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A Study on the Collaborative Optimization of E-commerce Logistics and Delivery Models

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Abstract: As China's e-commerce industry shifts from scale expansion to high-quality development, the core challenges in e-commerce logistics have evolved from mere delivery to issues of efficiency, cost, and service quality. Existing research has largely focused on horizontal comparisons between self-operated and platform-based franchise models, lacking a detailed analysis of the emerging trend toward the two-way integration of these dual models. Based on coordination theory and supplemented by case studies, this research analyzes the challenges of current e-commerce logistics delivery models, as well as the evolution of self-operated and franchise models from a polarized development pattern to a synergistic, two-way integration model. Ultimately, it proposes strategies for the coordinated optimization of delivery models. This study provides practical guidance for e-commerce logistics enterprises to overcome fulfillment bottlenecks and enriches the application scenarios of coordination theory in e-commerce logistics.

Keywords: E-commerce logistics; Delivery models; Collaborative optimization.

1. Introduction

Against the backdrop of China's rapid development in digital technology and the economy, the country's e-commerce industry is also undergoing high-quality development. The e-commerce and logistics sectors have become deeply integrated during this process. Zhang Mengjiao noted in her research that these two sectors are reorganizing commodity circulation and consumption patterns at the fastest pace and on the largest scale in history [1]. The rapid advancement of technology and big data has diversified logistics technologies and fueled the rapid growth of China's e-commerce sector today. According to the "China E-commerce Report (2024)" released by the Ministry of Commerce in 2025, the national e-commerce transaction volume reached 47.3 trillion yuan in 2024, representing a year-on-year increase of 7.9%; in the first half of 2025, the total value of cross-border e-commerce imports and exports reached 1.36 trillion yuan, up 11.7% year-on-year. The growth of the e-commerce sector is gradually shifting from scale expansion to improvements in efficiency and cost reduction. Yet the market's scale advantage remains significant, and demands on the logistics and delivery segment continue to rise.

As a core component of e-commerce transactions, logistics and delivery have become a bottleneck constraining the high-quality development of the e-commerce industry, as noted in a study by You Caihong Research [2]. On one hand, the complexity of fulfilling e-commerce orders continues to rise, increasing operational pressure across the entire supply chain—from the collection, sorting, and transportation of large volumes of packages to last-mile delivery. The sudden surge in order volumes during major shopping promotions further exacerbates pressure within the logistics chain. On the other hand, consumers' expectations for delivery timeliness and service experience are constantly rising. Consumer demands for timely delivery necessitate improvements in efficiency for both logistics and warehousing, as well as last-mile delivery. Meanwhile, research by Li Junjing et al. on logistics costs reveals that the gap between costs and efficiency is also widening [3]. Costs related to labor, land, and transportation are constantly rising, while intense market competition is forcing e-commerce and logistics companies to reduce fulfillment costs to maintain competitiveness. In particular, "last-mile" delivery has become the core challenge in balancing costs and service experience within the industry.

Research into e-commerce logistics and delivery models and strategies holds significant practical importance for industry development. High-quality logistics and delivery services directly impact consumer experience and brand loyalty, and are key to enhancing a company's market competitiveness. Through warehouse network optimization, delivery route improvements, and innovations in last-mile models, companies can effectively reduce fulfillment costs per order and increase profits. At the same time, the optimization of logistics and delivery models has expanded from improvements in individual segments to collaboration across the entire supply chain. By leveraging big data for demand forecasting, inventory pre-positioning, and dynamic allocation, delivery timeliness can be effectively improved, helping brands reduce inventory backlogs and accelerate cash flow, thereby driving supply chain collaboration and industrial upgrading between e-commerce and logistics enterprises. This paper takes JD Logistics and Cainiao Network as case studies to explore pathways for the collaborative optimization of e-commerce logistics and delivery models, providing practical references for industry development.

2. Theories and Problems of E-commerce and Logistics Collaboration

2.1. Introduction of Core Concepts

E-commerce logistics is a comprehensive logistics service system that emerged alongside e-commerce activities. Its purpose is to meet the physical delivery needs of online transactions. It employs big data technology to provide

integrated management of processes such as warehousing, transportation, sorting, packaging, distribution, and information processing.

A delivery model refers to the organizational structure and resource allocation methods adopted by e-commerce platforms to fulfill "last-mile" delivery. This includes the self-operated logistics model, typified by JD Logistics, as well as the platform-based franchise model—often referred to as the "third-party logistics alliance" or "network collaboration" model—with Alibaba's Cainiao Network serving as a prime example.

The crowdsourced logistics model refers to a platform using internet applications to distribute delivery tasks to non-professional, part-time individuals in the general public, leveraging their spare time and personal vehicles to complete on-demand, short-distance delivery services. This model is widely applied in sectors such as new retail and food delivery.

