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Practice of Supply Chain Optimization of Luckin Coffee from the Perspective of Digital Transformation and Its Industry Enlightenments

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Abstract

Against the backdrop of China's booming digital economy and evolving new retail formats, competition in the catering and retail industry has shifted from front-end marketing rivalry to back-end supply chain capacity building. Traditional experience-driven supply chain models fail to accommodate the diversified demands of young consumers and operational pressures of large-scale expansion, rendering digital transformation an imperative for enterprises to foster long-term core competitiveness. Taking Luckin Coffee, China's leading chain coffee brand, as the research subject and grounded in systems theory, dynamic capability theory, and the supply chain resilience lifecycle framework, this paper systematically examines the full-chain digital optimization practices of its supply chain spanning procurement, intelligent manufacturing, logistics scheduling, and store operations. The findings indicate that digital empowerment has enabled Luckin to effectively reduce operational costs, ensure nationwide product quality consistency, improve inventory turnover, and enhance supply chain resilience. This paper also identifies core challenges such as system computing bottlenecks, data security risks, overseas localization barriers, and interdisciplinary talent shortages, and puts forward targeted countermeasures. It concludes with a phased transformation path for small and medium-sized enterprises, providing practical references for the digital upgrading of the retail and catering industry.

Keywords

Digital Transformation; Supply Chain Management; Luckin Coffee; New Retail; Supply Chain Resilience

1. Introduction

With the deepening of globalization and the explosive development of information technology, the world economy is entering a new stage featuring intelligent development. For China's fiercely competitive new retail industry, the traditional supply chain management model dominated by "human governance" and empirical judgment is facing multiple bottlenecks such as sluggish response, high costs, and

unstable quality control. To address the increasingly diversified consumer demands of contemporary young groups, enterprises must rely on digital technologies to deconstruct and reshape the entire supply chain [1].

Since its founding, Luckin Coffee has rapidly reshaped the competitive landscape of China's freshly brewed coffee market with its disruptive business model. After its early period of reckless expansion and subsequent strategic restructuring, Luckin Coffee has achieved a remarkable turnaround. By the end of 2025, the number of Luckin Coffee stores worldwide had exceeded 18,000, making it the largest chain coffee brand in China in terms of store scale [2]. What underpins the efficient and stable operation of this huge commercial system is not merely capital operation or front-end marketing, but a digitalized full-industry-chain supply chain system embedded in the corporate gene.

Against the backdrop of the rapid development of China's digital economy and the continuous iteration of new retail models, competition among modern catering and retail enterprises has long evolved from front-end marketing and product competition to all-round competition of back-end supply chain systems. Taking Luckin Coffee, a leading brand in China's freshly brewed coffee industry, as the research object, this paper deeply analyzes how it reshapes its supply chain management system through digital transformation under the scale of ten thousand stores. Based on the theoretical framework, this paper sorts out the whole-industry-chain optimization practice of Luckin Coffee, from upstream global centralized procurement, mid-stream asset-heavy smart baking and manufacturing, to downstream store intelligent fulfillment. The research shows that through in-depth digital technology empowerment, Luckin Coffee has not only reduced logistics and inventory costs and improved product quality, but also built a highly resilient supply chain ecosystem that can quickly respond to the emotional consumption demands of contemporary young people. In addition, this paper summarizes the possible challenges faced by Luckin Coffee in the process of digital transformation and puts forward corresponding countermeasures, aiming to provide useful references for China's physical retail and catering industries in the digital transformation of supply chains.

2. Theoretical Foundations and Analytical Framework

2.1. Systems Theory

Systems theory is committed to exploring a universal methodology for understanding and analyzing diverse complex systems, and seeking basic principles, laws, and general models applicable to all types of systems. In a complex and dynamic business environment, the supply chain must be regarded as an organic integrated system [3,4]. This theory emphasizes that all links of the supply chain (procurement, production, logistics, sales) do not operate in isolation but are interdependent and mutually influential. Any change in one link will transmit to the

entire system. Therefore, digital transformation must be advanced with systematic thinking, avoiding partial optimization that harms overall effectiveness.

