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Overseas Warehouse Strategy and Information System Advancement in Chinese Cross-border E-commerce

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Abstract

This study focuses on overseas warehouses as critical infrastructure supporting the growth of Chinese cross-border e-commerce, analyzing their strategic value and the role of information systems in achieving operational efficiency. The industry is transitioning from traditional direct-shipping models reliant on international mail to logistics systems that utilize overseas warehouses for greater speed and cost-effectiveness. Consequently, overseas warehouses have evolved into strategic strongholds for building competitive advantage. Although various operational models exist, they share common challenges, including efficiency management, cost control, and regulatory compliance. The key to addressing these challenges lies in the application of information technology. Beyond Warehouse Management Systems (WMS), advanced technologies such as AI-driven demand forecasting and IoT-based inventory management are driving the "intelligent transformation" of overseas warehouses, creating new value. Future development is expected to involve coordinated networks of multiple warehouses and AI-optimized inventory allocation. This study concludes that the sophistication and intelligent transformation of information systems are essential to unlocking the full potential of overseas warehouses.

Keywords: Cross-border E-commerce, Overseas Warehouse, Information System

1. Introduction

1.1 Research Background

In recent years, fueled by the rapid development of digital technology and changing global consumption patterns, the China's cross-border e-commerce market has experienced remarkable growth. According to data from the Ministry of Commerce of China, the import and export value of cross-border e-commerce reached 2.63 trillion yuan (approximately US$365 billion) in 2024, a year-on-year increase of 10.8% and accounted for 6% of the total trade value.

However, as countries around the world strengthen regulations in areas such as customs control and data protection, traditional international logistics models have struggled to adapt. In particular, by the tightening of customs procedures in the European Union (EU) and the United States, Chinese enterprises are facing shipping delays and rising costs. In this context, the establishment of overseas warehouses, which stock inventory locally to enable rapid deliv ery and streamlined return processing, has become indispensable. These overseas warehouses now play an important role in mitigating regulatory risks and optimizing logistics efficiency.

1.2 Research Objectives and Methodology

This study aims to clarify the interplay between overseas warehouse strategies and the adv ancement of information systems in Chinese cross-border e-commerce enterprises, and to ide ntify factors that enable efficient international logistics operations. Specifically, it focuses on how information systems—such as WMS and data analytics infrastructure-are integrated and utilized in critical areas of overseas warehouse operations, including site selection, inventory management, and distribution.

The research methodology combines analysis of official Chinese government statistics an d publicly available data with case studies of leading enterprises (e.g., Alibaba, SHEIN, TEM U) and a comprehensive review of academic literature and policy reports. Through this integr

ated approach, the study will empirically examine the impact of technological advancement o n the effectiveness of overseas warehouse strategies.

2. Development of Overseas Warehouses and Changes in Logistics Structure

2.1 Definition of Overseas Warehouses

An overseas warehouse refers to a storage facility located abroad that provides a range of fundamental and value-added services to domestic manufacturers, brand owners, trading com panies, and logistics service providers. Fundamental services include cargo storage, transit, so rting, packaging, in-house processing, and distribution. Value-added services encompass orde r processing, customs clearance, return and exchange handling, supply chain finance, and ove rseas distribution.

Currently, the operational models of overseas warehouses are primarily categorized into t hree types:

① Platform-owned Warehouses: These are warehouses owned and operated by large-scale c ross-border e-commerce platforms. They leverage the platform's resources to provide efficient logistics services (e.g., FBA - Fulfillment by Amazon) for merchants on the platform.

② Third-Party Overseas Warehouses: These are independently operated by specialized logis tics providers (e.g., Cainiao, JD Logistics). They utilize their logistics expertise to offer flexib le services to diverse clients.

③ Seller-owned Overseas Warehouses: These are warehouses built and managed by sellers or brand companies themselves (e.g., SHEIN). This model allows for highly flexible operatio ns aligned with the company's own strategy and enables direct responsiveness to market dema nds.

