



## The changing role and behaviour of consumers in last mile logistics services: A review

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**Abstract** – The growth of e-commerce and omnichannel retailing has led to significant changes in urban logistics deliveries. In addition to the traditional delivery channels, new solutions have been introduced, such as click-and-collect, parcel locker delivery, crowdshipping, and on-site delivery. However, such solutions require seamless connections between different layers of the city logistics system. These connections form, in the Physical Internet terminology, a “hyperconnected city”. In this context, how do consumers make decisions about logistics services, either as prospective users or as suppliers of last mile logistics services? We argue that a thorough understanding of consumers’ decision-making about last mile services is a prerequisite for the effective exploration of future demand for these services and the design of transport policies. While there is abundant literature on new approaches of last mile logistics, a review of research on consumers’ decision-making and participation in such services is absent. This paper aims to provide such a review and, based on this, provides directions for future research. Based on the existing literature, we propose a conceptual framework that categorises decisions and system attributes affecting consumers’ decision-making. Highlights for future research include interaction between consumers’ demand and supply decisions, changes in consumer preferences, the importance of social networks, and the city-level impacts of hyperconnected last mile delivery.

**Keywords:** Last mile logistics; consumer; decision-making; consumer involvement; omnichannel retailing; physical Internet; hyperconnectivity

### 1. Introduction

The evolution of omnichannel retailing with its on-demand and customised deliveries has strongly affected the way last mile delivery operations take place. In recent years, online purchases have increased rapidly, and consumers<sup>1</sup> expect faster deliveries and more control over their ordered products. Considering some of the biggest retail markets, such as China, Germany, and the United States, last mile delivery of parcels accounts for 40% of the market (Joerss et al., 2016). Additionally, the last mile delivery market is projected to grow by 78% globally by 2030 (World Economic Forum, 2020). Emerging challenges for the ecosystem include emissions and congestion in urban areas, which are expected to increase by 32% and 21% by 2030, respectively (World Economic Forum, 2020).

Following the expanse of e-commerce, omnichannel retailing is emerging as the new overarching retail strategy (Risberg, 2022). Omnichannel retailing offers diverse delivery channels to enhance product distribution across all

possible consumer touchpoints (Risberg, 2022). This trend is primarily evident in the growth of e-commerce sales, resulting in increased pressure on service providers and the fragmentation of urban freight patterns, implying negative impacts on urban areas. In response, urban planners are actively seeking alternative solutions and working towards creating sustainable and cost-efficient urban freight transport methods (Holguín-Veras et al., 2020). If sufficiently integrated into logistics systems, technological advancements like parcel lockers and collaboration among last mile service platforms could relieve problems (Pisoni et al., 2022).

As part of the ongoing omnichannel revolution, end-users in last mile logistics are experiencing a significant transition from their traditional role as mere recipients of services, towards one of active carriers. They participate in the delivery process by picking up, handling, and transporting products not only for themselves but also for others (Wang et al., 2023; Wang et al., 2022b). We argue that in order to develop effective policies for future last mile logistics, it is crucial to comprehend the decision-making processes of consumers. This includes understanding their transportation demands as well as their involvement in the supply chain as service providers.

The Physical Internet (PI) offers a contextual vision for innovations in city logistics (Crainic & Montreuil, 2016). The PI envisions a future logistics system that integrates various elements mentioned above, enabling asset sharing and flow consolidation through standardised packaging, modularisation, protocols, and interfaces (Montreuil, 2020). A central tenet of the PI vision is hyperconnectivity, implying the full interconnection of services to create an open, dense network of delivery services. While existing research on the PI has predominantly concentrated on designing this system, there is a notable gap in addressing consumer decisions within the PI. The only study we have found addressing this aspect is by Bidoni and Montreuil (2021), which mentions the positive impact of consumer satisfaction on the adoption of new services (Bidoni & Montreuil, 2021). We are not aware of any other research explicitly addressing this decision-making behaviour within the PI framework.

Existing review studies have examined various partial aspects of consumer decision-making, concerning inbound and outbound logistics (Monnot et al., 2022) and omnichannel retailing (Mishra et al., 2021; Lafkihi et al., 2019), within the context of smart and sustainable deliveries (Pan et al., 2021). These studies focus on the demand side, mainly on consumer choices related to delivery services when ordering goods online. Recent reviews by Ma et al. (2022), Wang et al., (2023) and Yusoff et al. (2023) touch upon consumer behaviour and last mile delivery but with limited mention of consumer participation. Another study by Risberg (2022) proposes a decision framework for omnichannel retailers, highlighting logistics activities but overlooking consumer decision-making. Empirical studies have explored consumer decision-making in the last mile, considering factors such as delivery service (Merkert et al., 2022; Cai et al., 2021) and personal attributes (Wang et al., 2018). However, also here, there is a gap in understanding consumer behaviour towards third-party last mile services, such as crowdshipping. Therefore, our research objective is to fill this gap and provide a comprehensive review that contributes to the literature on PI, on last mile delivery and consumer decision-making. To achieve this objective, we focus our exploration on the following main question:

***How do consumers make decisions about hyperconnected last mile services, either as users or as suppliers, in the context of omnichannel retailing?***

To answer our main research question, we investigate the choices consumers make when engaging with hyperconnected last mile services, both as users benefiting from the services and as potential suppliers involved in last mile logistics. Our approach involves exploring user decision-making characteristics and satisfaction, considering the integration of these services within omnichannel retail experiences. Simultaneously, we consider consumers' willingness to become suppliers, also examining the role of crowdshipping. The question of decision-making applies to all forms of modern shipping solutions. From this inventory, we create a conceptual model that can guide research into the various aspects of the main question. Finally, we provide related recommendations for research.

The paper is structured as follows: Section 2 explains the literature review approach. It is followed by an explanation of the review results in Section 3. Section 4 discusses the various emerging research directions. Section 5 concludes with a summary of the findings.

## 2. Review approach

The research followed the Systematic Literature Review (SLR) approach (Van Wee & Banister, 2016; Xiao & Watson, 2019). The review is initiated by formulating the research problem. In a second stage, a coding scheme is created where the aim is to identify the synthesis of studies concerning the journals, research context, and methodological approaches. A screening of literature is done for relevance, and, after subsequent searches, a final set of papers is selected, followed by data extraction and analysis. Finally, the main findings of the review are synthesised and reported.

Figure 1 shows the main streams of literature considered in this review: (1) the omnichannel retailing literature, where the emphasis is on consumer behaviour in the final leg of omnichannel retail operations; (2) the last mile logistics literature, which explains innovative last mile delivery services; (3) decision-making literature, which primarily focuses on consumers' behaviour and decisions. Moreover, by adding the component of hyperconnectivity to these research streams, we aim to extend our literature review by considering the vision of the PI and providing an overview of studies conducted in this area. Vice versa, the older and larger streams of omnichannel retailing, last mile logistics, and decision-making literature contain several important insights that, positioned within the PI literature, enrich the PI framework.

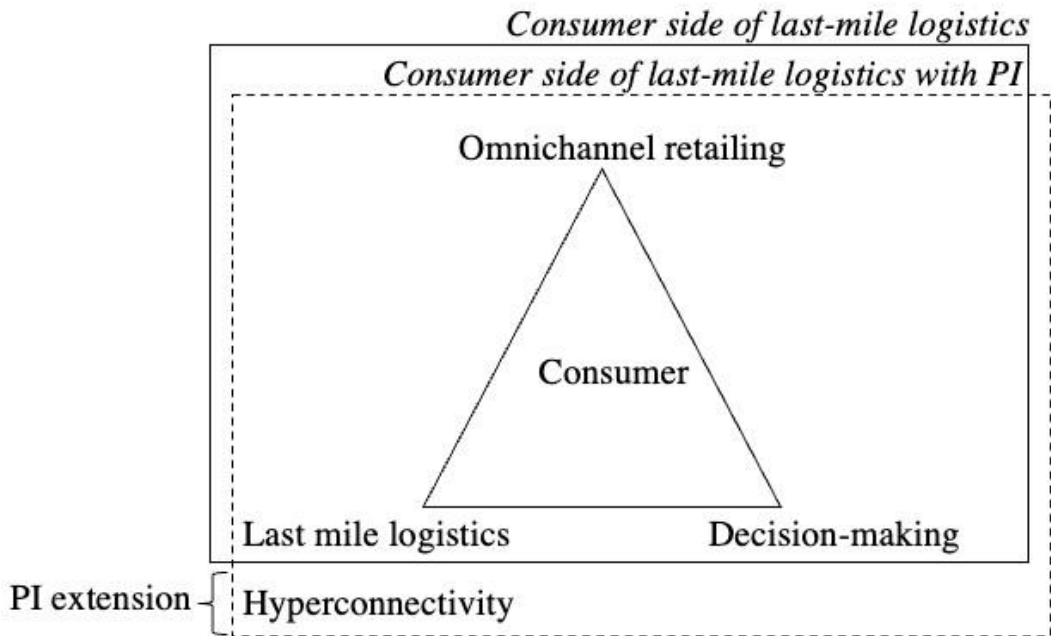


Figure 1. Main research streams considered in the review

In Figure 2 below, the process of our literature review study is illustrated. We construct the main body of literature using specific keywords. In our exploration of consumer-focused studies, our queries include terms such as “consumer,” “decision,” and “behaviour,” particularly in the context of the “last mile” and “omnichannel.” Additionally, we use variations of “crowdshipping,” including “crowd-shipping” and “crowdsourcing,” as keywords to explicitly incorporate studies in this area, considering crowdshipping enables consumers to act as service providers for deliveries. Moreover, we extend our search to cover the physical internet, hyperconnectivity, and consumer engagement in the last mile logistics. By applying a diverse range of keywords such as “physical internet,” “hyperconnect\*,” “decision,” “omnichannel,” and “last mile,” we ensure a comprehensive exploration of both consumer-centric and physical internet-related literature.

