digitalization, sustainability and innovation (European Commission, 2020a). Swedish e-commerce sales have recently experienced a period of exponential growth, from a steady 15% in 2018 and 2019 to a whopping 40% in 2020, mostly due to the pandemic (PostNord, 2020). However, Swedish e-commerce retailers are still in the nascent phase, relying on trial and error to refine their LM practices. For instance, Sallnäs and Björklund (2020) reported that eco-delivery options are still limited for Swedish e-commerce shoppers. Moreover, with the launch of Amazon.se in

2020, Swedish retailers faced a potential challenge that required them to revisit their LM practices.

The rest of the paper is structured as follows: by synthesizing the literature, an integrated framework for LM strategy planning is developed, which is discussed in Section 2. Furthermore, the general influential firm characteristics are overviewed in Section 3. Later, the findings are presented and discussed in Section 4. Finally, implications and future research directions are presented in Section 5.

2. Frame of reference

The LM process, as illustrated in Figure 1, is part of the overall order fulfilment process (Hübner *et al.*, 2016c) and is triggered by an e-consumer order. Retailers can "steer" the consumer during the order process (Area 1) via certain logistics parameters (Wollenburg *et al.*, 2018a). The LM process is initiated by a picking request and ends with delivery at the preferred consumer delivery location (Area 3). The overall LM process can be divided into LMBF and LMDe (Areas 2 and 3). Warehouse operations in omni-channel retailing consist of receiving, put-away, picking and sorting, packing and consolidation and shipping (Eriksson *et al.*, 2019). The two major LMDe modes are delivery to a "preferred" customer destination point (e.g. HD or delivery at the workplace) and click-and-collect (C&C) (e.g. at store or at a partner location). Traditional LMDe activities include parcel sorting (e.g. in one or several locations), transportation (e.g. milk-run, line-haul and local distribution) and hand-over to the consumer at the preferred delivery location. Retailers can influence the consumer's preferred delivery location by "steering" them (Area 1). Some activities, such as sorting before the line-haul, might also be performed in LMBF.

2.1 Firm characteristics in LM research

The way retailers design their LM practices can differ based on their firm characteristics (Ishfaq *et al.*, 2016; Kembro and Norrman, 2021). Previous omni-channel LM studies broadly underline several firm characteristics regarding LM practices (Table 1).

Successful online retailers tend to operate with a wider product assortment, since the assortment width influences LM practices (Agatz *et al.*, 2008; Marchet *et al.*, 2018; Kembro and Norrman, 2021; Kembro *et al.*, 2018; Lim and Winkenbach, 2018). Moreover, customer requirements have direct implications for firms' LM practices, e.g. in green delivery options or the long-tail assortment (Kembro *et al.*, 2018; Sallnäs and Björklund, 2020). Hübner *et al.* (2016c) argue that the omni-channel experience influences LM practices as firms mature over
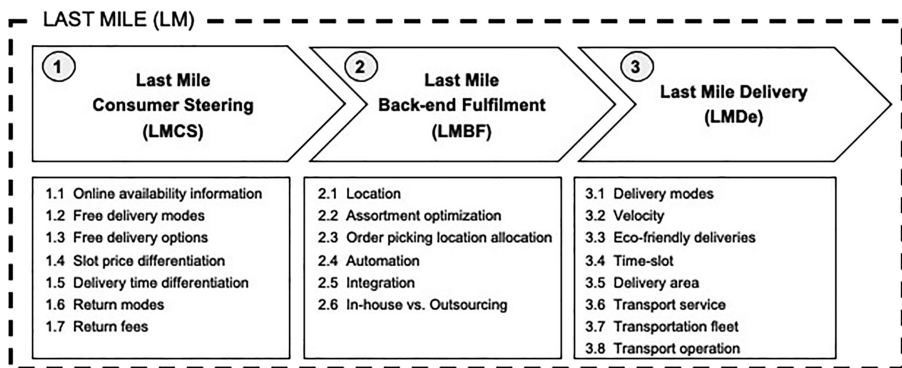

Figure 1.
The LM process

Firm characteristics	References
Assortment Width	Agatz *et al.* (2008), Melacini *et al.* (2018), Kembro *et al.* (2018), Lim and Winkenbach (2018), Kembro and Norrman (2021)
Customer Requirements	Kembro *et al.* (2018), Lim and Winkenbach (2018), Kembro and Norrman (2021)
Length of Retailer Omni-Channel Experience	Hübner *et al.* (2016c)
Online Order Volume	Wollenburg *et al.* (2018b), Eriksson *et al.* (2019), Kembro and Norrman (2021)
Retailer Size	Hübner *et al.* (2016c), Galipoglu *et al.* (2018), Kembro *et al.* (2018), Marchet *et al.* (2018), Wollenburg *et al.* (2018b), Kembro and Norrman (2021)
Retailing Sector	Galipoglu *et al.* (2018), Wollenburg *et al.* (2018b)
Sales Channel-Mix	Jeanpert and Paché (2016), Kembro *et al.* (2018)
Store and Online Order Characteristics	Kembro *et al.* (2018)
Store Network	Ishfaq *et al.* (2016), Hübner *et al.* (2016c), Larke *et al.* (2018), Maccarthy *et al.* (2019), Davis-Sramek *et al.* (2020)

Table 1.
Firm characteristics in
LM literature

time. Online order volume has been argued to drive the omni-channel online fulfilment capabilities in grocery retailing (Wollenburg *et al.*, 2018b), and the level of automation should be justified based on the extant of volumes, according to Eriksson *et al.* (2019). Firm size has been generally discussed as a significant firm characteristic in strategizing. Simpson and Docherty (2004) argue that larger firms generally have more financial resources to invest than small and medium-sized enterprises (SMEs). Larger retailers also have stronger bargaining power in their supply chains (Sallnäs and Björklund, 2020). Kembro and Norrman (2021) highlight that firm size and increased online ordering quantity drive automation in the fashion, consumer electronics and construction material retailing sector. Wollenburg *et al.* (2018b) argue that there is a significant difference between grocery and non-food LM, since online grocery shopping baskets contain more items than non-food online orders, undermining the generalizability of food-retail findings to non-food logistics. The scale and national width of the store network influence how omni-channel retailers leverage their stores as an integral part of LMDe (Ishfaq *et al.*, 2016; Hübner *et al.*, 2016c). Sales channel mix has implications for firm strategy (Jeanpert and Paché, 2016), as well as omni-channel warehouse operations (Kembro *et al.*, 2018). There might also exist interactions among some firm characteristics (e.g., size and sales channel mix). Nevertheless, Kembro and Norrman (2021) argue that the most influential LMBF contextual factors are the number of online orders, assortment range, fulfilment times and goods size.

