

Coordinating Inventory Replenishment and Local Delivery in Dingdong Maicai's Front-Warehouse Network

Xin Gao¹, Wangboyuan Xu^{2,*}

¹ Business School, James Cook University, 387380, Singapore

² Samuel Ginn College of Engineering, Auburn University, Auburn, AL 36849, USA

*Corresponding author: xuwangboyuan@gmail.com

Abstract

Recently, the front-warehouse model has improved the efficiency of order fulfilment for fresh e-commerce; however, coordination issues between inventory replenishment and urban distribution still exist, such as limited storage space, product perishability and fluctuating customer demand. This paper studies the coordination of inventory replenishment and urban distribution in Dingdong Maicai's front-warehouse network. A qualitative case study approach was used, and Dingdong Maicai's publicly available financial and operational reports and relevant academic studies published between 2019 and May 2026 were selected based on their relevance and credibility for thematic comparison to identify recurring operational problems and verify the company's own statements. The three problems found in the study are: insufficient demand forecasting and differentiated inventory management; an inflexible replenishment system and inefficient transportation plan; weak information coordination between warehousing and distribution. Based on the above analysis, a combined inventory model of differentiated allocation, centralized real-time replenishment, coordinated transportation planning and integrated digital data sharing can be adopted to enhance inventory turnover and last-mile delivery efficiency. The above results can provide a reference for other fresh e-commerce enterprises in the front-warehouse model.

Key words

front warehouse; inventory replenishment; urban distribution; fresh e-commerce; supply chain coordination

1. Introduction

Fresh agricultural produce has a short shelf life and is highly perishable, making it necessary to strictly control warehouse temperatures and the speed at which goods move throughout the entire supply chain; any delay at any stage can result in the loss of goods and financial losses. With the rapid development of on-demand retail, distribution centres have become the predominant model for e-commerce in fresh produce to improve distribution efficiency. Platforms place small storage points within three kilometres of residential neighbourhoods. Fresh products are sorted at these locations before being delivered within thirty minutes, helping to meet residents' demand for fresh produce. However, distribution centres have limited storage space, while customer orders tend to concentrate around lunch and dinner periods. The demand for delivery staff therefore varies considerably throughout the day. Under these circumstances, inventory replenishment and final delivery are closely connected. If the two processes are planned separately, stock losses and distribution costs may both increase. This shows the importance of improving coordination between warehouse operations and distribution across the supply chain [1].

The domestic fresh produce sector is increasingly focusing on improving operational efficiency within the existing market. For companies in this sector, reducing costs while maintaining efficient operations has become an important objective. Front warehouse operators generally face considerable cost pressure in daily operations. One contributing factor is the lack of effective coordination between inventory and delivery processes. When the two stages are managed separately, inventory losses and delivery costs can both increase. Existing studies have mainly examined inventory management or delivery operations independently. In comparison, relatively few case studies have focused on the coordination of warehousing and delivery under the front warehouse business model [2]. This paper selects Dingdong Maicai as a case study for analysis. As a typical representative of China's self-operated fresh produce front warehouse platforms, the company has established a mature two-tier warehousing and delivery system. Furthermore, as a listed company, it regularly discloses financial reports, making relevant operational data readily available for analysis [3,4]. The operational challenges the company

faces in coordinating warehousing and distribution are also common issues among similar fresh produce enterprises; the optimisation strategies summarised from this case study can also provide a viable reference for the industry in balancing product wastage, operational costs and delivery timeliness.

2. Methodology

A qualitative case study was used in this paper to investigate the coordination of inventory replenishment and urban distribution in Dingdong Maicai's front-warehouse network. The data sources are Dingdong Maicai's publicly available financial and operating reports [3,4] and relevant academic studies published between 2019 and May 2026 [1,2,5-12]. The sources selected were directly related to Dingdong Maicai or to inventory replenishment, urban distribution and supply chain coordination under the front-warehouse model. Priority was given to the company's official disclosures and academic studies that had traceable publication information. The three types of materials for this study are: inventory management, replenishment and transportation coordination, and information sharing. Based on the company's report and research by scholars, some problems in operations and corresponding countermeasures have been identified. Company-specific claims were verified with the official disclosure, and only numerical data from a traceable source were kept.