Our search terms are specified in British English, aligning with Scopus' standards. Notably, we avoid hyphens in terms such as “omni channel” and “last mile,” as Scopus recognises both British and American English variations without requiring hyphenation. Specifically, we search for omnichannel in two ways: (1) “omnichannel” and (2) “omni channel,” resulting in different numbers of search results. Additionally, we include the term

'consumer' in our search queries. However, this specific inclusion did not yield a significant number of eligible papers.

We searched Scopus and Web of Science using specific strings as shown in Figure 2 in the title, abstract, and keywords. No time constraints were applied, and articles had to be in English, published in indexed journals or proceedings. For cross-referencing and validation of our findings from Scopus, we utilised and Web of Science, finding that the same search strings resulted in similar findings in these databases. After the initial search, we remove duplicates and irrelevant publications. Finally, we apply snowballing techniques to the remaining papers, resulting in 93 unique papers included in this review.

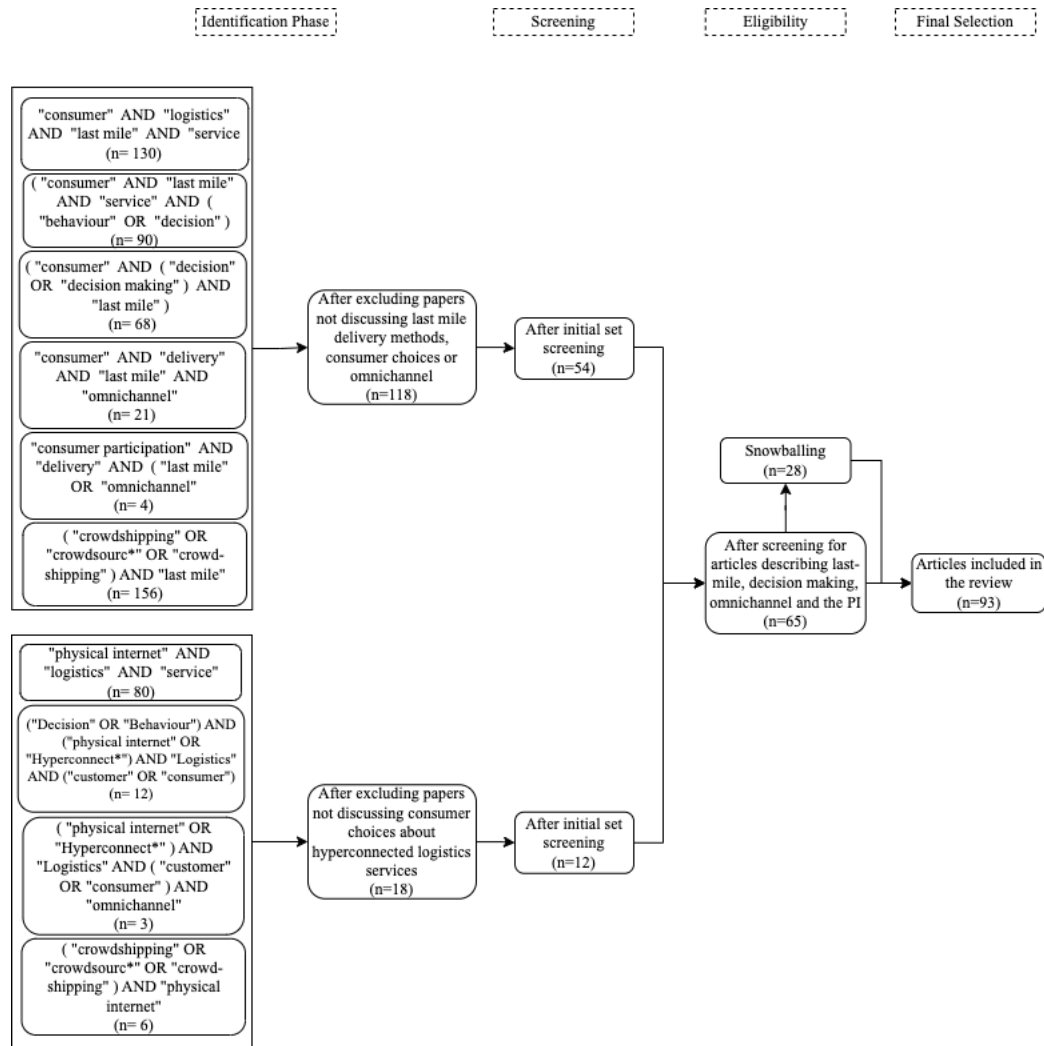


Figure 2. Paper selection process (date of search: 28 November 2023).

### 3. Review Results

#### 3.1. Bibliometric overview

As can be seen in Table 1, the set of 93 papers has a varied background from the mentioned areas of literature. In addition to seventy-seven journal articles, we also include eleven conference papers and five book chapters. Our analysis shows that the research interest in the topic increases after 2015. The distribution of research contributions among different countries shows a broad landscape of scholarly engagement. The United States, Singapore, China, South Korea, and France lead with 14, 13, 12, 12 and 10 contributions respectively. The publications listed in the table exhibit a wide array of focuses, ranging from transportation and retail to marketing and consumer services. These journals cover a broad spectrum of topics, including transportation research,

logistics and distribution management, retailing, and consumer behaviour. The publications cover different types of research including review papers, qualitative, and – predominantly – quantitative modelling. The publications are elaborated further in Table 2 based on the methods used.

Table 1. Bibliometric scope of the selected papers.

<b>Years</b>	2005 (2); 2006-2008 (0); 2009 (1); 2010 (0); 2011 (1); 2012 (2); 2013-2014 (0); 2015 (1); 2016 (5); 2017 (6); 2018 (11); 2019 (11); 2020 (12); 2021 (12); 2022 (15); 2023 (13); 2024 (1)
<b>Authors</b>	Wang,X. (12); Yuen,K.F. (12); Wong,Y.D. (9); Gatta,V. (6); Marcucci,E. (6); Montreuil,B. (5); Teo,C.C. (5); Ballot,E. (3); Koh,L.Y. (3); Buldeo Rai,H.(2)
<b>Countries</b>	USA (14); Singapore (13); China (12); South Korea (12); France (10); Others (32)
<b>Sources</b>	Journal of Retailing and Consumer Services (7); Transportation Research Part E; Logistics and Transportation Review (5); Transportation Research Procedia (5); Sustainability (4); Cities (2); IFAC Proceedings Volumes, IFAC Papers online (2); Industrial Management and Data Systems (2); International Journal of Logistics Management (2); International Journal of Physical Distribution And Logistics Management (2); IFAC Proceedings Volumes, IFAC Papers online (2); Industrial Management and Data Systems (2); International Journal of Logistics Management (2); Others (56)
<b>Approach</b>	Quantitative modelling (76); Review studies (14); Qualitative modelling (3)

Table 2 below provides an overview of the main research methods and modelling techniques used in the corpus of this review study. A detailed overview is provided in Appendix 1.

Table 2. An overview of the methods used.

