Changes in Patterns of Home-Based Shopping and its Last-Mile Delivery Logistics Services in Korea

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Abstract

With the advancement of online shopping, a new form of consumer activity known as home-based shopping has experienced rapid growth in Korea. It is no exaggeration to attribute the success of this home-based shopping surge to the efficient logistics services, particularly last-mile delivery services that ensure the timely and accurate delivery of online purchases to the designated delivery locations.
In Korea, this type of logistics service is referred to as “lifestyle logistics service”, which is responsible to deliver and distribute goods for individual’s or household’s everyday life such as groceries, personal care products, household essentials and other items supportive to one’s daily living.
Recognizing these trends, Korea Ministry of Land, Infrastructure, and Transport (MoLIT) has legislated the *Last-Mile Logistics Industry Development Act* in 2021.
This study aims at exploring the changing trends in home-based shopping and its supportive logistics service focusing on last-mile delivery logistics services such as parcel delivery and instant delivery, while suggesting improvement strategies to more sustainable last-mile delivery logistics systems. It also examines how the COVID-19 pandemic has impacted to home-based shopping customer behavior and the quantity and quality of last-mile delivery services. It helps to forecast the future stage of last-mile delivery logistics service supporting so-called “lifestyle logistics services” in Korea, so that five strategies to secure more resilient and responsive quality of last-mile delivery services toward the “new normal” era are recommended.
These five strategies include (1) augmenting transportation capacity by promoting modal shift to railways, upsizing vehicles, and introducing division of labor to last-mile delivery process; (2) increasing the capacity of logistics facilities by newly establishing or expanding hubs and sub-terminals, and implementing smart equipment and integrating high technology to adapt an advanced automation; (3) securing last-mile delivery infrastructure such as last-mile delivery stations and establishing an advanced delivery system; (4) achieving a sustainable and balanced supply and demand system of manpower by enhancing job quality and introducing dedicated work training program for skillful labor; and (5) establishing a supportive framework for innovation in last-mile delivery logistics systems in terms of technical, financial, and legal and institutional support.

Keywords: home-based shopping, online shopping, internet shopping, mobile shopping, last-mile delivery service, parcel delivery, instant delivery, food service platforms, two-wheelers, “lifestyle logistics services”, *Last-Mile Logistics Industry Development Act*, COVID-19 pandemic, new normal

INTRODUCTION

Purpose of study

The term of “lifestyle logistics services” in Korea refers to the delivery and distribution of goods that are part of an individual’s or household’s everyday life. This encompassed a broad range of items such as groceries, personal care products, household essentials, and other items related to one’s daily living. The core of this logistics services lies in the last-mile delivery service.

The objective of this study is to propose the strategies for sustainable logistics service systems to improve and enhance the last-mile delivery services, especially toward the new normal era. For this objective, this study explores how new business based on home-based shopping has shaped the structure of last-mile delivery services. It also examines how COVID-19 pandemic impacted to home-based shopping customer behavior and the quantity and quality of last-mile delivery services, to forecast the future stage of last-mile delivery logistics service supporting so-called “lifestyle logistics services” as a key sector in Korea.

Background

Traditional consumption activities were traditionally conducted through face-to-face interactions between sellers and consumers in physical markets or retail stores. This form of consumption involved visiting an actual store to make purchases, with variations based on product types. For instance, items like home appliances and furniture were often delivered and installed after consumers visited the store and made a purchase. Even in the case of grocery shopping, if the weight or volume was substantial, consumers could request home delivery services. Dairy products such as milk or freshly squeezed green juice were commonly delivered to homes either daily or on specified days of the week. Some restaurant foods such as specific Korean Chinese styled noodles and dishes and pizza were also frequently ordered through home delivery services.

Since the mid-1990s, consumer activities have evolved with the emergence and development of cable TV home shopping and catalog shopping. This marked a shift towards consumers ordering and receiving products without physically visiting stores. Simultaneously, parcel delivery services experienced significant growth. In the 2000s, the advent of internet shopping further transformed the landscape, with various online markets and shopping businesses experiencing active growth. Post-2010, the expansion of e-commerce accelerated, driven by the rise of social commerce and app-based shopping facilitated by smartphones and integrated app-based payment systems. Additionally, the COVID-19 pandemic has accelerated the trend towards non-face-to-face consumption activities, particularly home-based shopping.

The surge in new consumption patterns has, in turn, spurred the development of linked logistics services. This has given rise to specialized last-mile delivery services encompassing direct delivery through self-logistics systems, parcel delivery services (i.e. courier services), instant delivery using two-wheelers, and cloud delivery. The scope has expanded to include the delivery of food and daily necessities through small cars, personal mobility, and public transportation like subways.

Recognizing these changes, the Korean government, specifically the Ministry of Land, Infrastructure, and Transport (MoLIT), has defined and legislated businesses related to "last-mile delivery services" and the "last-mile delivery logistics industry."

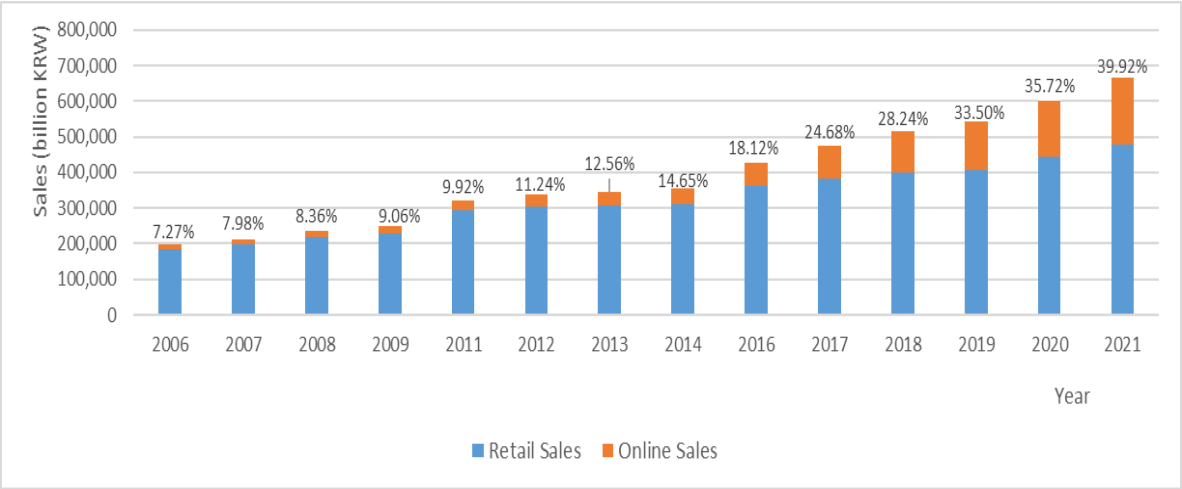
Given these transformations, it is crucial to anticipate the future of delivery logistics services business by examining the shifts in consumption activities resulting from the rise of home-based shopping. This analysis will inform the development of appropriate policies and strategies necessary for fostering sustainable and high-quality logistics services.

HOME-BASED SHOPPING: ONLINE SHOPPING

Growth of Online Shopping

Examining Figure 1, which illustrates the growth trend of Korean online shopping, provides an intuitive insight into the expansion of home-based shopping. Statistical data from 2006 indicates that out of the total retail sales of approximately 18.52 trillion won, online shopping sales constituted only about 1.34 trillion won, or 7.27%. However, the trajectory of online shopping sales experienced consistent growth. By 2021, the total retail sales had reached around 47.65 trillion won, with online shopping accounting for approximately 39.92%, equivalent to about 19.02 trillion won.

