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# Problems and Countermeasures in Quality Management: A Case Study of Cold Chain Logistics

**Haosen He**
School of Business Administration, Henan Polytechnic University, Jiaozuo 454000, China

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## Abstract

Cold chain logistics keeps perishable food at a controlled temperature from the point of production to the dinner table, so the way it is managed bears directly on food safety, product losses and distribution costs. Drawing on recent industry statistics, this paper first reviews the current state of cold chain logistics management in China, covering market size and potential, the level of technology application, and the condition of equipment and its maintenance. Four problems that hold back quality management are then identified: excessively high logistics costs, limited government support, unsatisfactory management and service levels, and a fragmented market. In response, countermeasures are discussed in four directions, namely refined cost control, stronger policy support and guidance, better management and services, and regionally differentiated operations. The paper argues that the healthy development of cold chain logistics depends on the joint efforts of government, enterprises and consumers, and closes with a brief outlook on the future of the industry.

## Keywords

Cold Chain Logistics; Quality Management; Transportation Management; Countermeasures

## 1. Introduction

As the Chinese economy develops, what people expect from their food has been quietly changing. Having enough to eat is no longer the issue; consumers now want food that is fresh, nutritious and safe, and they are increasingly willing to pay for that assurance [10]. Cold chain logistics, which keeps perishable products within a strict temperature range from harvest or production all the way to the consumer, has therefore grown from a specialised service into a basic requirement of the modern food system. An unbroken cold chain slows down microbial growth, preserves texture and taste, and cuts the losses that occur in ordinary, unrefrigerated distribution.

China's cold chain sector is expanding fast. Cold storage capacity keeps growing, fleets of refrigerated vehicles are being renewed and enlarged, and information

systems for temperature monitoring are being built out across the supply chain. Government has lent strong support: a series of policies has been issued in recent years to encourage enterprises to invest in cold chain infrastructure, and green supply chain initiatives have added further momentum [8]. Standards work is also under way, as regulators gradually assemble a system of technical specifications for food cold chain logistics [6].

Growth, however, has not solved the sector's underlying problems. Costs remain stubbornly high; the chain is thin in rural areas and easily broken in transfer; management practices vary widely between firms; and the market is scattered across regions with very different conditions. These weaknesses not only slow the industry down but also pose a real threat to food safety and consumer health.

Against this background, this paper examines quality management in cold chain logistics and searches for workable countermeasures. It first describes the current state of the industry, covering market size and potential, technology application, and equipment maintenance. It then analyses four major problems, namely high logistics costs, limited government support, weak management and service levels, and a fragmented market. Countermeasures are proposed accordingly, and the paper closes with a discussion of what government, enterprises and consumers each need to do.

## 2. Current Status of Cold Chain Logistics Management

### 2.1. Market Size and Potential

#### 2.1.1. Market Size

The cold chain logistics market keeps expanding, with both demand and revenue growing steadily. In the first three quarters of 2023, the total value of goods moved through China's cold chain reached RMB 6.4 trillion, up 4.2% year on year, while cold chain revenue over the same period came to RMB 417.8 billion, an increase of 3.6%. Figures for the first half of 2023 point the same way: total cold chain value stood at RMB 3.22 trillion, up 3.9%, cold chain freight volume reached 220 million tonnes, up 4.4%, and cold chain revenue amounted to RMB 277.9 billion, up 3.4%. Taken together, these figures confirm that both the demand side and the revenue side of the market are on a clear upward path.

#### 2.1.2. Market Potential

The market still has considerable room to grow. China is a major producer and consumer of agricultural products, and as household incomes rise, consumers keep asking for more variety, better nutrition and better taste in their food. The rapid rise of fresh food e-commerce has added another layer of demand, pushing the whole sector into a phase of fast growth; industry forecasts put the market at roughly RMB 897 billion by 2025. Investment in infrastructure is following the same trend. In the first three quarters of the year, RMB 36.507 billion flowed into cold storage projects,

up 7.53% year on year, while sales of new-energy refrigerated vehicles jumped to 9,257 units, an increase of 230.96%. International cold chain trade is also active: Chilean cherries and Russian king crab now reach Chinese dinner tables through well-established logistics corridors, which shows how far the country's cold chain reach has extended. All of this points to a market with a long growth runway.

### 2.2. Level of Technology Application

Technology has spread unevenly through the sector. The Internet of Things, big data analytics and cloud computing are widely used elsewhere in the economy, but cold chain logistics has yet to integrate them deeply, and adoption lags behind what is technically possible [1]. Taking fresh produce as an example, this gap translates directly into lower transport efficiency, higher costs and inconsistent service quality. The transport stage in particular trails that of developed countries. Blockchain-based traceability, which can follow a consignment through the whole chain and guarantee its quality and safety, is still at an early stage of application in China [9]. GPS tracking of refrigerated vehicles, which allows operators to monitor position and running status in real time and improve dispatching, is far from universal. Intelligent temperature control, which can hold different goods at their required temperatures precisely, still faces practical obstacles in day-to-day use. Behind all of this sits a broader weakness in cold chain handling technology: temperature swings during transhipment remain common, and every swing puts product quality at risk [7].