<b>Method</b>	<b>Author(s)</b>
<b>Factor Analysis</b>	Tang et al., (2021); Wang et al., (2020)
<b>Regression</b>	Millioti et al. (2020); Tang et al., (2021); Felch et al. (2019); Hagen, & Scheel-Kopeinig, (2021); Yuen et al. (2018); Meuter et al. (2005); Wang et al. (2023); Chatterjee and Kumar (2017); Marcucci et al. (2017)
<b>Structural Equation Modelling (SEM)</b>	Wang et al. (2021); Chen et al. (2018); Giglio and Maio (2022); Zhou et al. (2020); Edrisi and Ganjipour (2022); Cai et al., (2021); Kapser & Abdelrahman, (2020); Koh et al. (2023); Koh et al. (2023b); Wang et al. (2018); Tsai and Tiwasing (2021); Yuen et al. (2019); Titiyal et al. (2022); Aziz et al. (2021); Upadhyay et al. (2022)
<b>Stated Preference Experiment (SPE)</b>	Gatta et al. (2021); Gatta et al. (2018); Wicaksono et al. (2022); Cebeci et al. (2023); Cebeci et al., (2023b); Merkert et al. (2022); Polydoropoulou et al., (2022); Marcucci et al. (2021); Hsiao (2019); Maltese et al. (2021); Le and Ukkusuri (2019); Serafini et al. (2018); Miller et al. (2017); Mohri et al. (2024)
<b>Revealed Preference Experiment (RPE)</b>	Bjerkman et al. (2020); Cauwelier et al. (2023); Rossolov et al. (2021); Wieland (2021)
<b>Optimisation studies</b>	Raviv and Tenzer (2018); Di Febbraro et al. (2018); Zhang et al. (2023); Faugère and Montreuil, (2020); Orenstein and Raviv, (2022); Pan et al. (2021b)
<b>Descriptive analysis</b>	Mahdi Zarei et al. (2020); Rai et al. (2021)
<b>Conjoint analysis</b>	Rai et al. (2019); Nguyen et al. (2019)
<b>Cluster analysis</b>	Schaefer and Figliozzi (2021); Rai et al. (2021); Nguyen et al. (2019)
<b>Latent Class Analysis</b>	Wang et al., (2020); Mohri et al. (2024)
<b>Simulation</b>	Bidoni and Montreuil (2021); Devari et al. (2017); Akeb et al. (2018); Chen et al., (2017)
<b>System dynamics</b>	Melkonyan et al. (2020); De La Torre et al. (2019)
<b>Multi-criteria analysis</b>	Melkonyan et al. (2020)
<b>Focus group</b>	Vakulenko et al. (2018)
<b>Interviews</b>	Madlberger and Sester (2005); Haridasan and Fernando (2018)

A notable finding from the review study is that a significant portion of the studies employ survey techniques for collecting data. While a subset of the studies applies stated preference experiments (SPEs), where respondents are asked to choose from several alternatives, a considerable number of studies rely on structural equation modelling (SEM) techniques in which person-level indicators are used to estimate the dependent variable. Moreover, regression and factor analysis, as well as discrete choice models in SPEs, are applied in most of the studies. As noted by Mishra et al. (2021) and Monnot et al. (2022) focus on individual decisions may oversimplify the linkages among consumer choices, resulting in limited understandings of consumer decision-making.

To represent the heterogeneity in choice preferences, a few studies employ cluster and latent class analysis. Cluster analysis focuses on finding natural patterns or structures in the data based on the similarity of observations (Blashfield & Aldenderfer, 1978), while latent class analysis aims to identify unobserved latent classes that generate the observed response patterns (Boxall & Adamowicz, 2002). Although these methods are straightforward and easy to interpret, their generalisability and applicability in policymaking is challenging due to the complexity of identifying target groups. Clusters that emerge from a mathematical grouping of individuals are often difficult to identify or address in practice.

The reviewed studies reveal a scarcity of use of simulation techniques, the predominant focus is on optimisation. The small set of studies employing simulation in the realm of consumer decision-making focuses on crowdshipping. These studies explore crowdshipping as a collaborative last mile delivery solution (Akeb et al., 2018), examine consumer acceptance of this service in relation to their social network (Devari et al., 2017), assess the sustainability of last mile delivery services (Melkonyan et al., 2020) and consumer behaviour and the market dynamics (De La Torre et al., 2019).

Lastly, our review study shows a lack of research applying qualitative modelling techniques. The representation of social sciences and management sciences in this body of literature is low, compared to operations research and industrial engineering scholars. Nevertheless, qualitative modelling techniques can be a valid methodology to explore and understand the dynamics of a delivery service and to specify the assumptions for complex quantitative models. Moreover, the outcome of the qualitative research can provide transferable knowledge.

### **3.2. A conceptual model for consumers' logistics decisions**

This section outlines the conceptual framework, which is built on the studies found, organized around the typical consumer decisions observed in the literature. We first define a skeleton framework of consumer decisions and next discuss the different components of the model.

One of the first studies on logistics decision-making, by Bowersox (1978), identified five logistics components that form the industrial logistical system: facility location, inventory, transportation, handling and storage, and communication. Granzin and Bahn (1989) identified ten decision areas in consumer logistics and linked these to Bowersox's five functional subsystems. The decisions considered ranged from type of residence and vehicle type to post-trip communication, such as communicating with other households regarding the trip and the quality of the service (Granzin & Bahn, 1989). We take this framing as a starting point, noting that here the roles and choices associated with consumers were purely seen as for their own consumption purposes (Bahn et al., 2015), the final leg of the delivery being handled by the consumer. We enrich this framework with the supply-side choices involving consumer participation as a carrier or handler of products for others.

According to Granzin and Bahn (1989), facility location represents the point of consumption, while inventory is defined as the availability of a specific product for consumption at a desired place and time. Next, when it comes to transportation, the main consideration is the choice of transportation mode. In an omnichannel environment, consumers are provided with diverse shopping options, including online and in-store shopping, as well as hybrid choices like searching online and buying in-store, or vice versa. Each option triggers different logistics processes (Madlberger & Sester, 2005). Depending on the shopping channel decision, consumers make a delivery method choice. In the context of an omnichannel retailing, e-retailers provide consumers with various delivery methods, such as collection points, in-store pickup, parcel lockers, click-and-collect, crowdshipping, and home delivery (Risberg, 2022). These delivery options will also impact consumers' decisions regarding transportation as well as handling, and storage. Lastly, communication refers to the flow of information during the (post-) shopping process (Granzin & Bahn, 1989). While communication could be about the choice of shopping options or the delivery method, it could also be about the evaluation and feedback concerning the choices made.

The conceptual framework presented in Figure 3 can serve as a basis for modelling urban freight systems, including with statistical analysis using for example SEM, or more comprehensive behavioural urban freight models, using for example agent-based simulation.