2.2 An integrated framework for LM strategy planning

The proposed integrated framework for LM strategy planning in this study is a further development of the LM strategy planning frameworks by Hübner *et al.* (2016b) and Marchet *et al.* (2018). We maintain that LMCS, LMBF and LMDe should be considered in an integrated way when strategizing (Wollenburg *et al.*, 2018a, 2019). The framework, visualized in Figure 2, covers the important LMCS aspects in aligning business and LM strategies. Our framework – which presents the areas, parameters and options in a form similar to a morphological box or matrix (Zwicky, 1969; Ritchey, 2011) – extends prior contributions by incorporating salient LM aspects such as the environment, outsourcing and inventory management (the amended areas, parameters and options are marked in grey).

LMCS – i.e. guiding the consumer through channels and delivery options – can also be used at a tactical level to drive sales and resolve temporary physical bottlenecks (e.g., by

Areas	Parameters	Options			
① Last Mile Consumer Steering (LMCS)	1.1 Online availability visibility	Only web store		Physical stores & web store	
	1.2 Free delivery mode (always)	Attended HD	Unattended HD	In-store or attached C&C	Solitary C&C
	1.3 Free delivery options	Above a certain order value		Free freight subscription programs	
	1.4 Slot price differentiation	Yes		No	
	1.5 Delivery time differentiation	Yes		No	
	1.6 Return mode	In-store		Remote	
	1.7 Free return mode	In-store	Remote	No free return modes	
② Last Mile Back-end Fulfilment (LMBF)	2.1 Location	In-store	e-Fulfilment Centre	Central warehouse	Drop shipping
	2.2 Assortment optimization	Symmetric		Asymmetric	
	2.3 Order allocation	Dynamic		Static	
	2.4 Automation	Manual	Semi-automated	Fully automated	
	2.5 Integration	Separated	Integrated	Capacity optimized	
	2.6 Back-end fulfilment operation	In-house	Hybrid	Outsourced	
③ Last Mile Delivery (LMDe)	3.1 Delivery mode	Home or other destination		Click & Collect	
		Attended	Unattended	In-store	Attached	Solitary
	3.2 Velocity	Same day	1 – 3 days	4 – 5 days	> 5 days
	3.3 Eco-friendly delivery option	Yes		No	
	3.4 Time slot	Specific		Undefined	
	3.5 Delivery area	Local & regional	National	International	
	3.6 Transport service	Milk run	Courier	Linehaul + distribution	
	3.7 Transportation fleet	Fossil	Hybrid	Fossil free	
	3.8 Transport operation	Internal transport fleet	Hybrid solution	External transport fleet	

Figure 2.
LM framework

Source(s): Own developments marked in grey. Partially Based on Hübner *et al.* (2016c) and Marchet *et al.* (2018)

influencing the preferred delivery location). Our proposed framework covers consumer-steering parameters such as cross-channel inventory information (1.1), delivery speed differentiation (1.5) and consumer delivery and return fees (1.2, 1.3, 1.4 and 1.7), as highlighted by Wollenburg *et al.* (2018a). It should be noted that return mode (1.6) and return fees are included in LMCS even though they are not part of the LM process, since they influence delivery choices (Cai and Lo, 2020). Here, the LMBF and delivery parameters that we add to the model of Hübner *et al.* (2016b) are mainly within the areas of specialization (2.6 and 3.8), sustainability (3.3 and 3.7) and inventory management (2.1 and 2.2).

The online order-picking locations (2.1) are typically stand-alone e-fulfilment centres for only online orders, central warehouses serving both stores and online channels, in-store picking and vendor fulfilment (Ishfaq *et al.*, 2016; Ishfaq and Raja, 2018; Kembro and Norrman, 2020). According to Kembro and Norrman (2020), larger omni-channel firms typically rely on integrated central warehouses (2.5) with higher automation (2.4), complemented with in-store and supplier picking in the forms of drop-shipment or cross-docking solutions (2.1) with dynamic order allocation (2.3). Larger retailers generally opt for high warehouse automation, and some are already using robots extensively in their warehouses (Grewal *et al.*, 2017). Davis-Sramek *et al.* (2020), Larke *et al.* (2018) and Maccarthy *et al.* (2019) claim that omni-channel retailers incorporate existing store networks in their LM strategy to distribute online orders (2.1). Carrying a wide product assortment with free (1.2 and 1.3) home or solitary C&C (3.1) deliveries have gained popularity among omni-channel retailers (Lim and Winkenbach, 2018). Consumers can elect to receive their parcels during a specific time slot (1.4 and 3.4) which may be as wide as a whole day. Research shows that shoppers are willing to wait or to collect their orders when delivery is free (Buldeo Rai *et al.*, 2019b). Lim and Winkenbach (2018) state that omni-channel firms have leaned towards adopting higher centralization (3.5) when slower delivery times (3.2) are required and towards regional distribution (3.5) when delivery responsiveness is demanded (3.2). Local mini-fulfilment centres, so called "dark stores" with a narrow product assortment, are being

explored by e-tailers to offer fast deliveries on bestselling products (Rodrigue, 2020). Jocevski *et al.* (2019) highlight the importance of solitary and in-store C&C solutions (3.1), as well as allowing returns in all channels (1.6). LM deliveries are costly and have a big environmental influence. In this regard, alternative transport service options (3.6) are milk runs, linehaul with local distribution or couriers (Rodrigue, 2020).

A key decision after designing the most appropriate logistics strategies is to decide who performs the logistics operations (Cai and Lo, 2020). Retailers can differentiate themselves by developing their own LM in-house capabilities or cooperating with best-in-class LSPs (Buldeo Rai *et al.*, 2019a). Recently, Amazon US has integrated vertically forward with the aim of doing the majority of their deliveries in-house (Rodrigue, 2020). LM activities can be outsourced to different partners such as LSP's, online marketplaces and suppliers. The framework used in this study covers outsourcing of LMBF and LMDe, which are key decisions when configuring LM operations.

