The Future Delivered: Rethinking Last Mile in the Age of Instant Gratification

Arjun Sharma

Google Cloud Supply Chain
San Francisco, California
arjunsharma4@gmail.com

Received Jan 16, 2024, **Revised:** Feb 04, 2024, **Accepted:** Feb 20, 2024, **Published Online:** Feb 27, 2024
Reviewers: Anonymous Peer Review
Citation: Sharma, A., 2024. The Future Delivered: Rethinking Last Mile in the Age of Instant Gratification. *International Journal of Supply Chain Management, 13*(1), 1-15, https://doi.org/10.59160/ijscm.v13i1.6218

***Abstract*— This study explains the problems faced in last mile delivery (LMD) and suggests innovative solutions for them. The demand for home delivery services for delivering small package to the customers' doorsteps has expanded rapidly due to the exponential growth of online shopping. Last mile delivery has now become a key success factor for any business, thanks to the rapid development of information and communication technology (ICT), e-commerce and the COVID-19 pandemic. Final-mile delivery on the very same day as placing the order for a product, has turned out to be a critical success factor for businesses, since modern-day customers have grown new habits and hence new expectations - the expectation of expedited demand fulfillment through door-step delivery of the products they shop online. Though the costliest leg of the supply chain, LMD will always be what creates the competitive edge for the e-commerce. It is necessary for sustenance and success.**

***Keywords*—** *last mile, last mile delivery, supply chain, supply chain management, logistics, logistics management, SMC*

1. Introduction

For more than 10 years, there has been an exemplary shift in the international retail arena with all the retail firm quickly shifting to eCommerce channels from the conventional brick-and-mortar stores. For keeping their businesses germane or viable in an age where internet is an inseparable part of daily life, every business has no choice but to take the decision to go online. This is why it will be most appropriate to say that the internet has been able to transform the long-established conventional retail business into today's eCommerce [1].

Presently Supply Chain Management (SCM) has undergone significant structural change due to rapid development of ICT and e-commerce, change in the nature of consumer demand, consumer psychology and growing need for instant gratification. SCM now encompasses activities that were conventionally believed to be aspects of production, logistics, marketing, and operations management [2]. A modern online shopper now expects the products to be delivered at his or her doorstep on the very same day as placing the order, sometimes within a few hours. Retailers are finding it a crucial success factor – a key matrix in determining superior client service provided through shopping experience This has resulted in the growing importance of last mile delivery.

The culminating part of transportation in the logistical chain is also referred to a s the "last mile" phrase [3]. Last-mile delivery refers to the final phase in the process of delivery. Along its journey, a product generally passes from a warehouse shelf (generally at a distribution center), onto a truck that carries the product to the doorstep of the end user which is the final step of this process, and is termed as the last-mile of delivery. This last leg of the supply chain, the last-mile delivery, in general has very high shipping costs associated with it [4]. But that is just one aspect of the problems associated with it. There are several other problems associated with this segment of supply chain management. Out article delves into logistics management to provide an in-depth understanding of these problems and strives to provide innovative solutions.

2. Literature Review

A supply chain takes care of the conversion of raw materials into finished goods along with the delivery

Copyright © ExcelingTech Pub, UK (http://excelingtech.co.uk/)

of the products, on time, to actual consumers [5]. It, therefore, involves the whole gamut of activities from the procurement of raw materials to the supply of finished goods to the end-users and includes not only suppliers, manufacturers, distributors, and retailers, but also the end-users or the final consumers. It, therefore, is essential that these business processes relate to the general capability of the business and are aligned with the overall organizational goal. [6]. In the recent years, the spectacular growth of e-commerce acted as strong motivation for the expansion and progress of retail and logistics industries [7]. A firm needs to develop its strategic capabilities in order to handle its supply chain efficiently.

Figure 1: Global B2C e-commerce sales and growth – Pitney Bowes Parcel Shipping Index 2 [8]

Due to modification or alteration in the shopping behavior of the consumer, there has been changes in the "last mile", the expanse between the point of sale of a product and its final destination. Prior to online shopping, consumers we in charge of the last mile delivery. They themselves took care of transportation of whatever they purchased, to their households. However, with the exponential rise in online shopping, as people started purchasing everything online from books to furniture to shoes to sofas, and with the development and large-scale application of information and communication technologies ecommerce continued to witness double-digit growth. This made it necessary for the online merchants to revolutionize and remodel their last-mile delivery experiences in a bid to create the competitive edge essential for retaining their customers by offering superior customer services compared to their peers. At the global level, e-commerce is experiencing high growth CAGR of approximately 10% empowered by next generation technologies [9].

2.2 Understanding the Evolution of Supply Chain Management

Supply Chain Management refers to the methodology of developing and enhancing the business processes, which helps to make them better resilient with higher agility and ultimately results in higher competitiveness [5]. The scope and definition of supply chain management has always remained dynamic, changing with the contemporary needs of businesses. However, the primary function of SCM is continues to be the improvement in the competitiveness of the product or service offered by the business. From the both vertical and horizontal points of view, an integrated supply chain goes a long way into improving the level of performance of the firm [6]. The current structure of Supply Chain Management (SCM) has undergone a large change because of increase in e-commerce transactions. The culminating part of transportation in the logistical chain is also referred to as the "last mile" phrase [3]. The consumers remain the key focus in any supply chain, simply because the foremost principle behind the existence of any supply chain is the gratification or satisfaction of the needs of the final consumers or end-users and in the process generate profit for the business to ensure its viability and continuity (Chopra and Meindl, 2001). Initially Supply Chain Management was associated with the management of inventory within a supply chain. Later the concept was broadened to include management of each and every single function within a supply chain [11].

2.3 Understanding Last Mile Delivery (LMD)

The last mile or last kilometer, in supply chain management and transportation planning, refers to the final leg of any journey that comprises the movement of passengers and merchandises from the transportation hub to its final destination [12]. The primary aim of last mile delivery logistics is to deliver the parcel to the end customer on priority

[13]. More often than not, the last mile delivery will range from just a few blocks to 50 and sometimes even 100 miles [1].

Shipments, in the parcel carrier industry, reach a central depot that is reserved completely for an urban area, following a long-haul transportation using a truck, generally from other hubs or warehouses [14]. After reaching the unloading dock the goods are docked, trailers are then opened, and shipments get unloaded sequentially onto a conveyor. Quite a few of the terminals belonging to the postal service industry make use of telescope conveyors. These have the capability of being extended into a trailer that can help to reduce the efforts applied by the workers in physically unloading the goods from the trucks or containers and carrying them to the dispatch area. The central sorting system are thus connected using the conveyors, which are generally in the shape for a loop and consist of trays that are inclined. Addressees of shipments are automatically recognized, e.g., by OCR software or scanning a barcode, shipments are isolated each onto a separate tray, and circle through the terminal [8].