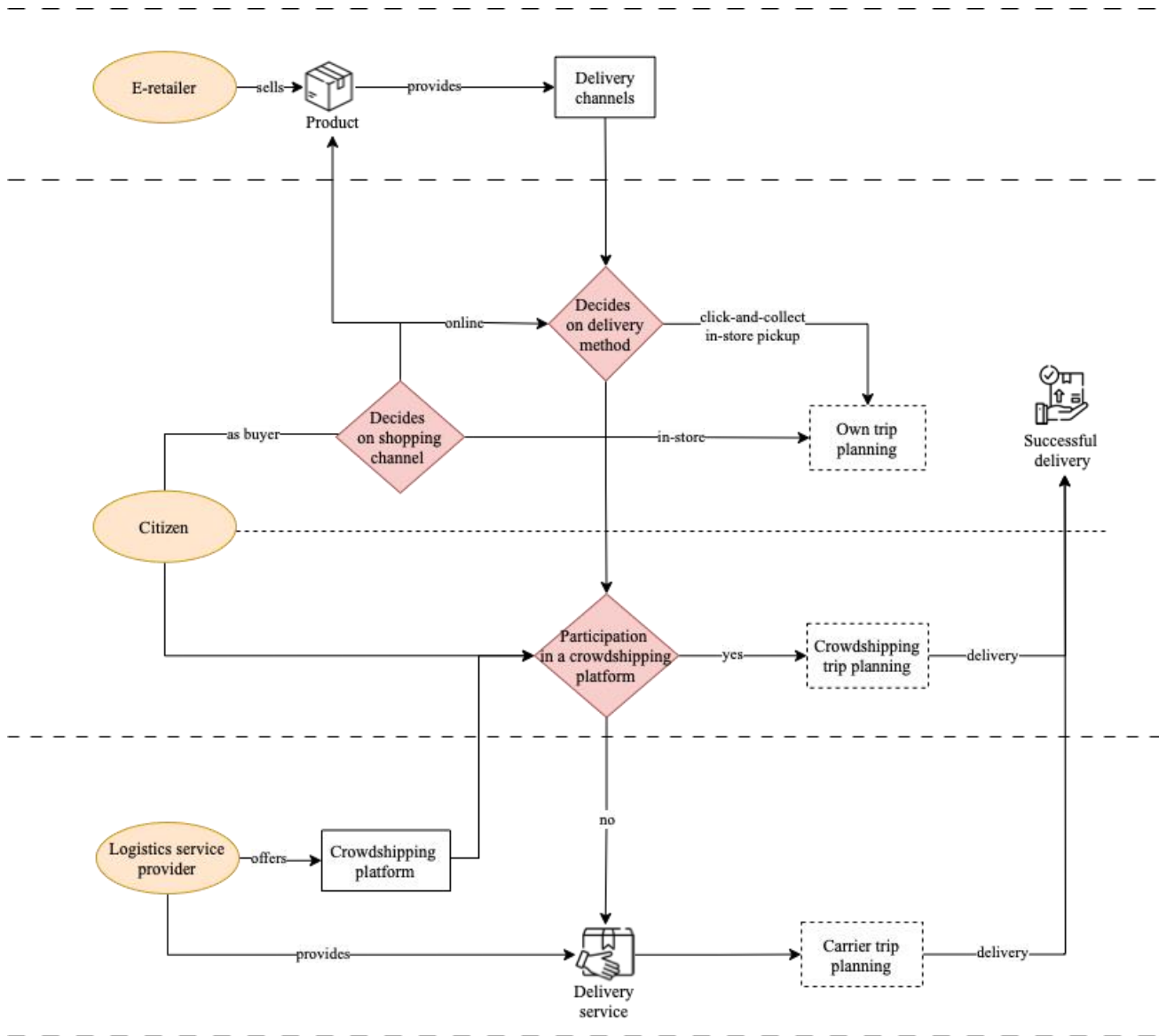


Figure 3. The conceptual framework for the review study (read the figure from left to right).

Although e-retailers offer delivery services, these services are integrated into the omnichannel strategy, and consumer choices are heavily influenced by them. With a range of delivery methods available, such as click-and-collect, crowdshipping, or home delivery, consumers' trip planning behaviour varies. Depending on the chosen delivery method, logistics service providers also play a crucial role in last mile delivery, which involves the execution of traditional delivery and the connection of travellers and senders through online platforms like crowdshipping.

In this context, a successful delivery refers to the parcel being delivered to the intended location of the consumer. The scheme also applies for return products, where delivery should be interpreted as “return delivery” and is implemented using the same decisions of a channel, a shipping method and an execution platform.

Beyond the consolidation of shipments by service providers, openly sourced and shared delivery networks also exist to support horizontal collaboration between service providers in e.g. freight platforms (Montreuil, 2012). In

the PI vision, these networks are expected to broaden and merge so that fragmented flows can be interconnected (Ballot et al., 2018).

In the following sub-sections, we discuss the framework in detail, with a substantive review focusing on the 3 key consumer decisions, including choices regarding shopping channels, delivery methods, and decision to become a service supplier. Of all the literature reviewed, the choice of delivery method has been studied most extensively, with 47 publications identified. For the choice of shopping channel, we identified 11 studies and for crowdshipping participation 17 studies. Lastly, 18 PI-inspired studies 6 of which mentioning the general PI exploratory studies are identified. A detailed overview, describing the objectives and the system attributes considered in each study, is provided in Appendix 1.

### **3.2.1. Decision on the shopping channel**

The shopping channel decision of a consumer impacts a chain of processes (Halibas et al., 2023). With the rise of e-commerce, consumers now have the option to make purchases online, revolutionising the conventional in-store shopping experience. This digital shift not only provides consumers with the convenience of browsing and buying products from the comfort of their homes but also poses a challenge for retailers in ensuring efficient and reliable last mile delivery (Madlberger & Sester, 2005). The shift from multi-channel to omni-channel retailing empowers consumers to seamlessly combine various buying channels. For instance, they can explore products in-store and purchase online or research online and buy in-store (Halibas et al., 2023). This diversity underscores the importance of last mile delivery services that enable product delivery. In line with this transition, Mahdi Zarei et al., (2020) find out that access to facilities and convenience are some of the most important factors affecting consumers' shopping channel choice. Piotrowicz and Cuthbertson (2019) highlight that consumer acceptance of online grocery shopping is influenced by factors such as delivery fees, delivery time, product quality, and convenience. Similarly, the parcel value and product category are some of the important specifications when it comes to the choice of shopping channel. In a choice experiment setting, Polydoropoulou et al. (2022) highlight that consumers would rather shop in-store if the item is large and of high value. The authors reveal that questions regarding the shipment, such as who will deliver the product and how the return process is done, influence preferences about the shopping channel choice. Similarly, Aziz et al. (2022) show that product availability (range) and parcel value are some of the determinants of the shopping channel choice. Chatterjee and Kumar (2017) investigate the willingness to pay for a delivery in different retail channels. The authors also conclude that consumers are in favour of omnichannel retailers for products such as furniture since omnichannel retailing allows consumers to connect online and physical stores (Chatterjee & Kumar, 2017). In the PI context, Derhami et al. (2021) examine the product availability under uncertain demand conditions and find out that the available inventory has a positive impact on the customer's willingness to accept a transshipment. However, the underlying behavioural factors driving these preferences require further exploration. Levin et al. (2003) also highlight that the category of products affects consumers' choice of shopping channel. Madlberger and Sester (2005) show that the characteristics of the purchase and its availability in the physical store might lead to different shopping channel choice. With a consumer choice model, Rossolov et al. (2021) highlight that each product category has unique characteristics, such as shopping frequency and volume, as well as usage conditions like duration and consumption levels. This diversity influences the choice of channel with regards to purchasing cost and time. Another study compares motivations of online and in-store shoppers based on product types, revealing distinct preferences (Haridasan & Fernando, 2018). In a choice model, Maltese et al. (2021) show that delivery cost has a negative effect on the choice of online shopping. Similarly, recent studies (Marcucci et al., 2021; Wieland, 2021) highlight that product price and delivery cost are the most important drivers for the shopping channel choice. Similarly, Hsiao (2009) identifies four attributes that affect consumers' utility when it comes to the choice of physical store and e-shopping: (1) travel cost, (2) travel time, (3) purchase price, and (4) delivery time. While existing research has examined the shopping choices independently, a significant research gap exists concerning an integrated approach, linking the context of several parallel shopping channels with various available delivery methods. Bridging this gap is essential for a comprehensive understanding of consumer behaviour in the evolving omnichannel landscape.

### **3.2.2. Decision on delivery method**



The selection of a delivery method is linked to the choice of shopping channel as consumers can receive items immediately when purchased at a physical store whereas with online shopping, consumers have to wait for product delivery (Hsiao, 2009). Delivery method choice includes a range of options for delivering products to consumers. Most of the papers from our set that focus on consumer decision-making (47 out of 93) relate to this decision. The selection process involves choosing the most suitable delivery methods based on several factors, related to the product, the service attributes, and the individual making the decision. The identified variations in e-commerce consumers' preferences and behaviours regarding different delivery methods present a significant research gap. These differences underscore the importance of comparing and transferring e-commerce and transport research findings across different countries and context.

### ***Product attributes***

In several recent studies, researchers have explored how consumer choices regarding last mile delivery are influenced by specific product characteristics. The literature presents conflicting findings in places. Bjerkan et al. (2020) show that for small and medium-sized parcels, consumers mostly prefer collection points as delivery location. In the case of heavier goods, home delivery is mostly preferred delivery option. Conversely, Cauwelier et al. (2023) show that consumers choice of last mile delivery method is not affected by the weight of the parcel. In a stated preference experiment conducted by Merkert et al. (2022), it is shown that parcel value significantly influences the choice of delivery method. The study emphasises that parcel lockers and drones become more appealing for high-value items. Additionally, consumers tolerate an increase in the delivery cost in the case of high-value product delivery (Merkert et al., 2022). In contrast, Nguyen et al. (2019) grouped products by value and found that consumers are willing to change their delivery preferences to reduce the delivery cost, regardless of the product category. Wang et al. (2023b) emphasise the importance of socio-demographic factors and product value. In a recent review study, Titiyal et al. (2023) highlight that product type has a direct influence on the consumer's last mile delivery method choice. Bjerkan et al. (2020) show that the use of pick-up points is prominent for non-heavy product segments such as shoes and textiles. Nguyen et al. (2019) highlight that various delivery attributes hold similar importance for different types of products; however, consumers' sociodemographic characteristics mostly drive their preferences for delivery service choices. Madlberger and Sester, (2005) highlights that the product categories have a significant effect on the consumer preferences for delivery methods such as home delivery, pick up point and delivery to the working place. In a recent study, Wieland (2021) find out that the preferences of consumers differ depending on the product category for click-and-collect method.

