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Analysis of the Current Status, Challenges, and Countermeasures in Cold-Chain Logistics and Distribution under the New Retail Model

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ABSTRACT

In recent years, online consumption and demand for on-demand retail have continued to grow. New retail models such as Hema Fresh, Dingdong Maicai, and community group buying have rapidly gained popularity, effectively breaking the time and space constraints of traditional fresh food consumption and bringing great convenience to residents' lives. Cold chain logistics and distribution are the core components for ensuring the quality of fresh products and supporting the development of new retail; however, their overall development level remains relatively lagging, becoming a key factor constraining the industry's quality improvement and upgrading. This article examines the current state of cold chain logistics and distribution in the new retail sector, analyzes its prominent issues, and proposes targeted improvement strategies to promote the sustainable development of new retail cold chain logistics and distribution.

KEYWORDS

New Retail; Cold Chain Logistics; Distribution

1. CURRENT STATUS OF COLD CHAIN LOGISTICS AND DISTRIBUTION IN THE NEW RETAIL MODEL

1.1. Inadequate Temperature Control Throughout the Supply Chain

In the operation of new retail cold chain logistics, maintaining continuous temperature control throughout the entire process is challenging, and "temperature chain breaks" are relatively common. Fresh produce must pass through multiple transfer points from the production area to the consumer, and temperature control may fail at any stage. At the production end, many fruits, vegetables, and seafood are not pre-cooled promptly after harvest; instead, they are often stacked and loaded at room temperature, leading to water loss and spoilage from the source, making it difficult to guarantee freshness. During trunk-line transportation, some refrigerated vehicles have aging equipment with unstable cooling performance. To cut costs, some companies lower the temperature or even temporarily shut off the refrigeration system during transit, resulting in significant temperature fluctuations. These issues become even more pronounced during urban transshipment and last-mile delivery. In transshipment cold storage facilities, temperature zones are often poorly defined, and it is common for frozen, refrigerated, and ambient-temperature goods to be stored together. Additionally, prolonged opening of warehouse doors during loading and unloading causes significant loss of cold air. During "last-mile" delivery, most stations still rely on standard electric vehicles, with delivery personnel using only simple foam boxes and ice packs for insulation. In the summer heat, ice packs melt rapidly, and in the winter cold, products are exposed to direct cold air, leaving them essentially at room temperature. Community group-buying pickup points generally lack refrigeration

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and freezing facilities; cold-chain goods are stored alongside regular packages, left unattended for extended periods, and frozen foods undergo repeated thawing, resulting in a significant decline in quality.

1.2. Insufficient Product Quality Consistency

Due to broken temperature control chains and careless handling, product wastage in new retail cold-chain delivery remains high, making it difficult to maintain consistent quality. Delicate fruits and vegetables such as leafy greens, strawberries, and blueberries are prone to bruising, crushing, and rotting during delivery, often resulting in large quantities of unsellable goods upon arrival. If temperatures for meat and seafood do not meet standards, they may become sticky, discolored, or develop off-flavors, rendering them unfit for consumption. Products like prepared meals, fresh milk, and short-shelf-life pastries have strict temperature requirements; even slight deviations can cause spoilage or expiration. Often, within the same batch of goods, some consumers receive items that are fresh and intact, while others experience softening or spoilage, resulting in inconsistent quality. High wastage not only leads to resource waste but also increases operational costs for merchants. Some merchants raise prices to offset these expenses, ultimately passing the burden onto consumers, creating a situation where "quality is inconsistent and prices are high."

1.3. Delivery Services Require Standardization

A positive shopping experience enhances consumer brand awareness and loyalty. When consumers enjoy convenient, comfortable, and professional service during the purchasing process, their positive impression of the brand is strengthened, and they are more likely to repurchase its products. New retail emphasizes immediate and on-time delivery, but the standardization of cold-chain logistics services remains insufficient, often resulting in a consumer experience that falls short of expectations. During morning and evening rush hours or promotional periods, a surge of orders can easily overwhelm distribution centers, leading to prolonged backlogs of fresh produce and frequent delivery delays. Inefficient route planning often results in riders taking detours or backtracking, which not only extends delivery times but also increases the risk of product jostling and damage. Additionally, careless handling—such as mixing fresh produce with daily necessities and standard parcels—frequently causes cross-contamination, odor transfer, and damage from compression. Some delivery personnel lack professional training and have insufficient knowledge of basic practices such as handling fresh produce with care and maintaining temperature control, leading to frequent instances of rough handling and haphazard stacking. When customers are not home or contact is difficult, goods are often left exposed for extended periods during redelivery, further reducing freshness and resulting in an increase in consumer complaints.