Monthly statistics derived from Statistics Korea's online shopping trend survey further highlight this growth. Korea's total online shopping sales escalated from approximately 7.31 trillion won in January 2017 to 18.05 trillion won in December 2021. This signifies a remarkable increase of approximately 147% over the span of five years, with a monthly average growth rate of approximately 1.52%. Such consistently high growth underscores the substantial shift towards online shopping in the Korean market.



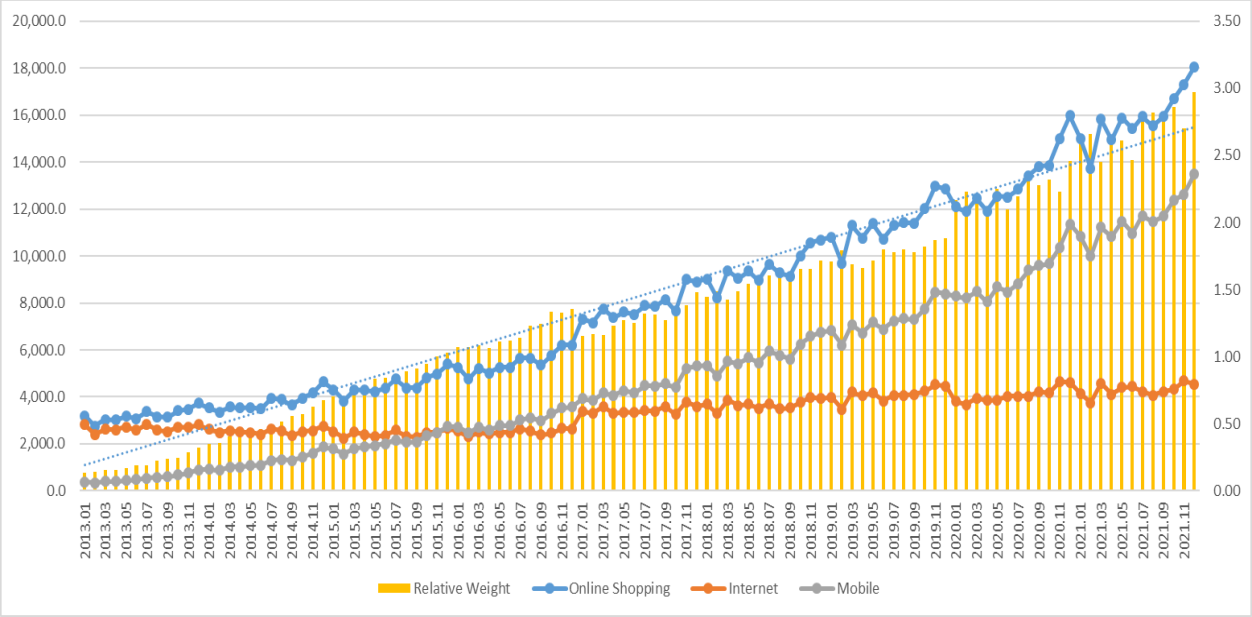
Note: The percentage figure indicates the percentage of online sales in total retail sales for each year.
Source: Statistics Korea, *Industry Statistics for Wholesale, Retail and Services*, https://kosis.kr.

Figure 1. Growth of Online Retail Sales

The expansion of online shopping is driving a transformation in the patterns of consumers' daily economic activities, specifically leading to the widespread adoption and growth of home-based shopping.

Changes in Purchasing Channels

The expansion of shopping through mobile devices has significantly outpaced the growth seen in the earlier method of internet shopping, particularly with the widespread adoption of smartphones. While both internet shopping and mobile shopping exhibit upward trends, it is evident that mobile shopping is experiencing a much more rapid growth rate. The relative ratio of internet to mobile did not surpass the 0.5 level until July 2014, reached the 1.0 level by the end of 2015, and as of December 2021, the gap has widened substantially to 2.97 times.



Note: The relative weight refers to the proportion ratio of mobile shopping sales over internet shopping sales. And, the unit of sales is billion KRW.

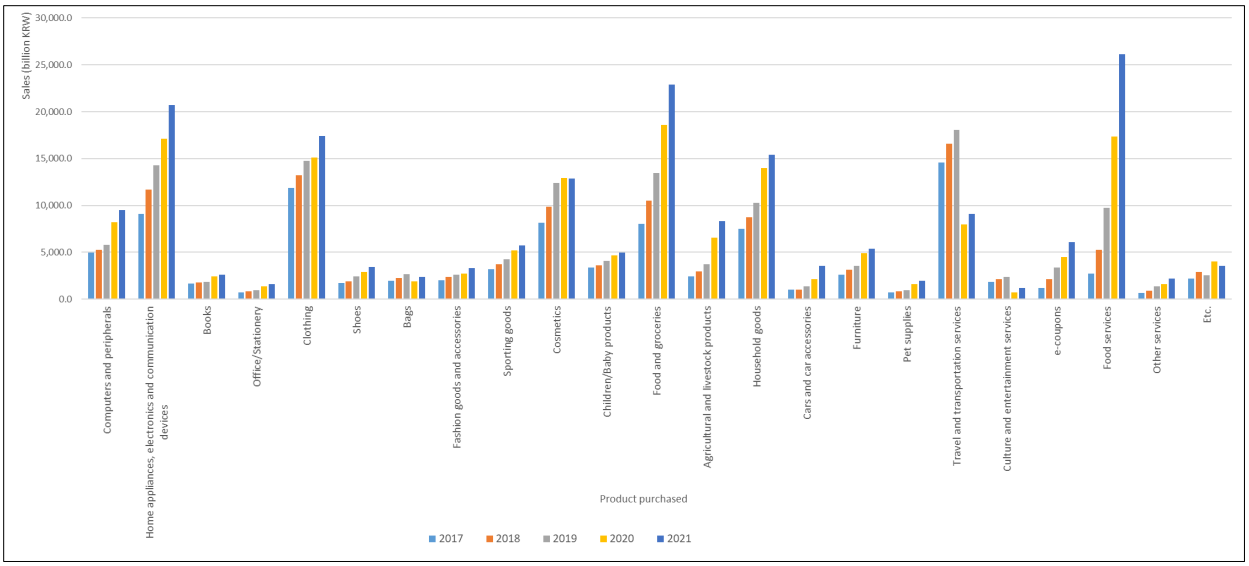
Source: Statistics Korea, *Online Shopping Trends Statistics*, https://kosis.kr.

Figure 2. Sales by purchasing channel in online shopping

Changes in Products Purchased

Analyzing trends in the proportion of online shopping purchases over the past five years reveals a shift in the types of items bought online. Previously, online purchases were predominantly intangible services like travel services or performance tickets, or standardized items like clothing that does not easily incur damage during delivery. However, since 2017, there has been a decline in the relative proportions of these items, while the proportions of food services, food and beverages, groceries, e-coupon services, as well as home appliances, electronics, and communication devices have seen a remarkable increase.