### ***Service attributes***

The plethora of available delivery methods, ranging from click-and-collect services to home deliveries, has transformed the way consumers choose their preferred delivery options. The plethora of available delivery methods, ranging from click-and-collect services to home deliveries, has transformed the way consumers choose their preferred delivery options. Click-and-collect services, for instance, allow consumers to make purchases online and collect them from a physical store within an omnichannel architecture (Risberg, 2022). Another delivery method where there is an active involvement of consumers is self-collection points, or parcel lockers. This service enables consumers to participate in the last mile delivery operation by picking up or dropping off their merchandise at a specific point. Crowdshipping leverages a network of individuals to carry out deliveries, often providing a more personalised and localised solution. Recently, many businesses have appeared in crowdshipping such as Easybring and Friendshippr (Rougès & Montreuil, 2014). Next, we describe the delivery methods in more detail. Central to this transformation are specific attributes inherent in these delivery methods, playing a pivotal role in shaping consumers' preferences and decisions.

Research by Milioti et al. (2020) emphasises that factors such as the accessibility and timeliness of the click-and-collect point significantly influence consumer choices. Various service determinants of parcel lockers are identified, such as accessibility and location (Vakulenko et al., 2018). The active use of parcel locker service also greatly depends on the network structure offered, which affects the accessibility of such a service (Schaefer & Figliozzi, 2021). In the case of a logistics service provider owned parcel locker service, the use of these services requires interconnection between retailers, logistics service providers, and consumers' intention to use.

Convenience and ease of use (Vakulenko et al., 2018; Tang et al., 2021; Yuen et al., 2018; Yuen et al., 2019; Tsai & Tiwasing, 2021) are some of the other attributes comprehensively studied by several scholars. Ease of use and convenience (Cai et al., 2021; Koh et al., 2023) are found to be influential in the choice of advanced

technology-enabled services. A recent study (Koh et al., 2023b) highlights that consumers' intention to use crowdshipping is due to the ease of use of the service. Generally, the choice of the home delivery option also lies in its convenience (Hübner et al., 2016).

Delivery time and reliability are among the key factors influencing the choice of parcel lockers (Merkert et al., 2022; Yuen et al., 2019; Tsai & Tiwasing, 2021). These characteristics of the delivery service also impact preferences for unmanned aerial delivery drones (Merkert et al., 2022). Some studies explore service attributes of crowdshipping, such as delivery time (Gatta et al., 2018). A recent study highlights that the willingness to use micro-depots highly depends on delivery time (Hagen & Scheel-Kopeinig, 2021).

Furthermore, certain studies focus on the choice of delivery methods for e-groceries, emphasising that high delivery costs strongly influence the preference for the click-and-collect option (Gatta et al., 2021; Marcucci et al., 2021), as well as consumers' willingness to pay for the service (Aziz et al., 2021; Maltese et al., 2021). Gatta et al. (2018) studied the effect of crowdshipping service cost from the perspective of consumer demand. Another study indicates that the delivery cost of parcel lockers should be lower than that of home delivery (Schaefer & Figliozzi, 2021).

Moreover, the perceived environmental impact of delivery methods is another crucial attribute that comes into play. Eco-friendliness is studied from the perspective of consumer acceptance for crowdshipping services (Wicaksono et al., 2022; Gatta et al., 2018). Rai et al. (2021) found that potential users favor crowdshipping due to possible sustainability improvements. Edrisi and Ganjipour (2022) highlight that environmental concerns affect consumer choices of advanced technology-enabled services as well as the click-and-collect service (Marcucci et al., 2021).

Some concerns regarding the parcel lockers include fault handling capability, malfunctioning, lack of information (Tang et al., 2021; Vakulenko et al., 2018), and security (Felch et al., 2019; Yuen et al., 2019). Regarding the advanced technology-enabled services, safety and privacy (Kasper & Abdelrahman, 2020; Koh et al., 2023, Polydoropoulou et al., 2022) become some of the attributes that can impact the consumer choice. Zhou et al. (2020) find out that the perceived risk associated with the self-collection service negatively affects the intention to use the service and the user's satisfaction. There are also some crowdshipping specific attributes since the crowdshipping service involved occasional carriers for the actual delivery task such as reputation of the occasional carrier (Le & Ukkusuri, 2019; Cebeci et al., 2023), and factors affecting user trust (Cebeci et al., 2023).

In a hyperconnectivity context, Kim et al. (2021) propose an agent-based model to implement the PI concept in urban logistics systems. This study sheds light on the benefits of such a hyperconnected network; however, consumers are modelled under naive behavioural assumptions in terms of their preferences for retailers, delivery pick-up times, and conditions (Kim et al., 2021). A recent study proposes a business model in which the consumer directly interacts with either a human operator or parcel lockers located at the micro-depot to pick up and return the parcels (Rosenberg et al., 2021). Interestingly, this study can be considered an implementation of PI in a last mile context by creating a shared micro-depot network with parcel lockers, even though there is no reference to the PI literature. In the PI literature, smart and/or modular lockers are introduced, which can diminish the logistics flow through consolidation (Montreuil, 2016; Pan et al., 2021b), and several designs of lockers are discussed (Faugère & Montreuil, 2020). Orenstein and Raviv (2022) propose a "hyperconnected service network" (HCSN) for parcel delivery by using each delivery node, such as automated parcel lockers, as a point at which a parcel could be dropped off and picked up. By designing such a network, the authors conclude that HCSN has the potential to improve service levels and reduce delivery costs for service providers. However, it is important to mention that the studies focusing on parcel lockers in PI are either on the conceptual level or network design by applying operations research.

All in all, in terms of delivery method choice of the consumers, the previous research mainly focuses on delivery methods independently. The lack of interaction and collaboration between these last mile delivery services creates ambiguity for consumers. They might face challenges in understanding how these services work together seamlessly, impacting consumers' decisions to use these services.

### ***Personal attributes***

Personal motivation plays a crucial role in shaping consumers' last mile behaviour (Mahdi Zarei et al., 2020). Chen et al. (2018) point out that consumers' intentions to use a parcel locker service are positively affected by their optimism. Edrisi and Ganjipour (2022) investigate whether consumer optimism has a positive impact on the adoption of sidewalk autonomous delivery robots. Similar to optimism, consumers' innovativeness is considered

a factor affecting the adoption of parcel lockers (Chen et al., 2018; Yuen et al., 2018). However, there is a gap in understanding how these attributes influence different delivery options when they are all available for consumers.

Previous experiences, habits, and consumer satisfaction are expected to affect consumers' perceptions and motivation to use a delivery method (Meuter et al., 2005). In particular, the omnichannel retailing strategy intends to provide positive consumer experiences at each consumer touchpoint. Vakulenko et al. (2019) investigate the effect of the online experience on consumer satisfaction. Cai et al. (2021) provide evidence that consumers' intentions to use a service is also affected by their habits. Together with familiarity and engagement, consumers are more likely to form habits concerning the delivery service (Cai et al., 2021). Tang et al. (2021) show that consumer experiences is negatively affected by the service price. Consumer satisfaction has also been a topic in the PI. Bidoni and Montreuil (2021) study changing consumer behaviour and demand variability for new urban logistics services. The authors state that consumer satisfaction, advertisements, word-of-mouth, and incentives have a positive impact on the use of new services (Bidoni & Montreuil, 2021).

Personal characteristics also refer to emotional attitudes towards the use of the service. With the involvement of consumers in logistics activities, consumers take over some of the activities that logistics service providers usually provide, such as picking up or dropping off a parcel at a collection point and becoming an occasional carrier to deliver a parcel for other consumers. Consequently, consumers might feel that their time and effort are used and that they are treated unfairly, which in the end impacts their satisfaction level for a given service (Wang et al., 2021). Vakulenko et al. (2018) provide evidence that consumers find the use of parcel lockers fun and interesting as they actively engage in the service. Similarly, Wang et al. (2018; 2020) emphasise that the adoption of automated parcel stations is not only about the movement of the parcel and associated service characteristics but also about emotional attitudes. Wang et al. (2020) find out that while some consumers find the use of self-collection points engaging as an empowerment tool, others would find the service intimidating.

In a recent review study, Bhukya and Paul (2023) focus on communication and social influence on consumer behaviour and discuss several research directions concerning e-retail, e-commerce, and the sharing economy. Giglio and Maio (2022) study the importance of communication between a logistics service provider and its consumers regarding the choice of crowdshipping. The author concludes that communication is essential for ensuring the quality and reliability of the crowdshipping service, as well as the trust and satisfaction of the participants. The paper mentions factors such as trialability and observability, which depend on the availability and accessibility of information and the use of feedback from new technology. These factors serve as predictors of consumers' choices. In a system dynamics model, De La Torre et al. (2019) explores the theory of word-of-mouth (WoM). The authors describe process of consumers evaluating a service and communicating that experience with other consumers (De La Torre et al., 2019) in a local food logistics network.