2.2 Current State of Overseas Warehouse Development

From 2021 to 2024, China's overseas warehouses expanded rapidly. According to the Min istry of Commerce, the number of warehouses increased from 2,000 to 2,500, while total floor area expanded from 16 million to 30 million square meters. Of this total, over 1,800 are dedic ated to cross-border e-commerce, covering more than 22 million square meters.

Regarding location strategy, in major markets such as the United States, Germany, and the United Kingdom, large consumer bases and advanced logistics infrastructure foster the devel opment of multi-warehouse networks. The United States, in particular, has become a strategic ally vital market for Chinese cross-border e-commerce.

Expansion into emerging markets complements traditional Europe and North America. In itiatives like the Belt and Road Initiative (BRI) and the Regional Comprehensive Economic P artnership (RCEP) have accelerated expansion into emerging markets such as Southeast Asia (Malaysia, Thailand, Vietnam), the Middle East (Saudi Arabia, UAE), and Latin America (M exico, Brazil). From January to July 2025, China's investment in BRI partner countries increa sed by 23.5% year-on-year. This represents a strategic shift aimed at diversifying geopolitical risks and gaining direct access to emerging markets.

This geographical diversification also enhances supply chain resilience by mitigating the i mpact of geopolitical tensions and logistics disruptions in specific regions. For instance, affec ted by the US-China trade friction, some companies have accelerated their expansion into the markets like Southeast Asia and Europe to reduce tariff risks.

2.3 Transformation of the Logistics Structure

Driven by evolving trade regulations, the logistics structure of Chinese cross-border e-co mmerce is shifting from traditional direct-shipping models to network models centered on ove rseas warehouses. This shift is not only a response to the trade regulations but also an endoge nous evolution toward logistics efficiency and competitiveness.

Between 2024 and 2025, the United States successively changed its tariff policies and de minimis threshold. In May 2025, de minimis provision for shipments from China was suspended, making imports subject to a 30% ad valorem duty or a specific duty of $25 (later $50). Furthermore, in August, de minimis exemption was suspended for all countries worldwide. These changes significantly heightened the risks of direct-shipped, low-value parcels, including potential customs delays, additional costs and new tariff burdens.

In response, Chinese cross-border e-commerce businesses are accelerating their transition to the overseas warehouse model. This shift is being bolstered by supportive measures from the Chinese government. In January 2025, the State Taxation Administration implemented the "export tax rebate upon departure" policy for exports utilizing overseas warehouses, thereby improving corporate cash flow. Meanwhile, platforms such as TEMU and SHEIN have promoted "Partial Managed Model" (Semi-Hosted), where goods are stocked in overseas warehouses in advance. This approach aims to stabilize delivery times and mitigate policy-related risks.

Thus, the shift toward overseas warehouses, catalysed by regulatory changes, has become a core strategy for sustaining Chinese cross-border e-commerce competitiveness.

3. Overseas Warehouse Operational Challenges

Chinese cross-border e-commerce enterprises consistently face the following three core challenges.

The first core challenge is demand forecasting and inventory management. Accurately predicting demand and optimally allocating stock across a network of overseas warehouses is extremely difficult. Maintaining this balance is critical: stockouts lead to lost sales and eroded customer satisfaction, while overstocking drives upholding costs and strains cash flow. Addressing this effectively requires moving beyond intuition to implement sophisticated, data-driven forecasting models.

The second major challenge is compliance with diverse and dynamic international regulatory frameworks. In key markets such as the EU and the U.S., regulations covering VAT/sales tax, product safety (e.g., CE, UL), data protection (GDPR), and labelling are not only complex but also frequently updated. Non-compliance risks severe penalties, and sudden regulatory changes—for instance, to import certifications—can render stocked goods unsellable. Successfully navigating this landscape demands continuous investment in local legal expertise or consultants, representing a significant operational cost and risk.

The third persistent challenge is maintaining cost competitiveness. Operations face mounting pressures from volatile international freight rates, rising local labor expenses, and high energy costs. Meanwhile, the disruptive low-cost, rapid-delivery models of platforms like SHEIN and TEMU have intensified industry-wide price competition. To ensure sustainable profitability, it is imperative to pursue comprehensive operational efficiency—optimizing workflows, labor, and returns processing—to build a systemic cost advantage.