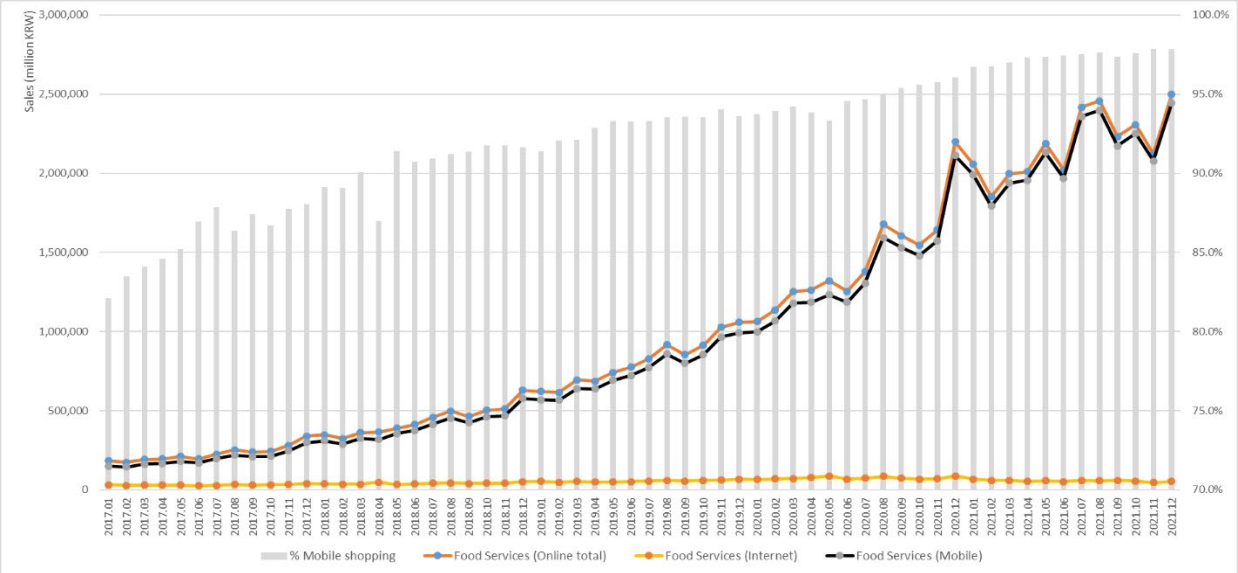
This diversification in purchased items, ranging from daily necessities such as groceries to durable goods like home appliances and electronics, signifies a noteworthy evolution in online shopping. The successful delivery of these varied items without issues or compromise in quality has played a pivotal role in establishing consumer trust in the online shopping process.



Source: Statistics Korea, *Online Shopping Trends Statistics*, https://kosis.kr.

Figure 3.Online Shopping Sales by Group of Products

Particularly striking is the transformation in the food service category of online purchases. Previously limited to conventional options like pizza, Chinese food, and lunch boxes, recent trends indicate an expanded range that includes offerings from high-end and gourmet restaurants. This shift underscores the potential for sustained growth in the online shopping business. Emphasizing the unique challenges faced by food service, especially the impact of cooling on the taste of cooked food, underscores the significance of prioritizing speed in delivery services. The remarkable surge in instant delivery services using two-wheelers further emphasizes the dynamic nature of this specific market segment.



Source: Statistics Korea, *Online Shopping Trends Statistics*, https://kosis.kr.

Figure 4. Online Sales of Food Services

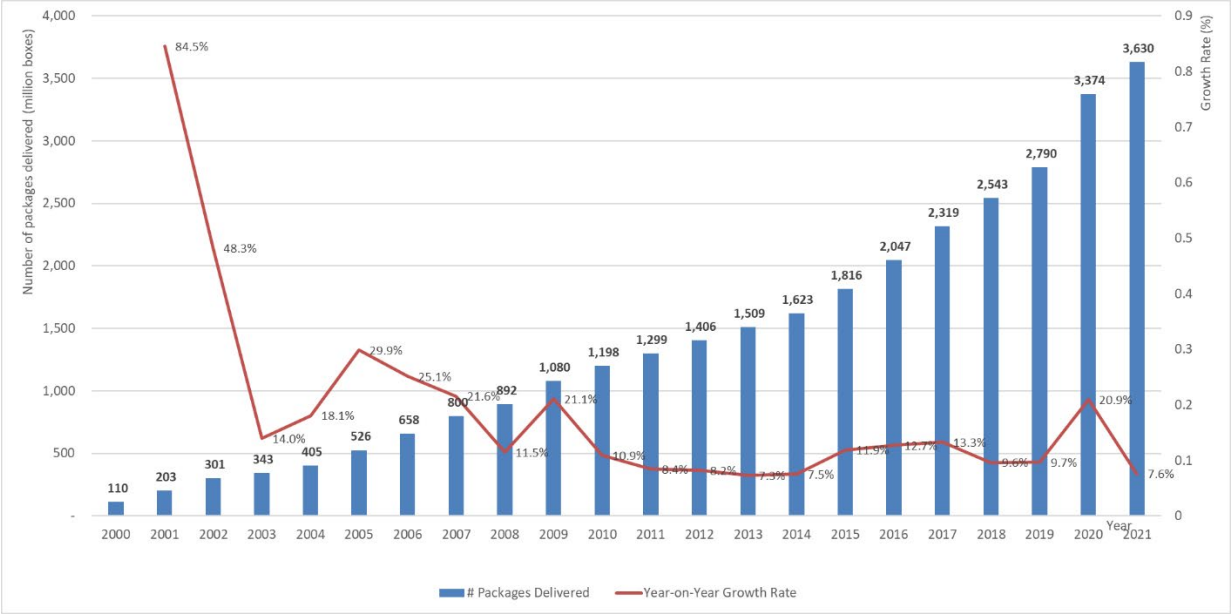
From January 2017 to December 2021, the food service sector recorded a noteworthy average monthly growth rate of 4.45%, showcasing a rapid expansion nearly three times higher than the overall online shopping sales growth rate of 1.52%. A distinctive feature of food service, setting it apart from other items, is its predominant reliance on mobile sales, as highlighted in Figure 4. This emphasizes the significant role played by mobile platforms in driving the substantial growth observed in the food service sector.

ADVANCEMENT OF LAST-MILE DELIVERY LOGISTICS SERVICES

Parcel Delivery Services (Courier Services)

Since 2010, the emergence and rapid growth of social commerce have diversified the range of items purchased through online shopping, and the age range of online shopping users has expanded. This has become a new driving force for the expansion of parcel delivery volume. Additionally, the widespread impact of COVID-19 towards the end of 2019 prompted a swift transition to a non-face-to-face economy, resulting in an explosive increase in delivery volume.

According to the statistics by Korea Integrated Logistics Association, the parcel delivery volume, which began with approximately 5 million boxes in 1992 when delivery services were first introduced in Korea, has seen substantial growth over the years. The volume increased to 110 million packages in 2000, 1,198 million in 2010, 3,374 million in 2020, and further rose to 3,630 million packages in 2021, maintaining a trajectory of rapid growth.