2.2. Dynamic Capability Theory

Dynamic capability theory refers to an organization's ability to continuously reintegrate internal and external resources to maintain competitiveness in a fast-changing market. It requires enterprises to respond quickly to market demands, accelerate product development, and seize fleeting business opportunities [4]. The theory comprises three core dimensions: sensing (identifying market changes and potential opportunities), seizing (mobilizing resources to grasp opportunities), and transforming (continuously optimizing resource allocation). In the context of supply chain digital transformation, dynamic capabilities are manifested as enterprises' ability to use digital tools to sense consumption fluctuations in real time, rapidly adjust procurement and production plans, and continuously restructure the supply chain network to cope with external shocks.

2.3. Supply Chain Resilience Lifecycle

Product supply chain resilience refers to the ability of a product supply chain to maintain its functions, recover quickly, and adapt to changes in the face of external shocks [5]. From the perspective of lifecycle, resilience covers three progressive stages [4]:

- Preparation stage (early warning capability): identifying risks in advance through information sharing and risk identification;
- Response stage (coping capability): rapidly allocating resources during disruptions to mitigate negative impacts;
- Recovery stage (repair and learning capability): quickly restoring core production capacity after disruptions and carrying out long-term optimization and experience accumulation.

This framework provides a process-oriented analytical tool for evaluating how digital technologies enhance supply chain resilience.

2.4. Interconnection Among the Three Theories and the Analytical Framework

The above three theories are not juxtaposed in isolation but form a progressive analytical logic of "structure—capability—process":

Systems theory provides a structural perspective, emphasizing the organic interconnections and overall optimization among supply chain links;

Dynamic capability theory provides a capability perspective, explaining how digitalization enhances enterprises' sensing, seizing, and transforming abilities;

Resilience lifecycle provides a process perspective, used to evaluate digital anti-risk mechanisms at different stages.

3. Development Overview of Luckin Coffee and Structural Analysis of Its Supply Chain System

3.1. Company Profile

Luckin Coffee is a leading local chain coffee brand in China. Founded in Xiamen in October 2017, it opened its first store in Beijing in January 2018. Positioned as "professional fresh coffee," the brand focuses on cost-effective freshly brewed coffee products and has achieved rapid market expansion relying on its digital business model. In May 2019, Luckin Coffee was listed on the NASDAQ in the United States, setting the world's fastest record from establishment to IPO. After 2020, the brand completed strategic adjustment and compliance rectification, further deepened the construction of its digital supply chain, returned to the essence of products and commerce, and achieved continuous improvement in business performance.

By the end of 2025, the number of Luckin Coffee stores worldwide had exceeded 18,000, among which the number of stores in the Chinese market ranked first in the coffee chain industry. Its business covers all provincial administrative regions in China and has successfully entered more than 10 countries and regions such as Singapore, Malaysia, and Australia, making it the second largest chain coffee brand in the world by store scale. Since 2022, Luckin Coffee has continuously deepened the digital transformation of the whole supply chain, and built a full-process digital management and control system covering coffee planting, baking and processing, logistics distribution, store operation, and consumer services, becoming a benchmark enterprise for digital supply chain construction in the physical retail industry [4].

3.2. Characteristic Structure of Luckin Coffee's Supply Chain System

3.2.1. In-depth Cooperative Global Supplier Strategic System

Relying on large-scale procurement demand, Luckin Coffee has built a global deeply-bound supplier cooperation network, forming an upstream supply chain ecosystem featuring "wide coverage, strong binding, and deep collaboration" [7]. For its core raw material coffee beans, Luckin has reached long-term strategic cooperation with top global traders Louis Dreyfus and Mitsui & Co., and established direct procurement bases in world-class coffee producing areas such as Ethiopia, Colombia, Brazil, and Guatemala. In 2024, its green bean procurement volume exceeded 150,000 tons, making it one of China's largest green bean importers. With large-scale procurement, it has gained strong bargaining power, and its green bean procurement cost is more than 15% lower than the industry average.