These three challenges are deeply interconnected, forming a complex management system. Failure in any one area—whether inventory misallocation, regulatory non-compliance, or cost overruns—can undermine the entire overseas warehouse strategy. Therefore, a holistic and integrated approach is essential for their effective resolution.

4. Application of Information Technology in Overseas Warehouses

4.1 Evolution of Overseas Warehouse Systems (WMS)

The Warehouse Management System (WMS) serves as the central nervous system for modern overseas warehouses, digitally integrating all internal operations. By providing real-time inventory visibility and automating processes from receiving to shipping, cloud-based WMS solutions deliver a level of efficiency, accuracy, and speed unattainable through manual methods, forming a critical technological foundation for competitiveness.

The fundamental architecture of a WMS is typically modular, consisting of four cor e components:

①Inbound Management: Handles goods receipt, barcode scanning, and reconciles sche duled shipments with actual arrivals.

②Outbound Management: Consolidates control over order processing, including order allocation, shipping instruction generation, and label printing.

③Inventory Management: Provides oversight of stock levels, monitors shelf-life dates, and facilitates internal stock transfers.

④Cycle Counting: Manages scheduled or ad-hoc physical inventory audits. Unlike tra ditional full shutdowns, intelligent WMS enables continuous counting of specific zones or SKUs without disrupting operations. Supported by PDAs for automated data capture, this process dramatically improves counting efficiency and accuracy.

The ultimate value of these integrated functions lies in ensuring the reliability of inv entory data. This high-fidelity data forms the essential foundation for accurate demand f orecasting, sound financial reporting, and, consequently, robust strategic decision-maki ng.

4.2 Characteristics of Overseas Warehouse WMS

The WMS for overseas warehouses has evolved from traditional single-facility systems to meet the distinctive demands of Chinese cross-border e-commerce, now incorporating severa l salient features. First, it enables centralized inventory management across multiple locations through a unified dashboard that provides real-time visibility into globally dispersed stock. Th is facilitates optimal inventory allocation and inter-warehouse transfers in response to demand trends, reducing risks of stockouts and overstocking while improving overall supply chain eff iciency. Second, it offers advanced external system integration, seamlessly connecting via AP Is with e-commerce platforms such as TEMU, Alibaba, and Amazon to automate order and lo gistics data exchange. Additionally, its deepening integration with corporate ERP systems uni fies operations and finance, supporting functions like data-driven inventory replenishment. Th ird, multilingual and multi-currency support is essential, accommodating local languages and enabling accurate settlement in various currencies, which underpins the smooth localization o f operations in global markets. Fourth, it provides critical compliance support, embedding reg ulatory information and tools—such as import declaration assistance and regulated product m anagement—to help operators navigate evolving requirements in key markets like the EU and the U.S. The table below summarizes the main differences between this evolved overseas wa rehouse WMS and the traditional WMS used in domestic general trade.

Table: Comparison of cross-border e-commerce overseas warehouse WMS and convention al WMS

Compare items	Overseas warehouse WMS for cross-border e-commerce	Conventional (domestic) WMS
Scope of Managem ent	Centralized management of multi-country warehouse networks	Limited to a single warehouse or domestic warehouse
External System Int egration	API integration with various e-commerce platforms and ERPs is essential	Integrate with own systems or li mited partners
Language Currency Support	Multilingual support and automatic clearing in multiple currencie s	Mainly operated in the national la nguage and national currency
Compliance Feature s	Comply with international laws and regulations such as VAT and commodity regulations	Mainly in accordance with dome stic laws and regulations
Focus on business p rocesses	Faster response to small, high-frequency B2C orders and optimiz ed returns processing	Relatively homogeneous order pr ocessing, mainly B2B

Source: ECCANGTMS & WMS, erp.91miaoshou Created with reference.

In summary, as cross-border logistics shift structurally toward a network paradigm centere d on overseas warehouses, the WMS has emerged as its key enabler.