1.4. High Operating Costs and Significant Profit Pressure

Cold-chain logistics inherently requires significant investment in equipment, facilities, and packaging. Combined with the industry's overall low operational efficiency, this results in persistently high costs, placing considerable pressure on corporate profitability. The costs of purchasing refrigerated vehicles, fuel, and maintenance are far higher than those for ordinary vehicles, while expenses for cold storage construction, daily electricity, and equipment maintenance also remain consistently high. Expenditures on consumables such as specialized insulated boxes, long-lasting ice packs, and temperature-control devices, along with cost losses due to high wastage, further drive up overall operating expenses. Small and medium-sized businesses and platforms have limited capacity to build their own cold chain infrastructure and thus rely heavily on third-party cold chain services. However, third-party service prices are relatively high, and market pricing lacks transparency. To capture market share, some companies are forced to lower product prices and delivery fees, resulting in continuously shrinking profit margins. This traps them in a dilemma where "improving quality incurs

high costs, while lowering prices makes profitability difficult," leading to low overall profitability across the industry.

2. CHALLENGES IN COLD CHAIN LOGISTICS AND DISTRIBUTION UNDER NEW RETAIL

2.1. Imbalanced Infrastructure Distribution

Advanced technology forms the foundation of cold chain logistics. The gradual improvement of cold chain logistics has driven the development of the fresh produce industry. Cold chain logistics in the context of new retail requires a high degree of specialization across all stages. Every step—from supplier-to-distribution-center transportation, the establishment and warehousing management of distribution centers, to distribution-center-to-customer transportation and the use of storage equipment—demands professional operation. Only through the combination of advanced cold chain logistics technology and appropriate management can the quality of fresh produce be guaranteed. At the production end, there is a shortage of pre-cooling and preservation facilities, resulting in weak preservation capabilities at the source; at the urban end, the layout of cold storage facilities and forward warehouses is unreasonable, with insufficient coverage in suburban and emerging areas; at the community level, the penetration of cold chain pickup points and smart refrigerated lockers is low, and there are obvious shortcomings in temperature control for the last mile. At the same time, many small and medium-sized businesses and third-party cold chain enterprises have limited resources and are unable to upgrade or renovate their equipment; their facilities are outdated and functionally limited, making it difficult to meet end-to-end temperature control requirements.

2.2. Lack of Professional Operational Management Capabilities

Overall operational management in the industry remains relatively rudimentary, lacking standardized and refined operational procedures, and suffering from insufficient professional management capabilities. Most companies do not have comprehensive cold chain operating standards, and each stage—including warehousing, transportation, loading/unloading, and distribution—relies solely on manual experience. Tasks such as order scheduling, route planning, and inventory management are poorly digitized; manual operations are inefficient and prone to errors, often leading to chaos during peak periods. Delivery personnel are predominantly temporary workers who lack systematic professional training and have insufficient knowledge of temperature control, freshness preservation, and standard operating procedures, making it difficult to guarantee service quality.

2.3. Inadequate Industry Collaboration Mechanisms

Existing cold chain standards lack detail and have weak enforcement mechanisms, and there is a lack of collaboration mechanisms across different stages and entities. The new retail model relies on big data and digital technologies, but its data-driven nature also introduces new food safety risks. First is the issue of data authenticity: food safety traceability systems depend on the authenticity and completeness of data, but under the new retail model, data may face risks of forgery or tampering, affecting the reliability of traceability systems. Second is the problem of information silos: data systems across different stages may not be interconnected, preventing end-to-end traceability of food safety information. For example, some small and medium-sized suppliers may lack digital capabilities, resulting in incomplete supply chain information and affecting the overall effectiveness of traceability; requirements for temperature control, packaging, and inspection of different product categories are not sufficiently clear, leaving enterprises without a unified basis for implementation. The lack of information exchange and data sharing among various links—including suppliers, warehouses, distributors, delivery points, and consumers—creates information silos, preventing real-time synchronization of order status, temperature data, and location information. Once quality issues or

supply chain disruptions occur, it becomes difficult to clearly define responsibilities among all parties, and losses cannot be effectively attributed.

2.4. Development Constraints for Small and Medium-Sized Entities

Cold chain logistics is a capital-intensive industry characterized by high upfront investment and long return cycles, resulting in a significant imbalance between costs and returns. Building their own cold chain facilities and establishing professional delivery teams is prohibitively expensive for small and medium-sized businesses. Relying on third-party services, however, presents challenges such as high costs and inconsistent service quality. Fierce price competition within the industry forces companies to continuously squeeze profits in order to capture market share, leaving them unable to invest in facility upgrades and management optimization. This traps them in a vicious cycle of "low cost, low quality, and low profit," significantly limiting their growth potential.