3. Supply Chain Model and Operating Status of Dingdong Maicai

3.1 Current Supply Chain Model

With the rise of online shopping, consumers' expectations for delivery speed are constantly increasing. The supply chain connects all the steps involved in transferring products from suppliers to consumers, including procurement, stock management, warehousing, transport and delivery. Compared with general merchandise, the supply chain for fresh food e-commerce requires much closer coordination. For fresh food e-commerce, these steps are more difficult to manage because many

fresh products have a short shelf life, and they may lose freshness in a short time. To reduce this problem, Dingdong Maicai has built a network of front warehouses, while the company still uses central warehouses. These smaller warehouses are located near residential areas, so products are stored closer to customers, in which way reduces delivery distance and helps the company complete customer orders faster.

Dingdong Maicai uses two kinds of warehouses in its supply chain, and the two kinds of warehouses have different functions. Central warehouses are mainly responsible for purchasing, product checks, storage, and supplying goods to different areas; front warehouses are smaller and are located closer to residential communities. These front warehouses store products according to demand in nearby areas, and their employees also prepare and pack customer orders. When a customer places an order through the mobile application, the system checks the delivery address and sends the order to a nearby front warehouse; employees then select and pack the products, while delivery workers collect the order and deliver it to the customer. Because the delivery distance is shorter, most orders can be completed in about 30 minutes, which meets customers' need for fast delivery [5]. At the same time, central warehouses send products to front warehouses based on their inventory needs; these activities work together and support the movement of products from warehouse storage to final delivery.

3.2 Current Business Operations

Dingdong Maicai has gradually improved its business performance in recent years, and the company's recent financial reports show some of this progress. According to Dingdong (Cayman) Limited, the company recorded revenue of RMB 6.243 billion in the fourth quarter of 2025, while its Gross Merchandise Value (GMV) reached RMB 6.703 billion; the company also achieved Non-GAAP profitability for the thirteenth quarter in a row [3]. In the first quarter of 2026, the company reported GMV of RMB 6.333 billion, which was 6.3% higher than the figure from the same period in the previous year, and its net profit reached RMB 165 million; during the same period, the fulfillment expense ratio decreased from 22.9% to 20.6% [4].

The lower fulfillment expense ratio shows that the company has improved its control over operating costs;

together with its continued profitability, this change also indicates an improvement in the company's overall operating efficiency [3, 4]. However, the company still needs to make further improvements in inventory replenishment and last-mile delivery because these activities remain important parts of front warehouse operations.

4. Analysis of Stock Replenishment and Urban Distribution Issues at Dingdong Maicai's Distribution Centres

4.1 Lack of differentiated inventory management for fresh produce

As a typical fresh e-commerce platform adopting the front warehouse model, Dingdong Maicai faces recognised challenges in fresh inventory control and product wastage [12]. The front-warehouse model requires inventory to be prepositioned close to consumers before demand occurs, which makes accurate forecasting and timely replenishment critical for both service levels and cost control [6][7]. Therefore, inventory management for perishable goods must take into account both expiry dates and fluctuations in market demand. Applying a single control method would increase the risk of both stock-outs and losses [6]. Distributed operation with multiple front warehouses may cause regional supply-demand imbalance, resulting in inventory misallocation across the fresh produce supply chain.

4.2 Restocking mode and cold-chain transport efficiency

Dingdong Maicai encounters high cold-chain fulfilment costs and insufficient regional delivery resource coordination, which are common concerns for front warehouse operators [12]. In the front-warehouse model, restocking and last-mile delivery are closely interlinked. Inefficiencies in one area can quickly cascade into higher costs and lower service quality in the other [7]. Separate route planning by different front warehouses within one commercial area may lead to redundant transportation and empty return trips, pushing up cold-chain operating costs. To address this, existing research has shown

that if a front warehouse logistics network implements integrated, coordinated dispatching, it can consolidate transport capacity within a given area, optimise delivery routes, improve logistics efficiency and reduce overall costs [7]. This suggests potential avenues for improving Dingdong Maicai's restocking and delivery operations.