Recently, environmental attention has increased dramatically among e-commerce firms due to intensified competitive and customer pressure (Mangiaracina *et al.*, 2015). Transportation has arguably the largest environmental LM impact (Halldórsson and Wehner, 2020). There is an on-going debate over whether online retailing has a larger environmental impact than store-based retailing from a logistical perspective (Pålsson *et al.*, 2017), with little consensus among scholars, since much depends on the preferred delivery alternative, and on the transport modes by which off-line consumers visit the store. Eco-friendly consumer deliveries are most likely essential for retailers to succeed as consumers become increasingly concerned about the environment (Buldeo Rai *et al.*, 2019b). Driverless autonomous trucks (Grewal *et al.*, 2017) and electric transportation fleets (Mangiaracina *et al.*, 2015) offer opportunities to reduce environmental impact. Autonomous fleets are not included in the framework because they are yet to be commercialized; however, there already exist couriers in Sweden offering a fossil-free transportation fleet, while several LSPs aim to become 100% fossil-free within the coming decade, so eco-friendly delivery and transportation fleets are incorporated in the integrated framework to explore current logistics practices.

Product availability is one of the most important aspects of logistics service quality in omni-channel retail (Murfield *et al.*, 2017), yet Cai and Lo (2020) observe, in their systematic review, an absence of omni-channel inventory management literature. An important LM inventory management decision is *where* to store the products that retailers sell. Products may be handled in a symmetric assortment, which entails displaying the full assortment in all locations, or as an asymmetric assortment, with locations displaying various subsets of the whole. The assortment optimization parameter is included under the LMBF area, even though the assortment strategy partially steers consumers towards different channels. A common approach, when the assortment is wide, is to deploy an asymmetric assortment by keeping the longer tail of products in central locations or with their suppliers (Agatz *et al.*, 2008; Melacini *et al.*, 2018). An important picking location added under *inventory management* is drop shipping (2.1). Retailers can also work with a sophisticated cross-docking solution, in which the suppliers send the products to the retailers who, in turn, consolidate and send the complete order to their consumers (Ishfaq *et al.*, 2016; Ishfaq and Raja, 2018; Kembro and Norrman, 2020; Kembro *et al.*, 2018). Retailers applying cross-docking or drop-shipping practices do not store the products in-house. The other configuration parameter – *assortment optimization* – and the location option – *drop shipping* – are included in the LMBF area.

3. Methods
This study takes a sequential, dual-phase approach (Figure 3). In Phase 1, an integrated strategy planning framework was developed, following an iterative process of reviewing the

literature to complement the existing frameworks by Marchet *et al.* (2018) and Hübner *et al.* (2016b), while the key firm characteristics were identified. Also, interviews were carried out with e-commerce decision-makers to identify the most critical firm characteristics in LM practices and to validate the developed LM Framework. In Phase 2, the framework served as a measurement instrument for a large-scale sector-wide quantitative study on 200 Swedish retailers with e-commerce sales. The resulting data were analysed, primarily based on descriptive statistics, to shed light on how LM practices differ based on the identified critical firm characteristics (RQ2).

3.1 Phase 1
In this phase, the first round of interviews, each lasting for around 1 h, were carried out with 10 informant logistics executives (Table 2). Firms were selected to ensure that various retail sectors and sizes in Sweden would be represented and that the informants have several years of prior experience as retail decision-makers so that they would be in a position to reflect on the industry as well. The list of firm characteristics was compiled from the reviewed literature, and researchers and practitioners – mainly involved in the research project – were consulted to validate the list before the interviews. The executives received the questions prior to the interviews so that they could prepare, think and reflect upon them. Primarily, open-ended questions were used to give the executives the opportunity to share their knowledge and to express their opinions freely. The interviewees were also asked to rank the top three firm characteristics influencing LM practices from the compiled list (see the interview guide in Appendix 1). Additional interviews were performed until saturation was achieved regarding the critical firm characteristics in LM practices. Due to restrictions
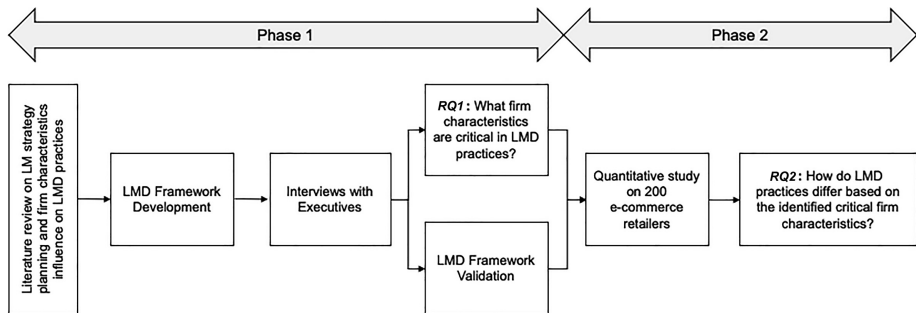

Figure 3.
Study design

Firm	Retail sector	Size	Retailer type	Position
A	Furniture and Home Decoration	Large	Omni-channel	Logistics Executive
B	Home and Office Electronics	Large	Omni-channel	Logistics Executive
C	Sport and Outdoor Life	Large	Omni-channel	CEO
D	Home and Office Electronics	Large	Omni-channel	Logistics Executive
E	Car Spare Parts	Large	e-Tailer	Logistics Executive
F	Furniture and Home Decoration	Medium	Omni-channel	Logistics Executive
G	Clothes and Shoes	Medium	Omni-channel	Logistics Executive
H	Beauty	Medium	Omni-channel	COO and CTO
I	Grocery	Large	e-Tailer	Logistics Executive
J	Fashion	Small	Omni-channel	CEO

Table 2.
Overview of the interviewed firms

resulting from the COVID-19 pandemic, the interviews were carried out online via Microsoft Teams, which contributed to having easier access to executives. All interviews were audio-recorded and transcribed. The responses were manually coded, and quotes were revised and confirmed by the interviewees as suggested by Plowright (2011).

