Optimizing Inventory Management in Chinese E-Commerce

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Abstract. In today's digital age, China's e-commerce industry is showing a vigorous development trend, with the market size continuing to expand and transaction volume repeatedly reaching new highs. In this context, effective inventory control methods play an irreplaceable key role in the stable operation of e-commerce enterprises, like the cornerstone of a building. This study focuses on industry-leading e-commerce websites such as JD.com and Alibaba, exploring in depth how they optimize their inventory systems in response to rapidly changing customer demands and numerous logistics and distribution difficulties. Through a comprehensive comparison and review of existing inventory management technologies, the application of cutting-edge technologies such as multi warehouse coordinated management and AI driven precise prediction is highlighted. The study also provided practical and feasible solutions for common problems such as stockouts and inventory backlog by analyzing actual business processes, which strongly proves that optimizing inventory management can significantly improve operational efficiency, promote the e-commerce industry to enhance competitiveness, and achieve sustainable growth.

Keywords: Inventory Management, E-Commerce, Supply Chain, Logistics, Optimization.

1   Introduction

Over the past decade, China's e-commerce industry has experienced exponential growth due to technological advancements, expansive digital infrastructure, and shifting consumer behaviors. According to Lam et al. (2023), the Chinese market presents a dominant situation on trading online in the world, with over half of the retail goods sold on the internet [1]. This position significantly outpaces other major economies, such as the United Kingdom (36%), South Korea (32%), and Denmark (20%) [1]. This rapid expansion of China's e-commerce industry requires innovations in supply chain and inventory management to meet the demands of a highly competitive and fast-paced market. Unlike traditional retail, e-commerce requires great flexibility on goods, which underscores the critical role of optimized inventory management.

Existing literature highlights inventory management as a cornerstone of e-commerce efficiency. According to Zhao, inventory management is a crucial component of

logistics management. He went into detail on how effective inventory management can help businesses attain economies of scale, balance supply and demand, and avoid supply and demand problems [2]. Li also points out the necessity of a high-standard inventory model to guarantee a continuous supply of products. However, due to the high demand and exponential development of the e-commerce industry, the traditional means of inventory management may reach their limit [3]. Hence, understanding current management flaws is essential to address evolving challenges effectively.

In such a situation, many Chinese e-commerce platforms emerged. Some platforms based on Business to Consumer (B2C) include JD.com, Alibaba, and Pinduoduo, which stand out from a series of platforms. This paper reviews the latest inventory management strategies adopted by leading Chinese e-commerce enterprises, such as Alibaba, JD.com, and Pinduoduo, and evaluates their effectiveness in addressing sector-specific challenges. By analyzing emerging trends—including AI-driven forecasting, multi-warehouse coordination, and resilient supply chain models—the study aims to identify best practices and propose future directions for innovation.

The significance of this research lies in its potential to guide enterprises in mitigating risks such as overstocking, stockouts, and supply chain disruptions. Furthermore, optimized inventory systems contribute to sustainable growth by reducing waste, improving resource allocation, and enhancing competitiveness in a market.

2   The Current Situation and Challenges

The Chinese e-commerce landscape is unparalleled in its global dominance and innovation, but it suffers from systemic inefficiencies in inventory management shaped by different factors.

At the core of those inefficiencies lie the sectors of the characteristics of the e-commerce orders. B2C platforms are faced with the management of vast and diverse product catalogs. This encompassed millions of stock-keeping units (SKUs) across categories ranging from fast-moving consumer goods to high-value electronics. Taking Pinduoduo, one of the B2C platforms as an example, according to Guihang et al., the State Post Bureau reported that the parcel volume of Pinduoduo exceeded over 25% of the total volume for the whole country in the first half of 2019, processing 27.76 billion parcels [4].

Compounding this complexity is the high fluctuation of demand and the obvious seasonality of the products. Seasonal peaks like Singles' Day, which is on every 11th November in China, create an unpredictable trend fueled by social commerce and livestreaming. A critical challenge emerging from these dynamics is the persistent inaccuracy of demand forecasting. Kahneman et al. argue that people are inconsistent, and noise exists wherever judgment does [5]. Many studies have shown that algorithms can perform better in making final decisions than humans do [5]. This led to a failure to account for real-time variables, such as viral product trends on streaming platforms like Douyin (TikTok) or sudden shifts in consumer behavior. These failures of prediction often result in overstocking of unpopular items and stockouts of high-demand goods, eroding profit margins and customers' trust.

Equally pressing is the logistical complexity of multi-warehouse coordination. Especially for platforms like JD.com, consumers usually expect same- or next-day delivery. Those platforms have adopted decentralized warehouse networks with inventory hubs strategically located near urban centers [6]. By 2023, JD.com will have operated more than 1,600 warehouses and 100 smart logistics parks [7]. However, keeping inventory levels across different areas while minimizing shipping costs and avoiding redundancies requires advanced predictive analytics and real-time data integration. JD.com's AI-powered '211 Guaranteed' services, which promise home delivery within 24 hours, exemplify this approach [8]. Consumer suffers from high delivery costs due to the lingering gaps in rural logistics infrastructure, where fragmented networks and underdeveloped last-mile capabilities delay shipment and drive-up costs.