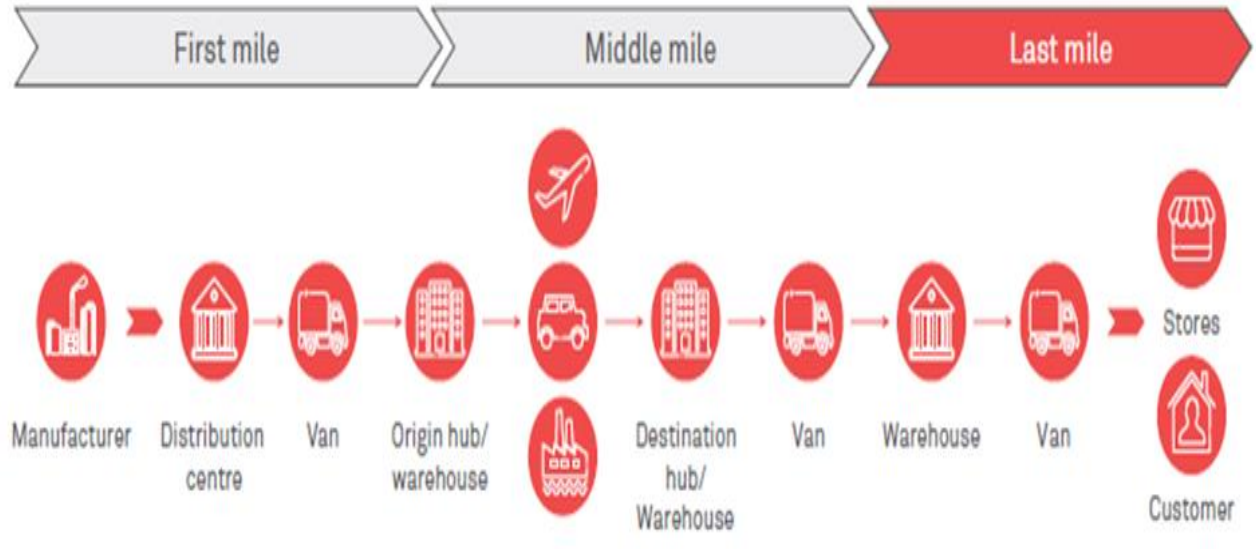

Figure 2: Last Mile Delivery Process [8]

Over the last 15 years (2005–2020) the number of articles, concerning last mile delivery, that have been published, has seen considerable increase. An exhaustive analysis of the literature reveals 5 dimensions of the last mile: 1) last mile delivery, 2) transportation, 3) operations, 4) distribution and 5) logistics. Each one of these aspects is related to the other and has clustered characteristics. For example, operational characteristics include last mile operations, last mile transportation as also last mile delivery, in contrast last mile distribution is tactical in nature, while last mile logistics can be categorized to have strategic characteristics. Also, it has been observed that despite the fact the sustainability concept can be incorporated into all levels of the last mile, the focus of current literature landscape is predominantly eon the operational aspects of last-mile [15]. Last-mile delivery works by transforming a business through the improvement in the customer experience, increase in sales and revenues, reduction in costs, and enhancement of efficiency and betterment of operations. Consequently, businesses have the potential to develop and acquire their competitive edge in the contemporary retail industry [16].

2.4 Importance of Last Mile Delivery in Supply Chain

The COVID-19 pandemic was a game changer especially in the e-retail industry. The new data published by Adobe shows that $1.7 trillion was spent in the U.S. on online shopping during the last couple of years, when there was global pandemic. it is $609 billion higher than what was being spent during the 2 years that preceded the COVID-19 and represents about 55% rise in expenditure undertaken online [17]. The exponential increase in last mile delivery over the last few years can be attributed to the remarkable expansion of same-day delivery services alongside the growth of e-commerce. The pandemic was a key reason behind the intensification of this effect and at present what we are witnessing is an alteration in the ways in which our society, in general, and logistics, in particular, operate [18]. Getting the last-mile delivery correct is likely to have an enormous effect on the prospects of any business because of the simple reason that it is high-priced and it has an important role to plays in providing customer satisfaction [19].

Periodic delivery of parcels to many end customers is impacted in the logistic network. Several strategies and logistic models have been devised to lessen the major cost which is correlated with this operation. Distribution logistics use these models to manage the problem effectively [20]. Numerous scenarios are enumerated which describe the relation between economic, technological, cultural dimensions, and new transport solutions are subsequently developed.

Quick commerce startups have focused on ultrafast deliveries, generally aimed at catering to those consumers who require a smaller collection or combination of goods within just a few minutes. This approach was particularly helpful during the global pandemic last year and yielded positive results, but since then the growth has slowed down [21].

The last-mile delivery phase of logistics is vital for the effectiveness of the full supply chain logistics management. This critical phase is the key to a happy and delighted customer, but it is also a hard task to achieve. The leadership of the organization may seem to be working at cross purposes by sudden change in list of requirements on the one hand the consumers who are waiting for products while there has been an environmental activist group who are raising red flags about the carbon emissions that would result from the production [22].

For any business an efficient last-mile process has the capacity to help the business bring down its logistics costs through the minimization of the time and resources that are necessary for delivery. This can also be helpful for businesses for reducing the risk of damage or delay during transit [23].

Despite the fact that it is possible to incorporate the concept of sustainability into every level of last mile, the current focus of majority of the literary work is on the operational aspect of last mile delivery.

2.5 Global Last Mile Delivery Market

The market for last-mile delivery is spread across the global having a large number of regional segments. Every single region is unique in nature with its own separate characteristics that is influenced by several factors which include local regulations, consumer behavior, and most importantly the infrastructure of that region. However, every one of these regions are witnessing growth in accordance with the spill over from the exponential rise in e-commerce (where the pandemic acted as the catalyst) and the increasing demand for fast delivery services [24].

The worldwide market size for last mile delivery was valued at US$131.5 billion in 2021 [25] and US$ 132.71 billion in 2022 and is anticipated to expand at a compound annual growth rate (CAGR) of 8.8% from 2023 to 2030 [26] and $288.9 billion by 2031 [25]. The rise in consumer expectations, regarding same or next-day deliveries of the purchased products, had been a major factor driving the growth of this market. Change in the nature of consumer demand made visibility and the real-time tracking of the products, in transit, imperative for both buyers and sellers. This was further complicated by the increase of on-demand services which faced significant challenges due to urban congestion and considerations pertaining to sustainability [26].

The market for last-mile delivery is characterized by a landscape that is fiercely competitive and dynamic. The competition is hardened by the presence of a large number of players offering a plethora of different delivery solutions that can cater to the increasing demands and diverse needs of individual consumers and businesses. The last-mile landscape, therefore, embraces established logistics providers, well-known e-commerce behemoths, pioneering and inventive startups, and technology firms. The major players in the industry will make attempts to increase their prominence in terms of market share through the application of different development strategies, which include launching new or improved products and mergers & acquisitions. In addition to this, these firms unremittingly introduce novel features aimed at providing superior customer experience, which further intensifies the already fierce competition within the last-mile delivery market [26].