2.2. Core application scenarios in investment management

The synergistic development of e-commerce and logistics is essentially a dynamic process of matching supply and demand. E-commerce companies store goods in logistics companies' warehouses, with the logistics companies responsible for warehousing management, order picking, packaging, and other services. This cooperative model helps e-commerce companies reduce inventory costs and improve inventory turnover rates. Additionally, logistics companies provide transportation services for e-commerce firms. This cooperative model ensures that goods are delivered to consumers quickly and safely. Furthermore, logistics companies offer one-stop services spanning procurement, warehousing, transportation, and delivery, handling the entire logistics process for e-commerce firms. Gu Yutong's research indicates that collaborative models between e-commerce and logistics can simplify logistics processes for e-commerce firms and improve operational efficiency [4].

Synergy between e-commerce and logistics encompasses information flow, commerce flow, logistics, and the integration of resources and capabilities. The foundation of this synergy is the coordination of information flow. E-commerce platforms generate vast amounts of order information, product details, and customer address data, which must be transmitted to the logistics system in real time and with precision. Conversely, the logistics system must provide real-time updates on the status of goods to both the e-commerce platform and consumers during the fulfillment process, thereby ensuring the coordination of information flow. A common example is the Cainiao platform, which establishes unified data standards and an information platform to connect merchants, consumers, and multiple courier companies, synchronizing information among all three parties in real time to ensure the efficient operation of the platform-based model. Commerce and logistics must be deeply integrated, with logistics planning incorporated into the commerce decision-making process. In JD.com's "warehouse-to-delivery integration" model, inventory deployment is closely aligned with logistics distribution, thereby effectively reducing distances and delivery times.

E-commerce and logistics must achieve a match between resources and capabilities; naturally, different e-commerce platforms have varying requirements for logistics models due to their distinct positioning and strategies. The synergy between e-commerce and logistics is not merely a matter of outsourcing or in-sourcing operations, but rather a dynamic, structural alignment and optimization across multiple dimensions—including information, commerce, and resources—based on each entity's strategic positioning.

2.3. Industry Status

Since 2025, China's e-commerce logistics industry has gradually developed, with its delivery scale continuing to expand. Although the growth rate of e-commerce transaction volume has begun to slow, the total number of logistics parcels continues to grow. At the same time, after years of development, China's e-commerce logistics sector has formed a landscape where "self-operated" and "platform-based franchising" serve as the two poles, with multiple models coexisting, and the basic mainstream model structure has gradually stabilized. While the platform-based franchise model dominates, franchise-based express delivery companies—such as the "Three Tong and One Da" network coordinated by Cainiao Network—remain the absolute backbone of China's e-commerce fulfillment. The vast majority of parcels generated by platforms like Taobao, Tmall, and Pinduoduo are transported by this system. Cainiao Network's strengths lie in its extensive network coverage and relatively low costs, enabling it to meet large-scale, universal delivery needs. JD.com, which operates a self-owned logistics model, has become the industry's benchmark for service and a symbol of quality thanks to its fast delivery times, exceptional service model, and superior customer experience. In the logistics market, SF Express, as another major player, serves the high-end e-commerce market through its direct-operated network.

More diverse and emerging logistics models are also being widely adopted across various sectors. For example, models such as crowdsourced logistics, community group-buying pickup, and on-demand delivery are rapidly developing in sectors like fresh produce and supermarket home delivery. These models are gradually integrating into the last-mile delivery systems of mainstream e-commerce platforms, serving as effective supplements to address specific scenario needs.

2.4. Core Issues

The logistics industry is developing steadily. With advancements in society and technology, the industry has become closely integrated with technology and makes effective use of big data. However, there are still many challenges in "last-mile" delivery.

The most critical challenge in "last-mile" delivery within the logistics industry is cost. Low delivery density, scattered orders, and rising labor costs are the primary factors. Redeliveries caused by unclear addresses or recipients being away from home further increase costs. Secondly, the terminal outlets in the franchise-based express delivery model are typically independently operated, resulting in inconsistent service quality, staff stability, and management standards, which leads to an unstable customer experience. This also causes significant variations in delivery timeliness and service quality across different regions and at different times.

Consumer demands in the market are diverse. However, the current mainstream delivery models struggle to provide refined and personalized services, resulting in persistent and numerous issues at the last mile. Furthermore, the convenience and positive service experience of reverse logistics are also crucial components of standardized last-mile

service, yet problems such as cumbersome processes and slow response times still exist.

The existence of these issues—including cost variations, disparities in service quality, and the need to meet personalized demands—not only affects the consumer shopping experience but also directly hinders e-commerce platforms' ability to improve service quality and control costs. Furthermore, they directly impact the reputation and brand image of logistics companies, compelling the industry to seek breakthroughs through model innovation and technological advancements.