For other core raw materials, Luckin Coffee has reached an exclusive strategic cooperation on milk sources with Fonterra, established a joint packaging R&D system with COFCO Packaging, and carried out product co-creation with leading enterprises in sub-fields such as Bloomage Biotech and Fino. It has not only deeply participated in the product R&D links of suppliers, but also realized stable raw material supply and cost optimization. For example, Luckin Coffee jointly developed customized thick

coconut milk with Fino, creating the phenomenal hit product "Coconut Latte," with sales exceeding 100 million cups in the first year of launch; it cooperated with Sanyuan Biology to develop an erythritol formula suitable for coffee drinks, promoting the health-oriented upgrading of products and achieving symbiosis and win-win results for the upstream and downstream of the supply chain [8].

3.2.2. Whole-Industry-Chain Collaborative Strategic Alliance

Through cross-industry and cross-field strategic alliances, Luckin Coffee has built a whole-industry-chain collaborative supply chain system, realizing efficient resource integration and value maximization [9]. On the raw material side, Luckin Coffee has signed strategic cooperation agreements with the agricultural ministries of major coffee producing countries such as Ethiopia and Colombia, and established a joint R&D center for coffee planting technology to improve coffee bean quality and supply stability from the planting source. On the production side, the brand has built two world-class intelligent baking factories in Ningde, Fujian, and Kunshan, Jiangsu, with a total annual baking capacity of over 300,000 tons. They not only provide roasted coffee beans for its own stores, but also provide OEM services for other brands in the industry, maximizing the value of production capacity and realizing scale effect and profit improvement.

In terms of technology R&D, Luckin Coffee has reached long-term R&D cooperation with universities and research institutions such as Jiangnan University and the Chinese Academy of Tropical Agricultural Sciences, focusing on joint research in multiple core fields of coffee, and has obtained more than 200 related technical patents. In the field of logistics distribution, Luckin Coffee has reached in-depth strategic cooperation with SF Express and JD Logistics. Relying on the partners' national logistics network, it has built a cold chain distribution system covering the whole country, realizing next-day delivery service for more than 98% of stores. Through multi-dimensional strategic alliances, Luckin Coffee has integrated high-quality resources of the whole industry chain and built a supply chain ecosystem with great resilience and competitiveness.

3.2.3. Symbiotic and Win-Win Digital Franchise Ecosystem

With "full digital control" as the core, Luckin Coffee has built a symbiotic and win-win franchise system, which has become the core support for its large-scale expansion. Luckin Coffee has set relatively friendly franchise thresholds, launched special support policies for sinking markets, and realized full-process standardized management and control of all franchise stores through the digital system, completely breaking the industry pain point of the traditional franchise model that "loose management leads to chaos while strict management leads to stagnation" [10]. In the store expansion link, relying on the big data intelligent site selection system, Luckin Coffee conducts multi-dimensional and all-round quantitative evaluation of alternative store locations and outputs investment feasibility analysis reports. The

success rate of franchise store site selection is 40% higher than the industry average. In daily operation, the brand conducts 24-hour uninterrupted monitoring of order data, raw material inventory, equipment operation status, product production standards, and food safety compliance of all stores nationwide through a real-time digital monitoring system. In case of abnormal data, the system will automatically trigger an early warning, and the regional operation team will intervene at the first time, providing franchisees with full-process risk response and after-sales support [7]. During periods of special market fluctuations, Luckin Coffee has launched preferential support policies for many times to ease the operating pressure of franchisees, greatly improving their brand loyalty and stickiness, and forming a benign ecosystem of symbiosis and win-win between the headquarters and franchisees.

3.2.4. Grid Penetration Layout Covering All Levels of Markets

To seek new growth poles, Luckin has accelerated its sinking to third- and fourth-tier cities and even county-level markets, and built a full-level grid layout strategy of "deep cultivation in core cities + penetration in sinking markets," realizing all-round coverage of the Chinese market. In first-tier and new first-tier cities, Luckin Coffee focuses on office buildings, universities, and business districts with a high-density honeycomb layout, with the number of stores in a single city exceeding 800 at the highest, firmly occupying the core consumer market. In third-tier and lower sinking markets, the brand takes county towns as the core and radiates to townships, building a capillary network covering more than 2,800 districts and counties nationwide.