### 2.3. Equipment Technology and Maintenance

How advanced the equipment is, and how well it is maintained, largely decides whether cold chain quality is up to standard. Many companies, however, work with outdated equipment and skimp on routine care. Backward facilities are a common problem across the industry: cold chain equipment is expensive to buy or upgrade, so some firms keep running obsolete machinery for years in order to save money. An ageing refrigeration unit may no longer hold temperature accurately, which is enough to damage goods with strict temperature requirements. Old equipment also tends to consume more energy, pushing operating costs up further. Daily maintenance matters just as much as the equipment itself. Even the most modern facility will degrade if cleaning and servicing are neglected: performance falls, breakdowns follow, product quality suffers and repair costs mount. In practice, because maintenance work is tedious, quite a few cold chain companies leave it half done [2].

## 3. Problems in Cold Chain Logistics Management

### 3.1. Excessive Logistics Costs

High cost is the most direct bottleneck restraining the quality development of the

cold chain system. Ordinary vehicles and warehouses simply cannot meet cold chain requirements. Fruit and vegetables, for instance, generally need to be stored and moved at a constant 0–4°C, a service that conventional transport and warehousing cannot provide. Refrigerated vehicles, by contrast, are expensive. Based on domestic market information for 2022–2023, Table 1 compares the prices of refrigerated and ordinary vehicles across size classes.

**Table 1.** Price comparison between refrigerated and ordinary vehicles by size class (unit: RMB 10,000)

| Specification | Large | Medium | Small | Mini |
|---|---|---|---|---|
| Refrigerated vehicle | 40–60 | 20–30 | 10–15 | 6–8 |
| Ordinary vehicle | 30–40 | 15–25 | 8–12 | 3–6 |

As the table shows, refrigerated vehicles command a hefty premium, which limits the capacity of most regions to organise large-scale cold chain operations. Temperature-controlled warehouses are no cheaper: a constant-temperature store of 100–2,000 cubic metres costs seven to ten times as much to build and run as an ordinary warehouse of comparable size. Few enterprises can shoulder that burden; at present only a handful of large companies own independent temperature-controlled facilities, so the supporting role the cold chain could play in regional economic development remains limited. High construction costs are thus a structural feature of the system rather than a temporary difficulty [3].

### 3.2. Limited Government Support

Government attention to the cold chain has grown in recent years, and a series of supportive policies has been issued, but implementation still falls short in several respects. First, the support is neither deep nor wide enough. In many rural townships the cold chain infrastructure remains rudimentary and needs sustained public investment and attention. Second, policies land unevenly. Regions differ in geography and environment, and areas where cold chain construction is inherently difficult tend to fall behind, whatever the policy documents say on paper [4]. Third, government talks too little with firms and the market, so some measures fail to match what enterprises actually need, which weakens their effect.

### 3.3. Unsatisfactory Management and Service Levels

Weak management and service show up at several points in the chain. (1) The cold chain as a whole lacks systematic, standardised management. Production, processing, storage and delivery are loosely connected, information does not flow between them, and resources are allocated inefficiently, too slowly to keep up with rapidly changing demand. (2) Service quality is uneven. Standards vary between providers, and few firms offer targeted or personalised service schemes, so the diverse and rising expectations of fresh food consumers go unmet. (3) The industry is short of trained people. Many practitioners lack the specialised knowledge and

skills the work requires, which caps both service quality and management efficiency. For fresh produce in particular, every link from farm to consumer is sensitive to temperature and time, and a single lapse in management can degrade the product or destroy its value outright, costing the firm money and reputation.

### 3.4. A Fragmented Market

A scattered market is another basic difficulty on the road to high-quality development. Demand for cold chain services exists almost everywhere, but regional development levels and customer density differ sharply, and this produces a fragmented pattern. The fragmentation is largely spatial: customers are spread between city and countryside within regions, and between regions across the country. In practice, most cold chain facilities, firms and organisations cluster in cities and on urban fringes, while rural areas lag behind; yet rural e-commerce is well developed and the need to ship fresh goods in and out of villages is real and pressing. With few resources on the ground, supply and demand struggle to match [5]. At the national scale, the north-west and south-west present a different version of the same problem: vast territory, sparse population, modest total demand and widely dispersed users, all of which depress commercial returns and hold back the development of a high-quality cold chain in those regions.