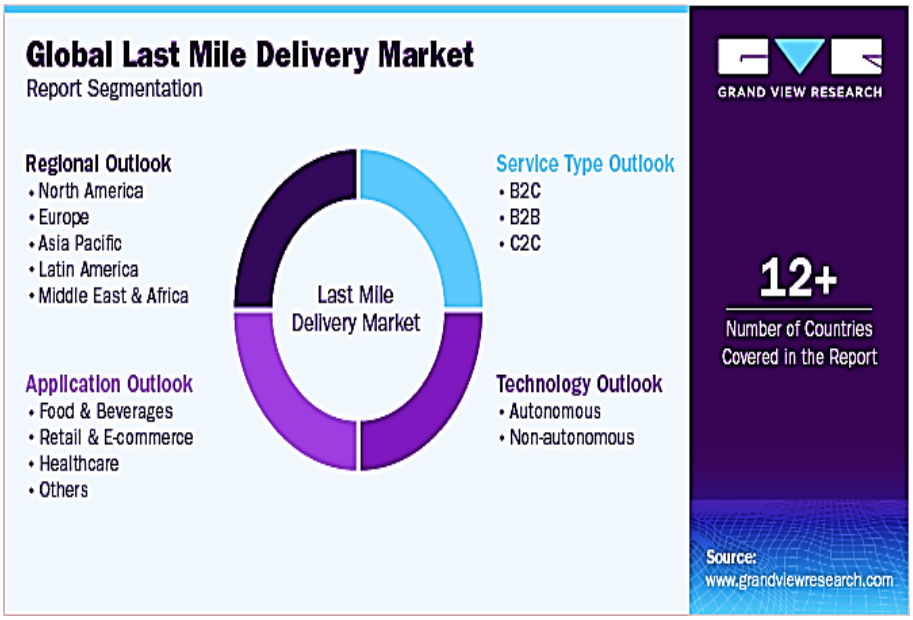

Figure 3: Global Last Mile Delivery Market [26]

Last mile delivery market growth continues to be driven by such factors as the progress and expansion of the e-commerce industry and upsurge in trading activities, on account of globalization, technological progressions in delivery vehicles, and sustained rise in demand for speedier delivery of packages to the final consumers [25]. Among all the regions, Asia Pacific is anticipated to witness notable expansion with a CAGR of 11.1% over the next 4-5 years, as a result of the robust growth of the region and its transformation into one of the most important forces in the rapidly evolving logistics landscape. The dominance of the Asia Pacific region in the last-mile delivery market is believed to be the outcome of several key drivers. There has been spurt and exponential rise in e-commerce activities in this region led by the rise in middle-class population, significant increase in market penetration of smartphones, and rapid expansion of internet connectivity, leading to a huge increase in online shopping and demand for efficient deliveries. [26].

The marvels of same-day delivery and drone deliveries have been able to redefine the consumer experience and convenience of these clients. As a result of which various eCommerce companies are constantly trying to find various ways to stay in this cut-throat competition [1]. Investments undertaken by prominent market players and their innovations had been instrumental in boosting the growth of the last mile delivery industry. For instance, “Scout”, a delivery robot, was launched by Amazon. It was a small machine that was of the size of a small cooler and was capable of rolling along and navigating sidewalks and make delivery of packages at the doorstep of customers [27]. This was what encouraged Amazon to present an innovative concept in the field of autonomous last mile delivery service. The forecast for automotive last mile delivery market is anticipated to behold several types of developments that are the outcome of the initiatives undertaken by top companies, thus leading to the growth of the market [25].

The transport of goods through freight train networks and merchant ships is considered as the most efficient and cost-effective route of shipping goods. The flip side of this is when goods reach the high-capacity freight station of shipping port, they must be transported to their final destinations without delay. This last phase of the supply chain is more often than not the least efficient and covering almost 53% of the total shipment cost. This has thus been coined as the “last mile problem”. This problem could also include delivering in urban localities. Shipment to retail store owners, restaurants and various other merchandise in contributing to central business hub may result in bottlenecks and several other safety issues [4].

The streamlining of last mile logistic facilities by Amazon has propelled competing retailers to strengthen their own last mile delivery logistics to compete with Amazon. The smoothness of Amazon last mile delivery logistics has induced CEOs of other major transportation and logistics companies to evolve by developing alternative logistical strategies [28].

2.6 Problems of Last Mile Delivery

The concept of last mile delivery pertains to the concluding phase of the logistics process and involves the transportation of goods from a local hub or a distribution center to the final destination, which usually is the doorstep of the customer or a retail store. There are quite a few factors, both internal and external, that combine together to make last mile delivery a challenging task for companies to accomplish. The following in particular have a decisive role to play.

1. Traffic Congestion: This refers to the traffic in the urban areas, traffic jams, the time taken for loading and unloading of the products, areas that are remote or are difficult to access.
2. Inefficient Delivery Routes: Frequently the location of the warehouses would be outside the cities, which helps to reduce distances needed to be covered for product delivery. Nevertheless, planning routes in advance is essential to ensure timely delivery.
3. Costs Involved: The process of last mile delivery is as extremely expensive one. Nevertheless, the goal will always be to deliver the order to the customer with the minimum time lag or minimum delay or, in other words as soon as possible and that too without any charge. For this reason, any inefficiency within the process has a definitive role to play in significantly escalating the costs, which includes fuel charges, and brings down the performance level of the company [28].

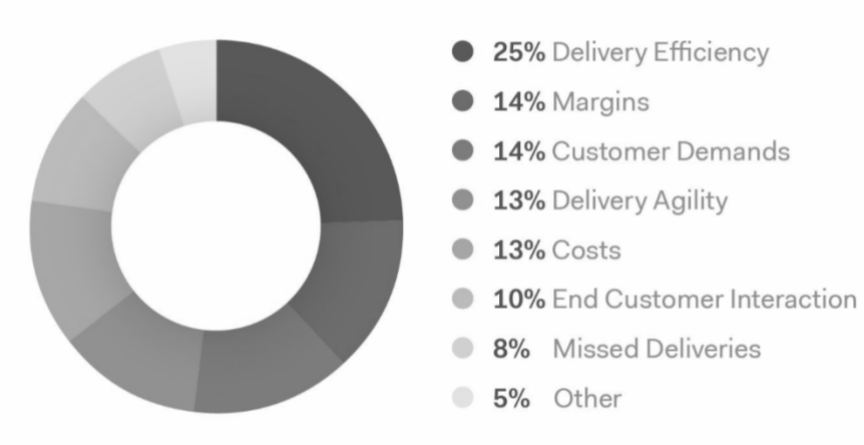

Figure 4: Key Last Mile Problems [29]

It can hence be said that all the loopholes that pertain to this final leg of the supply chain are referred to as the last mile delivery problems. The foremost purpose of the last mile delivery is to deliver the correct package to the right customer without any significant delay; which means that each one of the elements which has the potential to cause hindrance and make the delivery process inefficient are the last mile delivery problem [1].

The ever-growing volume of smaller shipments and variation in their frequency, fueled by the growth of e-commerce, present a huge challenge to the providers of logistics service [30]. Increasing volume of parcels to be delivered to the customers' door steps result in the increase in the number of delivery vans that are entering the city centers and this keeps adding to the vehicles to the already heavy traffic leading to congestion, pushing up the levels of pollution, and creating negative impact on the health of the population [31]. At the same time, innovations and novel technologies are being fostered with the objective of increasing the efficiency of providers of logistics service, as much as foster the creation of new enterprises and business models in the home delivery sector [30].