To support this strategy, Luckin has restructured its logistics trunk and branch distribution network, and set up multi-level front warehouses to ensure that stores in remote areas can still enjoy the same raw material freshness and replenishment frequency as those in first-tier cities. By 2025, the proportion of stores in sinking markets had reached 52.7%, becoming the core engine of brand growth. Contemporary young consumers value "social capital and circle shaping," and expect consumption scenarios with high "check-in" value and high "conversation" value. Luckin has deep insight into this emotional demand. It has built a highly recognizable brand IP system, and carried out cross-border co-branding with well-known IPs such as Moutai, Palace Museum Cultural Creativity, and LINE FRIENDS, continuously creating cross-circle marketing events. Related topics have topped social media hot searches many times, and a single co-branding topic has been played more than 5 billion times, greatly improving the brand penetration and influence among young consumers [7,11]. This kind of cross-border cooperation is not only a carnival of front-end marketing, but also an extreme test of back-end supply chain collaboration capabilities. When hit co-branded products are launched, Luckin's supply chain can instantly allocate tens of millions of special packaging materials and raw materials to stores nationwide, demonstrating amazing supply chain flexibility and collaboration

efficiency.

4. Optimization Practices of Luckin Coffee's Supply Chain Management

4.1. Centralized Procurement and Inventory Optimization Based on Accurate Demand Forecasting

Traditional catering procurement often relies on the personal experience of store managers or purchasers, resulting in a serious bullwhip effect. By introducing advanced data analysis technology, Luckin has completely reshaped the procurement process.

Luckin has built a huge data middle platform, which collects historical sales data, weather changes, holiday effects, online public opinion heat, and even micro-events in surrounding communities. It uses data analysis technology to build a demand forecasting model to further improve the accuracy of demand forecasting. The system can automatically predict the consumption of specific raw materials such as coffee beans, thick milk, syrup, and cups in designated stores in the next week or even a month. This fundamentally solves the problems of inventory backlog and cost increase caused by inaccurate demand forecasting [12].

On the basis of accurate forecasting, Luckin has realized in-depth collaboration with core suppliers in inventory management. On the one hand, it adopts the Vendor Managed Inventory (VMI) model, where suppliers actively replenish goods according to the actual demand of the enterprise combined with the forecast data opened by Luckin, which can reduce management costs and reduce the risks of overstock and shortage. On the other hand, it implements Jointly Managed Inventory (JMI) and establishes joint management centers to promote information sharing and collaborative operation [4]. For example, suppliers can view the consumption speed of packaging materials in Luckin's national central warehouses in real time, and automatically trigger their own production scheduling and delivery processes. This practice embodies the "whole-chain information sharing" required by systems theory and the "sensing demand changes" logic of dynamic capabilities.

4.2. Upgrading of Production and Manufacturing Links

In its self-built baking bases, Luckin implements the "digital strategy" in every step of production. Luckin's modern factories fully apply advanced automation equipment. In the production process, thousands of sensors monitor the specific details of the production process in real time, record production data in real time, form a data chain, and enter the central control room, realizing intelligent monitoring and optimization of the production process. This "digital twin" technology enables the system to instantly capture and automatically correct tiny deviations in the baking curve, greatly retaining the best flavor characteristics of coffee beans and significantly reducing the raw material loss rate [13].

Facing the high-frequency new product launch demand at the front end, the production scheduling logic of factories must shift from "large-scale rigid manufacturing" to "small-batch flexible manufacturing." Luckin's production scheduling system is directly connected with sales data, and can dynamically adjust the operation plans of each production line according to the real-time sales speed of each category, achieving high capacity utilization and quickly responding to the personalized needs of the front end [14]. This is a typical manifestation of the "seizing market signals—transforming production configuration" logic of dynamic capabilities.

4.3. Intelligent Scheduling and Cost Control of Warehousing and Logistics Network

Logistics cost is a key component of enterprise operation cost, and its management and control level is directly related to the market competitiveness of enterprise products and services. Luckin has carried out in-depth digital reconstruction in the logistics link.