External risks, particularly supply chain disruptions, further exacerbate these operational obstacles. Even though there is a rise in online ordering due to the influence of COVID-19 [1], the epidemic initially provided a devastating blow to the e-commerce platform. Those unpredictable risks exposed the weaknesses of the centralized supplier model and led to the closure of key hubs [9]. For instance, in Shanghai in 2022, paralyzed port operations and delayed shipments for weeks. Similarly, climate-related events have highlighted the industry's reliance on geographically centralized production zones. The delay or even damage by transporting products to consumers is pressuring and re-exacerbating the challenge of stocking.

3   Practical Cases

3.1   JD.com's Inventory Management Innovation

JD.com, a leader in China's B2C e-commerce sector, has built its competitive edge on a vertically integrated inventory network. As of 2015, the company operated 166 large warehouses across 44 cities and 7 logistics centers in Beijing, Shanghai, Wuhan, Xi'an, Chengdu, Shenyang, and Guangzhou, forming a nationwide supply chain capable of rapid delivery [8]. By 2023, JD will have expanded its warehouse count to over 1,200 facilities, with a focus on automation through projects like the "Asia No. 1" smart logistics centers. These warehouses, such as the 160,000-square-meter Beijing hub, integrate IoT, robotics, and AI to streamline operations, reducing inventory turnover days from 38.1 days in 2019 to 30.3 days in 2021 [8]. Jingdong's intelligent warehouse technology provides strong hardware support for inventory management. To better integrate supply chain resources and achieve efficient operation of inventory, Jingdong has built four supplier collaboration modes around the platform's commodity collection features. This feature promises 24-hour urban delivery. Reducing the dependency on third parties' logistic companies, which further enhanced the efficiency.

JD.com's "Asia No. 1" smart warehouses represent the best achievement of its technological investment in inventory optimization. The warehouses are designed with a three-zone layout: storage, sorting, and distribution, each optimized for speed and precision. For instance, robotic arms in the storage zone retrieve items 50% faster than manual labor, while AI algorithms predict optimal stock placement based on regional demand patterns [8].

Due to the diverse collections of goods provided by the platform, JD.com's inventory strategies revolve around four supplier collaboration modes, which include FBP, LBPs, SOP, and SOPL [7].

The first mode is Fulfillment by JD.com (FBP), which refers to the situation where JD.com manages warehousing, delivery, and customer service. The selling goods are centrally stored and delivered by JD's logistics for nationwide distribution. This model minimizes stockouts and enhances customer satisfaction through services like cash-on-delivery and POS integration. The second mode refers to Logistics by JD (LBP), where JD provides an individual operational background. After a consumer orders on the platform, merchants should package and deliver the ordered product within 12 hours to the closer transit center of JD.com. Then the orders would be transmitted to the front-end distribution center for JD.com within 36 hours. The issue invoices will be sent to consumers simultaneously. Meanwhile, SOP and SOPL both refer to seller's own platform, where merchants manage all logistics, including packaging and delivery. However, SOP is like LBP with a distinction on sending invoice by merchants. These two models are mostly focusing on the merchants own, while JD only provide an operation background. These two systems reduce the stock cost by JD and provide greater freedom to the merchants selling on JD.com.

Combining the automatic system with the four separate models, JD.com succeeded a balance between scalability and service quality, which guaranteed the efficiency of logistics and reduced stock burden for JD.com. A decentralized warehouse allows JD.com to flexibly alter the stocks in different areas. According to Wang, the inventory turnover dates reduced from 38.1 days in 2019 to 30.3 days in 2021. This result is a benefit from the effective communication with suppliers for promoting the FBP and LBP systems [8].

In the future, JD.com intends to use intelligent supply chain integration to reduce the effect of these difficulties. JD.com wants to cut procurement waste by 25% by 2025 by implementing blockchain for real-time supplier transparency and AI for dynamic demand forecasting [8].

3.2   Alibaba's Inventory Optimization Practice

Alibaba Group operates across multiple models: B2C (Tmall), C2C (Taobao), and B2B (Alibaba.com). Its inventory management is deeply linked with the Cainiao Network, a logistics platform launched in 2013 to address China's fragmented "logistics dark age"- a period characterized by manual processes, struggling with remote areas, and inefficiencies [10]. Cainiao coordinates over 10 million merchants and third-party logistics providers like SF Express, aiming for "24-hour domestic and 72-hour global delivery" [10]. Tmall, Alibaba's premium B2C arm, manages a multiechelon distribution network comprising Central Distribution Centers (CDCs), Front Distribution Centers (FDCs), and Producer-linked Distribution Centers (PDCs) to optimize cross-regional inventory flows [11].