Parcel Delivery can be termed as the final step in Supply Chain Networks (SCN) and it is coined as the Last Mile Delivery (LMD) problem. It is usually modelled as a routing problem, wherein Distribution centers are located from where vehicle fleets collect the parcels and deliver them to the end customer [32]. The problem with the last mile logistics is the fact that while customers want the deliveries fast yet free, last mile logistics is also the most expensive and time intensive amounting to around 53% of the total shipping costs. Inefficiencies which get added in the last mile logistic process makes the cost of deliveries that much higher [33]. Unfortunately, inadequate and poor infrastructure and elevated logistics costs, absence of quality control of manufacturers and retailers so far as logistic services are concerned, and inaccurate postal address system are likely to continue to act as impediments to the growth of the market [25].

During actual parcel delivery operations, characteristics of the territory where the parcels are being delivered, and the type of packages are fundamental when planning the route of the vehicles. To cite an example, if the parcels to be delivered are large or heavy, only heavy vehicles could be used. On

the other hand, if most packages are small and light-weight, bikes or motorcycles or smaller delivery vans could utilize [20].

At present, online retailers are trying incessantly to catch-up with the ever-changing consumer behavior – their preferences, needs and yearnings. Shoppers not only demand fast but also free shipping. Thanks to the phenomenal growth of ICT almost everyone has access to a smart mobile device with good internet connection - nearly everyone has a device in his or her back pocket. As a consequence, people have easier and faster access to online stores as compared to before, and this has led to exponential spawning of orders and fulfillment options. At present, therefore, the customers expect their orders to reach them wherever they are physically present, be it their homes, be it their offices, or be it their vacation destinations. All these factors not only make "last mile" experience the key attribute in leaving a lasting impression on the consumers, but also plays a crucial role in getting together additional customer data that can prove hugely relevant and important for studying the market and consumer behavior and prove to be important source of business intelligence in this era of Big Data [8].

In the meantime, businesses continue to face several other difficulties related to the disruption of supply chain. The flow of expected inventory levels from producers and wholesalers to point-of-sale has now become a thing of the past. All of these groundbreaking changes should be lessons to the businesses and remind them that it has become imperative for them to effectively handle not only costs of optimizing the last-mile experience but also grab and exploit the opportunities arising out of this rapidly altering ecosystem [8]

1.2.1 *Long Wait Time*

Despite the convenience of door-step delivery and same-day or one-day delivery, customers still have to wait quite a bit before receiving their delivery. There is a significant time lag between the real-time status of the online order that reads that the package is "out for delivery" – a prominent last-mile problem. While the status gets updates that the parcel is on its way, the customers still have to wait for a considerable period of time before the parcel is finally received by him at the designated delivery location. This is a common occurrence due to the presence of numerous stops (including multiple deliveries by one delivery person) and delays in the concluding stretch of shipping. This is particularly relevant for deliveries in the urban areas. When it comes to the rural areas, slow down in delivery is caused by long distances that need to be covered in-between stops, with just a couple of packages getting delivered at each of these stops. Both the volume and the speed remain subdued. This is not to say that the situation is any better in urban areas. The urban areas face the issue of delay that is caused by traffic congestion, which is a common every-day occurrence and the intensity varies from time to time with the traffic congestion becoming particularly difficult to negotiate during peak working hours [34].

1.2.2 *Delay in Transportation*

In spite of being the most essential part of supply chain, last mile delivery is the least effective leg of the chain. Viable transport and logistics are stated as one of the main areas in which justifiable mediation would have the utmost effect in terms of aiding more sustainable routes [35, 36]. Another major hurdle in populated areas and last mile delivery logistics is supporting new policies that promote more viable parcel deliveries that has not considered, urban vehicle movements, promoting futile policies which can be sluggish to move when delivering required resources [37]. It is essential to remove these barriers to optimum last-mile delivery in order to make sure that superior quality of transportation operations is maintained and the customers are able to derive pleasant experience [38].

In Poland e-commerce achieved its success of a price. The Polish e-commerce sector is fiercely competitive, because of the presence of an intangible value chain and the ease with which the consumers are able to compare the attributes associated with the purchase of a product which includes such parameters as price, delivery, opinions related to the e-shop. The sellers on the internet compete with each other using a large number of instruments. One of the crucial factors for winning against market competition is logistics – logistical efficiency is a huge differentiator and creates sustainable competitive advantage. Deliveries, to the end customers, that are organized efficiently would, more often than not, prevail and help to determine the choice of the online store. However, it must be remembered that the key issues do not relate to the time and price of delivery. The specificity of trading via internet or more popularly eCommerce is the way the customers are dispersed in each territory. The B2C (business to customer) or retail customers usually place orders for goods in small quantities (time and again in single pieces), but they do it comparatively more often. In addition to this, in a large number of cases, the customer continues to be outside of their permanent or normal place of residence especially during the working hours of the post office or the company delivering the goods. This is a feature that is unique to the characteristics of the logistics in e-commerce. Under the circumstances,

transport companies have recommended certain solutions that have the potential to enable them to fulfil the requirements of the e-commerce market [39].

1.2.3 *High Cost*

One of the key explanations as to why last mile delivery is believed to be a crucial part of the eCommerce logistics is that it contributes to about 28% of the total cost of delivery of the final product [34]. Beyond a doubt, direct delivery to the door-steps of the consumers is a costly affair and most of the time the associated costs are not covered by the customer. The company has to bear it all. Several factors such as complex routing, traffic congestion, and the need for specialized vehicles or equipment all contribute to the high cost of final mile delivery [40]. Apart from this, the expectation from the consumers pertaining to the same-day delivery of products puts a higher burden on the company's finances. Further making things worse are the ordeal of the eCommerce companies that have to consistently face the inconsistent demands of their consumers, such as sudden spurt in the volume of purchases during the holiday season [1]. The problems are further magnified by the elevated shipping costs and inadequacies related to the last-mile problem which are the outcome of the ongoing wave of ecommerce sales in the United States. This has resulted in the increase in the volume of packages delivered on a day-to-day basis, and customer expectations have gone up significantly and ask for not only quick but also free delivery [34].

1.2.4 *Lack of Transparency*

Transparency is crucial element for the success of any business. The consumers need to be at the top of every information such as where exactly are their packages located and how much time will they take to reach the said consumer. As a response to this, several of the businesses especially the 3PLs started generating the codes necessary for tracking the products that are in transit for being delivered to the customers. These codes that are used for tracking allow the consumers to acquire some form of visibility over the delivery of their product. Nevertheless, these fell short of the expectations of the modern customers who are habituated with receiving on-demand services and constantly need to be aware of the progress of the process of delivery of their purchase to their doorsteps [1]. Such clients tend to demand full access to the instantaneous visibility of the delivery of their purchased goods. In simple terms these consumers ask for ways and means for tracking the entire last mile delivery phase of the products they purchase.

1.2.5 *Lower Efficiency*

As always, customers continue to remain the key factor that drive the logistical aspect of the last mile and push for increased efficiency in eCommerce logistics [1]. The package can actually have a large number of destinations as well as pickup places which depends on the type of delivery that is requested by the client, such as doorstep delivery that is attended by the client, doorstep delivery that is not attended by the client, delivery at the reception boxes, or at the post offices [41]. A number of other challenges that are tied in with the need to have higher efficiency can mean only one thing, which is faster delivery. Almost every one of the industries has been penetrated by what is called the "on-demand" business model that boasts of ensuring delivery of services and products at a lightning speed while providing the convenience of online retail purchases to the clients.