3. RESPONSE STRATEGIES

3.1. Addressing Infrastructure Shortcomings and Ensuring Balanced Distribution

The focus should be on strengthening two key weak links: pre-cooling at the source and last-mile delivery. At the source, mobile cold storage units and simple pre-cooling facilities should be promoted to ensure that fresh produce is rapidly cooled and preserved after harvest; In urban areas, forward-deployed warehouses and distribution centers should be strategically located based on order density to expand coverage in suburban and emerging areas; at the last mile, partnerships with communities, convenience stores, and property management companies should be established to set up low-cost shared cold-chain pickup points and deploy smart refrigerated lockers, thereby addressing temperature control gaps in the "last mile." At the same time, cost-effective professional insulated boxes and long-lasting ice packs should be promoted to enhance the freshness retention of simple packaging. In county and rural areas, a model involving government subsidies, corporate participation, and social capital cooperation can be adopted to gradually improve basic cold chain infrastructure. Priority should be given to key towns and townships, with coverage then gradually expanded to avoid blind investment and ensure both feasibility and practicality.

3.2. Standardize and Enhance Professional Operational Management Capabilities

Develop concise, actionable end-to-end operational guidelines that clearly define temperature control standards, loading/unloading requirements, packaging specifications, and handover procedures for each stage, and ensure strict compliance by enterprises. Conduct regular inspections and maintenance of refrigerated trucks, cold storage facilities, and other equipment to ensure proper refrigeration functionality. Establish real-time temperature monitoring mechanisms to enable timely alerts and corrective actions in case of anomalies. During peak order periods, pre-allocate transport capacity and implement order sorting and distribution to prevent prolonged product backlogs. Strictly enforce the separation of fresh produce from general merchandise during delivery, implementing dedicated vehicles, personnel, and routes. Simultaneously, strengthen basic training for delivery personnel, disseminating knowledge on temperature control, freshness preservation, and standardized operations. Link service quality to performance evaluations to gradually enhance the professional competence of staff. Standardized management does not require massive capital investment; the key lies in long-term persistence and strict implementation. Although this may slightly increase management costs in the short term, it will effectively reduce losses and complaints in the long run, yielding significant overall benefits.

3.3. Unify Industry Standards and Strengthen Collaborative Coordination

To ensure the quality and safety of fresh produce, cold chain logistics industry standards play a critical role. Taking the EU's cold chain logistics standards as an example, there are strict and detailed regulations regarding temperature control for different types of fresh produce. For instance, the refrigeration temperature for fresh meat must be strictly maintained between -1°C and 1°C, with temperature fluctuations during transport not exceeding ±0.5°C; for fresh vegetables, the appropriate refrigeration temperature is generally between 0°C and 5°C. By categorizing products into different types—such as fruits and vegetables, meat, and prepared meals—and refining unified standards for temperature control, packaging, inspection, and handover, we can enhance the standards' practicality and enforceability. Led by industry associations and leading platforms, the entire industry should be encouraged to adopt these standards, gradually reducing discrepancies between companies. A unified information-sharing platform should be established to break down data silos across suppliers, warehouses, distribution centers, and delivery stations, enabling real-time synchronization of order, temperature, location, and inventory information, with full traceability and query capabilities throughout the process. Standardized cooperation agreements should be signed to clearly define responsibilities at each stage. In the event of supply chain disruptions, spoilage, or quality deterioration, the responsible party shall bear the corresponding losses to prevent mutual buck-passing. Promote shared delivery and consolidated order models to aggregate scattered orders, improve vehicle load factors, and reduce per-order delivery costs. The core of standard development and collaborative coordination lies in balancing the interests of all parties; through long-term stable cooperation, shared costs, and shared benefits, we aim to achieve efficient coordination and mutual benefit.

3.4. Strengthening Industry Market Regulation

Industry associations and platforms should jointly conduct routine supervision and inspections, regularly verifying temperature control compliance, equipment condition, and adherence to operational standards, while publicly naming and penalizing non-compliant enterprises. Establish a corporate credit rating system to provide support—such as priority order allocation and policy incentives—to enterprises with good credit, while restricting cooperation with and gradually phasing out those with poor credit. Consumers should be encouraged to participate in oversight by inspecting product condition upon receipt and promptly filing complaints if issues are discovered; platforms should implement a pre-compensation mechanism. Government departments should intensify spot inspections and severely crack down on fraudulent cold-chain practices and non-compliant operations to safeguard food safety standards. By combining regulatory oversight with self-discipline, we can curb the phenomenon of "bad money driving out good," guide enterprises toward honest business practices and standardized development, gradually purify the industry environment, and promote the long-term healthy development of cold-chain logistics and distribution.

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