3.2 Phase 2
The developed LM Framework served as a base for the instrument to collect quantitative data from 200 retailing firms with e-commerce via a questionnaire. The sample was extracted from a list of 10,000 Swedish firms engaged in retailing (sorted based on their revenue compiled from the Amadeus-Bureau van Dijk database). As a first criterion, retail firms without any e-commerce activity were filtered out, excluding roughly half of the firms, which is in line with the general rate of e-commerce adoption among Swedish retailers (Svensk Handel, 2020). Roughly, 600 firms were contacted. From these, 200 complete responses were retrieved, i.e. a response rate of 33%. To classify the retailers, and to address RQ2, firm size (European Commission, 2020b) as well as five retailer categories (based on sales channel-mix) were used. Considering that the Swedish retail population is dominated by SMEs (only 1% are large) and that most of the retailers conducting e-commerce are store-based, an abundant sample of large and online-focused retailers were selected to better address RQ2. Therefore, data collection on SMEs and store-focused retailers was halted once data collection on 120 SMEs and 120 store-focused retailers had been completed. The sample frequency statistics on the size and sales channel-mix is illustrated in Figure 4, where the sizes of the grey circles in each box indicate the relative size of the sample.

The data collection within each stratum enabled coverage of various retail sectors, which was a missing link in prior research. The sector spread of the sample (presented in Figure 5) is generally in line with the Swedish retailer population, in which roughly 60% of the population is represented by 5 sectors (PostNord, 2020).

4. Empirical findings and discussion
To address the RQs in order, the critical firm characteristics in LM practices (from the interviews with e-commerce executives) are first presented. Next, the relevance of an
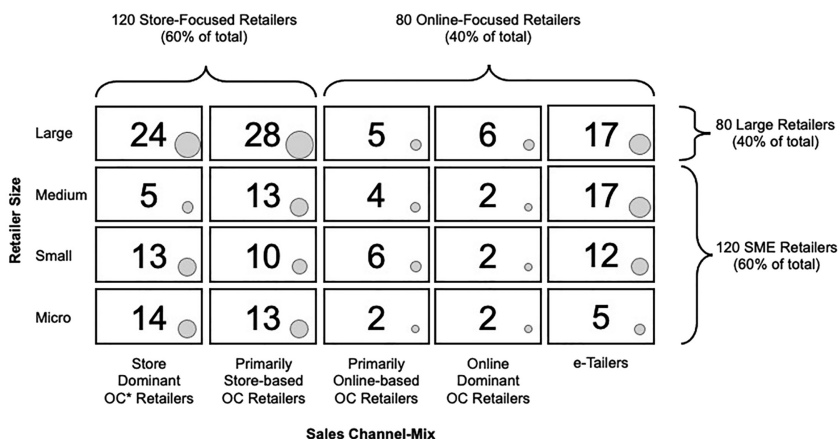
Retailer Size: Micro ≤ €2m, €2m < Small ≤ €10m and €10m < Medium ≤ €50m, and Large > €50m

Sales Channel-Mix (online sales share of total sales): 0% < store dominant retailers ≤ 10%, 10% < primary store-based retailers ≤ 50%, 50% < primary online-based retailers ≤ 90%, 90% < online dominant retailer < 100%, and e-tailer = 100%
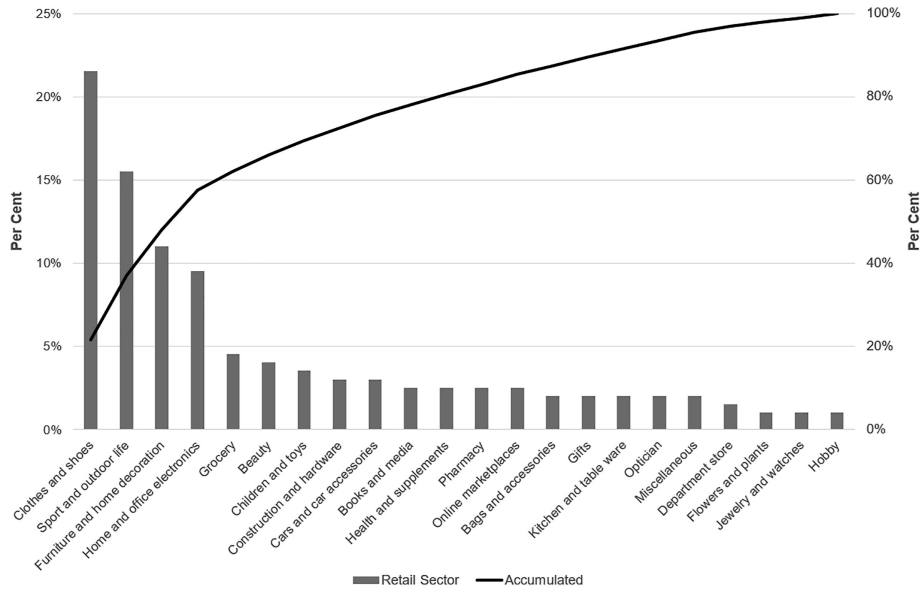
*OC: Omni-channel

Figure 5.
Sample overview
based on retail sectors

integrated LM strategy is underlined (hence validating the developed LM Framework in Figure 2). Finally, these critical characteristics are used to map out whether and how LM practices differ among firms. An overview of the LM practices of 200 Swedish retailers is available in Appendix 2.

4.1 Critical firm characteristics and LM practices
Interestingly, the interviewed executives found all the variables in Figure 2 to be relevant for LM strategizing, stressing that LM can be used as a differentiator, whether by developing unique in-house capabilities, collaborating with an LSP or relying on vendors.

> A key e-commerce success factor is to offer consumers a wide assortment. As the assortment grows, so does the challenges of managing the long tail. For those who do not have the capability in terms of warehousing nor the monetary means to keep that inventory, a sophisticated drop-shipping/cross-docking solution will be required
>
> – COO and CTO Omni-channel Retailer H

In this regard, the interviewees underlined the contribution of LM in ensuring timely product provision at the consumers' preferred location. This aligns with existing literature maintaining the significance of timeliness, condition and availability in LM (Murfield *et al.*, 2017). They further highlighted how firm strategy, LMCS, LMBF and LMDe are closely linked in LM planning. This reinforces the literature stressing the importance of aligning firm and logistics strategy (Cao, 2014; Jeanpert and Paché, 2016; Jocevski *et al.*, 2019; Lim and Winkenbach, 2018) and considering LMCS during LM strategizing (Wollenburg *et al.*, 2018a, 2019).