The application of last mile delivery solutions can help to achieve higher efficiency throughout the supply chain. Technology has the key role to play when it comes to the last mile delivery and same-day delivery. Technology also plays a massive part in making sure that the products purchased are automatically dispatched to the correct person, at the precise moment and in the correct area [1]. Technology, beyond a doubt, can make a significant difference by helping to increase the general efficiency of the process and the organization and later on decreasing the overall time taken for the delivery of the product. Being a crucial step in the process of delivery, last mile has the potential to affect the overall experience and satisfaction of the customers with respect to the company. Poor last-mile efficiency can result in the delayed or damaged delivery of products purchased, frustration of the customer, and ultimately, loss of business [23].

1.2.6 *Friction*

Customer friction refers to any impediment or obstacle that makes the customer either hesitant to complete their customer journey and in worst cases would urge them to even leave the seller [42]. Zendesk's Customer Experience Trends Report [43] A frictionless delivery, therefore, serves as a boon for every eCommerce company since it assures elevated efficiency levels and bigger reductions in expenses. Handling all sorts of customer inquiries related to their delivery is one of the largest hindrances that result in the friction in last mile delivery. These inquiries encompass a large number of things related to the ways in which their packages ought to be

delivered. For instance, it has to be delivered only on weekdays and during office hours or such demand as contact less delivery in which the insist that the delivery boy should not ring the doorbell. In order to make sure that the delivery process remains frictionless, the companies need to employ sophisticated state-of-the-art technology that will facilitate continuous and open communication between the customer and the delivery person [1]. With growing customer demands, achieving frictionless delivery can be a challenging task. That is why it's important to keep track of potentially problematic areas that can disturb operations [19].

2. Discussion

At present, the efficient movement of material flow to the end user from the producer is one of the key missions of logistics. A large part of this comes down to the last mile delivery process of a company. The last-mile delivery market has turned into an essential constituent of the logistics industry worldwide, taking care of the delivery of goods to final consumers, on time. With the thriving of the e-commerce sector and consistent ascent of consumer expectations, the final-mile or last-mile delivery market is also witnessing constant growth and continuous innovation [24]. It means that, for an organization to remain viable and sustainable in this market, it is absolutely necessary that they get hold of get hold of means and ways to augment their efficiencies in this area. This a crucial part of the supply chain of a business organization and companies, without exception, especially in the e-commerce industry will want to make sure that they make it as quick and as efficient as possible. This warrants constant supervision of the process and technological upgradation and innovation, in order to stay abreast of the what is happening in the industry, how rivals are upgrading themselves. Needless to say, a significant amount of fund needs to be committed for this purpose and this makes it is the most expensive leg of the journey taken by the end products in order to reach their ultimate destination.

Various state-of-the-art scientific methods have been developed and dedicated to finding solutions for different problems arising at various stages of the logistics system. However, the operational efficiency and effectiveness of the logistics system in terms of last mile delivery is considered to be a conundrum that is separate from the problems of augmenting the general efficiency including the final consumers [44].

In this age of online retail, the processes of the last-mile delivery projects acquire a lot of importance as they are the ones who have the most impact on the competitive edge of the online businesses simply because they have several touchpoints with the customers as well. As a result of these connection issues, it becomes essential to address the delivery process itself with cutting-edge innovative solutions. The next stage of the delivery project is last mile shipping, in which, a package is made to move from a shipping hub to either the home of the consumer or a grocery store which is its factual destination [45].

Across the world, the present state of a large number of industries is being defined by the momentous growth of e-commerce. The last mile is an offshoot of the final leg of the supply chain that came into higher focus by the sudden surge in the e-commerce (e-retail in particular) driven by rise in consumer demand for door-step delivery. Door-step delivery became particularly important during the COVID period when mobility of the general public was either nil or severely restricted. Last mile delivery, hence has witnessed a immerse rise in popularity during the latest pandemic period, because of the growth in demand for door-step and contactless delivery of the products purchased [25]. But in the post COVID period, the convenience of getting their purchases delivered to their door-steps with minimum hassle and at a time most convenient for them has kept the demand high. With the continued growth in the flow of e-commerce orders, annual revenue generation is hitting record highs almost every year. The key players in the last mile are facing such difficulties as handling the ever-growing customer demand and the consequent rapid and substantial expansion in the volumes of transportation. For handling such situations both e-retailers and providers of logistics services work towards implementing innovative service solutions, frequently empowered by technological developments [46].

2.2 Paradox

There is no doubt that the presence of an efficient last mile delivery is necessary for keeping the consumers happy. Consumers now-a-days want fast delivery of their products to their door steps. However, they also want this to be a free service. But due to the very nature of this leg of supply chain it is extremely expensive if not the most. It is also the most time-consuming part of the supply chain of any product. Nevertheless, it is easy for consumers to switchover to the rival if a company fails to provide these

services in accordance with consumers' desires and preferences. Which means the companies have no choice but to undertake these vast expenses themselves for strengthening their last-mile process and make it as efficient as possible with regular supervision and upgradation in order to ensure that the customers receive top-class services – essential for customer retention and for growing customer base further.

Last mile shipping could make up for as much as 53% of the total cost of a shipment and typically, firms absorb about one fourth of that cost themselves, but this figure is gradually rising because of inefficiencies of the supply chain that are resulting in continuous escalation of cost [47]. The rapid and exponential expansion of online shopping has augmented the demand for Last Mile Delivery, with majority of the consumers preferring home delivery of their purchases over all other options [48]. An increasing number of consumers ask for online orders, speedier delivery, and flexible methods of delivery [41]. All these conveniences, however, should go to them without any addition to the cost of purchases. Added services at no additional cost - value addition at the same price, nothing extra. It is, therefore, obvious that last-mile efficiency has the power to affect the reputation of a business, both positively (if the clients are happy with the timely delivery of products) and negatively (when the clients are disgruntled). The well execution of last-mile process has the potential to enhance the reputation of the business, while poor last-mile efficiency can thoroughly damage the reputation.

2.3 Emerging Solutions

From the foregoing discussion it is evident that the process of the last-mile delivery projects is the most impactful one so far as online businesses are concerned since this is related to multiple touchpoints with the customers. The next stage of the delivery project being last mile shipping, in which a package moves from the shipping hub to the actual destination of the end-product, which usually is either the home or office of the consumer or is a grocery store. Since this is the most significant step in the process of distribution of goods, every firm wants to make sure that this part of the journey of a product remains hassle-free and moves ahead as smoothly as possible [46].

Meeting the supply requirements of demand created by shippers is a hurdle that is being tackled by numerous last mile tech platforms. These logistic organizations, help to bridge the gap which enables the shippers' real time data being received and the receiver thus allowing managers to act on priority when situations like delayed delivery, error in shipment address or product damage needs to be dealt with. Currently, many retailers are partnering with numerous third-party services like Instacart and even ones like Shipt. But paying heed to current trends in inflation and economic uncertainty, most consumers are not willing to dole out extra payments to avail same day delivery benefits [46].