Luckin has fully introduced advanced Warehouse Management System (WMS) and Transportation Management System (TMS). The WMS supports the standardization of raw material warehousing and outbound delivery, enhances the interaction and collaboration between the upstream and downstream of the supply chain, significantly reduces inventory turnover days, and improves the efficiency of capital use. At the same time, it optimizes distribution routes and makes intelligent decisions through the TMS. Combined with satellite navigation and AI algorithms, the cold chain logistics system dynamically predicts the raw material demand of each store, which not only ensures the freshness of short-shelf-life materials such as fresh milk, but also realizes the "next-day delivery" coverage of an extremely high proportion nationwide [15].

In addition, the enterprise comprehensively considers various factors, rationally plans logistics nodes, and optimizes the layout of the logistics network. Luckin scientifically selects locations for regional central warehouses and front warehouses according to the density of stores in each region. It also introduces Activity-Based Costing (ABC) in logistics cost accounting, allocates logistics costs to each operation link, analyzes cost drivers, so as to accurately reflect actual consumption, avoid cost distortion, and effectively improve the quality of logistics cost accounting [16].The collaborative application of WMS and TMS reflects the "overall optimum" principle of systems theory, while pre-judging demand and allocating transport capacity corresponds to the "preparation/early warning" stage of the resilience lifecycle.

4.4. Digital Closed Loop of Smart Store Operation and Youth Emotional Interaction

The daily operation of Luckin stores is almost built on algorithms. On the one hand,

all coffee equipment in Luckin's tens of thousands of stores nationwide are connected to the Internet of Things. The headquarters system can not only monitor the health status of equipment in real time for advance maintenance, but also directly deliver extraction parameters to coffee machines. When new products are launched, formula parameters are delivered to the whole country with one click, and store employees only need to scan codes to let the machine automatically complete complex production. This completely gets rid of the dependence of traditional coffee shops on the personal experience of senior baristas and eliminates human errors [17].

On the other hand, through full-link digital investment in APPs and mini-programs, Luckin has connected customer relationship management, supply chain management, and e-commerce platform data, realizing the linkage of user portraits, demand forecasting, intelligent production scheduling, and dynamic inventory. It collects and integrates customer behavior data scattered in various stores in real time, and deeply understands customers' consumption preferences. Based on these data, Luckin can continuously launch new products that meet the needs of young groups for "emotional comfort" and "social sharing," and realize marketing transformation through precise push, truly achieving "data-driven decision-making, supporting front-end emotional innovation and back-end accurate response" [9].

5. Multi-dimensional Value Analysis of Digital Transformation of Luckin Coffee's Supply Chain

5.1. Cost Reduction in Procurement and Logistics and Improvement of Profitability

Through whole-industry-chain integrated management and digital empowerment, Luckin has successfully stripped redundant costs in the traditional supply chain. The scale effect of global centralized procurement has greatly reduced procurement costs compared with the market average; accurate demand forecasting has greatly reduced the loss of expired raw materials; and logistics routes optimized through the TMS and mixed-loading technology have reduced the average monthly replenishment cost per store [12]. Scientific logistics cost control can reduce the total product cost, give enterprises greater flexibility in product pricing, attract consumers with more competitive prices, and seize a favorable market position. This is also the core confidence that Luckin can still maintain highly competitive gross profit margin and net profit margin in the long-term high-intensity price war.

5.2. High Standardization and Consistency of Product Quality Across Cycles

For chain catering, stable quality is the lifeline. By building self-built high-standard digital intelligent manufacturing bases and adopting fully digital and automated equipment, Luckin's production capacity has been greatly improved, which can meet huge order demand even during peak hours and ensure stable and reliable product

quality. At the same time, high-quality raw materials from places of origin help product upgrading, which not only improves the in-cup performance of products, but also establishes an industry benchmark image of "high quality and low price" in the minds of consumers. The same drink produced by tens of thousands of stores nationwide achieves millimeter-level consistency in flavor [11].

