Information Systems and Economics (2026)
Clausius Scientific Press, Canada

DOI: 10.23977/infse.2026.070113
ISSN 2523-6407 Vol. 7 Num. 1

Research on Backend Management Process Optimization of Distribution Mini-Program for Agricultural Product Processing Enterprises: A Case Study of Jiangsu Shishilian Agricultural Products Processing Co., Ltd.

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Keywords: Agricultural Product Processing, Distribution Mini-Program, Backend Management, Process Optimization, Shishilian

Abstract: With the rapid development of fresh food e-commerce and community group buying, the distribution of agricultural product processing enterprises has become a crucial link connecting production areas with consumers' dining tables. However, the optimization of front-end mini-program user experience often overshadows various backend management issues, such as fragmented order processing, lagging inventory synchronization, and inefficient multi-party collaboration. Taking Jiangsu Shishilian Agricultural Products Processing Co., Ltd. as the research object, this paper systematically reviews the practical problems faced by agricultural product processing enterprises in the backend management of distribution mini-programs, based on an in-depth investigation of its processing and distribution center. The results show that by developing an in-house ERP system and integrating it with a food traceability information platform, the enterprise has achieved process optimization including unified order processing, intelligent sorting operations, and dynamic inventory linkage, thereby effectively reducing product loss and management costs. Based on this, the paper proposes an optimization framework of "lightweight front-end, integrated back-end", hoping to provide operational references for the intelligent transformation of similar enterprises.

1. Introduction

The digital transformation of agricultural product circulation is advancing from "front-end display" to "full-chain collaboration". The popularity of fresh food distribution mini-programs has made it easy for consumers to place orders online, but the real bottleneck of efficiency lies not in the front end but in the backend management system. Issues such as smooth order flow, real-time inventory updates, and accurate sorting and distribution directly affect an enterprise's profitability and sustainable development. Jiangsu Shishilian Agricultural Products Processing Co., Ltd. (hereinafter referred to as "Shishilian") provides a noteworthy analytical sample in this field.

As an important production base for Beijing Shishilian Technology Co., Ltd. in the Yangtze River Delta, Shishilian was officially put into operation in Gugaozhen, Jiangyan District, Taizhou

City in May 2024. It is equipped with intelligent and automated fresh-cut vegetable production lines, with a daily processing capacity of 30 tons of fresh-cut vegetables and a collection and distribution capacity of 100 tons of full-category food ingredients. On the basis of completing preliminary quality upgrades, the company can consider investing a certain amount of automated intelligent equipment to reduce manual operations in relevant applications, thereby improving the operational efficiency and stability of the production lines [1]. Therefore, the enterprise did not simply digitize traditional operation processes; instead, it established the concept of "system first" from the beginning, adopting a fully self-developed ERP system and a food traceability information system. This combination of management system and technical architecture makes it a window for studying the reengineering of backend management processes in agricultural product processing enterprises. This paper selects Shishilian as the research object, focusing on the backend management process of its distribution mini-program, and mainly discusses two questions: First, what difficulties do agricultural product processing enterprises face in the backend management of mini-programs? Second, what referable ideas does Shishilian's exploratory practice provide?

2. Particularities and Practical Dilemmas of Backend Management of Distribution Mini-Programs for Agricultural Product Processing Enterprises

2.1. Essential Differences from Pure Platform-Based E-Commerce

The distribution mini-program of an agricultural product processing enterprise is fundamentally different from the common internet-based platform fresh food e-commerce. The latter is essentially a traffic-driven business, whose core task is to match buyers and sellers, with backend management focusing on merchant onboarding, transaction commissions, and ad placements. An agricultural product processing enterprise, however, operates on two legs: "physical processing + digital platform" — with a processing workshop in the front and a mini-program taking orders in the back. Its backend system must simultaneously handle production planning, raw material inventory, processing progress, distribution scheduling, and many other tasks. To put it simply, a platform-based e-commerce acts like a broker, merely connecting the two sides; the backend of a processing enterprise, on the other hand, must act as the "general manager," overseeing every link from raw material intake to finished product dispatch. This essential difference determines that the former's backend can be relatively lightweight and modular, whereas the latter's backend must be deeply coupled with business processes. A data disconnection in any single link will directly affect whether the workshop can start production, whether the warehouse has stock, and whether delivery vehicles can depart on time.

2.2. Triple Dilemmas Overlapping

During visits to similar enterprises, the author found that although business owners and managers attach great importance to "digitalization," backend management problems are often intertwined — not isolated issues, but multiple problems overlapping and amplifying each other.