> The omni-channel business and logistics strategy need go hand-in-hand when steering consumers through different channels and building the appropriate logistics structure. Sales turnover in each channel, environmental aspects and cost levels should be considered.
>
> – Logistics Executive Omni-channel Retailer F

The executives underlined that firms not only steer consumers to use certain channels but also steer them towards choosing delivery options and LSPs with a beneficial financial freight net expense, i.e. freight income minus freight cost. This is usually practiced by defining a pre-selected delivery option in the checkout where shoppers are provided with a range of delivery fees.

> We steer consumers towards financially beneficial delivery options and logistics service providers without jeopardizing service and sustainability aspects. We do this by delivery pricing differentiation, defining pre-selected online check-out delivery options, and informing consumers regarding the most popular option.
>
> – Logistics Executive e-Tailer I

Generally, the executives perceived the list of firm characteristics to be comprehensive. Nevertheless, after the ranking process, two firm characteristics clearly stood out (Figure 6).

All interviewees pinpointed that *firm size* is influential in LM practices in several ways, such as in the possibility of taking on larger investments, better know-how, more physical locations, wider assortments and superior negotiating power, which all is in line with the literature (Simpson and Docherty, 2004; Sallnäs and Björklund, 2020).

> We are promoting in-store delivery since it gives us the opportunity to sell more when the customer visits the store, it reduces our freight cost, and it is better for environment. We can provide faster consumer deliveries through in-store click and collect and it gives the consumer the possibility to immediately exchange the product if needed.
>
> – CEO, Omni-channel Retailer C

The second most critical characteristic, mentioned by 80% of the executives, is the "sales channel-mix". The executives highlight the importance of offering a variety of delivery options in all geographic areas (postal codes) to cover the preferred choice of consumers. Generally, in Sweden, the standard delivery time from a national picking location is 24–48 h for customers in urban areas. Same-day remote delivery is available mainly in larger cities
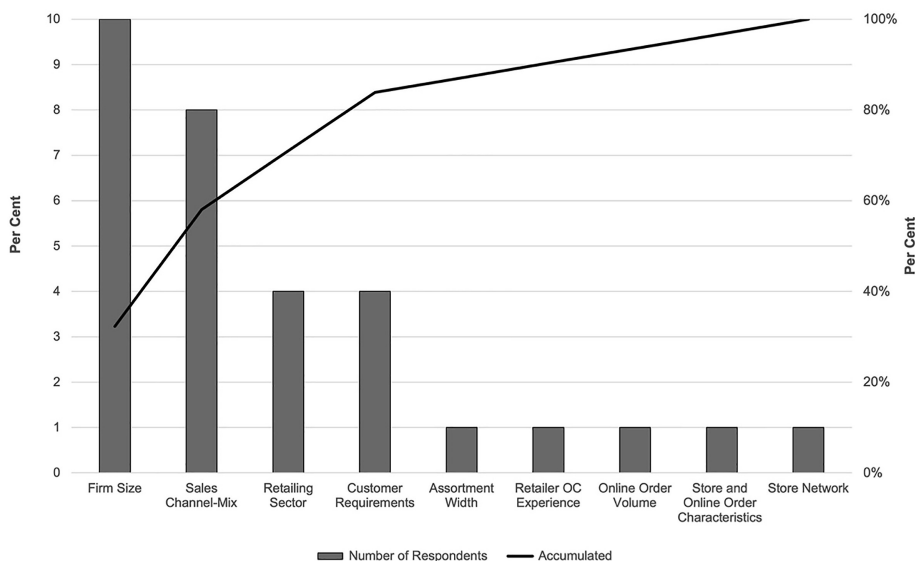

Figure 6.
Firm characteristics ranked by the executives

with a picking location strategically located nearby the city, or if in-store picking is used as a complement. It is apparently more important to provide the expected delivery time, to keep the delivery promise and to inform customers of delivery delays than offering fast delivery. Meanwhile, the executives contend that it is sufficient to have one LSP per delivery option, since having too many LSPs might confuse their consumers and reduce their negotiation power. It was also brought forth that larger firms can address environmental change by collaborating with LSPs to achieve fossil-free deliveries by 2025.

The executives further stress the potential prevalence of dark stores and mini-fulfilment centres with limited assortments, especially among larger firms, to offer faster deliveries in strategic areas (see also Rodrigue, 2020). Although the interviewees gave opposing opinions on the predominance of same-day deliveries in the future, they all agreed that providing reliable deliveries within 1–2 days may become common practice. The interviewees believe that having the right balance in channel sales would be critical for omni-channel retailers and that these firms can capitalize on in-store picking as a complement to the central location, which is in line with the literature (Davis-Sramek *et al.*, 2020; Larke *et al.*, 2018, Maccarthy *et al.*, 2019).

4.2 LM practices

In this section, differences in LM practices are discussed in terms of the critical firm characteristics identified in Section 4.1 (firm size and sales channel mix).

4.2.1 Firm size. The findings show that firm size matters when retailers design LMBF and LMDe, while LMCS practice does not appear to differ based on size. In general, larger retailers have a more advanced LMDe and LMBF set-up than their SME counterparts. This is in line with the literature arguing that larger retailers can afford heavier investments, have superior internal know-how and have greater supplier negotiation power (Simpson and Docherty, 2004; Sallnäs and Björklund, 2020). Larger retailers offer more LMDe options with C&C and HD, attended HD timeslots and same-day delivery. Some large grocery and DIY retailers have developed their own internal transportation systems. Larger retailers pick their online orders more often in a central picking location with higher automation, and work more often with an asymmetric assortment, than the SME retailers. They also appear to have a higher level of automation, in line with the findings by Grewal *et al.* (2017). In contrast, SMEs practice manual picking and a symmetric assortment more often in their LMBF. While clear patterns were found in the LM practices of large firms, surprisingly, this was not the case regarding firm size and LMCS, as it appears that LMCS practices do not differ with firm size. The only identified difference is that larger retailers offer delivery time differentiation, and more often charge for HD timeslots. The role of firm size in LM practices is visualized in Figure 7, and an overview of the data is provided in Appendix 3.