Successful orchestration of orders for reaching the last mile necessitates the presence of a mixture of solutions. At present, either these solutions are emerging and are being adopted or in process of being scaled, or are evolving and are undergoing various stages of development and are being deployed as pilot projects or test runs. These solutions can be broken down into following three areas:

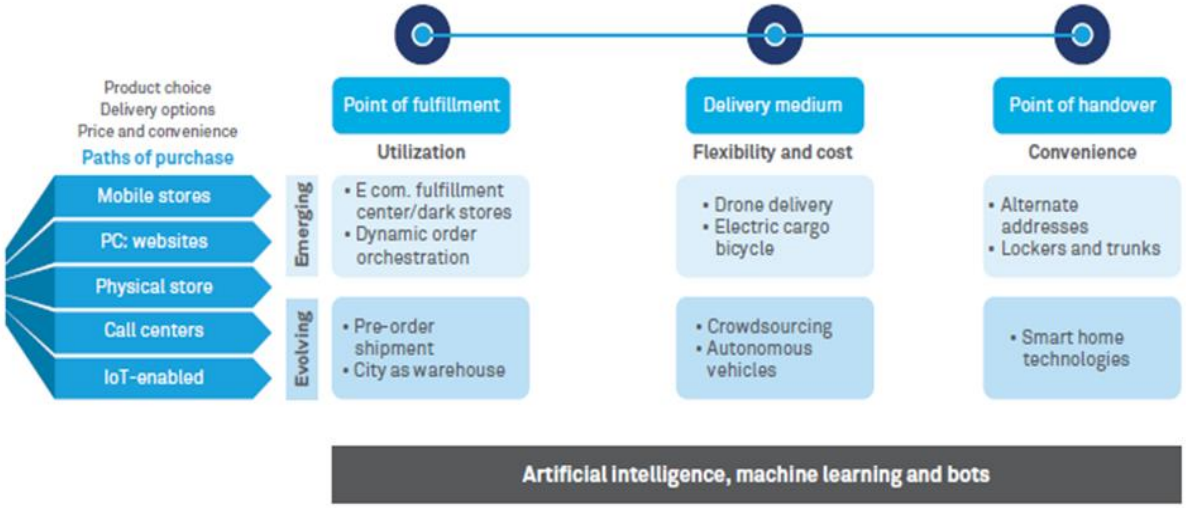

Figure 5: Fulfilment solution path [8]

A case study of last mile delivery logistics shows a state where viable ICT can lead to smarter policy decisions, and improved route scheduling, urban planning, and collaboration to promote viability. Our vision is reinforced by a proposal for an ICT platform to qualify intelligent and sustainable last mile delivery logistics that provides a number of opportunities for calculating and ICT research to engage in this important yet under braced domain [3]. The implementation of sophisticated logistics technologies in an extensive manner, including the use of real-time tracking systems, algorithms for the optimization of routes, and application of automated delivery solutions, has improved the efficiency and enhanced the visibility of last-mile operations. The combination of the impact caused by these drivers have solidified the leadership position of North America in the last-mile delivery market in 2022, which endorsed this region's assurance towards addressing the developing needs of contemporary consumers in this modern digital era. With the continued expansion of e-commerce and advancement in the logistics technologies, North America appears to be poised for maintaining its influential role in shaping the future of last-mile delivery [26].

Numerous ways are open for research about drone collaboration for last mile delivery. E-commerce evolution and vehicle RFID technology will enhance logistic distribution as a fertile area. Provided the relevance of LMD limitations in the economic, technological and environmental spheres, it is our expectation that our contribution will assist the ongoing exploration of novel collaboration approaches between drones and other transportation vehicles [20].

3. Recommendation

Execution of deliveries is an extremely responsible and tough work to carry out since the company is constrained by time and a massive volume of deliveries every day. Hence, it is crucial to have a proper plan on execution in place along with a route plan that can help to identify the most cost-effective route for product delivery [50].

3.1 Localized Parcel Collection & Distribution Hubs

The companies can have small parcel collection and distribution centers located in specific locations which are at the center of their operational fields. From the data the company collects about customers it is possible to identify areas to which the most number of deliveries go. A hub can be located at approximately the center of such regions. The hubs would be able to cater to a radius of 15 - 20 kms surrounding its location. While there will be warehousing costs involved, the transportation costs, cost of monitoring, bringing back undelivered products or products returned or refused, would be significantly lower. Also, the company would be able to cut down on the time of delivery lost due to traffic congestion. Some of the delivery locations can even be covered on foot.

3.2 Employing School and College Kids having their own Two Wheelers

The school and college kids look for earning quick money from part time jobs. They can be employed at lower pay-scale. Recruiting the local kids also has another advantage. They are the most well-versed with the road network in the area, especially the short cuts. Using alleys and lesser used roads that are congestion free and even the short-cuts, these young stars would be able to deliver parcels at a faster speed, reducing the wait time for the consumers between "out for delivery" and "delivered" status of their purchases. Having their own two wheelers make their commutations easy. The fuel costs would be borne by the company. This way expenses on garage and maintenance of the vehicles would be the expense heads that the company can avoid.

3.3 Use of Cargo Bi-cycles for Commutation of Delivery Executives

This is a solution designed for the delivery process that is being suggested for reaching the heart of large cities where the common feature is traffic jams and vehicular congestion. Cycles move faster, with ease and even through the roads where larger vehicles cannot make a headway. For delivery of smaller parcels, that are not lumpy and can be easily carried away, using these bicycles to commute. Due to the very nature of the vehicle, it is pollution free and clean. Hence the problem of environmental pollution will be taken care of. A fleet of cargo bi-cycles can replace delivery vans which can be exclusively used for delivery of lumpy products such as furniture.

These cargo bicycles can be used to deliver smaller and lighter parcels from micro depots that can be located closer to the routes the bicycles generally follow. This will help to minimalize the time taken by return journeys. Two-wheelers can easily move though narrow spaces and lanes unlike large delivery vans and it will not make sense to use them for small deliveries.

3.4 Self-Service

Door-step delivery, an attractive last-mile solution offered by the eCommerce service providers is not hassle free. It is expensive and time consuming. Moreover, the consumers want this service at zero cost to them. Making a large number of stops for delivering a small size parcel is not only inefficient but time as well as cost-consuming. The delivery executive needs to make a stop at each one of the customer's residences, walk up to their doors, and check out in person if someone is present at home to receive the delivery. If not then such a delivery is considered to be a failed one and the parcel that was to be delivered, now needs to be returned to the depot where it will be stored for another delivery attempt in the near future or for a pickup by the customer himself from a location agreed mutually. The other alternative is for the delivery person to seek out a neighbor of the customer where the goods package can be left with the express permission of the client. This again creates the possibility or the risk of loss of the product. To avoid all these problems the company may offer a self-service locker at the locality post offices for storing the parcel at a nominal cost. The packages can be dropped off at these centers and stored in these lockers and the clients can pick them up at a time most convenient for them.