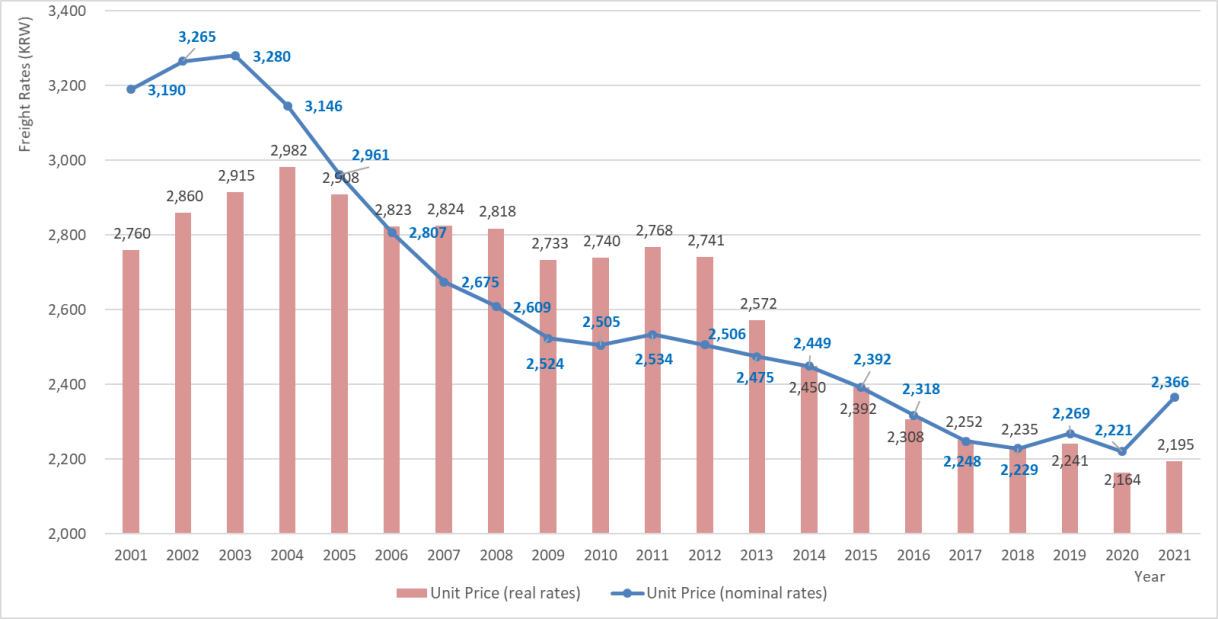


Source: Korea Integrated Logistics Association (KILA), Last-Mile Delivery Logistics Service Statistics: Trends in packages handled by parcel delivery services, National Logistics Information Center.

Figure 5. Number of Packages handled by Parcel Delivery Services

Due to fierce competition among courier companies, the average freight rate has consistently declined. The nominal delivery fee per package decreased from 3,280 Korea won (KRW) in 2003 to 2,221 KRW in 2020. Accounting for the consumer price index for parcel delivery services, the real delivery fee also dropped from 2,982 KRW in 2004 to 2,164 KRW in

2020, representing a decline to 72.6% of the peak level. While this reduction in freight rates has benefited consumers by fostering increased price competitiveness, it has created challenges for workers. Lower rates have led to reduced wages for delivery workers, exacerbating their working conditions. In 2021, the unit price for each courier company was increased in line with the implementation of the 'social agreement,' aimed at safeguarding the welfare of courier workers. The average freight unit price was determined to be 2,366 KRW, indicating an increase of 145 KRW compared to the previous year.

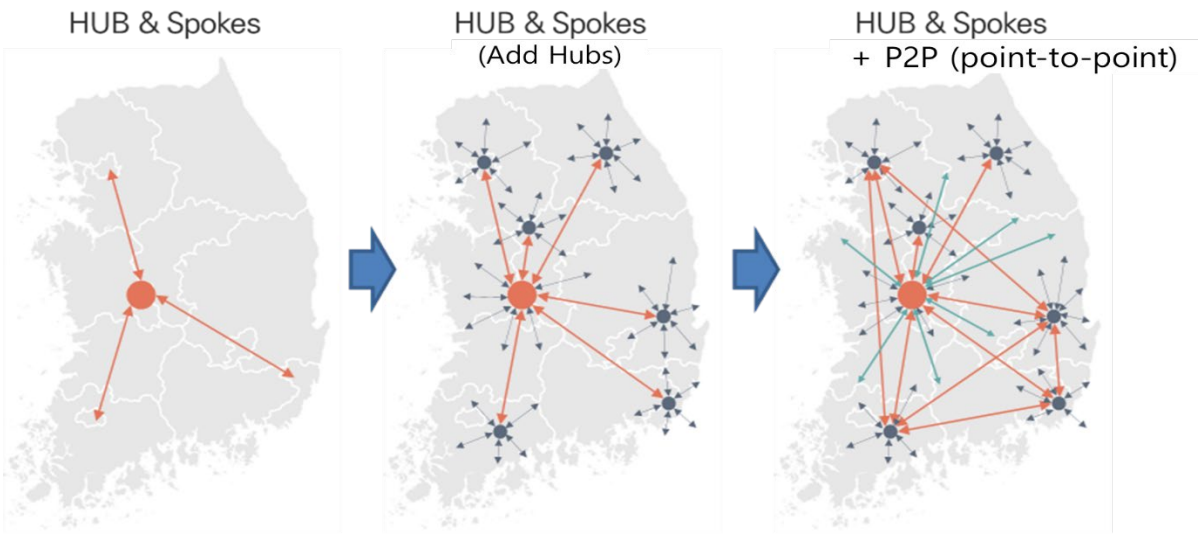


Source: Korea Integrated Logistics Association (KILA), Last-Mile Delivery Logistics Service Statistics: Trends in average freight rates for parcel delivery services, National Logistics Information Center; Statistics Korea, Consumer Price Index (CPI), https://kosis.kr.

Figure 6. Trends in the Average Freight Rates of Parcel Delivery Services

As the demand for delivery services experiences rapid growth, parcel delivery companies have adapted their response strategies. The parcel delivery service business, traditionally operating on a hub-and-spoke logistics network, initially established hub terminals near transportation or geographical centers to create a logistics service network. However, due to the continuous increase in cargo volume, the industry transitioned to a multi-hub network, installing and operating additional hub terminals in various regions. Most recent developments have led to the adoption of a hybrid network, combining both hub-and-spoke systems and Point-to-Point (P2P) networks.

Concurrent with these network changes, significant transformations are underway in the processes for parcel delivery services. The traditional one-delivery-per-day system, encompassing daytime home delivery, nighttime trunk transportation, and hub terminal and sub-terminal sorting functions, became insufficient to handle the surging parcel freight volume. In response, the sorting capacity of hub terminals and sub-terminals was expanded, and a two-delivery system per day was introduced. To accommodate the rising parcel freight volume, considerable investments are being made in automation and intelligence to enhance the capacity of hub terminals and sub-terminals.



Source: Seo, *et al.*, 2022, *Innovation Strategy for Transport System after COVID-19 (Part 2): Improving the Industrial Environment of Last-Mile Logistics and Exploring Policies based on Field Survey*, Korea Transport Institute, Figure 2-4, p.18.

Figure 7. Shift trends of Network for Parcel Delivery Services

Moreover, as the variety of items utilizing parcel delivery services has expanded, new services distinct from traditional courier offerings have emerged. Beyond general delivery, specialized same-day delivery, convenience store delivery, and unmanned locker delivery are now available. The market has also witnessed the diversification of delivery service products, including one-click delivery services tailored for startups, sole entrepreneurs, influencers, etc., golf bag delivery, airport luggage delivery, and airport storage services. Even within standardized delivery services, such as offering early morning and morning delivery as service products for each specific time zone, attempts at service quality differentiation based on various characteristics like delivery time, commodity, and customer preferences are being made.

Instant Delivery Services[1]

Since 2010, with the advent of food service platforms such as *Baedaltong* (initiate in April 2010), *Baedal Minjok* (June 2010), and *Yogiyo* (November 2011), food delivery services, once considered supplementary to the existing restaurant industry, have matured into an independent industry. This conceptual expansion encompasses the last-mile delivery logistics industry, inclusive of the parcel delivery service and instant delivery service business. It was formally recognized and established as a distinct classification within the logistics industry with the enactment of the Last-Mile Logistics Industry Development Act in 2021.