3. Case Analysis and Collaborative Optimization Strategies

3.1. JD Logistics — Integrated Warehousing and Distribution

The core of JD Logistics' self-built logistics operational structure is "warehouse-to-delivery integration." JD's network primarily consists of large automated regional distribution centers such as Asia No. 1, thousands of forward distribution centers located across the country, as well as delivery stations and last-mile delivery teams that penetrate deep into urban areas. To date, JD Logistics operates over 1,600 warehouses. Within JD's transportation system, goods are pre-positioned in warehouses closest to consumers based on big data forecasts. Once a consumer places an order, the system automatically assigns the nearest warehouse for sorting and packing, with JD's own delivery personnel completing the door-to-door delivery. The essence of this model is "substituting storage for transportation," which achieves optimal delivery speed by shortening the physical distance between goods and consumers.

JD Logistics' unique model has also enhanced its competitive edge in delivery speed. Its flagship "211 Timed Delivery" service has become JD's most competitive offering in the logistics market. Currently, JD's delivery network covers nearly the entire population of China, with over 90% of orders delivered within 24 hours. This stable, predictable, and exceptional delivery experience has attracted and retained a large number of users on the JD platform who place high demands on service speed.

The cost structure of JD's self-operated model is characterized by "high fixed costs and low marginal fulfillment costs." High fixed costs primarily include expenses for leasing or constructing land and warehouses, purchasing and maintaining automated sorting equipment, depreciation of proprietary delivery vehicles, and compensation and benefits for a large workforce. In her research, Nie Yanfang found that relatively controllable marginal costs stem from the implementation of refined, end-to-end management and high levels of automation. In regions with sufficiently high order density, JD.com can effectively control the processing and delivery costs per order [5].

3.2. Cainiao Network—Platform-Based Franchising

Unlike JD Logistics, Cainiao follows a platform-based model. Since its inception, Alibaba's platform strategy has aimed to build an intelligent logistics backbone network capable of handling an average of 10 billion parcels daily.

Cainiao's operational structure is essentially a logistics data collaboration platform and resource integration hub. As noted in Zhou Jinhong's research, Cainiao does not maintain its own large delivery fleet or workforce; instead, it uses technology and standardized protocols to connect major courier companies, warehousing service providers, last-mile delivery firms, and a vast network of neighborhood pickup stations into a coordinated logistics network [6]. After merchants generate orders on the Taobao or Tmall platforms, they select a partner courier company through the Cainiao system, and the collection, transportation, and delivery of goods are then handled by the selected courier companies.

The ability to integrate resources is the most powerful strength of the Cainiao model. It avoids the "overload" of orders that comes with building a proprietary logistics network and leverages the existing resources of the entire industry through a light-asset model. At the last mile, Cainiao has ingeniously resolved the conflict between delivery efficiency and service diversity by vigorously expanding its "Cainiao Stations." Serving as parcel drop-off and service centers within communities, these stations not only provide couriers with centralized delivery points—significantly boosting delivery efficiency—but also offer parcel collection and self-pickup services for consumers who cannot receive deliveries at home. Furthermore, they have expanded into community services such as parcel shipping and group buying, becoming a vital offline traffic gateway.

By collecting and analyzing end-to-end data from e-commerce platforms, logistics partners, and local stations, Cainiao Network can optimize operations in terms of demand forecasting and route planning. Similar to JD.com, Cainiao Network predicts best-selling products and regional sales volumes ahead of major sales events, guiding merchants to pre-allocate inventory across warehouses. It also performs intelligent order sorting and optimal route planning to help courier companies improve both trunk line transportation and last-mile delivery efficiency. The differences between Cainiao and JD.com are illustrated in Table 1.

Table 1. Comparison of JD.com and Cainiao's Models

Comparison Dimensions	JD.com's Self-Operated Logistics Model	Cainiao Network's Platform-Based Franchise Model
Asset Model	Capital-intensive: Self-built warehouses, fleets, and teams	Light-asset: Building a platform and integrating external resources
Core Competencies	Operational Control: Strong oversight and execution across the entire supply chain	Ecosystem Integration: Data-driven cross-entity collaboration capabilities
Service Experience	Exceptional and Consistent: Fast turnaround times and high service standardization	Universal and Flexible: Relatively slower turnaround times, with service quality dependent on franchise locations, but continuously improving
Cost Structure	High fixed costs; order density is key to profitability	Low fixed costs, primarily consisting of R&D and platform operating expenses
Coverage	Relies on self-funded infrastructure development; expansion speed is limited	Achieve rapid nationwide and even global network coverage through integration
Model flexibility	Relatively limited model, making it difficult to accommodate all product categories	High flexibility, capable of integrating with various types of logistics service providers to meet diverse needs
Suitable scenarios	Standard products with extremely high requirements for delivery speed and customer experience	Open platforms with massive SKUs, price sensitivity, and a mix of C2C and B2C

3.3. Collaborative Optimization Strategies for Delivery Models

3.3.1. Innovations in Last-Mile Delivery

The "last mile" is the primary focus of optimization, involving a transition from a single "door-to-door delivery" model to a diversified, integrated last-mile service network.