Yuen et al. (2018) highlight that the decision to use self-collection points can be influenced by consumers' conformance with their social environment, such as family and peers. Zhou et al. (2020) examine the degree to which opinions of others influence the adoption of self-service parcel delivery options such as collection points and parcel lockers. Given that new delivery services are not entirely experienced by the majority of consumers, the social environment is expected to play a vital role in the acceptability of the service (Felch et al., 2019). In an empirical study, Mahdi Zarei et al., (2020) find out that family and friends influence consumer's last mile delivery method selection. Cai et al. (2021) find that consumer decisions about logistics technologies are affected by the opinions of others. Devari et al. (2017) propose a model to test the effect of crowdshipping by using consumers' friends or acquaintances to deliver the parcels. The study sheds light on the potential benefits of the service for friendship-based last mile delivery. The paper mentions four levels of friendship that affect the willingness and preferences of consumers to perform or receive crowdsourced delivery. Akeb et al. (2018) study a crowdshipping service based on neighbour relay as a solution to diminish delivery failure. A recent study (Rai et al., 2021) identifies four consumer segments to explore preferences for crowdshipping delivery. The findings show that consumers are more inclined to choose crowdshipping if the carrier is someone from their neighbourhood or one of the retailer's employees.

### **3.2.3. Decision to become a service supplier**

Willingness to become a delivery service supplier, referred to here as an occasional carrier, has been the subject of several studies. In a recent review study, Mohri et al. (2023) identify key factors influencing individuals'

participation as service providers. The authors emphasise factors like reimbursement schemes, flexibility, parcel characteristics and platform functionalities, such as tracking tracing.

In a behavioural study, Marcucci et al. (2017) demonstrate that compensation levels are one of the most significant incentives for becoming an occasional carrier. Similarly, Le and Ukkusuri (2019) point out that the expectation of payment is influential, covering not only the cost of delivery driving time but also other expenses such as fuel and maintenance costs. Like Marcucci et al. (2017), the authors suggest that socio-demographic characteristics significantly influence respondents' decisions to become a bringer for a parcel. In another behavioural study, Wicaksono et al. (2022) reveal that additional travel time, compensation, and package weight can significantly influence the propensity to become an occasional carrier. Le et al. (2021) model occasional carriers' willingness to be paid under different pricing and compensation schemes. In a recent study, Cebeci et al. (2023b) point out that the conditions under which crowdshipping exacerbates or alleviates environmental issues are critical. The study concludes that individuals from low-income groups are more inclined to participate as bringers and are more willing to take longer routes to deliver packages to others. Serafini et al. (2018) find that, besides remuneration and safety concerns, the location of delivery points is another important factor for occasional carriers in becoming a service supplier. Miller et al. (2017) highlight that delivery time and the purpose of the existing trip influence the choice of becoming an occasional carrier. The authors conclude that off-peak hours and leisure trips might lead to a greater willingness to consider becoming an occasional carrier since such trips typically offer more schedule flexibility. Alongside these characteristics, a few studies focus on the beliefs and attitudes of occasional carriers. For instance, Koh (2023b) studies the beliefs of occasional carriers in their ability to successfully perform specific tasks in terms of technology usage. Upadhyay et al. (2022) explore the willingness of occasional carriers to engage in crowdshipping services by assessing their motivations. Wang et al. (2023b) discover that motivational factors like the willingness to participate in paid crowdshipping and the sense of shared responsibility in unpaid crowdshipping impact individuals' decision to become occasional carriers. In their work, Chen et al. (2017) introduce a novel approach for the collection of e-commerce returned goods using taxis as transportation means and shops as collection facilities. Their study, conducted in a crowdshipping context, leads to the conclusion that crowd-based reverse logistics can be both feasible and more sustainable.

While the optimisation studies discussed do not directly explore consumer behaviour, they provide practical insights into integrating crowdshipping with existing delivery services. For instance, Raviv and Tenzer (2018) design an open and shared PI infrastructure, highlighting the economic viability of crowdshipping. Similarly, Di Febbraro et al. (2018) present a model where ride-sharing and crowdshipping services could use the same infrastructure. In another study, crowdshipping is studied by combining parcel lockers and public transport passengers (Zhang et al., 2023). By illustrating the practical implications of crowdshipping, these studies highlight its potential to enhance delivery efficiency, reshape consumer preferences, and mitigate last mile delivery challenges.

## **4. Research directions**

In this section, we provide several research directions building on the above. We distinguish 3 promising areas of work. Firstly, we examine several research directions concerning demand and supply decisions of active consumer participation in the delivery process. Secondly, we provide future research avenues, examining how social interactions influence decision-making in the context of delivery services. Lastly, we outline the effects of hyperconnected service networks.

### **4.1. From consumers to prosumers of last mile delivery**

As stated in previous reviews (Mishra et al., 2021; Wang et al., 2023; Ma et al., 2022) and supported by several empirical studies (Wang et al., 2018; Pisoni et al., 2022), the development of omnichannel retailing architecture has made meeting consumer expectations and fast delivery requests more crucial than ever before. Existing literature primarily examines the acceptance of new delivery services, either by focusing on a specific service (Chen et al., 2018) or by comparing multiple delivery options (Cai et al., 2021). However, in line with marketing literature, changes in consumer consumption patterns have transformed their relationship with businesses (Tax et al., 2013; Lemon et al., 2016; Vakulenko et al., 2019 ; Rimmer & Kam, 2018). Despite this, there is a notable

research gap concerning the evolving role of consumers, who are not just users of services but also providers of services for others.

Notably, citizens are increasingly participating in last mile deliveries (Wang et al., 2023). For instance, they send or deliver parcels for others through platforms like crowdshipping (Le & Ukkusuri, 2019), or they handle their ordered products by picking up or dropping them off at designated locations such as collection points (Marcucci et al., 2021), parcel lockers (Vakulenko et al., 2018), or micro depots (Hagen & Scheel-Kopeinig, 2021). To our knowledge, until now, research has focused on only one of these perspectives of consumer: either as a service user or the service supplier. However, the behaviour of citizens as simultaneous producers and consumers, a phenomenon known as prosumers, in the context of last mile delivery services is overlooked. This integrated approach of consumer decision-making presents a unique opportunity to formulate policies for future last mile logistics, recognising that consumers serve as both service users and contributors, impacting the logistics sector as a whole. This holistic view has the potential to provide a complete understanding of the relationships between consumers, retailers, and logistics service providers, thereby enhancing our insights into evolving market patterns.

Another aspect that is mentioned in the literature concerns the return deliveries in optimising last mile deliveries and enhancing the overall consumer experience (Polydoropoulou et al., 2022; Rosenberg et al., 2021). A potential avenue for future research involves investigating consumer perceptions and attitudes towards the return process, where emotions like satisfaction or frustration play a significant role in decision-making. The influence of return policies on purchasing decisions is noteworthy. Additionally, there's an opportunity to explore the impact of environmentally friendly return options, similar to the approach suggested by Chen et al. (2017) in the context of crowdshipping.

Existing research has primarily employed choice experiments and structural equation modelling techniques to explore the acceptance of new delivery services (Cai et al., 2021; Vakulenko et al., 2019; Merkert et al., 2022). The objective of these studies is to investigate the trade-off between delivery-specific characteristics and consumer behaviour based on consumer surveys. However, there is a need to use revealed preference data to empirically assess the use of these services. This is mainly because revealed preference data, derived from real consumer behaviour and choices, provides valuable insights into the actual preferences and decision-making processes of consumers. Additionally, integrating findings from consumer surveys into simulation studies enhances the robustness of the analysis. These surveys provide qualitative insights, helping contextualise the quantitative data obtained from revealed preferences. Together, these methodologies create a comprehensive framework for evaluating the use of services.

Lastly, the generalizability of many studies is limited due to specific choice situations or person-level indicators used to assess consumer decision-making. To address this limitation, we suggest that future studies consider the context dependency effect by incorporating cross-cultural and geographical comparisons, and that transferability evaluations are undertaken.

## **4.2. Role of consumers' social environment**

As presented in the review framework, consumers become a critical part of the logistics operations because of their decisions about their deliveries as well as their participation in the delivery as carriers. Moreover, they have an interconnection with other actors in the last mile, namely, retailers and logistics service providers. Individual decision-making of consumers is embedded in social networks and creates a system-wide effect. Future research could focus on exploring the interconnections between these actors and its influence.

