

## **LEVERAGING LAST MILE DELIVERY IN OMNICHANNEL RETAIL: SYNERGIES, CHALLENGES AND FUTURE OUTLOOK**

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### **Abstract**

*eCommerce brought multiple channels first on the supply side, introducing the concept of offering the same product from different supply sources, and then a seamless omnichannel experience on the sales side. The described evolution in the logistics sphere required solving the so-called the first mile problems in different procurement channels and the last mile of delivery through different channels of the customer's choice. This paper is focused on the issue of the last mile of delivery in an omnichannel retail environment. The sources of synergies through the presentation of different models used to organize omnichannel delivery of products to customers. These models combine different product collection points and different product delivery points to the end customer. Through extensive analysis of the literature, four key areas discussed by researchers were determined: the biggest problems in last mile delivery; different vehicles used for last mile delivery; the role of algorithms in last-mile delivery processes; and automation of the final delivery process.*

**Key words:** last mile, delivery, eCommerce, logistics, omnichannel.

## **1. INTRODUCTION**

Few things in retail are as important as providing your customer with the ordered product, at the right place, within the planned timeframe and at right price i.e. costs of delivery. As customers' demands and expectations increase, so does the pressure for retailers to deliver the right value, bringing the issue of adequate last mile delivery to an entirely new level. Last mile delivery refers to the final step of the delivery process where goods are transported to the final customer (Lim & Srari, 2018). Although the definition might seem rather straightforward, last-mile delivery is a very challenging and complex interminglement of marketing and logistic operations and processes. To create value for their customers, retailers, now more than ever, have to rely on AI implementation, process optimization (i.e. offering same-day deliveries) and making their entire value-chain more sustainable.

However, last-mile delivery excellence is not achievable as a stand-alone feat, but rather as the result of the combined fulfillment strategy optimization. Fulfillment strategy encompasses all activities ranging from the customer order taking, to the delivery of the product to the customer (Difrancesco et al., 2021). At this moment omnichannel fulfillment represents the pinnacle of combining different customer touchpoints to create value. In this sense, last-mile delivery is the crucial (and most tangible) link between retailer and customer.

eCommerce experienced a boom at the turn of the 20th century into the 21st century by introducing the concept of offering the same product from multiple procurement channels - Amazon caused a revolution in commerce by offering books from different booksellers at the same time with the possibility of comparing prices, book condition, delivery time, etc. Joining the wave of commerce digitalization, brick-and-mortar retailers have introduced omnichannel on the sales side, first adding a new channel and then creating a seamless omnichannel experience. From this evolution, it is clear that the critical steps that retailers solved the problems of the so-called the first mile (starting the product from the place where it is) and the last mile of delivery through different channels of the customer's choice. This paper is focused on the issue of the last mile of delivery in an omnichannel retail environment. Since omnichannel retail is all about combining different sales channels to create synergy, the focus of this paper will be to explore how last-mile delivery contributes to this. By taking a look into existing research, as well as market practice, we will identify prominent modalities of omnichannel fulfillment, and analyses the role which last-mile delivery plays in it. This will point out key areas for synergy creation, as well as implementation challenges. Finally, last-mile delivery literature will be analyzed in order to identify key research trends, as well as the importance and position of omnichannel fulfillment in it.

## **2. ENHANCING RETAIL THROUGH OMNICHANNEL FULFILLMENT – CONCEPT, SYNERGIES AND CHALLENGES**

Omnichannel fulfillment refers to the integration and coordination of multiple sales channels- such as physical stores, e-commerce platforms, mobile applications, and social media-to

provide customers with a seamless shopping experience (Ishfaq et al., 2016). This approach allows retailers to meet the growing expectations of consumers who demand flexible shopping options and consistent service across channels. With the rise of e-commerce and the shift towards digital shopping, omnichannel fulfillment has become a cornerstone of modern retail strategy (Siawsolit & Gaukler, 2021). According to market data 75% of consumers using buy-online-pick-up-in-store (BOPIS) are likely to make an additional purchase (Ross, 2019), underscoring the importance of omnichannel capabilities in maintaining competitiveness and customer loyalty. By effectively implementing omnichannel fulfillment, retailers can improve customer satisfaction, increase operational efficiency, and enhance revenue generation.