4.3 General operational challenges: information coordination in front warehouse logistics

For multi-tiered fresh produce logistics networks in the front warehouse industry, insufficient information coordination between warehousing and distribution systems is a widely discussed challenge [8]. Inventory management, replenishment scheduling and last-mile delivery may operate on separated systems. Poor system connectivity limits data exchange and unified collaborative decision-making. As a result, inventory updates cannot be quickly synchronised with delivery scheduling, reducing operational responsiveness. In practice, different functional departments often hold different operational priorities. Warehousing teams focus on reducing food wastage, while delivery teams prioritise on-time delivery. Misaligned performance evaluation standards across departments hinder cross-department cooperation. For this reason, fresh logistics networks require full information sharing and consistent supply-chain-wide performance indicators. Without unified standards, information isolation and conflicting departmental targets may trigger problems such as inaccurate demand forecasting, delayed replenishment and uneven capacity allocation. These interrelated issues will further raise fresh wastage and overall fulfilment costs [8]. Addressing these coordination challenges is essential for improving the efficiency and sustainability of front-warehouse-based fresh e-commerce operations.

5. Recommendations

5.1 Improve Inventory Management System

The results of analysis show that Dingdong Maicai has the potential to further improve the way for invento-

ry management. The company can consider the change of customer demand, and the inventory amount of each front warehouse.

Firstly, Dingdong Maicai can conduct flexible transfers between warehouses based on stock levels and customer demand. For example, if there is a stock imbalance between the two warehouses, the company can transfer goods from the warehouse with excess stock to the one lacking inventory and thus reduce the excess stock and prevent a stock-out. As a result, the system will operate the nearby front warehouses as an interconnected network and distribute goods among them according to stock levels and customer demand.

In addition, some research has shown that by adjusting demand, modifying the shelf life of products, and optimizing warehouse space utilization, food waste and inventory both can be reduced [6]. Therefore, the company can manage the inventory of various fresh food products differently. For instance, as fresh produce has a short shelf life and is easily perishable, the company will keep a lower inventory of such products and need to order them more often. For goods that are relatively easy to store for a long time and have stable consumer demand, the company can keep a higher inventory to reduce the risk of stockout. Based on the storage attributes and demand patterns of all products, companies will make full use of the warehouse space to reduce the storage time of perishable goods and enhance the efficiency of inventory management overall.

Furthermore, the company should consider what the customers will need in the future. In generally, historical sales data can reflect customers' repeat purchasing patterns [9]. However, specific factors such as weather conditions, public holidays, promotional campaigns and regional purchasing habits may all influence the types and quantities of products customers purchase. Previous research has shown that, when weather information is incorporated, sales forecasting models' ability to explain changes in sales for individual products improves by approximately 47%, and their ability to explain changes at the product category level improves by 56% [10]. Consequently, Dingdong Maicai may take these factors into account when estimating future customer demand in future sales.

5.2 Improve Replenishment and Transportation Coordination

This study finds that front warehouses of Dingdong Maicai have limited storage space and a simple restocking mechanism, so it is hard for them to keep inventory balanced with changes in customer demand during peak hours. In addition, the front warehouses in the same area do not have unified vehicle and route planning. Therefore, Dingdong Maicai can make a model that combines focused replenishment at night with flexible replenishment during the day. For instance, the company can supply products to front warehouses at night based on expected customer demand, while daytime replenishment can be adjusted according to actual orders, current inventory, and sales changes. At the same time, Dingdong Maicai should connect replenishment plans with transportation arrangements. Existing studies show that good route planning and shared delivery arrangements can increase the amount of goods carried by each vehicle and reduce transportation costs [7]. A possible proposal is to group several nearby front warehouses into a single delivery area and have one vehicle make multiple stops at these warehouses along a planned route for restocking. For example, when several front warehouses in the same area need different amounts of goods to be restocked, the company can determine the vehicle's load, the order of delivery, and the arrival times according to the requirements of each warehouse, the load capacity of the vehicle, and the distance among the warehouses. Instead of using a separate vehicle to replenish each warehouse, the company can use one vehicle to replenish both warehouses. This arrangement can reduce the number of trips and improve the overall efficiency of replenishment and transportation.