4.3 Transition to Smart Warehouses

4.3.1 Inventory Optimization through AI Demand Forecasting

The core challenge of demand uncertainty, where experience-based forecasts often lead to stockouts or overstocking, is directly addressed by intelligent WMS. By integrating AI algorithms that analyze diverse data—from historical sales and marketing plans to market and social trends, the system generates accurate demand forecasts. These forecasts automatically determine optimal reorder points and quantities, mitigating stockout risks and avoiding excess inventory. Furthermore, they directly inform dynamic inventory allocation across the warehouse network. For instance, if AI predicts rising demand in Europe and falling demand in the U.S., the system will propose transferring stock accordingly. This enables pre-positioning inventory closer to end markets, simultaneously shortening lead times and lowering logistics costs.

4.3.2 Visualization and Optimization of Operational Processes through IoT

IoT technology integrates physical operations into the digital system, ensuring end-to-end visibility. Through smart labels (QR codes, barcodes, RFID) and PDA scans, every process—inbound, storage, picking, shipping—is recorded in the WMS in real time. This visibility serves two primary purposes. First, it provides constant, accurate inventory data, eliminating dependence on daily cycle counts and mitigating risks of lost sales or excess stock. Second, the data fuels operational optimization: the WMS analyzes picker routes to prescribe the most efficient paths, increasing order throughput and reducing labor costs. Furthermore, sensors monitor warehouse conditions (e.g., temperature, humidity) to safeguard product quality. Together, these capabilities boost per-unit-time processing efficiency, directly countering the challenges of rising costs and intense competition.

4.3.3 Maximizing Operational Efficiency through Automation and Robotics

Smart warehouses address the critical constraints of labor shortages and human error by deploying automation and robotics to enable stable, high-quality operations 24/7. Automated Guided Vehicles (AGVs) and Autonomous Mobile Robots (AMRs) transport goods and fulfill orders, alleviating manual burdens. Concurrently, inventory-counting robots routinely traverse aisles, using RFID technology to capture stock data with high speed and accuracy. These technologies not only relieve staff from repetitive tasks but also significantly reduce shipping errors. Furthermore, these automated systems operate in a coordinated sequence under WMS based on shipping orders, equipment picks items, transports them to packing stations, and prepares them for carrier handoff. This deep integration allows the warehouse to function as a cohesive system, maximizing equipment utilization and processing capacity, which directly sustains cost competitiveness.

4.3.4 Data-Driven Compliance and Decision-Making

The intelligent WMS directly addresses the complex, high-risk challenge of complying with diverse national tax and regulatory frameworks, evolving into a proactive platform for navigating dynamic regulatory changes. For instance, it embeds country-specific VAT and sales tax rules to auto-generate reports and can flag products facing import restrictions or expiring certifications, thereby mitigating compliance burdens and risks. More profoundly, it provides robust support for executive decision-making. By generating multifaceted data reports—on metrics like inventory turnover, SKU profitability, and workforce productivity—it enables data-driven strategic judgments, moving beyond reliance on intuition. In this way, the transition to intelligent warehouses transcends task optimization; it is a systemic innovation that enhances supply chain resilience and competitiveness, forming the critical foundation for the sustainable growth of Chinese cross-border e-commerce in a complex global landscape.

5. Case Studies

5.1 TEMU's Semi-Hosted Model and WMS Integration

TEMU's Semi-Hosted Model (2024□2025) mandates that sellers use its certified overseas warehouses and meet strict Service Level Agreements, notably shipping orders within 72 hours of receipt. Compliance requires a WMS that is API□integrated with the platform. Providers such as ECCANG have deepened integration with TEMU□certified warehouses, offering dedicated functions like return management and customs□document generation. Consequently, the WMS has evolved from an operational tool into essential infrastructure for compliance and efficiency within the cross□border ecosystem—without it, satisfying TEMU's logistics demands would be extremely difficult.

Key integration requirements include data□format and API compatibility, real□time inventory synchronization, end□to□end logistics transparency, high automation of order processing, and robust data security. This integration drives the shift to an intelligent warehouse, which systematically addresses core operational challenges through three pillars: AI□driven demand forecasting and dynamic inventory allocation; IoT and automation for operational efficiency; and embedded, data□driven compliance functions.