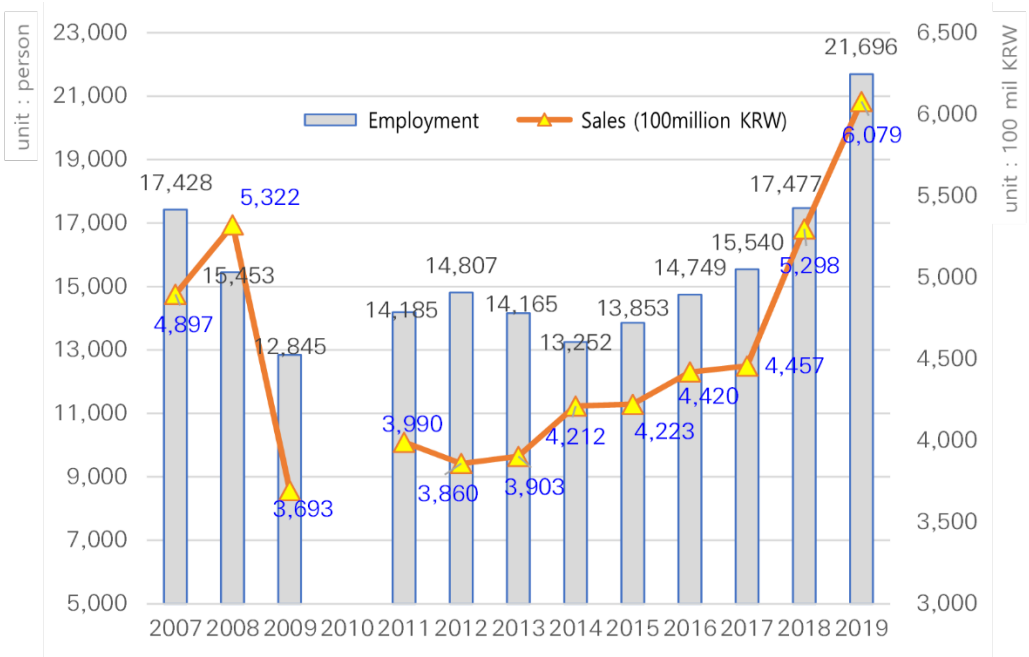
Under this legislation, only parcel delivery industry and small package delivery agency service industry are designated as sub-industries of the last-mile delivery logistics service sector. It requires to note that the small package delivery agency service industry incorporates the existing instant delivery service business (in a narrow sense), with a specific focus on motor

[1] It covers a comprehensive definition of instant delivery services, encompassing both the traditional narrow-scope instant delivery service and the small package delivery agency service specifically oriented towards food delivery, which has recently expanded to include comprehensive food service platforms business.

bicycles as the primary means of transportation. It also includes a segment of the food delivery service facilitated through the recently growing food service platforms.

Instant delivery service initially began as a service facilitating direct P2P (peer-to-peer) connections between shippers and receivers for document deliveries, utilizing motor bicycles for transportation. However, with the recent surge in home-based shopping and the growth of the non-face-to-face living economy, its business scope and scale have expanded significantly. It now includes services for ordering food and purchasing daily necessities, utilizing small cars, personal mobility (PM), and public transportation, contributing to its rapid expansion. There has been a swift transition in customer interaction from traditional phones and PCs to mobile apps. Simultaneously, the process of delivering orders to drivers has become more intricate compared to the past.

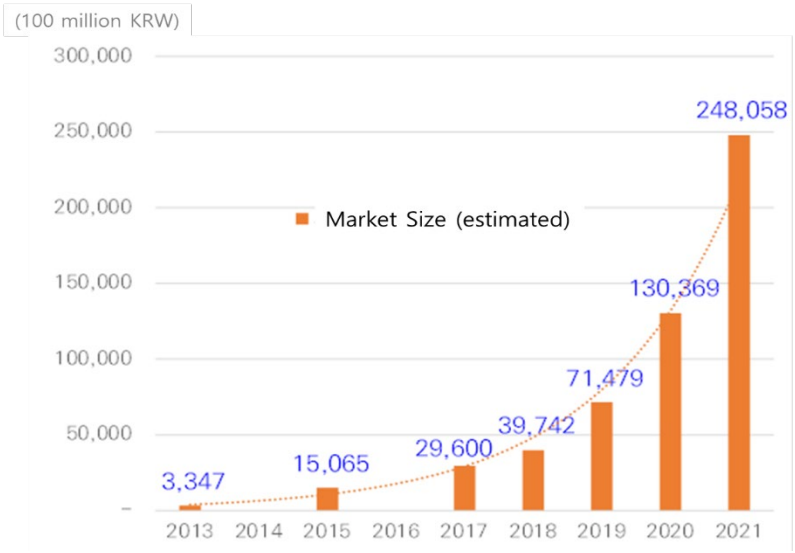
When statistics for the instant delivery service industry were compiled for the first time in 2007, employment stood at 17,428 people, and sales amounted to 489.7 billion KRW. Although there was a decrease in both employment and sales around 2010, a positive trend emerged in subsequent years. From 2014, employment began to grow, and sales started to increase from 2012. By approximately 2019, employment had grown to about 21,696 workers, and sales reached approximately 607.9 billion KRW.



Note: No data for the year of 2010 was released.
Source: Statistics Korea, *Report on the Transportation Survey*, https://kosis.kr.

Figure 8. Employment and Sales of Instant Delivery Service Industry

The food service platform business was launched in earnest towards the end of 2010. As illustrated in Figure 9, the order amount has experienced exponential growth, increasing from approximately 334.7 billion KRW in 2013 to 3.9742 trillion KRW in 2018 and further surging to 24.8058 trillion KRW in 2021.



Source: Seo, *et al.*, 2022, *Innovation Strategy for Transport System after COVID-19 (Part 2): Improving the Industrial Environment of Last-Mile Logistics and Exploring Policies based on Field Survey*, Korea Transport Institute, Figure 2-13, p.30.

Figure 9. Market Size of Food Service Platform Business (Estimated)

IMPACT OF COVID-19 AND CHALLANGES

Impact on Home-based Shopping

Examining the shifts in the consumer sentiment index following the onset of COVID-19, there was a notable decrease after reaching its peak in January 2020 (104.2). It then exhibited an upward turn in April but has been on a declining trend since the second wave of the pandemic. Across consumption categories, the travel, culture, and dining sectors experienced the most significant decline and the slowest recovery.

In the case of food service combined with instant food delivery services, it underwent rapid growth, expanding to approximately 6.5 times its size in 2017. Substantial growth in e-coupon services (274%), and sports and leisure goods (151%), home appliances, electronics, and communication devices (139%) and food and beverages (137%) were also observed.

As of March 2020, when COVID-19 spread most rapidly compared to the end of 2019, there was a stark disparity in the rate of increase/decrease by product category. Items such as automobiles and automobile accessories, agricultural, livestock, and marine products, books, household goods, furniture, and food and beverages demonstrated high growth in the mid-30s to 80% range over the past three months. Conversely, cultural and leisure services, travel and transportation services, fashion goods and accessories, cosmetics, clothing, office stationery, and bags experienced declines in the high 10s to 80% range. Comparing the first quarter of 2020 with the first quarter of 2019, total online shopping sales increased by approximately 16.79%. Sales generated logistics activities grew by 26.16%, and sales generated parcel delivery services grew by approximately 22.04%, significantly surpassing recent growth rates and indicating a robust upward trajectory.