The company can also use the return trips more effectively in this way. Vehicles can be used to collect the packaging materials after completing the replenishment or delivery order to reduce redundant transport. Other proposals include the Design of the delivery network. Based on the above studies, the company can reduce operating costs and improve delivery efficiency by building a front-end warehouse system to optimize product supply paths and transportation routes [8]. Therefore, Dingdong Maicai can establish front-end warehouses in multiple areas and service regions according to changes in order volume, customer distribution and delivery

distance in different areas. Therefore, the company may consider increasing the number of warehouses and delivery vehicles in areas with a large number of orders and combine delivery zones in areas with a small number of orders or overlapping service areas to reduce delivery distance and waste of resources.

5.3 Improve Information Sharing and Performance Evaluation

The study found that Dingdong Maicai's business systems do not share data effectively and the departments also lack unified performance goals. In the future, Dingdong Maicai will build a whole-process platform for inventory, replenishment, customer orders and delivery information. Warehouse staff, replenishment planners and delivery teams can share operating data and make decisions according to this data on the platform. Thus, the departments can coordinate stock levels, replenishment and distribution of goods, etc., based on the same data. Therefore, the company will improve coordination and reduce communication lag due to fragmented information and a mismatch between supply and demand.

Second, the company can introduce a whole-system monitoring mechanism for the operation of Dingdong Maicai's main supply chain. The system will collect all kinds of data from all departments about their work at the same time, such as how quickly inventory is moving, how often products are out of stock, whether deliveries meet the schedule, how efficiently vehicles are used, and the level of customer satisfaction. The above common indicators can reflect the overall health of the supply chain and prevent improvements in one area from leading to higher costs or resource waste in other parts of the company.

Finally, enhance the linkage between information sharing and cross-departmental decision-making in the company. Based on the above analysis, Dingdong Maicai should coordinate inventory, transportation and distribution decisions to enhance cooperation in the supply chain [11]. All Departments can use the shared data platform for inventory allocation planning, replenishment, transportation and delivery. Thus, the division of labor will be both fair and reasonable. Research on Multilevel Logistics Networks has also found that integrated network planning can optimize the use of resources

and overall operating efficiency [8]. Dingdong Maicai should thus link the shared operating data with performance appraisal and departmental decision-making to improve supply chain coordination.

6. Conclusion

This study examines the fresh produce supply chain at Dingdong Maicai's distribution centres, with a focus on the connection between stock replenishment and urban delivery. The analysis identifies several operational problems, including limited inventory forecasting methods, inflexible replenishment arrangements, uneven resource allocation among distribution centres and insufficient information sharing between distribution centres and delivery services. These problems are closely connected to the lack of an integrated coordination mechanism between distribution centres and delivery services within the two-tier supply chain.

Different departments also use different performance priorities, while information is not fully shared across the relevant stages. This situation can contribute to demand forecasting errors, delays in replenishment and an imbalance in transport capacity allocation. These operational problems may subsequently increase fresh produce wastage and overall order fulfilment costs. Improving information sharing across the supply chain would therefore be an important step. The company could also introduce a more flexible replenishment mechanism together with a unified planning system to strengthen coordination between different operational stages.

Fresh produce warehousing and distribution are closely connected in the on-demand retail sector, and the findings of this study have several practical implications. For Dingdong Maicai, closer coordination between these two processes could improve supply chain management and support more efficient daily operations. The findings could also be useful for other retailers operating under a similar front warehouse model. There are, however, some limitations to the study. As the analysis is based on one business case, the results may not apply equally to other companies or operating environments. The available information from this case was also used as the main basis of the analysis rather than operational data collected from several platforms. Comparing different

platforms and examining a larger number of cases in future research could help determine whether similar coordination issues occur under different operating conditions and provide a broader understanding of coordination between fresh produce warehousing and distribution.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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