4.2.2 Sales channel-mix. Store-focused retailers steer shoppers to physical stores by offering a range of services or information (e.g. free in-store delivery, access to store inventory levels, free in-store return option and delivery time differentiation with same-day delivery). These findings are consistent with the studies by Ishfaq *et al.* (2016) and Hübner *et al.* (2016c) who cover, however, only larger retailers. On the contrary, online-focused retailers promote remote services by offering consumers more options for remote returns and free deliveries (whether irrespective of value or free delivery over a certain value). Store-focused retailers offer in-store and attached C&C LMDe options more often than firms with a higher online sales share. In contrast, in the LMDe area, consumers are offered more delivery options by online-focused retailers, and also more often attended HD timeslots at a premium charge, as well as eco-friendly deliveries. In the LMBF area, online-focused retailers appear to pick their online orders in a central picking location with higher automation, while also serving international consumers. They operate with an asymmetric assortment with the longer tail in the central
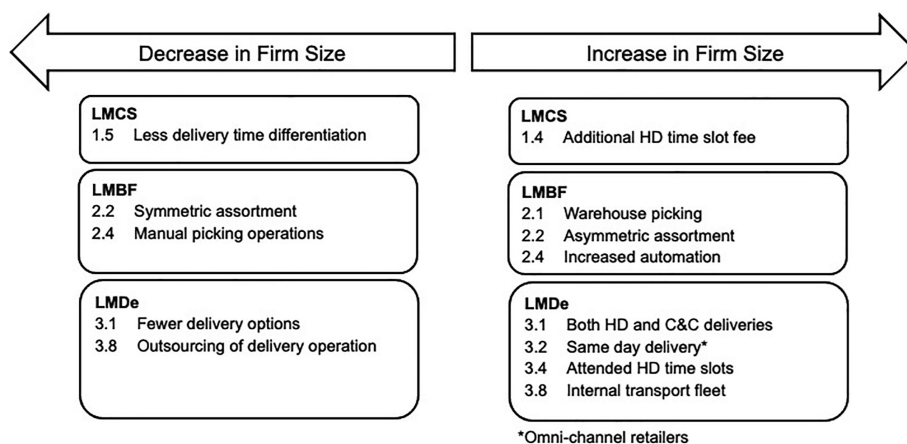
Figure 7.
Firm size and LM
practices

picking location, complemented, to a greater extent, by drop-shipping. The centralization of LMBF and inventory in combination with increased automation improves operational efficiency and service provision through quicker deliveries and improved order accuracy. It also reduces the capital tied up in inventory. These results on asymmetric assortment support the findings by Agatz *et al.* (2008) and Melacini *et al.* (2018). However, it seems that store-focused retailers, picking online orders in the store, using regional distribution, and working with a symmetric assortment are more prevalent. Interestingly, 100% of the store-dominant retailers perform LMBF operations in-house. This supports Kembro *et al.* (2018)'s claim that omni-channel retailers initially tend to keep the fulfilment process in-house.

To summarize, how retailers steer consumers, and how they configure LM, seem to differ based on the sales channel mix. Online-focused retailers have more advanced LM back-end operations and LMDe offerings. Meanwhile, their store-focused counterparts, with a smaller online sales share, steer consumers to use their stores. The differences in LM practices, as they associate with online sales share, are illustrated in Figure 8 (see also Appendix 3). These observations reveal three distinct groups of e-commerce retailers based on logistics practices considering sales channel mix: store dominant omni-channel retailers, online-focused retailers and primarily store-based omni-channel retailers (Figure 9). The first group leverage their stores for LM practices, while the second group have a more competitive remote delivery offering. Surprisingly, the third group leverage their stores while offering competitive remote services; hence, competing with their existing store network, indirectly.

However, the relative potential impacts of firm size and sales channel mix appear to differ between the different LM areas. In LMCS and LMDe, *sales channel-mix* seems to make the largest difference, while in LMBF, *firm size* is more critical. The circles in Figure 10 indicate how the different configuration areas are influenced by the characteristics; the bigger the share of the circle, the bigger the influence. This could imply that the findings of the study by Wollenburg *et al.* (2018b) regarding the LMBF in the grocery sector could hold true in other sectors as well (see also Kembro and Norrman, 2021). This study also highlights that firms do not only steer consumers towards different channels; they also steer consumers towards delivery options with a beneficial financial freight net.

5. Concluding remarks
To explore the LM practices of e-commerce retailers, this study demonstrates an integrated consideration of LMCS, LMBF and LMDe in strategizing, by drawing on the literature
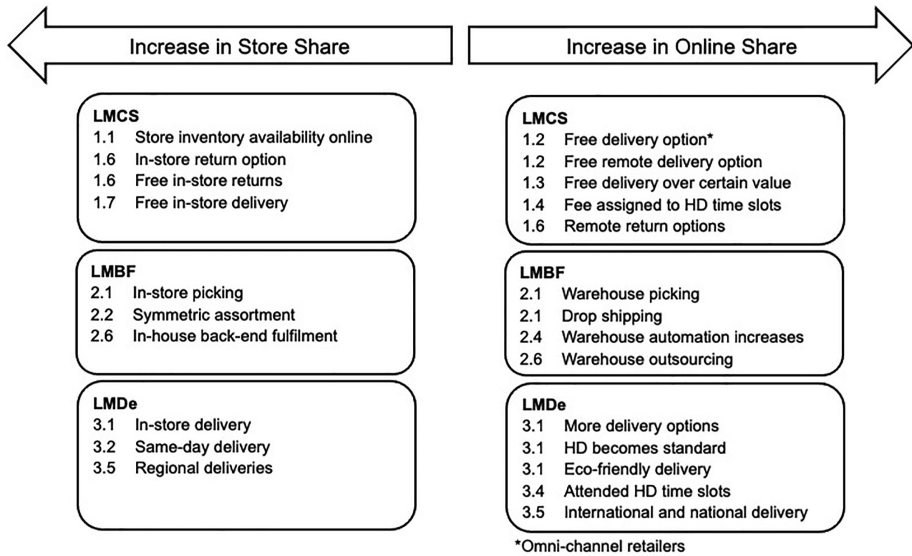
Figure 8.
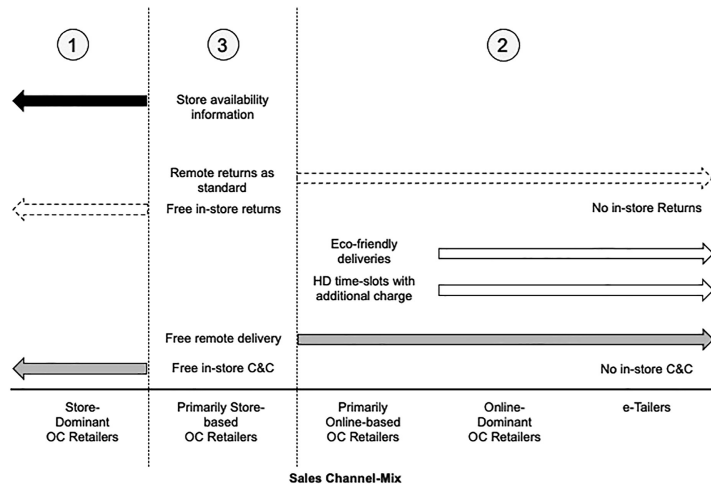Retailer sales channel-mix and LM practices