Impact on Last-Mile Delivery Logistics Service Industry

As for the freight volume of parcel delivery, the impact of COVID-19 became pronounced in March following a significant spread in February 2020. From January to February 2020, it increased by 14.2% compared to the previous year. However, the volume of parcel delivery in March reached approximately 290 million units, marking an increase of around 18.6% compared to the average for January and February (5.2% in 2019). Moreover, even from April to July, a period that typically exhibits moderate growth, the increase was significantly higher than the established trend.

Analyzing the trend of the freight volume of parcel delivery over the past 10 years, comparing it to the same period of the previous year, the first quarter experienced an increase ranging from a minimum of 5.4% to a maximum of 13.7%, while the second quarter usually showed growth ranging from a minimum of 6.4% to a maximum of 14.8%. However, in the first quarter of 2020, when COVID-19 spread earnestly, it surged by about 19.3% compared to the same period of the previous year. In the second quarter, the initial stabilization period, it continued to rise by about 20.4%, showcasing a growth rate approximately twice as high compared to the previous year.

Regarding the impact on food delivery services, the changes in freight volume was estimated by examining the trend of changes in food service sales among online shopping sales, as discussed earlier. For the three months between March and May 2020, when COVID-19 began spreading earnestly, online sales for food services consistently exceeded the trend line.

Changes in Last-Mile Delivery Logistics Service Consumer's Behavior

An online survey was conducted with 1,153 participants during the second week of November 2020. The survey aimed to examine changes before and after the onset of COVID-19 and to forecast the future considering four different pandemic scenarios, which are the cases of endemic, stabilization, short-term eradication, and medium-term eradication.

Analyzing the changes in parcel delivery usage before and after the onset of COVID-19, it's evident that the average monthly usage by users experienced a significant increase. Before the outbreak, the average monthly usage was 6.2 times, and after the outbreak, it surged by 56.5% to 9.7 times a month. Delving into the specifics of instant delivery services, the average monthly usage before the outbreak was 4 times, but it rose by 75% to 7 times after the pandemic, surpassing the growth rate of parcel delivery services (56.5%). In addition, it is crucial to note that the age groups of the last-mile delivery logistics service users have been expanded and the production items purchased online and handled by last-mile delivery services also has been diversified.

Examining the consumer's behavior patterns in parcel delivery services, online purchases dominated before COVID-19, constituting 61.0%, followed by supermarket delivery at 15.1%, TV shopping at 12.9%, and direct overseas purchases at 9.4%. Post-COVID-19, there was a decline in overseas purchases. Notably, after the outbreak, food purchases increased by 5.6%, rising from 34.7% to 40.3%. In terms of delivery and reception methods, in-person delivery dropped from 50.2% to 19.4%, while non-face-to-face contactless delivery increased significantly by 30.8 percentage points from 49.8% to 80.6%. For instant delivery service users, in-person and non-face-to-face delivery methods were at 59.6% and 40.4%, respectively, before

the outbreak. After the pandemic, in-person delivery plummeted to 30.7%, while contactless delivery surged by 28.9 percentage points to 69.3%.

When predicting changes of parcel delivery service users based on different COVID-19 development scenarios, it was found that the service needs in these scenarios would increase by 13.9-28.4% compared to the pre-pandemic. While users are more optimistic about future scenarios, the altered behavior patterns are expected to persist. Similar trends were observed in terms of product items and delivery-reception methods.

Examining changes predicted by instant delivery agency service users under the four scenarios, the increase by 18.4-31.0% compared to the pre-outbreak period was also expected, slightly surpassing courier service predictions. Despite a more positive outlook for service delivery methods post-COVID-19, the prevailing change situation is anticipated to largely continue.

Prediction of Infrastructure Investment from the Supplier's Perspective

Recently, with the rapid increase in parcel delivery cargo, the three major parcel delivery companies in Korea have actively invested in their freight terminals, concentrating on the establishment of new logistics facilities to support more sustainable delivery service. Over the past three years, there has been a remarkable shift in facility composition towards more concentrated and specialized facilities to enhance delivery services. There are plans for new investments totaling approximately 1.14 trillion KRW. These investments aim to acquire new facilities and enhance the automation infrastructure of existing freight terminals.

Among companies that have undertaken the construction of hub terminals and sub-terminals nationwide in the past three years, there is a focus on advanced automation of terminals. This shift indicates that, in response to the surge in cargo volume, investments are transitioning from a quantitative expansion of parcel delivery service infrastructure to optimizing the operation of facilities. This reflects a strategic effort by logistics companies to enhance productivity and efficiency.

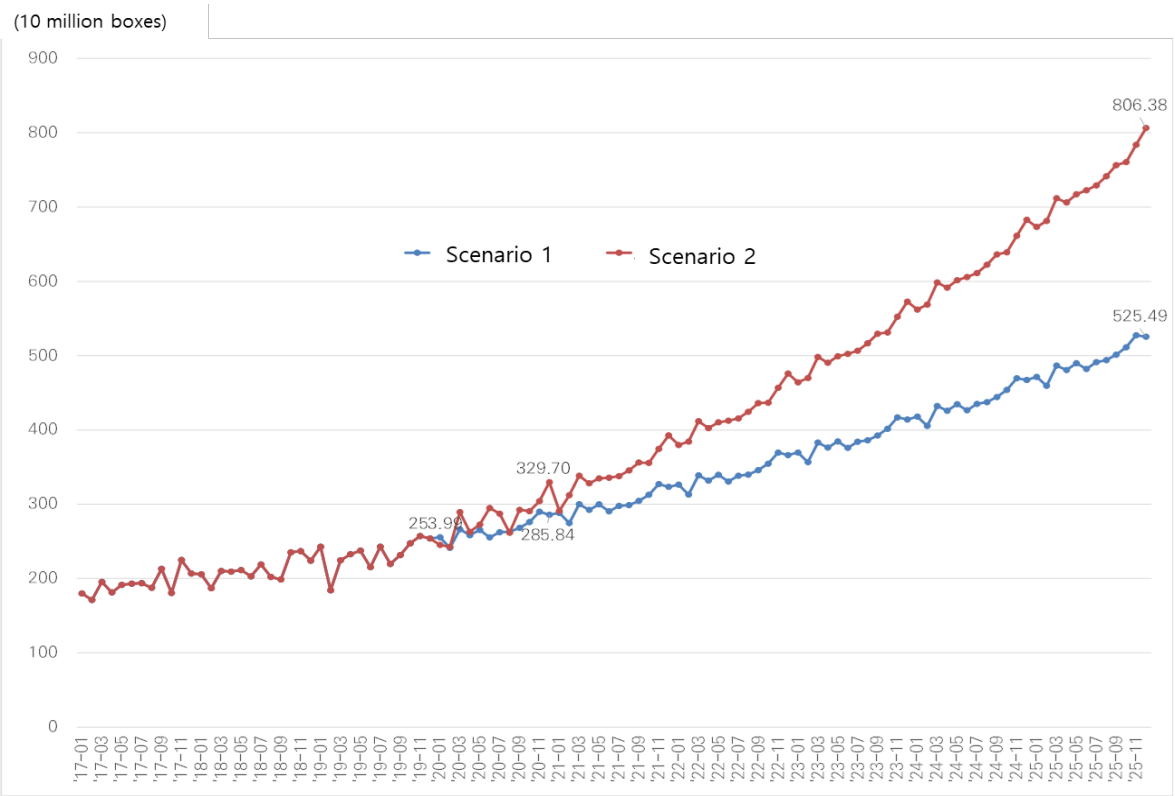
Overlook and Challenges

To forecast the future parcel volume, a scenario analysis by dividing the periods into 'before the coronavirus outbreak' and 'after the coronavirus outbreak' as of January 2020 was conducted. Using regression analysis, this study treated the sales of items influencing parcel delivery volume in online shopping and the change in parcel delivery volume during the same period as independent and dependent variables, respectively.