5.3. Comprehensive Improvement of Operational Efficiency

Digital transformation has brought a qualitative leap to Luckin's overall operational efficiency. The automated ordering and scheduling system frees up store managers' energy, allowing them to focus more on customer service; the WMS greatly shortens the order response time. The efficient logistics network accelerates inventory turnover, effectively reduces inventory backlog, reduces enterprise capital occupation, and improves capital turnover rate, providing sufficient financial support for operation work.

5.4. Significantly Enhanced Supply Chain Resilience

Digitalization is not only a tool for cost reduction and efficiency improvement, but also the key to cultivating new quality productive forces. Digital empowerment effectively promotes the diversification of enterprise supply chain allocation and improves the overall operation efficiency of the supply chain, thereby reducing the negative impact of centralized supply chain allocation and inefficient operation on new quality productive forces [3]. At the same time, in the face of sudden situations such as drastic market fluctuations and local supply chain disruptions, Luckin has shown strong supply chain resilience:

(1) Preparation stage: based on its strong data middle platform, it conducts advance research and judgment on potential risks based on existing information and operation laws.

(2) Response stage: it can quickly and dynamically integrate and allocate human, material, and transportation resources to maintain key operations.

(3) Recovery stage: it can restore production capacity and supply level at an extremely fast speed.

6. Challenges and Coping Strategies of Digital Technology Application in Luckin Coffee

Despite remarkable achievements, behind the scale of ten thousand stores and extreme efficiency, Luckin Coffee's digital supply chain still hides challenges that cannot be ignored.

6.1. Main Challenges and Systemic Risks

6.1.1. Computing Power Bottleneck and Ultimate Pressure Bearing of Software System Architecture

With the number of stores exceeding 18,000, the digital system currently applied by Luckin Coffee is facing huge computing power support pressure. Real-time transaction data of stores nationwide need to be collected, transmitted, and analyzed 24 hours a day. At the same time, it faces tens of millions of instantaneous concurrent orders triggered by morning peak hours or various marketing promotions such as the "9.9-yuan coffee" campaign, which puts forward extremely high requirements for the stability of the high-concurrency processing capability of the supply chain system [18]. Any short server downtime or data delay will lead to nationwide front-end fulfillment paralysis and store order chaos. Moreover, with the continuous expansion of business scale and the expansion of overseas markets, the traditional centralized architecture is difficult to adapt to the global multi-regional business layout. The existing software system architecture is in urgent need of expansion and upgrading.

6.1.2. Data Security Risks and Consumer Privacy Leakage Risks

With the continuous improvement of laws and regulations such as the Personal Information Protection Law of the People's Republic of China and the Data Security Law, higher requirements have been put forward for enterprise data compliance management. As an Internet new retail enterprise highly dependent on user data, Luckin Coffee's digital system has accumulated massive user consumption data, store operation data, core supply chain data, and supplier business data [19]. Data assets have become the core assets of enterprises, but they also face severe network security and data privacy leakage risks. In the event of large-scale data leakage, it will not only face huge legal penalties, but also completely destroy the brand trust built by consumers on the basis of emotional identity. In addition, the expansion of overseas markets also needs to adapt to data security regulations in different countries and regions, such as the EU's GDPR and personal information protection laws in Southeast Asian countries, which greatly increases the difficulty of cross-border data transmission and compliance management [20].

6.1.3. Challenges of Supply Chain Localization and Digital Adaptation in Overseas Market Expansion

In the process of global expansion, Luckin Coffee's digital supply chain system faces the core challenge of local adaptation in overseas markets. The mature digital supply chain system in China relies on China's perfect digital infrastructure, developed logistics network, and mature digital supporting industries. However, in some overseas markets such as Southeast Asia and Africa, due to the relatively weak local digital infrastructure, imperfect logistics network, and large differences in regional culture and administrative regulations, the mature digital system and supply chain model in China cannot be directly replicated, which seriously affects the efficiency of store expansion and supply chain implementation [4,13]. Therefore, how to realize the regional adaptation of the supply chain digital system is the core problem faced by enterprises in global development.