Similar with JD.com, Alibaba's inventory management leverages algorithmic agility and data-driven collaboration. According to Deng et al., Alibaba launched the One-Stock Pool Initiative in 2021 [5]. This program is like the supplier collaboration modes

promoted by JD.com, and the implementation of this program majorly focuses on Tmall Mart. In dozens of China's largest cities, Tmall Mart has regional distribution centres (RDCs), which act as the main storage facilities for their respective areas. Inventory is often delivered by suppliers to RDCs before being dispersed around the nation. Every RDC alone and regularly places orders [5]. Compared with the system of JD.com, this program can be referred to as the LBP mode. Liu et al. point out the crucial role of Vender lead time played on this program [5]. With a higher lead time, the fill rate of orders will decrease significantly. This is because a higher lead time is caused by an increase in number of orders, which makes it more difficult for merchants to catch up the with orders of such high quantity. As a result, the number of orders will reduce. According to the data provided by Liu et al., the lead time increases by roughly 10%, and the fill rate often drops by nearly 20% when the order quantity doubles from the average [5].

The 'One Stock Pool Plan', as an important initiative for Tmall's inventory management, has played a key role in optimising the inventory management of Regional Distribution Centres (RDCs), and to further achieve efficient distribution of inventory across regions, Tmall has also constructed a multi-level system. According to Dai and Li, they provide a detailed system for Tmall Mart featuring the cross-regional inventory allocation, which is called Multiechelon System [10]. The system also included the replenishment process that showed from the dashed line from the picture.
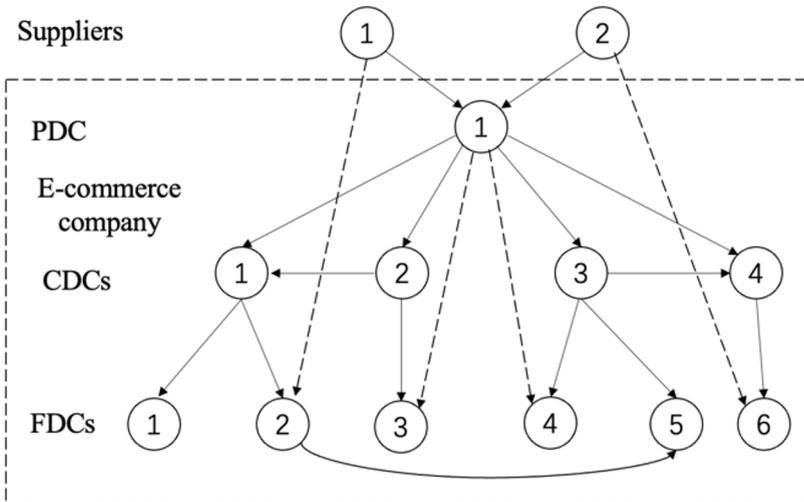

Fig. 1. Multilevel system in Alibaba

Alibaba's multiple-echelon distribution system includes several interconnected layers that optimize the flow of goods and inventory replenishment from suppliers to consumers. According to the figure 1, it consists of four parts. The first one is the suppliers, refers to the manufacturers that produce the products and supply them to the distribution network. Followed by is the Producers' Distribution Centers (PDCs), located near suppliers, where PDCs receive products directly with low transportation costs and time.

Then the goods flowed to Central Distribution Centers CDCs, these centers manage inventory and coordinate replenishment to ensure that FDCs are stocked with the necessary products. Then, lastly, the goods are sent to Front Distribution Centers (FDCs), FDCs fulfill customers' orders and rely on timely replenishment from CDCs to maintain adequate inventory levels and meet customer demand.

This multi-layered approach allows for efficient inventory management and replenishment, reducing transportation distances and costs [11]. With more than one center for each stage, it enables quick responses to customer demands by choosing the closest FDCs from consumers and reduces the inventory burden for each stage.

Although Alibaba has implemented a nearly complete inventory system, further improvements are needed for future development. Alibaba plans to open ten new foreign hubs by 2025 to increase resilience through global Cainiao expansion. In pilot regions such as Southeast Asia, blockchain integration for cross-border traceability has already reduced customs delays by 50% [12].

4   Conclusion

To conclude, the study emphasises how important effective inventory management is to raise the effectiveness and level of competition of Chinese e-commerce platforms. Platforms like JD.com and Alibaba are implementing several approaches to handle the difficulties brought on by quick changes in the market and consumer behaviour. One example of a proactive approach to inventory optimisation is JD.com's utilisation of "Asia No. 1" smart warehouses. JD.com has set the standard for the industry by decreasing inventory turnover days and increasing delivery efficiency.

Similarly, Alibaba's integration of the Cainiao Network and the One-Stock Pool Initiative demonstrates an active approach to overcoming logistical inefficiencies and enhancing supply chain collaboration. The multilayered distribution model allows for flexible responses to customer demands, positioning Alibaba as a leader in inventory management practices.

In the future, both JD.com and Alibaba are planned to enhance their supply chains through advanced technologies like blockchain and AI. While Alibaba intend to expand globally and JD.com focuses on intelligent integration, they position themselves to overcome challenges and improve efficiency, ultimately benefiting their operations and customer satisfaction.

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