The regression equation, derived to estimate future parcel volume with online shopping sales as an independent variable, showed a very high correlation with an R-squared of 0.833. Under scenario 2, it was estimated that when online shopping sales increase by 1 billion KRW, the parcel delivery volume increases by about 15,600 packages, and the amount of parcel delivery freight volume per unit sale of online shopping is anticipated to increase by about 300 packages more than in scenario 1.

In terms of future estimates for online shopping sales, scenario 1 predicts sales of approximately 28.1 trillion KRW in December 2025, while scenario 2 anticipates approximately 45.7 trillion KRW. This suggests additional growth of approximately 62.5% compared to

scenario 1. The average monthly growth rate is expected to rise from about 1.37% based on Scenario 1 to about 2.05% in Scenario 2, allowing for an additional monthly growth of about 0.68 percentage points compared to the normal assumption.



Source: Seo, *et al.*, 2021, *A Study on the Post COVID-19 Response Strategy of Transportation Sector (Part 4): Future Innovation Strategies of the Logistics Industry to meet the contactless society and the non-contact Economy,* Korea Transport Institute, Figure 5-7, p.101.

Figure 10.Future Parcel Delivery Freight Volume Estimation by Scenario

The projection for the future volume of instant delivery services was formulated based on online food service sales in two different scenarios. As of December 2025, considering current trends, Scenario 1 is anticipated to reach 1,136 trillion KRW, whereas Scenario 2 is projected to reach 2,347 trillion KRW. This represents an estimated growth of approximately 106.6% compared to a scenario unaffected by the impact of COVID-19. The average monthly growth rate for Scenario 1 is 3.09%, while Scenario 2 is expected to demonstrate a higher rate of 4.24%, indicating an additional monthly average growth of about 1.15 percentage points.

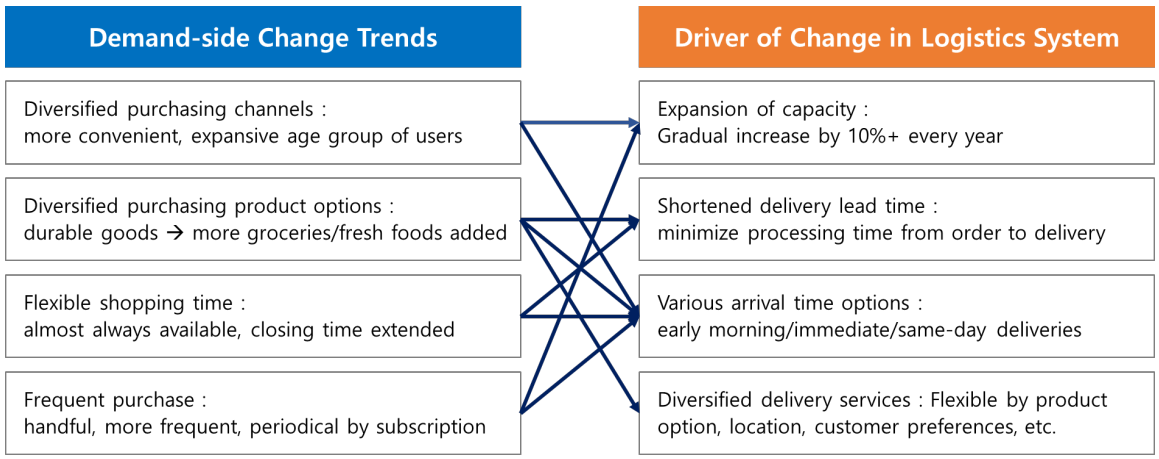
The analysis results reveal notable quantitative and qualitative changes in the last-mile delivery services such as parcel delivery and instant delivery services. With the continuous and anticipated growth in service needs, addressing tasks related to additional logistics service infrastructure, network reorganization, and the enhancement of operational processes becomes imperative. The variety of products using last-mile delivery services and the broadening age range of users indicate a sustained long-term increase in the volume of freight being handled by last-mile delivery logistics services. Managing this escalating cargo volume necessitates not only additional infrastructure and equipment but also a consideration of

additional manpower, requiring a comprehensive review from physical, socioeconomic, and environmental perspectives.

As the spectrum of items handled by last-mile delivery service continues to diversify, there arises a need for differentiated supply strategies concerning human and physical resources to enhance service provision. Particularly, in response to the rapid surge in demand for food and beverages, groceries, and food services, implementing an investment strategy for the cold chain logistics infrastructure becomes essential.

As the spectrum of items in terminal delivery continues to diversify, there arises a need for differentiated supply strategies concerning human and material resources to enhance service provision. Particularly, in response to the rapid surge in demand for food, beverages, and related services, implementing an investment strategy for fresh logistics infrastructure becomes essential.

In the field of last-mile delivery services, user demands are increasing not only for speed and accuracy but also safety, reliability, and appropriateness. Therefore, strategies for enhancing service quality and management need to be upgraded accordingly. Furthermore, adapting to the increasing preference for non-face-to-face delivery methods presents a challenge in reconfiguring existing delivery service processes.



Source: Seo, *et al.*, 2022, *Innovation Strategy for Transport System after COVID-19 (Part 2): Improving the Industrial Environment of Last-Mile Logistics and Exploring Policies based on Field Survey*, Korea Transport Institute, Figure 2-37, p.69.

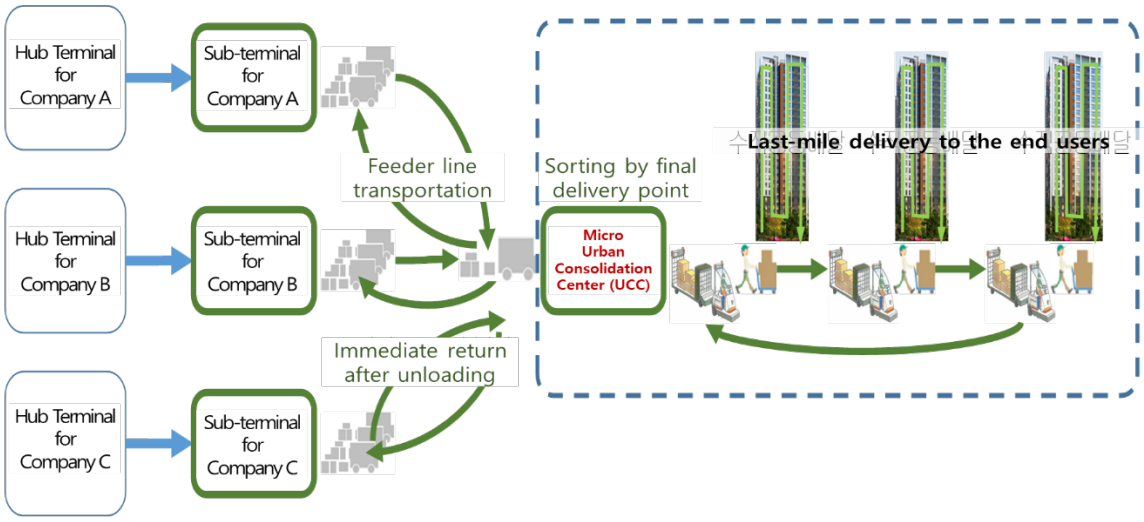
Figure 11. Drivers of Change in Last-Mile Delivery Logistics Systems

IMPROVEMENT STRATEGIES FOR SUSTAINALBE LAST-MILE DELIVERY LOGISTICS SYSTEMS

With the advancement of technology and the recent impact of the COVID-19 pandemic, the world is transitioning into the era of the "new normal," marked by significant changes in the socioeconomic system. This study introduces five key strategic changes aimed at establishing a sustainable logistics system, especially last-mile delivery-related logistics services supporting the everyday life even in this new normal era. These strategies intend to adapt to the challenges and opportunities presented by the new normal to ensure resilience and responsiveness in emerging and evolving markets.