4. Conclusion

The face of retail and shopping has changed markedly over the last two decades, thanks to the rapid development ICT and the proliferation of handheld internet enabled mobile devices that have made shopping possible even from the comfort of their own home. To add to that the global pandemic relegated the consumers to their homes making them opt for door-step no-contact delivery. This neither was nor is an easy task for the online sellers who had to absorb the cost of delivery to ensure the consumers remain happy and the quality of service is maintained in the fiercely com. In particular, logistics related to last mile, are gradually assuming dimension which has a bigger perspective than simply the necessity to ensure the consumers' convenience and being an exercise for optimization of transportation. The COVID-19 has been a huge threat to nearly every aspect of modern day-to-day life. The related operational responses have been practically completely more reactive in nature than proactive. In a similar manner, the logistics networks that connects the consumers to the goods have remained under tremendous pressure because of substantial increase in online shopping. The article has highlighted the key problems involved in last mile delivery and suggested certain probable solutions. It is clear from the discussion that LMD is the critical differentiator and it is here to stay as long as ecommerce is there. So it is essential that this part of the supply chain remains robust and companies should keep improvising to ensure superior customer satisfaction. What is important is keeping in mind the use of cost saving solutions that are also environment friendly. Hence the suggested remedies are expected to add less to costs besides using green energy and green

transportation to deliver to their customers.

References

[1] Fixlastmile, "Last mile delivery for eCommerce: Challenges, benefits, and future implications," 21 Feb 2020. [Online]. Available: https://www.fixlastmile.com/blog/last-mile-delivery-for-ecommerce/. [Accessed 08 Jan 2024].

[2] J. T. Mentzer, T. P. Stank and T. L. Esper, "SUPPLY CHAIN MANAGEMENT AND ITS RELATIONSHIP TO LOGISTICS, MARKETING, PRODUCTION, AND OPERATIONS MANAGEMENT," Journal of Business Logistics, vol. 29, no. 1, pp. 31-46, 2011.

[3] O. Bates, A. Friday, J. Allen, F. McLeod, T. Cherrett, S. Wise, M. Piecyk, M. Piotrowska, T. Bektas and T. Nguyen, "ICT for sustainable last-mile logistics: data, people and parcels," ICT4S2018: 5th International Conference on Information and Communication Technology for Sustainability, pp. 49-67, 2018.

[4] A. Samet, "Last-mile delivery: What it is and what it means for retailers: Indider Intelligence," 12 Oct 2023. [Online]. Available: https://www.insiderintelligence.com/insights/last-mile-delivery-shipping-explained/. [Accessed 11 Dec 2023].

[5] S. Parkhi, S. Joshi, S. Gupta and M. Sharma, "A Study of Evolution and Future of Supply Chain Management," AIMS International Journal of Management, vol. 9, no. 2, pp. 95-106, 2015.

[6] J. Saragih, A. Tarigan, E. F. Silalahi, J. Wardati and I. Pratama, "Supply Chain Operational Capability and Supply Chain Operational Performance: Does the Supply Chain Management and Supply Chain Integration Matters?," Int. J Sup. Chain. Mgt, vol. 9, no. 4, pp. 1222-1229, 2020.

[7] S. Moagăr-Poladian, G. Dumitrescu and I. A. Tănase, "Retail e-Commerce (E-tail) – evolution, characteristics and perspectives in China, the USA and Europe," Global Economic Observer, vol. 5, no. 1, pp. 167-178, 2017.

[8] C. Castillo and A. Jain, "Delivering on the "last mile": A shift from the traditional supply chain: Wipro," 2024. [Online]. Available: https://www.wipro.com/consulting/delivering-on-the-last-mile-A-shift-from-the-traditional-supply-chain/. [Accessed 03 Jan 2024].

[9] Statista, "eCommerce - Worldwide," Nov 2023. [Online]. Available: https://www.statista.com/outlook/emo/ecommerce/worldwide?currency=usd. [Accessed 02 Jan 2024].

[10] J. Saragih, A. Tarigan, E. F. Silalahi, J. Wardati and I. Pratama, "Supply chain operational capability and supply chain operational performance: Does the supply chain management and supply chain integration matters," Int. J Sup. Chain. Mgt, vol. 9, no. 4, pp. 1222-1229, 2020.

[11] M. Habib, "Supply Chain Management (SCM): Theory and Evolution.," in Supply Chain Management - Applications and Simulations, InTech, 2011, pp. 1-14.

[12] M. Kiba-Janiak, J. Marcinkowski, A. Jagoda and A. Skowrońska, "Sustainable last mile delivery on e-commerce market in cities from the perspective of various stakeholders. Literature review," Sustainable Cities and Society, vol. 71, 2021.

[13] FarEye, "What is last mile delivery? The definitive guide," 10 Oct 2022. [Online]. Available: https://fareye.com/what-is-last-mile-delivery. [Accessed 05 Dec 2023].

[14] N. Boysen, S. Fedtke and S. Schwerdfeger, "Last-mile delivery concepts: a survey from an operational research perspective," OR Spectrum, vol. 43, pp. 1-58, 2021.

[15] N. T. Ha, M. Akbari and B. Au, "Last mile delivery in logistics and supply chain management: a bibliometric analysis and future directions," Benchmarking: An International Journal, vol. 30, no. 4, pp. 1137-1170, 2023.

[16] C. Woods, "The benefits of last mile delivery for businesses - Locate2u," 21 Feb 2023. [Online]. Available: https://www.locate2u.com/last-mile-delivery/benefits-of-last-mile-delivery/#:~:text=Last%2Dmile%20delivery%20transforms%20a,in%20the%20modern%20retail%20industry.. [Accessed 08 Jan 2024].

[17] J. Koetsier, "E-Commerce Jumped 55% During Covid To Hit $1.7 Trillion," Forbes, 15 Mar 2022.

[18] R. Patel, "What is Last Mile Delivery? Importance, Trends, and Technology: UpperInc," 26 Oct 2023. [Online]. Available:

https://www.upperinc.com/guides/what-is-last-mile-delivery/. [Accessed 03 Jan 2024].

[19] Elogii, "E-Commerce Last-Mile Delivery - How to Stay Ahead of the Changing Landscape," 10 May 2022. [Online]. Available: https://elogii.com/blog/e-commerce-last-mile-delivery/. [Accessed 03 Jan 2023].

[20] J. Gómez-Lagos, A. Candia-Véjar and F. ENCINA, "A New Truck-Drone Routing Problem for Parcel Delivery Services Aided by Parking Lots," IEEE Access, vol. 9, no. 2021, pp. 11091-11108, 2021.

[21] A. Samet, "Last-mile delivery: What it is and what it means for retailers," 12 Oct 2023. [Online]. Available: https://www.insiderintelligence.com/insights/last-mile-delivery-shipping-explained/. [Accessed 09 Jan 2024].

[22] C. Woods, "The benefits of last mile delivery for businesses - Locate2u," 21 Feb 2023. [Online]. Available: https://www.locate2u.com/last-mile-delivery/benefits-of-last-mile-delivery/#:~:text=last%2Dmile%20delivery-,Improved%20customer%20service,enhance%20the%20overall%20customer%20experience.. [Accessed 13 Dec 2023].