Deepening integration with community fulfillment networks. Community group buying has now become the norm, and the group-buying pickup model has also become a common practice. Pickup points are distributed throughout cities, primarily exhibiting a pattern of "central concentration and peripheral dispersion," closely tied to population density and the commercial structure of neighborhoods. E-commerce platforms can draw inspiration from the community group-buying pickup model, expanding its application from fresh produce to a wider range of daily necessities. By sharing a single pickup network for both express parcels and group-buying goods, platforms can reduce the costs of establishing last-mile service points and enhance operational efficiency.

Promote the widespread use of unmanned service stations and smart parcel lockers. Unmanned technology can reduce labor costs at the last mile. By integrating technologies such as the Internet of Things and AI, the establishment of 24-hour unmanned community service stations or clusters of smart parcel lockers can not only meet consumers' needs for round-the-clock parcel pickup but also integrate value-added services such as parcel drop-off and temporary storage. Establishing unified construction and operational standards will significantly enhance consumer satisfaction and convenience.

3.3.2. Supply Chain Collaboration

Through deep supply chain collaboration, challenges can be resolved before consumers place orders. Develop strategies for inventory pre-positioning and centralized inventory layout. E-commerce platforms and brands must break down data silos to achieve full transparency in supply chain information, allowing both parties to access and utilize data. E-commerce platforms can leverage their big data forecasting capabilities to guide brands in centrally managing national inventory. Based on forecasts, inventory is dynamically distributed to regional warehouses, forward warehouses, or physical stores closest to consumers. When a consumer places an order, the order is transmitted to the e-commerce platform. Merchants can then ship the goods directly from the nearest store or forward warehouse based on the online order, achieving "minute-level" delivery. At the same time, this clears inventory from offline stores, reducing inventory costs and the risk of stockouts across the entire supply chain. Currently, JD.com's data-driven inventory allocation strategy has already proven its feasibility.

3.3.3. AI-Driven Innovation

With the rapid evolution of artificial intelligence, big data, the Internet of Things, and blockchain technology, the logistics industry is gradually moving toward smart logistics, demonstrating significant results in areas such as order forecasting, transportation scheduling, warehouse management, and delivery optimization. The rise of smart logistics has not only improved fulfillment efficiency for e-commerce transactions but has also driven the digital transformation of logistics systems, facilitating the transition from traditional to smart logistics. By leveraging big data and artificial intelligence, e-commerce logistics can fundamentally reshape decision-making and operational methods. Using machine learning models to analyze various variables—such as historical sales data, promotional campaigns, weather conditions, and social media trends—e-commerce logistics can achieve more accurate predictions of product sales and logistics demand. With the widespread adoption of artificial intelligence, AI algorithms can plan optimal pickup and delivery routes in real time for thousands of delivery personnel within rapidly changing urban traffic networks. This significantly reduces the time delivery personnel spend on the road, shortens distances, avoids traffic congestion, and accounts for complex constraints such as estimated delivery time windows, vehicle load factors, and delivery personnel workloads. Companies such as Cainiao and Meituan are actively applying these technologies to optimize their vast delivery networks.

In modern society, the use of autonomous trucks in long-haul transportation and automated robots in warehouse sorting is gradually increasing. This reduces reliance on human labor and lowers labor costs, while also enabling 24/7 uninterrupted operations, thereby enhancing the efficiency and stability of the entire logistics chain.

4. Conclusion

This analysis of e-commerce logistics models, combined with the case studies of two major logistics enterprises—JD.com and Alibaba—examines the collaborative optimization of e-commerce delivery. Companies need to

select models that are "compatible" with their own business models, strategic goals, and stages of development. The "last mile" remains a core challenge in logistics and delivery. Issues such as high costs, inconsistent timeliness, and non-standardized services will continue to be challenges the industry must overcome in the future. To address these issues, it is essential to move beyond a narrow focus on individual delivery segments and pursue systematic innovation across multiple dimensions, including the construction of community fulfillment networks, deep supply chain collaboration, and the application of artificial intelligence technologies. Building an open, collaborative, and mutually beneficial logistics ecosystem—by integrating the strengths of merchants, technology providers, offline retail outlets, and community resources—can enhance corporate competitiveness and secure a competitive edge.

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