The first strategy entails augmenting transportation capacity. It is imperative to enhance capacity not only in last-mile delivery transportation between sub-terminal and destinations but also in trunk line transportation between hub terminal and sub-terminal. To bolster trunk line transport capacity, considerations include modal shift to railways and augmenting the size of freight trucks. Regarding utilization of heavy-duty trucks, actively exploring the potential of 11-ton hydrogen fuel trucks is crucial, given their introduction and expansion, with a focus on its environmental impacts.

For the feeder transportation, the primary goal is to increase the capacity without increasing the vehicle fleet. Strategies involve enlarging the size of vehicles for last-mile delivery, for instance by utilizing 2.5-ton trucks and implementing a division of labor. Division of labor entails distinguishing between transportation and the very last-mile delivery work for the overall delivery process. Currently, a worker is assigned to "truck driving" task from a sub-terminal to each delivery point, and to the last mile "delivery" task to each customer. Once segregating these tasks, feeder line delivery drivers solely handle transporting packages to the designated area. They then return to the sub-terminal to load cargo for another round of feeder line transportation, thereby elevating the turnover rate of delivery trucks, facilitating additional freight volume processing. Last-mile deliveries are managed by assigning dedicated personnel.

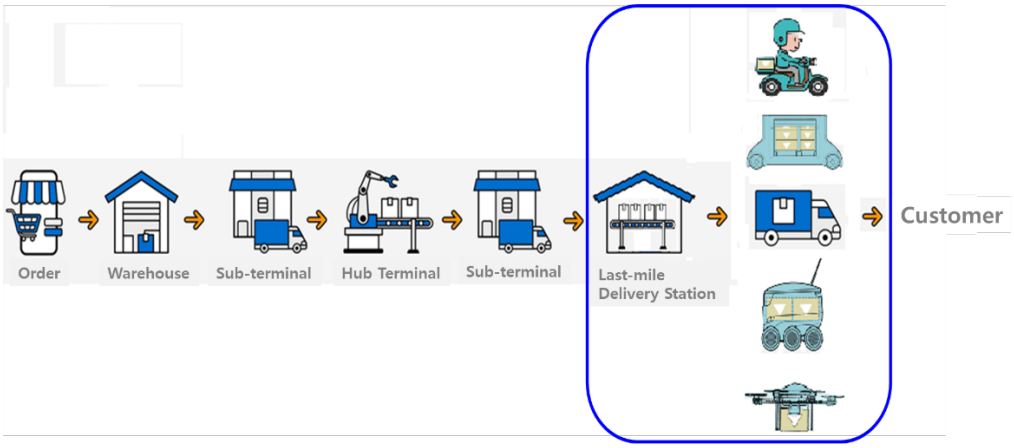


Source: Seo, *et al.*, 2022, *Innovation Strategy for Transport System after COVID-19 (Part 2): Improving the Industrial Environment of Last-Mile Logistics and Exploring Policies based on Field Survey*, Korea Transport Institute, Figure 5-6, p.153.

Figure 12.Division of Labor for Last-Mile Deliveries (feeder line transporting vs. last-mile delivering)

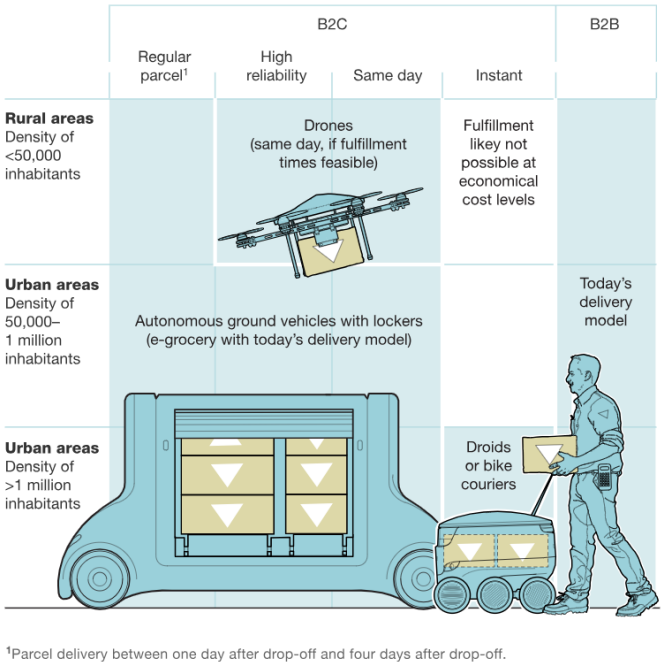
The second strategy focuses on increasing the capacity of logistics facilities, such as hubs and sub-terminals for delivery services. This can be accomplished through the establishment of new hub terminals, expansion of existing ones, or the establishment of additional sub-terminals. Recognizing the potential challenges in securing land for new facilities, it is imperative to urgently implement smart equipment and advanced automation to improve the operational efficiency of existing terminals. Especially concerning the direct link to final last-mile delivery, the strategic priority lies in securing sub-terminals with fulfillment functions in urban areas.

The third strategy centers on securing last-mile delivery infrastructure and establishing an advanced delivery system. Building upon the previously mentioned division of labor in the last-mile delivery process, the installation of a dedicated last-mile delivery station is recommended. Furthermore, it is essential to implement a strategy that selectively introduces and utilizes cutting-edge delivery systems, considering the size, density and distinctive characteristics of each city and region.



Source: Seo, *et al.*, 2022, *Innovation Strategy for Transport System after COVID-19 (Part 2): Improving the Industrial Environment of Last-Mile Logistics and Exploring Policies based on Field Survey*, Korea Transport Institute, Figure 5-11, p.161.

Figure 13. Conceptual Diagram of "Last-Mile Delivery Station"



[1]Parcel delivery between one day after drop-off and four days after drop-off.

Source*: Martin Joerss, Florian Neuhaus, and Jürgen Schröder, 2016, "How customer demands are reshaping last-mile delivery",* Travel, Transport & Logistics*, October 2016, McKinsey&Company, https://www.mckinsey.com/industries/travel-logistics-and-infrastructure/our-insights/how-customer-demands-are-reshaping-last-mile-delivery*

Figure 14. Future of Last-Mile Delivery: Available delivery options by density of locale, customer preferences and product options

The fourth strategy focuses on achieving a sustainable balance in manpower supply and demand. This entails enhancing job quality in the logistics sector related to last-mile delivery by refining the fare structure, instituting a worker protection system, and advocating for workers' rights and interests through improvements in their work environment. Additionally, a dedicated training program for the professional development of skilled labor should be implemented to ensure consistent results.

The final strategy aims to establish a supportive framework for innovation in last-mile delivery logistics services. This encompasses acquiring technological capabilities through national R&D projects, offering financial support, eliminating unnecessary regulations, and streamlining rules. The supportive framework would promote automation of logistics facilities by integrating advanced technologies, the establishment of a comprehensive parcel delivery network with fulfillment functions, the deployment of upsized trucks and eco-friendly electric vehicles, and the adoption of new transportation modes.

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