## 4. Countermeasures for Quality Management of Cold Chain Logistics

### 4.1. Strengthening Cost Management

Cost management is the first lever to pull, and it should rest on two legs: government guidance and enterprise self-management. On the government side, local authorities can use their advantages in organisation and information to gather data on the local cold chain, on comparable regions, and on practice in developed countries, and turn the findings into practical development plans that spell out construction requirements and cost configurations for local firms to consult. Governments can also bring in economists and management scholars to design general-purpose schemes suited to local enterprise conditions, giving firms a reference framework as they expand their cold chain business. On the enterprise side, the appropriate tool is refined management: firms should analyse their own information and development plans in the light of government guidance, break costs down item by item, control them directly, cut non-essential spending and keep the financial burden within bounds.

### 4.2. Strengthening Policy Support and Guidance

Policy can do more, and support can come from several directions at once. Tax and fee reductions, preferential land use and direct funding all have a part to play. Authorities could, for example, cut taxes or provide fiscal subsidies to encourage

enterprises to invest in cold chain infrastructure, and use land policy to make cold chain projects cheaper to run. Special funds could also be established to support research and development in cold chain technology and push the industry to upgrade. The guiding principle is simple: use policy to lower the cost of doing the right thing.

### 4.3. Improving Management and Service Levels

Management and service levels determine the efficiency of the whole system, and improving them means advancing on several fronts at once. First, fresh produce calls for refined, science-based management, yet many cold chain firms still run on traditional models without effective information tools or system support. The result is higher operating costs, lower service quality and slower response. Second, the cold chain involves many links, including production, processing, storage, transport and sales, and every link needs precise control and close coordination. In practice, the absence of unified standards leaves information silos between links, misallocates resources and drags efficiency down; temperature and humidity monitoring gaps on the road still cause fresh produce to spoil in transit, bringing direct financial losses. Third, customer service is underdeveloped. As competition intensifies and demand diversifies, good service is what wins and keeps customers, but many firms invest too little in it, lack professional service teams and cannot respond in time, which erodes satisfaction and loyalty. Fourth, talent is scarce. Cold chain logistics is a highly specialised field, but training mechanisms are incomplete, and people who combine expertise in cold chain technology, information systems and management are rare, which limits what the industry can achieve [7, 9]. In short, firms need to invest more in information systems, push data sharing and process standardisation across links, build responsive customer service teams, and bring in and train capable people, so that the professional level of the whole industry rises.

### 4.4. Implementing Regionally Differentiated Management

Regions differ, and management should differ with them. Differentiated regional management means that each locality sets its own concrete goals and methods for cold chain development, while keeping service coverage broad, so that the arrangements fit local conditions. In the sparsely populated provinces of the west and centre, where demand is scattered, a corridor-based model is worth trying. Local government service departments could act as hubs, building service stations along the main transport routes and equipping them with small power-generation units so that fresh agricultural products can be held temporarily when needed; when idle, the stations could sell storage commercially to other users. Local governments could also publish their area's cold chain capacity and demand on official websites and new media, sharing the information between logistics firms and consumers so that intended cooperation can be concluded quickly. Better

information flow of this kind improves both information management and business efficiency, and gives local cold chain development a firmer footing.

## 5. Conclusion

Quality management in cold chain logistics is a complex, systemic undertaking, and it requires effort from government, enterprises and consumers alike. Government should strengthen its support for the industry: increase spending on infrastructure through fiscal allocations and special funds, broaden investment channels so that social capital can take part, and move quickly to issue industry standards and norms, including refrigerated vehicle temperature control standards and cold storage construction standards, so that the industry has a unified operating guide and a clear quality benchmark. Targeted support in taxation and financing, such as tax relief for cold chain firms and encouragement for financial institutions to lend to them, would ease the funding constraints many firms face.

Enterprises, for their part, should tighten their own management, raise service levels and efficiency, cut costs and build competitiveness. They can bring in experienced professionals to advise on management systems and staff training, set up internal development programmes that produce logistics managers with well-rounded skills, and put in place rules that give employees a clear basis for action in cold chain transport. On the technical side, firms should actively develop cold chain management technology and equipment, strengthen information systems so that consignments can be tracked precisely from end to end, and support the growth of third-party cold chain specialists so that resources are allocated rationally. Innovations such as intelligent management systems, optimised routing and better energy control all help to lower operating costs and lift margins, as does raising the utilisation of existing facilities. Consumers, finally, are not passive participants: their food safety awareness and their willingness to choose qualified cold chain firms and products push the whole industry to improve, and rising expectations for freshness and delivery speed are exactly the pressure the sector needs.

No single actor can carry the industry forward alone. Cold chain logistics bears on the quality and safety of food and pharmaceuticals, on economic development and on the quality of everyday life. Only by combining the efforts of government, enterprises and consumers, and by steadily raising service quality and efficiency, can the industry achieve genuinely high-quality development in the years ahead.

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