As Harrington et al. (2016) also emphasise, consumers are highly affected by the community that they live in. In other words, consumer decisions are influenced not only by product and service characteristics but also by factors such as active communication, information sharing, and peer referrals. Consumers might be willing to use their social network, such as their family, friends, and co-workers, if they think that their shopping experience is improved (Mishra et al., 2021). Future studies should consider these elements to expand our understanding of consumer acceptance of these innovative services. In the literature, there are a few studies focusing on the influence of social networks on innovative delivery services. However, their predominant focus is on the preferences and tendency of consumers to use social networks for an individual service or a technology by means of choice modelling (Devari et al., 2017), linear regression (Felch et al., 2019), or structural equation modelling (Cai et al., 2021; Wang et al., 2021). With these approaches, the complex relationship between the decisions of consumers may be oversimplified. For instance, choice models assume independence of irrelevant alternatives, neglecting the

complex interplay of various factors. Linear regression techniques, on the other hand, might miss nonlinear relationships crucial in decision-making. Structural equation models, while powerful, heavily rely on model specification and may not fully capture the complex interactions. While all these methods offer valuable insights, traditional approaches often lack the ability to incorporate dynamic elements representing the evolving nature of social interactions. These dynamic aspects are vital, especially when examining complex, real-time social environments. We recommend extending the literature on consumer decision-making by considering the effect of the social environment with dynamic and scalable models, which consider both the evolving nature and the scalability of social interactions. Another research direction can be concerning how interactions between different social network groups would influence consumers' choice preferences. As an approach, simulation studies could be used to explore different scenarios by considering the evolution of social interactions and their impact on the adoption of novel delivery methods as a network.

Social influence plays a significant role in shaping consumer behaviour. As suggested in a recent review study (Bhukya & Paul, 2023), social influence can enhance delivery by leveraging cutting-edge information and communication technology, motivating consumers to become carriers (Devari et al., 2017; Akeb et al., 2018) and jointly deliver for others (Bhukya & Paul, 2023). With the emergence of a new type of consumer valuing sustainable practices throughout the supply chain, highlighted by Pan et al. (2021), the eco-friendliness of these social networks could drive a shift in consumer preferences under certain conditions such as delivery time, delivery distance and remuneration levels. However, it is crucial to explore the safety and privacy aspects for the success of such platforms.

Previous studies have shed light on the impact of several personal attributes, such as consumers' innovativeness, previous experiences and habits, on the acceptance of a new service. However, there have not been many studies investigating the influence of different social groups on the acceptance of a new delivery service considering these attributes. This is important for two reasons. Firstly, as mentioned in Akeb et al. (2018), there are many stakeholders involved in the last mile delivery. Secondly, consumers typically do not have prior experience with the new service and their choice is highly influenced by their social environment, as mentioned in Yuen et al. (2018), Zhou et al. (2020) and Devari et al. (2017). By studying the relationship between social networks and the choice of a service, consumer decision-making could be better explained. To achieve this, both qualitative and quantitative approaches can be applied. Interviews and focus group analysis can be useful for exploring the objectives and preferences of different stakeholders. Additionally, piloting activities, field surveys, and simulation studies can be employed to better understand the complex structure of consumer decision-making.

### **4.3. Effects of hyperconnected service networks**

There is a lack of comprehensive empirical studies that investigate the effect of horizontally as well as vertically connected, collaborative services. Existing literature concentrates on identifying characteristics of individual delivery services (Vakulenko et al., 2018; Polydoropoulou et al., 2022; Cauwelier et al., 2023), or horizontal collaboration of private channels (Kim et al., 2021). Future studies could explore the combined vertical and horizontal integration of partial delivery services as a network. Vertical integration involves the creation of new service chains by connecting individual services. This could include crowd-based delivery services seamlessly integrating with parcel lockers or micro-depots. In terms of horizontal integration, collaboration between competing actors could impact the use of capacity and increase efficiency. Their combined deployment results in hyperconnected urban freight networks.

The interconnectivity issue is not trivial and requires further exploration through multiple scenario analyses, as also mentioned by Treiblmaier et al. (2016). In our context, interconnectivity involves the technological and social potential for actors to connect vertically or horizontally. Hyperconnectivity emerges as a system property resulting from ubiquitous interconnectivity, giving rise to a horizontally and vertically integrated service network. Particularly in the context of last mile delivery, numerous small-scale micro-services often operate independently without interconnection. If these services could collaborate and interconnect, they could collectively form a hyperconnected last mile delivery network that is more robust and impactful than the sum of its individual parts.

Connectivity between platforms and ease of use are some of the other aspects that need further investigation since they influence consumers' experience and loyalty to use these connected services. In particular, the question of aggregation of service experiences requires attention. Marketing studies focusing on consumer involvement show that different service providers together form consumer experience irrespective of their individual role in the

core service (Vakulenko et al., 2019). Finally, the question of coordination among services and building trust towards a new service become increasingly important as mentioned by Tax et al. (2013), Lemon et al. (2016).

In the PI literature, the aspect of consumer decision-making considering the service attributes is either overlooked or limited to the constraints of consumer time-windows (Crainic et al., 2020), the spatial distribution of consumers (Ben Mohamed et al., 2017), demand uncertainty (Crainic et al., 2020), deterministic time of the day (Orenstein & Raviv, 2022), and service time choices (Ben Mohamed et al., 2017; Orenstein and Raviv, 2022) in optimisation studies. In line with some scholars (e.g., Kim et al., 2021; Bidoni & Montreuil, 2021), demand modelling, forecasting, and a more accurate reflection of practice regarding delivery times, delivery failures, and consumer preferences need to be investigated further. Considering realistic behavioural assumptions about consumers (as an end-user or the service supplier in the PI) can allow for more comprehensive and well-directed research outcomes towards a fully connected PI network.

In summary, noting there is a limited body of research dedicated to exploring consumer decision-making in the realm of the PI, future investigations have the opportunity to contribute significantly by advancing our understanding of last mile logistics services collaborating in an open network. There is a need in this context to explore the synergies among different service providers and investigate the feasibility of implementing white-label services, where multiple logistics service providers use the same delivery person or share infrastructure such as delivery vehicles and parcel locker facilities.

The connection of these services as a network and the inclusion of consumers as essential decision-makers, considering their specific preferences and trust towards these services, are overlooked in the literature. To address this gap, the PI vision can provide guidance on how to connect these services through advanced information technologies and online platforms. Moreover, there are several policy instruments that can be tested in this context. These may include implementing zero-emission zones and providing subsidies for the use of shared and connected delivery services.

Lastly, an essential avenue for exploration lies in the seamless integration of crowd-based delivery services with conventional options such as parcel lockers and micro-depots. Understanding the dynamics of this integration is crucial, as it directly impacts consumer behaviours. Research efforts should focus on designing dynamic models that simulate scenarios integrating crowdshipping, parcel lockers, and other emerging services. These simulations can provide insights into how these services collectively influence prosumer decisions within the omnichannel retail landscape.

## 5. Conclusions

Despite the strong growth of the literature on omnichannel logistics, PI, and city logistics in recent years, there is little empirical research available on consumer decision-making. We position our review in the context of the vision of the PI as service supplier and the omnichannel services that shape the demand for transport. Incremental shifts in retailing operations toward a seamless omnichannel architecture have transformed consumers from mere end-users of services into service providers and logistics operators. This includes initiating, receiving, and returning purchased goods, as well as carrying out a delivery for others. These developments underscore the pivotal role of consumers in last mile logistics.

We define three distinctive decisions: (1) selecting the shopping channel, (2) choosing the delivery method, and (3) accepting to carry a shipment for others. The shopping channel encompasses the choice between online and in-store or hybrid shopping choices, which ultimately affects the selection of different delivery methods. Within this context, the choice of delivery method is elaborated upon, considering product-specific, delivery-specific, and personal-specific characteristics. Lastly, we emphasise the importance of crowdshipping as a novel concept within the PI framework, where citizens become carriers.

Our review shows that only a few connect multiple last mile logistics services into a PI-like service network, in order to study the impact of this hyperconnectivity, taking into account consumer behaviour. Current studies either focus on optimisation or use naive behavioural assumptions. Complementing these with behavioural studies are recommended. Important further gaps include the simultaneous nature of consumers as producers of services termed prosumers, the role of social networks, interconnectivity among delivery services and attention to the transferability of findings across the multiple pilots reported.