The key components of omnichannel fulfillment revolve around several core activities and business processes. First, inventory management is central, ensuring that stock levels are synchronized across channels in real-time to avoid stockouts or overstocking. Retailers must maintain visibility and control over inventory at distribution centers, physical stores, and online platforms. Second, order management systems are essential to facilitate the processing of orders from different channels, allowing for smooth transitions between purchasing and fulfillment stages. Third, logistics and delivery strategies, including last-mile delivery and returns management, play a vital role in ensuring that goods reach consumers in the most efficient and cost-effective manner. Retailers also rely heavily on data analytics to monitor consumer behavior, optimize stock levels, and enhance supply chain performance. In a Statista study (2021), 55% of retailers cited real-time data order tracking as a critical factor in successful omnichannel fulfillment strategy.

A well-executed omnichannel strategy creates opportunities for synergy across various sales channels, which can enhance both customer experience and operational performance (Cotarelo et al., 2021). For example, retailers can leverage physical stores as micro-fulfillment centers for e-commerce orders, reducing delivery times and costs for last-mile logistics. The ability to combine online and offline inventory allows retailers to offer more flexible fulfillment options, such as ship-from-store or buy-online-return-in-store (BORIS), leading to more efficient use of stock and reduced shipping expenses (Jin & Huang, 2021).

Furthermore, omnichannel fulfillment enables the use of shared data across channels, which can provide retailers with a comprehensive view of customer preferences, facilitating personalized marketing strategies and inventory management. Data indicates that retailers implementing omnichannel fulfillment solutions saw a 25% increase in profitability due to reduced operational costs and higher customer engagement (Alburger, 2024). This synergy not only drives revenue growth but also enhances customer retention by offering a unified and convenient shopping experience across all touchpoints.

Despite its numerous advantages, omnichannel fulfillment presents several challenges for retailers. One of the primary difficulties is the complexity of managing inventory across multiple channels (Ashcroft, 2022). Ensuring that inventory data is accurate and synchronized in real-time is critical but difficult to achieve, especially when multiple fulfillment options-such as ship-from-store or in-store pickup are available.

Discrepancies in inventory visibility can lead to stockouts or overstock situations, ultimately resulting in lost sales or excess carrying costs. Additionally, the high cost of infrastructure and technology investment poses a significant barrier. Retailers must integrate advanced order management systems, warehouse management solutions, and real-time data analytics to support seamless fulfillment, which can be financially prohibitive for smaller companies.

Another challenge lies in the coordination of logistics and delivery operations, where retailers must balance the cost-effectiveness of deliveries with the speed and convenience that customers demand (Tagashira & Minami, 2019). Moreover, managing customer expectations in terms of fast delivery times and flexible return options adds pressure on retailers to optimize their supply chains while maintaining profitability.

### **3. THE IMPORTANCE OF LAST-MILE DELIVERY IN MODERN RETAIL**

Within the omnichannel fulfillment model, last-mile delivery plays a crucial role, as it directly impacts customer satisfaction and operational efficiency. As the final step in the delivery process, last-mile delivery involves transporting goods from a fulfillment center or retail location to the customer's doorstep (Lim & Srari, 2018). Last-mile delivery represents the final step in the supply chain, involving the transportation of goods from a distribution center or retail location to the end consumer. It is a critical component of logistics operations, especially in the context of e-commerce and omnichannel retailing where together with the first mile delivery accounts for majority of costs and problems (Macioszek, 2018).

This stage is often the costliest and logistically most complex part of the supply chain, accounting for up to 53% of overall shipping costs in some cases (Statista, 2024). In an omnichannel context, last-mile delivery must be optimized to accommodate different fulfillment methods such as same-day delivery, BOPIS, or home delivery from stores. Retailers are increasingly turning to solutions like micro-fulfillment centers and crowdsourced delivery networks to minimize costs and improve delivery speed. A well-integrated last-mile strategy not only enhances the customer experience by offering faster and more flexible delivery options but also reduces operational costs, particularly through the use of technology such as real-time tracking and route optimization (Dev et al., 2019).

The role of last-mile delivery has grown significantly in recent years, as consumer expectations for fast, flexible, and reliable delivery options have increased. Organizations now view efficient last-mile delivery as a strategic asset that directly influences customer satisfaction, brand loyalty, and competitive positioning. Optimizing last-mile delivery is no longer a mere operational concern but a core part of an organization's value proposition and customer engagement strategy. Retailers who can effectively manage last-mile logistics are better positioned to meet customer demands, reduce delivery times, and minimize costs, all of which are critical for sustaining profitability in a competitive retail market (Jeanpert & Paché, 2016).