6.1.4. Shortage of Compound Professionals in Digital Supply Chain

The design, operation, maintenance, and iterative upgrading of a fully digital supply chain require a large number of high-end compound talents who not only understand industrial supply chain management but also master intelligent algorithms and data analysis. At present, the supply of professional talents related to digital supply chain in China's chain retail industry is seriously insufficient. The talent training of relevant majors in universities is disconnected from the actual needs of the industry, and the competition for talents in the industry is fierce. At the same time, enterprise expansion in overseas markets also requires digital talents with international vision and familiarity with overseas trading environments. The current talent shortage has become an important problem restricting the continuous upgrading of enterprise supply chain digitalization.

6.2. Systematic Coping Strategies and Optimization Paths

6.2.1. Upgrading Digital Infrastructure

To alleviate the computing pressure of central cloud servers and reduce the risk of network disconnection, Luckin should further upgrade its system architecture. It can introduce edge computing capabilities at nodes such as regional central warehouses or large stores, and sink part of the real-time data processing of stores to the edge side. This can not only greatly reduce the concurrent pressure of central servers, but also ensure that the local ordering and fulfillment systems of stores can still maintain basic operation when the wide area network communication is briefly interrupted, thereby improving the fault tolerance of the entire network. At the same time, it will continue to upgrade the supply chain digital system architecture and adopt the microservice architecture model to improve the scalability and flexibility of the system and adapt to the global multi-regional business layout needs [11].

6.2.2. Building a Strong Data Security Firewall and Privacy Protection Mechanism

In response to data security and privacy leakage, Luckin Coffee should establish a full-link data security governance system, set up a special data security management department, improve the whole-process management system of data within the enterprise, and adopt advanced network security protection technologies to prevent network attacks and data leakage risks. At the same time, it shall strictly abide by domestic laws and regulations such as the Data Security Law and the Personal Information Protection Law, standardize the collection, storage, and use of users' personal information, and protect users' privacy and security [21].

For overseas markets, a global data compliance management team should be established to conduct in-depth research on data security-related laws and regulations in different countries and regions, formulate data management rules adapted to local regulatory requirements, realize the compliance of cross-border data transmission, and avoid compliance risks in overseas markets [22].

6.2.3. Promoting the Localization Strategy of Overseas Supply Chains

When entering overseas markets, enterprises should formulate differentiated regional supply chain strategies according to the digital development level of different regions. For mature overseas markets with digital infrastructure such as Singapore and Australia, the mature digital supply chain system in China can be deeply replicated to realize the rapid implementation of full-link digital management and control. For markets with relatively weak digital infrastructure such as Southeast Asia and Africa, a progressive development model should be adopted, with priority given to the implementation of core procurement-logistics-store operation digital modules, and the digital supply chain system should be gradually improved in combination with local infrastructure conditions and partner resources to ensure that digital transformation is coordinated with the overall globalization strategy [23].

At the same time, it is necessary to accelerate the localization layout of overseas supply chains, establish strategic alliances with local high-quality third-party cold chain logistics giants, make full use of local existing infrastructure to build a localized supply chain network, reduce operating costs in overseas markets, and improve supply chain response efficiency.

6.2.4. Building a Compound Talent Training Echelon Combining Industry, University, and Research

Strengthen talent introduction and carry out professional training. Internally, enterprises should take digital transformation as an important goal of strategic transformation, establish a sound internal talent training system, carry out regular digital skills training for employees in supply chain-related departments, and set up a "supply chain digital team" composed of business, technology, and data talents to improve the organization's digital transformation capability. Externally, enterprises can deepen industry-university-research cooperation with top universities at home and abroad in the fields of industrial engineering and logistics operations research, and customize the training of scarce supply chain algorithm talents.

In addition, Luckin can increase the introduction of high-end digital and international talents, establish a competitive salary incentive system in the industry, attract high-end talents in the field of supply chain management worldwide, and provide human support for the continuous upgrading of supply chain digitalization.