[23] Driver Logistics, "Last Mile Efficiency: The Make or Break Factor for Your Business: LinkedIn," 01 Feb 2023. [Online]. Available: https://www.linkedin.com/pulse/last-mile-efficiency-make-break-factor-your-business-/. [Accessed 11 Jan 2024].

[24] Wise Systems, "Last-Mile Delivery Market Size: Growth Trends, Projections & More," 07 Aug 2023. [Online]. Available: https://www.wisesystems.com/blog/last-mile-delivery-market-size/. [Accessed 07 Jan 2024].

[25] Allied Market Research, "Last Mile Delivery Market," Allied Market Research, 2022.

[26] Grand View Research, "Last Mile Delivery Market Size, Share & Trends Analysis Report By Service Type (B2C, B2B, C2C), By Technology (Autonomous, Non-Autonomous), By Application, By Region, And Segment Forecasts, 2023 - 2030," Grand View Research, 2023.

[27] M. Moon, "Amazon will no longer publicly test its Scout delivery robots: Engadget," Oct 07 2022. [Online]. Available: https://www.engadget.com/amazon-ends-scout-robot-test-113516997.html. [Accessed 09 Jan 2024].

[28] Keshavdas M, "How Amazon Uses Last Mile Delivery To Improve Logistics:," 28 Jun 2022. [Online]. Available: https://www.fleetroot.com/blog/how-amazon-uses-last-mile-delivery-to-improve-logistics/. [Accessed 11 Jan 2024].

[29] AR Racking, "What is last mile delivery and why is it so important for logistics?," 14 Nov 2023. [Online]. Available: https://www.ar-racking.com/en/blog/what-is-last-mile-delivery-and-why-is-it-so-important-for-logistics/. [Accessed Jan08 2024].

[30] Onfleet, Inc., "What is The Last Mile Delivery Problem? Here's How to Solve it," 05 Jan 2023. [Online]. Available: https://onfleet.com/blog/last-mile-problem/. [Accessed 05 Feb 2024]

[31] M. Ghajargar, G. Zenezini and T. Montanaro, "Home delivery services: innovations and emerging needs," IFAC-PapersOnLine, vol. 49, no. 12, pp. 1371-1376, 2016.

[32] N. Boysen, S. Fedtke and S. Schwerdfeger, "Last-mile delivery concepts: a survey from an operational research perspective," R Spectrum, vol. 43, pp. 1-58, 2021.

[33] M. Joerss, J. Schröder, F. Neuhaus, C. Klink and F. Mann, "Parcel Delivery: The Future of Last Mile," McKinsey & Company, New York, NY, USA, 2016.

[34] FarEye, "5 Innovative Strategies to Tackle the Last Mile Problem in Delivery and Logistics," 13 Oct 2022. [Online]. Available: https://fareye.com/resources/blogs/last-mile-delivery-problem-and-solution#:~:text=The%20last%20mile%20problem%20lies,the%20cost%20of%20deliveries%20higher.. [Accessed 05 Dec 2023].

[35] A. Samet, "Last-mile delivery: What it is and what it means for retailers," 12 Oct 2023. [Online]. Available: https://www.insiderintelligence.com/insights/last-mile-delivery-shipping-explained/. [Accessed 03 Jan 2024].

[36] WWF, "The potential global CO2 reductions from ICT use: Identifying and assessing the opportunities to reduce the first billion tonnes of CO2," 2008.

[37] L. Hilty and J. C. T. Bieser, "Opportunities and risks of digitalization for climate protection in Switzerland," University of Zurich., 2017.

[38] M. Goulden, T. Ryley and R. Dingwall, "Beyond 'predict and provide': UK transport, the growth paradigm and climate change.," Transport Policy, vol. 32, pp. 139-147, 2014.

[39] A. N. Weber and J. (. A. Badenhorst-Weiss, "The last-mile logistical challenges of an omnichannel grocery retailer : a South African perspective," J Trans Supply Chain Manag, vol. 12, no. 1, pp. 1-13, 2018.

[40] M. Moroz and Z. Polkowski, "2nd International Conference "Green Cities - Green Logistics for Greener Cities" - The Last Mile Issue and Urban Logistics: Choosing Parcel Machines in the Context of the Ecological Attitudes of the Y Generation Consumers Purchasing Online," in Transportation Research Procedia, Szczecin, Poland, 2016.

[41] P. Sykes, "Last Mile Delivery Costs — Challenges and Solutions: Routific," 09 Jun 2023. [Online]. Available: https://www.routific.com/blog/last-mile-delivery-costs. [Accessed 10 Jan 2024].

[42] S. Sorooshian, S. K. Sharifabad, M. Parsaee and A. R. Afshari, "Toward a Modern Last-Mile Delivery: Consequences and Obstacles of Intelligent Technology," Appl. Syst. Innov., vol. 5, no. 4, pp. 82-97, 2022.

[43] Ellogii, "Frictionless Delivery That Elevates Customer Experience," 12 Jul 2021. [Online]. Available: https://elogii.com/blog/frictionless-delivery/. [Accessed 11 Jan 2024].

[44] Zendesk, "Customer Experience Trends Report 2020," 2021. [Online]. Available: https://d1eipm3vz40hy0.cloudfront.net/pdf/cxtrends/cx-trends-2020-full-report.pdf. [Accessed 09 Jan 2024].

[45] A. Galkin, L. Obolentseva, I. Balandina, E. Kush, V. Karpenko and P. Bajdor, "Last-Mile Delivery for Consumer Driven Logistics," Transportation Research Procedia, vol. 39, pp. 74-83, 2019.

[46] M. Suguna, B. Shah, S. K. Raj and M. Suresh, "A study on the influential factors of the last mile delivery projects during Covid-19 era," Oper Manag Res, vol. 15, no. 1-2, p. 399–412., 2022.

[47] Y. Vakulenko, P. Shams, D. Hellström and K. Hjort, "Service innovation in e-commerce last mile delivery: mapping the e-customer journey," J Bus Res, vol. 101, pp. 461-468, 2019.

[48] Onfleet, Inc., "Last Mile Delivery: What it is and How You Can Succeed at it," 21 Jan 2023. [Online]. Available: https://onfleet.com/blog/what-is-last-mile-delivery/. [Accessed 08 Jan 2024].

[49] G. Calabrò, M. Le Pira, N. Giuffrida, M. Fazio, G. Inturri and M. Ignaccolo, "Modelling the dynamics of fragmented vs. consolidated last-mile e-commerce deliveries via an agent-based model," Transp. Res. Procedia, vol. 62, pp. 155-162, 2022.

[50] D. Anwar, "Do Consumers Really Prefer Same-Day Deliveries? The Results Of This Survey May Surprise You: Digital Information World," 08 Aug 2022. [Online]. Available: https://www.digitalinformationworld.com/2022/08/do-consumers-really-prefer-same-day.html. [Accessed 11 Nov 2023].

[51] R. Patel, "Amazon Last Mile Delivery: How Amazon uses Last Mile Delivery for its Logistics: UpperInc," 07 Nov 2023. [Online]. Available: https://www.upperinc.com/blog/amazon-last-mile-delivery/. [Accessed 11 Jan 2024].