The effectiveness of last-mile delivery depends on several key activities, including order processing, route planning, fleet management, and delivery execution (Lim & Srari, 2018).

Order processing involves the efficient handling of customer orders to ensure accurate and timely dispatch. This step is closely followed by route planning, where advanced algorithms and data analytics are used to optimize delivery routes, reducing travel time and fuel consumption. Fleet management is another essential activity, requiring the coordination of delivery vehicles to balance load capacities, maintenance schedules, and real-time tracking of shipments. The final step, delivery execution, encompasses the actual handoff of goods to the customer, which can include various delivery methods such as home delivery, locker-based delivery, or curbside drop-off. Each of these activities contribute to the overall efficiency and cost structure of last-mile delivery operations.

Cost considerations are particularly significant in last-mile delivery. High costs are primarily driven by factors such as labor, fuel, vehicle maintenance, and infrastructure investment. For instance, labor costs can account for more than half of the expenses due to the need for a large workforce to manage deliveries, especially in urban areas with dense populations and traffic congestion (Sykes, 2023). Additionally, investments in technology, such as route optimization software, GPS tracking, and automated dispatch systems, are essential for improving efficiency but also add to the capital expenditures required for a robust last-mile operation. Retailers are increasingly exploring innovative solutions, including micro-fulfillment centers, crowdsourced delivery networks, and autonomous delivery vehicles, to mitigate these costs and enhance service levels.

#### **4. LAST-MILE DELIVERY AS A CRUCIAL PRECONDITION FOR OMNICHANNEL FULFILLMENT**

Omnichannel fulfillment is a strategy that integrates multiple sales and distribution channels—such as physical stores, e-commerce platforms, and mobile apps—to create a seamless shopping experience for customers (Difrancesco et al., 2021). This approach allows consumers to move fluidly between online and offline channels, offering them options like buying online and picking up in-store (BOPIS), curbside pickup, or home delivery. Last-mile delivery is a critical component of omnichannel fulfillment because it directly affects how quickly and efficiently goods can be delivered to the end consumer, regardless of where they make their purchase.

In an omnichannel setup, the complexity of last-mile delivery increases as retailers must coordinate deliveries from various sources, including centralized warehouses, local stores, and third-party logistics providers. The importance of last-mile delivery in this context lies in its ability to provide the flexibility and speed necessary to meet diverse consumer expectations. Efficient last-mile operations can help reduce delivery times, optimize costs, and enhance customer satisfaction, all of which are essential for the success of an omnichannel fulfillment strategy.

Scientific literature identifies various types of omnichannel fulfillment strategies, each with its own approach to meeting customer needs while optimizing operations. Centralized fulfillment is one of the most traditional models, where orders from different channels are processed and

shipped from a centralized distribution center. This model allows for greater control over inventory and operations but can result in longer delivery times, particularly for last-mile delivery.

In contrast, decentralized or store-based fulfillment uses physical retail locations as hubs for processing and fulfilling orders. This approach can significantly reduce delivery times, especially for local customers, but may introduce complexity in inventory management across store locations. Another model is hybrid fulfillment, which combines elements of both centralized and decentralized systems, allowing retailers to optimize inventory management and delivery speed based on customer location and order type.

Taylor et al. (2019) outline several key types of omnichannel fulfillment that are widely used in modern retail. The most prominent ones include Buy Online, Pick Up In Store (BOPIS), Buy Online, Return In Store (BORIS), Ship From Store (SFS) and Ship To Store (STS). Each approach offers unique advantages for both retailers and consumers, providing flexibility and efficiency while addressing different logistical and customer satisfaction needs.

*BOPIS* is one of the most common omnichannel fulfillment models, where customers place an order online and collect their purchases at a physical retail store. This method reduces last-mile delivery costs for retailers and offers convenience for customers who prefer to avoid shipping fees or long delivery times. It is particularly advantageous for retailers with a robust brick-and-mortar presence, allowing them to leverage store inventories and minimize shipping-related delays. One key difference between BOPIS and other fulfillment models is the integration of online and offline experiences, giving consumers more control over when and where they receive their orders.

*BORIS*, or Buy Online, Return In Store, enables customers to purchase products online but return them in a physical retail location if needed. This model enhances customer convenience by allowing returns without the hassle of shipping products back. It also reduces return processing times and provides retailers with an opportunity to convert returns into new sales in-store. The key distinction of BORIS lies in its focus on post-purchase flexibility, improving the overall customer experience while reducing return-related logistics costs.