7. Industry Enlightenments and Discussion on Replication Feasibility

The great success of Luckin Coffee has undoubtedly made the whole industry see the application value of digital technology. However, it is extremely difficult for enterprises to fully copy Luckin Coffee's supply chain model. First, a large amount of capital is needed to build a global procurement network, production bases, and cold chain transportation systems. Second, the threshold for building a digital system is relatively high, and enterprises need talents with digital construction experience.

Third, it is necessary to have a broad market and strong brand appeal to share the fixed costs of enterprise operation and support the operation of the digital supply chain.

Although "full replication" is extremely difficult, its underlying logic still has universal enlightenment for the majority of physical retail enterprises, catering enterprises, especially large and medium-sized chain enterprises in the growth period. To build an efficient and agile digital supply chain system, small and medium-sized enterprises can adopt a phased implementation strategy:

Initial stage: Focus on lightweight collaboration of core single products. Small and medium-sized enterprises do not need to blindly build huge and complex systems such as "double middle platforms" at the beginning. They should adopt the asset-light operation mode and focus on direct source procurement of core single products. Core information sharing can be realized through lightweight tools. For example, use shared spreadsheets to update inventory and order data in real time, and use enterprise communication platforms to transmit production progress, so as to realize "no omission of core information and low-cost sharing methods" [13]. In terms of logistics, they can rely on third-party professional cold chain logistics and share its trajectory query system without building a physical system by themselves, so as to master the management and control capability of key nodes of the supply chain with low investment [23].

Growth stage: Establish standardized processes and interest mechanisms for cross-departmental and external partners. After forming a certain scale, the focus will shift to process reengineering and solidification. Internally, simplify the organizational structure, coordinate by core departments, and set up special teams for key nodes. Externally, establish a scientific supplier performance evaluation system, reward excellent suppliers, and promote long-term strategic cooperation. In terms of interest collaboration, adopt the mechanism of "short-term incentive + flexible bottom guarantee," such as setting quarterly high-quality rewards and adopting monthly rebates, to enhance the willingness of upstream and downstream partners to collaborate.

Mature stage: Build an ecological network of value co-creation. After forming a stable and efficient digital supply chain capability, enterprises can transform it into a core product competitive advantage. Not only use it to create star hits to drive their own expansion, but also gradually open supply chain capabilities to ecological partners. For example, open the site selection system and raw material quality control system to franchisees or peers, and upgrade from a closed supply chain system to an open and collaborative industrial ecological network.

8. Conclusion

In the current business environment full of uncertainty and fierce involution, Luckin Coffee, with its remarkable rebirth and ten-thousand-store expansion, has provided

the most vivid and convincing benchmark case of Chinese local enterprises for "digital technology empowering supply chain management." It profoundly reveals that the dazzling front-end brand marketing and high-frequency hit innovation must be built on the back-end digital supply chain base with strong cost control, consistent quality, and extremely fast response speed.

Through global centralized procurement, long-term in-depth strategic cooperation with upstream suppliers, construction of a vertical industrial chain under the asset-heavy intelligent manufacturing model, and digital reconstruction of terminal store fulfillment systems for warehousing and logistics relying on advanced digital management systems and Internet of Things technology, Luckin Coffee has successfully built a full-industry-chain digital closed loop from green coffee beans to terminal consumers' drinks. This has not only greatly reduced the total operating cost of the enterprise but also improved the overall turnover efficiency, helping the enterprise to keenly capture market demand and organize dynamic new quality productive forces of network-wide resources in a short time.

Facing the increasingly complex global market competition pattern and the continuous sinking terminal market layout, Luckin Coffee and the majority of China's chain retail enterprises still need to carefully respond to the systemic risks of multiple challenges, and continuously strengthen the anti-risk capability and system resilience of the supply chain system through the continuous iterative optimization of algorithm models and underlying system architecture [24].

The practice case of Luckin Coffee fully confirms that the in-depth digital transformation of the whole supply chain link is no longer an optional item for the development of physical retail enterprises, but a required course for enterprises to build long-term core competitive barriers and achieve high quality development. The transformation experience of Luckin Coffee will also continue to promote the optimization, upgrading, and value promotion of China's and even the global new retail industry chain ecosystem.

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