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**Appendix 1  
Overview of studies**

Author (s)	Research objective(s)	Method(s)	Estimation model	Data source	Decision(s)				
					Shopping channel	Delivery method			Becoming a service supplier
						Product	Service	Personal	
Millioti et al. (2020)	To identify the acceptance of consumers on click-and-collect service	Regression	Binary logit	Survey			√		
Gatta et al. (2021)	To study the difference in preferences for delivery channel choices	SPE	Multinomial logit	Survey			√		
Tang et al. (2021)	To investigate consumer satisfaction with the smart parcel locker services	Regression Confirmatory factor analysis	--	Survey			√	√	
Bidoni and Montreuil (2021)	To model consumer behaviour for new urban parcel logistics services.	Simulation	--	Historical data				√	
Wang et al. (2021c)	To explore the fairness perspective of logistics services about self-collection service	SEM	--	Survey				√	
Vakulenko et al. (2018)	To understand consumers changing attitudes towards parcel lockers	Focus group	--	--			√	√	
Schaefer and Figliozzi, (2021)	To analyse the location and accessibility of parcel lockers for different population groups	Cluster analysis	--	Open access data			√		
Devari et al. (2017)	To test the effect of crowdshipping by using consumer's friends or acquaintances for delivering the parcels	Simulation		Survey				√	
Akeb et al. (2018)	To study a crowdshipping based on neighbour relay as a solution to diminish delivery failure	Simulation	--	--				√	
Gatta et al. (2018)	To understand and evaluate the environmental and economic impacts of a crowdshipping platform	SPE	Multinomial logit	Survey			√		

Chen et al. (2018)	To investigate consumer's intention to use parcel lockers	Partial least squares SEM	--	Survey				√	
Bhukya and Paul (2023)	To provide an overview of the literature on social influence in consumer behaviour	Review	--	--				√	
Giglio and Maio (2022)	To study the determinants of crowdshipping adoption in university cities	SEM	--	Survey			√	√	
Zhou et al. (2020)	To test the influence of psychological factors on consumers' behavioural intention to adopt self-service parcel delivery services	SEM	--	Survey			√	√	
Mahdi Zarei et al., 2020	To identify consumer's last mile logistics beliefs in an omni channel environment	Descriptive analysis	--	Survey	√			√	
Wicaksono et al. (2022)	To explore how demand and supply side for bicycle crowdshipping meet in a parcel delivery market	SPE	Multinomial logit	Survey			√		√
Rai et al. (2021)	To identify which type of consumer is interested in crowd logistics	Descriptive analysis Cluster analysis	--	Survey			√	√	
Edrisi and Ganjipour (2022)	To identify the factors impacting the adoption of sidewalk autonomous delivery robots	Partial least squares SEM	--	Survey			√	√	
Cebeci et al. (2023)	To explore the effect of trust on crowdshipping from the users' perspective	SPE	Hybrid choice	Survey			√		√
Felch et al. (2019)	To study consumer acceptance of alternative delivery services	Regression	Linear regression	Survey			√	√	
Cai et al., (2021)	To understand consumer's usage behaviour of logistics technologies: buy-online-and-pickup-in-store, smart locker and drone delivery	SEM	--	Survey			√	√	
Hagen, & Scheel-Kopeinig, (2021)	To examine acceptance and willingness-to-pay for last mile micro depot	Regression	Probit regression	Survey			√	√	

Kapser & Abdelrahman, (2020)	To investigate the users' acceptance of ADVs in last mile delivery	SEM	--	Survey			√		
Koh et al. (2023b)	To explore how consumer health concerns can affect consumers' subjective views and their decisions to use CL	SEM	--	Survey			√		√
Koh et al. (2023)	To investigate the factors influencing consumer acceptance of drone delivery	SEM	--	Survey		√			
Hübner et al. (2016)	To analyse the challenges and opportunities of last mile fulfillment and distribution in omnichannel grocery retailing	Review	--	--			√		
Yuen et al. (2018)	To explore consumers' intention to use self-collection points	Regression	Hierarchical regression analysis	Survey			√	√	
Meuter et al. (2005)	To explore the factors influencing consumers trial behaviour about innovative delivery modes	Regression	Multiple regression Logistics regression	Survey				√	
Wang et al. (2018)	To study the behaviour of consumers towards automated parcel stations	SEM	--	Survey				√	
Wang et al. (2020)	To investigate consumers' motivation of adopting self-collection service for e-commerce delivery	Latent class model Confirmatory factor analysis	--	Survey				√	
Tsai and Tiwasing, 2021	To investigate determinants of consumers' intention to use smart lockers.	Partial least squares SEM	--	Survey			√		
Yuen et al. (2019)	To analyse the determinants of consumers' intention to use smart lockers for last mile deliveries	SEM	--	Survey			√		
Rai et al. (2018)	To explore to which extent consumers are willing to adopt last mile options	Conjoint analysis	--	Survey			√		
Merkert et al. (2022)	To investigate consumer preferences about parcel lockers and unmanned aerial delivery drones	SPE	Mixed logit model	Survey		√	√		

Bjerkkan et al. (2020)	To study demographic characteristics, travel behaviour and last mile practices for pick-up points and home delivery	RPE	Descriptive analysis	Survey		√			
Cauwelier et al. (2023)	To characterize personal shopping mobility and weight categories of online purchases	RPE	Descriptive analysis	Survey		√			
Derhami et al. (2021)	To study the product availability under uncertain demand and in the presence of consumer substitution and inventory transshipment	A data-driven model	--	--		√			
Nguyen et al. (2019)	To study the changing preferences towards online retailing based on different product segments	Conjoint analysis Cluster analysis	--	Survey		√			
Titiyal et al. (2022)	To investigate the impact of e-fulfillment on consumer loyalty across different product types	Least squares SEM	--	Survey		√			
Madlberger and Sester (2005)	To analyse the last mile services in B2C e-commerce by focusing on consumer decisions	Interviews	Non-parametric test	survey		√			
Wang et al. (2023)	To investigate consumer preferences for parcel delivery	Regression	Multinomial logit	Survey		√			√
Halibas et al. (2023)	To investigate the evolution and trends of the research and channel shopping behaviours	Review	--	--	√				
Polydoropoulou et al. (2022)	To study the perceptions of Greek end-users/consumers, regarding the introduction of innovative delivery services.	SPE	Mixed logit	Survey	√		√		
Levin et al. (2003)	To investigate how to combine online and offline services in the most complementary way for different product categories	Averaging model	--	Survey	√				
Rossolov et al. (2021)	To assess the purchasing behaviours of end-	RPE	Binomial logit	Survey	√				

	consumers for online or in-store shopping								
Aziz et al. (2021)	To assess both consumers' habits to buy groceries and their potential behaviour change	SPE	Multinomial logit	Survey	√		√		
Haridasan and Fernando, (2018)	To compare online and in-store shoppers motivations based on product type.	Means-end approach Interview	--	--	√				
Chatterjee and Kumar (2017)	To examine differences in consumer willingness to pay for online purchases of functional and expressive products	Regression	Parametric tests	Open access data	√				
Marcucci et al (2021)	To estimate market shares for e-grocery, distinguishing between home deliveries and click&pick, using the in-store option as a reference	SPE	Multinomial logit and Latent class	Survey	√		√		
Hsiao (2019)	To explore how consumers evaluate the time and cost attributes of physical store and e-shopping.	SPE	Binary logit	Survey	√				
Wieland, (2021)	To identify the main drivers of store choice on the basis that both in-store, online and cross-channel shopping are available.	RPE	Conditional logit-Nested logit	Survey			√		
Maltese et al. (2021)	To explore the willingness to e-grocery, and delivery preferences	SPE	Multinomial logit	Survey	√		√		
Mohri et al. (2023)	To present a comprehensive and timely review of the crowdshipping (CS) literature	Review	--	--					√
Le and Ukkusuri (2019)	To understand the acceptability of crowdshipping	SPE	Mixed logit	Survey			√		√
Le et al. (2021)	To design and evaluate different pricing and compensation schemes for crowdshipping		Matching and routing model	Real-world data					√
Serafini et al. (2018)	To analyse the willingness to act as a crowdshipper	SPE	Multinomial logit	Survey					√
Miller et al. (2017)	To measure the potential willingness of individuals to	SPE	Multinomial logit	Survey					√



	become occasional carrier								
Upadhyay et al (2022)	To explore motivational factors that influence participate in crowdshipping	SEM	--	Survey					√
Zhang et al. (2023)	To explore the impact of prioritizing outlier parcels in a crowdshipping initiative	Optimisation model	--	--					√
Raviv and Tenzer (2018)	To introduce a logistics business model that utilizes crowd-shipment	Optimisation model	--	--					√
Di Febraro et al. (2018)	To better exploit the supply capacity, a shared mobility service is proposed in this paper for both people and freights	Optimisation model	--	--					√
Marcucci et al (2017)	To analyse the feasibility and behavioural levers that might facilitate the diffusion of crowdshipping in urban areas.	Regression	Multinomial logit	Survey			√		√