*Ship From Store (SFS)* involves using physical retail locations as mini-distribution centers to fulfill online orders. This model is especially effective for retailers with large store networks, as it allows for faster and more localized shipping. By utilizing store inventory, SFS helps reduce delivery times, particularly in urban areas where proximity to customers is a critical factor. The primary difference between SFS and other methods is its focus on store-based fulfillment, which enhances delivery speed and reduces the burden on centralized distribution centers.

*Ship To Store (STS)* is a fulfillment option where customers order products online and have them shipped to a nearby store for pickup. Unlike BOPIS, where the product is already in stock at the store, STS allows customers to access a wider range of products by leveraging the retailer's entire inventory network. This model is particularly beneficial for high-demand or

specialized items that may not be stocked at every location. The main advantage of STS is that it expands product availability without the need for extensive store inventory.

In summary, each type of omnichannel fulfillment - whether it's BOPIS, BORIS, SFS or STS - addresses specific customer needs and logistical challenges. BOPIS emphasizes convenience and speed, while BORIS focuses on flexibility and customer control. SFS and STS, on the other hand, optimize inventory utilization and logistics. Together, these models provide retailers with the tools to create a seamless omnichannel shopping experience, aligning with evolving consumer behaviors and market demands.

## **5. LAST-MILE DELIVERY-ORIENTED LITERATURE RESEARCH FOCUS**

To identify and understand dominant research directions within the last-mile delivery a keyword-based analysis of the existing literature was conducted. Using the Scopus database, by observing all articles in English, published between 2014 and 2024 with the term “last-mile delivery” within the title or abstract, a total of 715 papers were identified.

A keyword-based analysis of paper titles and abstracts was performed using VOS Viewer software. A total of 98 keywords with occurrence in more than 15 papers were derived and allocated to four cluster groups, based on their co-occurrence association strength (Figure 1).



delivery on omnichannel fulfillment will shed new light onto the importance of optimizing and further developing these activities.

## **6. CONCLUSION**

Last mile delivery is becoming one of the most relevant topics in contemporary literature in the field of trade, especially retail. The importance of the topic is imposed by the modern consumer, who is characterized by a desire for comfort and convenience, as well as excellent information and access to various tools offered by the modern Internet. A consumer equipped in this way requires that, at one moment, the goods be delivered to desired address and at another moment he can pick them up from a fixed point when he is on the move, whether it is a store where he can top up his purchases or at a parcel machine that he can visit outside of working hours' time.

Technological progress is challenging retailers to raise the level of service by considering the options of delivery anywhere, delivery from any point of supply, same day delivery and so on. Research has shown that retailers are optimizing their business model by combining pick-up points from their own warehouse with other suppliers' warehouses or from the retail store. On the other hand, they are ready to deliver the parcel to an address or to a store or parcel machine, even accepting to send redirects during the delivery process. The delivery tracking service during the journey of the goods from the dealer to the customer is becoming an expected must-have part of the service.

An analysis of the extensive literature dealing with the issue of last mile delivery points to four areas into which it is possible to classify the published texts. The first group of papers is the largest and deals with various problems of the last mile delivery process, including, for example, the problems of delivery costs, pollution costs, etc. Another extensive group of research papers deals with the use of different means of transport during the last step of delivering the goods to the customer. These articles deal with the use of drones, then the use of autonomous vehicles without drivers and similar solutions resulting from technological progress. The third group of texts deals with the growing literature in the field of artificial intelligence and its application in the creation of last mile delivery algorithms. Finally, the fourth group of authors in their texts deals with the already very present procedures of automation and the introduction of robots to facilitate and cheapen the procedure within the last mile delivery process.

The development of research in the field of last my delivery is completely certain. New research will be stimulated by some development trends in the field of trade, especially retail. The first important trend refers to the development of digitalization of processes in trade, strengthening the role of artificial intelligence in better predicting the needs and expectations of consumers. Another important dictate from the market comes from the labor market, which on the one hand, is characterized by improved professional readiness of workers i.e. higher level of education, and on the other hand, by the decreasing number of workers, especially for operational executive positions. By crossing these trends, we get the growing importance of automation

and the use of artificial intelligence in last-mile delivery processes. This is what researchers in this field will increasingly deal with.

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