Figure 9.
Groups of retailers based on LM practices, considering sales channel-mix

([Wollenburg *et al.*, 2018a](#), [2019](#)), and interviews with e-commerce logistics executives. The developed LM Framework ([Figure 2](#)) incorporates new LMBF and LMDe aspects such as environment, specialization and inventory management. The findings of this study highlight *firm size* and *sales channel mix* as critical firm characteristics in LM practices ([RQ1](#)). Further, it is noted that LM practices differ greatly based on these critical firm characteristics. Surprisingly, it appears that LM practices differ more with sales channel mix than with firm size. Furthermore, this study underlines that firms do not only steer consumers towards different channels; they also steer consumers towards delivery options with a beneficial financial net freight cost.
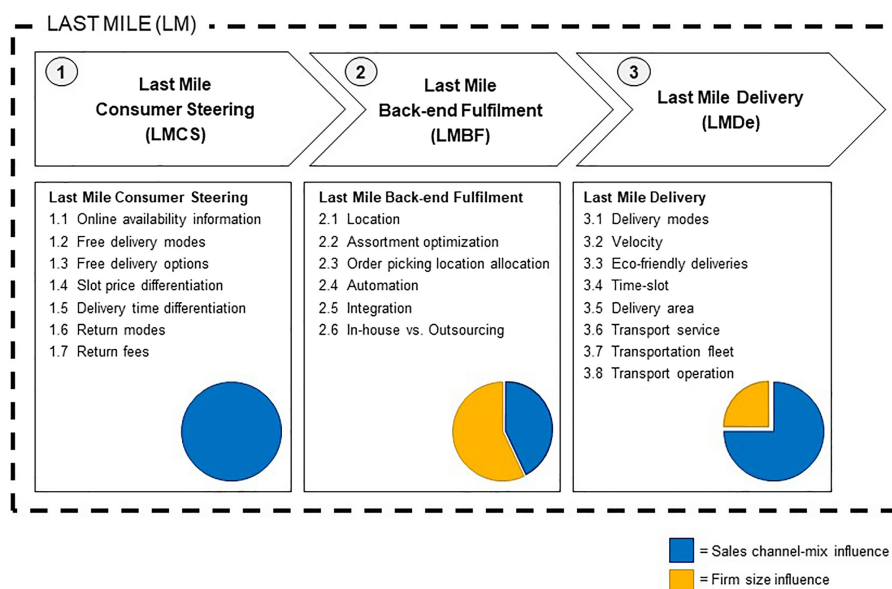
Figure 10.
Influence of firm size
and sales channel-mix

5.1 Practical implications

The findings of this study provide multiple insights for practice. *First*, it sheds light on the significance of jointly considering LMCS, LMBF and LMDe in strategizing. The study reveals how managers should configure their LM practices considering their size and sales channel mix. *Second*, the developed LM Framework provides an overview of the underlying options and parameters in different areas of LM planning. This can serve as an important tool, especially since there exists no magic formula fitting all retailing firms (Ishfaq *et al.*, 2016; Kembro and Norrman, 2021). *Third,* the empirical results can provide managerial insights into benchmarking, making competition analysis and strategic positioning, especially in the complex realm of e-commerce logistics characterized by extreme dynamism and, hence, trial and error. Such insight could help understand when, where and why a certain configuration fits, and what LM practices should be revised (Kembro and Norrman, 2021). For instance, the results show that primarily store-based retailers leverage their stores, in conjunction with a competitive remote delivery offering at the same time. This can be highly relevant in light of potential further network consolidation, and future growth of the online share of non-food retailing (PostNord, 2020).

5.2 Research implications

The study broadly contributes to the emerging literature on e-commerce and omni-channel logistics (Marchet *et al.*, 2018; Cai and Lo, 2020). *First*, building on Hübner *et al.* (2016b)'s original framework, an LM Framework is developed which incorporates LMCS, LMBF and LMDe in an integrated fashion. *Second*, the findings from the large-scale study reduce the knowledge gap regarding if and how LM practices differ based on firm size and sales channel mix. The study also underlines the significance of *when* a certain configuration and practice is used, which is a gap in the existing literature (Kembro and Norrman, 2021). *Third*, the study broadens the findings from prior research, which has focused predominantly on the fashion and groceries sectors or large firms (Ishfaq *et al.*, 2016; Hübner *et al.*, 2016c). Our results highlight that primarily store-based retailers are, surprisingly, indirectly competing with

their existing store networks by offering a competitive remote delivery offering. Our findings further establish that larger retailers have more sophisticated LMDe and LMBF practices than their SME counterparts. The study reconfirms Sallnäs and Björklund's (2020) findings that eco-friendly deliveries are far from common practices now; however, most executives stress their environmental focus, in relation to current and future developments. This can be linked to the fact that retailers see fossil-free deliveries as an opportunity to reduce their environmental impact (Mangiaracina *et al.*, 2015). The largest retailers are driving the change towards fossil-free deliveries through cooperation with LSPs to reach ambitious targets.

5.3 Future research

While this study is shaped primarily by the paucity of research regarding e-commerce LM practices, it would be of academic and practical interest to explore the association between the LM practices and the corresponding firm performance. It appears that retailers with an attractive delivery offering are in better positions, leading to better firm performance when retail sectors reach the breakpoint where future growth is expected to happen online, and store networks are consolidated. In this regard, future studies could consider different approaches to configurational analysis, such as qualitative comparative analysis (Ketchen *et al.*, 2021). Also, we did not examine the inter-relationships between the parameters and options in this study. Due to the multi-dimensionality and complexity of LM practices, we believe that morphological analysis offers promising potential to identify the total set of interrelationships (Ritchey, 2011; Zwicky, 1969). Moreover, given the strong growth of e-commerce, future studies could consider exploring how sales channel mix changes influence LMCS, LMBF and LMDe over time through longitudinal studies.