AI forecasting leverages TEMU's sales data to auto□calculate safety stock and reorder points, mitigating both stockout□related lost sales and overstock□induced cash□flow strain. IoT devices enable real□time process visibility, while automated robots and AGVs, directed by the WMS, ensure 24/7 operations—reducing error, maximizing throughput, and upholding the 72□hour SLA (Service Level Agreement) amid rising labor costs. Moreover, the WMS stores country□specific VAT and product□certification rules, auto□generating required documentation for regulated goods, thereby enabling compliant shipments even for sellers with limited regulatory expertise.

Thus, the high□standard logistics performance demanded by TEMU's model is not merely supported by WMS connectivity but is fundamentally enabled by an intelligent warehouse core built on AI, IoT, and integrated analytics.

5.2 Cainiao Network's Intelligent Logistics Infrastructure

Cainiao Network has advanced its "Global Five-Day Delivery" service from five business days to five calendar days, setting a new industry benchmark. This achievement is powered by an intelligent logistics foundation integrating AI-driven demand forecasting, IoT-based real-time tracking, and a cloud-based WMS at the core of its smart warehouse network.

Cainiao's system is built on a scalable, cloud-native architecture. A big data platform aggregates operational data from warehouses worldwide, which an AI engine analyzes forecasting, inventory optimization, and route planning. These insights are executed through cloud WMS, coordinating logistics across the network.

Cloud WMS delivers value beyond traditional management in three key areas. First, it uses Alibaba's transaction data to accurately predict demand and pre-position inventory in overseas warehouses, enabling both high turnover and fast delivery. Second, integration with IoT sensors, AGVs, and automated robots increases operational efficiency, ensures full visibility, and maintains reliability during peak periods. Third, built-in compliance functions automate processes like export declarations and VAT handling, helping sellers meet international regulations easily.

Cainiao's case shows that overseas warehouse systems are evolving from operational tools into strategic, autonomous optimization platforms. The WMS acts as a "digital twin," using data to continuously improve the physical network. Thus, the "Global Five-Day Delivery" reflects optimization of the entire intelligent logistics ecosystem—where advanced information systems themselves become a key competitive advantage.

5.3 Summary of Case Studies

The advancement of information systems—specifically the integrated use of AI and IoT technologies built upon a WMS foundation—is fundamentally redefining the strategic value of overseas warehouses. These systems not only provide robust solutions to traditional challenges in demand forecasting, inventory optimization, operational efficiency, and cost control but also, as evidenced by cases such as TEMU and Cainiao, enable adaptation to the fast-evolving strategies of cross-border e-commerce platforms. As a result, technological sophistication is becoming a key differentiator for delivering a superior customer experience in the global marketplace.

The intelligent transformation of overseas warehouses is therefore no longer a future vision, but a strategic imperative. It has become the essential cornerstone for Chinese cross-border e-commerce to advance into its next stage of sustainable and competitive growth.

6. Conclusion

This study has systematically analyzed the strategic value of overseas warehouses and their supporting information systems in Chinese cross-border e-commerce. It demonstrates that evolving international regulations (e.g., the U.S. de minimis threshold) and intense competition are accelerating a structural shift from direct shipping to a network-based logistics model centered on overseas warehouses. In this paradigm, establishing warehouses is insufficient; competitive advantage now critically depends on integrating AI and IoT with core WMS.

The research establishes that transitioning to Smart warehouses systematically addresses core operational challenges. By integrating AI-driven forecasting, IoT-based automation, and embedded compliance, these systems evolve from operational tools into strategic infrastructure, as shown by the cases of TEMU and Cainiao Network. This confirms the thesis that information system sophistication is a decisive factor in strategic effectiveness.

Looking ahead, the advancement of multi-warehouse coordination and technologies like generative AI will further enhance supply chain adaptability. Deep integration of advanced systems with warehouse operations is now a strategic imperative for the sustainable growth and global competitiveness of Chinese cross-border e-commerce. This intelligent transformation will optimize costs, redefine the customer experience, and serve as the core engine for the industry's next phase.

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