It is highly relevant to further investigate the surprising finding that primarily store-based retailers are indirectly competing with their own existing store networks, with the risk of cannibalization, by offering competitive remote delivery options.

This study focused on e-tailers and omni-channel retailers. Future research could explore LM practices in the manufacturing-to-consumer context, and the resulting encroachment implications from an inter-organizational perspective. Moreover, as e-commerce facilitates internationalization, future research could investigate how e-commerce LM expansion strategies change over time in the context of growth in international online sales.

Finally, given the identified differences in LM practices based on firm size, future research could delve into the reasons *why* SMEs and large firms have different approaches. The peculiarities of SMEs resulting from their vulnerability, short-sightedness in decision-making (Arend and Wisner, 2005) and the role of managers in strategizing (Ruth *et al.*, 2021) can be promising angles to shed light from. It is worth considering contextual implications, especially regarding the quantitative data in this study. Sweden has a high level of e-consumer maturity with high environmental awareness, a high percentage of firms selling online, a high blue-collar total cost and a low population density. Future studies in other countries or contexts could examine whether the findings generalize across other circumstances.

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Appendix 1

The executive interview guide consisted of five questions:

(1) What does "last mile" mean to you?

(2) What are the logistics variables that you consider when designing your last mile activities?

(3) Rank the three most critical firm characteristics when designing last mile?

(4) Are any of the logistics variables, that you mentioned earlier, influencing firm performance more than others?

(5) How do you believe that COVID-19 and Amazon.se will influence e-commerce logistics strategies going forward?

Appendix 2
Summary of general LM practices

Areas	Parameters	Options				
1 **Last Mile Consumer Steering (LMCS)**	1.1 Online availability visibility	Only web store (43%*)		Physical stores & web store (57%)		
	1.2 Free delivery mode (always)	Attended HD (9%)	Unattended HD (4%)	In-store or attached C&C (66%*)	Solitary C&C (15%)	
	1.3 Free delivery options	Above a certain order value (51%)	Free freight subscription programs (3%)			
	1.4 Slot price differentiation	Yes (63%)	No (37%)			
	1.5 Delivery time differentiation	Yes (38%)	No (62%)			
	1.6 Return mode	In-store (86%*)	Remote (88%)			
	1.7 Free return mode	In-store (79%*)	Remote (24%)	No free return modes (31%)		
2 **Last Mile Back-end Fulfilment (LMBF)**	2.1 Location	In-store (62%*)	e-Fulfilment Centre (18%)	Central warehouse (64%)	Drop shipping (10%)	
	2.2 Assortment optimization	Symmetric (69%*)	Asymmetric (31%*)			
	2.3 Order allocation	Dynamic (51%)	Static (49%)			
	2.4 Automation	Manual (38%)	Semi-automated (50%)	Fully automated (12%)		
	2.5 Integration	Separated (14%*)	Integrated (49%*)	Capacity optimized (37%*)		
	2.6 Back-end fulfilment operation	In-house (66%)	Hybrid (2%)	Outsourced (32%)		
3 **Last Mile Delivery (LMDe)**	3.1 Delivery mode	Home or other destination (79%): Attended (70%)	Unattended (53%)	Click & Collect (91%): In-store (68%*)	Attached (12%*)	Solitary (61%)
	3.2 Velocity (fastest delivery)	Same day (13%)	1 – 3 days (76%)	4 – 5 days (9%)	> 5 days (2%)	
	3.3 Eco-friendly delivery option	Yes (8%)	No (92%)			
	3.4 Time slot	Specific (68%)	Undefined (32%)			
	3.5 Delivery area	Local & regional (11%)	National (39%)	International (50%)		
	3.6 Transport service	Milk run (16%)	Courier (71%)	Linehaul + distribution (23%)		
	3.7 Transportation fleet	Fossil (92%)	Hybrid (8%)	Fossil free (0%)		
	3.8 Transport operation	Internal transport fleet (2%)	Hybrid solution (2%)	External transport fleet (96%)		

* = Omni-channel retailer

Appendix 3

Area	Parameter	Option	Firm size			
			Micro (%)	Small (%)	Medium (%)	Large (%)
LMCS	1.4	Charges a delivery fee for time slots	50	62	71	73
LMBF	2.1	In-warehouse picking	42	67	88	79
LMBF	2.2	Asymmetric assortment	21	24	30	50
LMBF	2.4	Semi- or fully fully-automated warehouse operation	20	52	64	76
LMBF	2.4	Manual warehouse operation	80	48	36	24
LMDe	3.1	Both HD and C&C delivery options	42	60	73	85
LMDe	3.2	Same-day delivery	8	12	10	19
LMDe	3.4	Offers attended HD time slots	30	37	63	70
LMDe	3.8	Internal or hybrid transportation fleet	0	0	4	9

Table A1.
Firm size and LM
practices

Appendix 4

Area	Parameter	Option	Online sales share of total sales (%)			
			1–10 (%)	11–50 (%)	51–99 (%)	100 (%)
LMCS	1.1	Information about individual store availability online	63	66	42	N/A
LMCS	1.2	Free remote delivery option	44	73	69	80
LMCS	1.2	Free in-store delivery	72	69	46	N/A
LMCS	1.3	Free delivery over a certain order value	25	58	46	57
LMCS	1.4	Charges a delivery fee for HD time slots	30	28	60	72
LMCS	1.6	In-store return	97	95	42	N/A
LMCS	1.6	Remote return option	56	90	96	100
LMCS	1.7	Free in-store returns	91	86	42	N/A
LMBF	2.1	In-store picking	72	61	54	N/A
LMBF	2.1	Supplier warehouse picking (drop shipping)	0	5	8	24
LMBF	2.1	In-warehouse picking	44	67	88	87
LMBF	2.2	Asymmetric assortment	19	31	38	N/A
LMBF	2.4	Fully or semi-automated warehouse operation	50	61	78	60
LMBF	2.6	Outsourced warehouse operation (fully or hybrid)	0	35	24	41
LMDe	3.1	HD option	78	73	85	85
LMDe	3.1	Eco-friendly delivery option	3	5	15	13
LMDe	3.1	In-store C&C delivery	78	72	46	N/A
LMDe	3.2	Same day delivery	28	13	15	4
LMDe	3.4	Offers attended HD time slots	65	53	80	87
LMDe	3.5	National or international delivery	63	92	92	98

Table A2.
LM practices across
sales channel mix

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