First, order processing is frustratingly fragmented. Many companies receive orders from too many channels — some from the mini-program, some by phone, some from WeChat group chains, and even some old customers who still send handwritten orders. Employees spend most of the day just aggregating orders from these channels, and mistakes are easy when busy: orders missed, addresses copied wrong, quantities reversed — all causing later trouble. Studies have calculated that labor costs for order processing alone can account for 15% to 20% of total costs in fresh food distribution enterprises. A large part of this cost is actually wasted — repeated entry and repeated verification across different channels, all low-efficiency drudgery.

Second, inventory management is alarmingly lagging. Agricultural products are not easy to handle — they are perishable, difficult to store, and highly seasonal. Stock may be available today but gone tomorrow, so inventory information must be timely and updated in real time. However, in many enterprises, the data synchronization between the backend management system and the front-end mini-program is like a layer of gauze — either it doesn't sync for a long time, or it doesn't sync at all. The result is ridiculous: the warehouse is empty, but the mini-program still shows “in stock”; or vegetables have been put into storage for a long time, but the mini-program still shows “out of stock.” Customers place orders, but when it comes time to deliver, there is no stock, so they have to call to apologize and refund, damaging their reputation.

Third, multi-actor collaboration is unbearably inefficient. From production to processing, warehousing, logistics, and sales, each link requires management, but the information transmission methods are still stuck in the era of “WeChat groups + phone calls.” The production department says raw materials are arriving late, but the processing department doesn’t know and is still waiting for materials to start work; the warehouse says a certain variety is overstocked, but the sales department doesn’t know and is still pushing that product; the delivery driver says the road is bad and will be half an hour late, but customer service doesn’t get the message, and the customer has already started complaining. Without a unified information sharing platform, each link is like “blind men touching an elephant” — communication distortion, supply-demand mismatch, either overstock or stockout, and all costs are borne by the enterprise. Only by continuously improving and optimizing the logistics distribution model can we truly achieve efficient, safe, and convenient delivery of fresh agricultural products from production areas to consumers, and help the sustainable development of China's fresh agricultural product e-commerce [2].

2.3. Problem Awareness of Shishilian

The dynamics and complexity of the digital economy require new enterprise capabilities to match [3]. Shishilian has a special business structure — it serves both B-end and C-end customers. The B-end mainly provides full-category ingredient distribution to government agencies, schools, and restaurant chains, with large order volumes, relatively fixed product categories, concentrated delivery times, and emphasizes scale and standardization. The C-end sells fresh-cut vegetables to surrounding community residents through the mini-program, with small and fragmented orders, each person wants different things, and time requirements are high — they want delivery as soon as possible after ordering today. The backend management demands of B-end and C-end are actually conflicting: the former requires stable planning, batch processing, and controllable processes; the latter requires flexible response, consolidation of small orders, and speed priority. If an agricultural product processing enterprise runs on both tracks at the same time, the backend management process must take into account both scale efficiency and response speed — a single model is definitely not enough. The two logics must be combined, which is precisely where few in the industry can truly do well.

3. Methods for Optimizing Backend Processes in Shishilian

3.1. Management System: Integrated Management and Traceability Platform

The backend management system of Shishilian has a very practical feature: it integrates integrated management and traceability functions, with the two working together. First, the integrated management system, simply put, integrates functions that were originally managed separately – such as order taking, inventory management, accounting, and settlement – into one platform, preventing them from operating independently. At the same time, the food traceability

information system is responsible for recording full-chain information from raw material procurement to finished product outbound, with every piece of data clearly recorded. Interestingly, the traceability information in this system is no longer a "post-mortem" supplement but is automatically recorded upon completion of each operation link and immediately verified. For example: a sorter scans the batch code of raw materials with a gun, and the system immediately determines whether the batch is qualified – whether pesticide residues exceed the limit, whether it is within the shelf life, and whether there is a quality inspection report. Only after passing the inspection can it proceed to the next process. This "record as you do, verify as you record" approach not only improves data credibility (no one can change data afterward) but also eliminates the error-prone manual form filling and repeated verification. From a research perspective, this design that synchronizes process control and information collection essentially builds a closed-loop quality traceability mechanism. Its value is not only to meet regulatory requirements but also to turn post-event correction into in-process intervention, thereby significantly reducing management risks.

3.2. Order Processing: From "Manual Order Assignment" to "Intelligent Routing"

In transforming the order processing process, Shishilian focused on three key actions: first, gather orders from all directions into one place, then reasonably assign them according to rules, and finally execute accurately at each link. In the past, orders from mini-programs, phones, WeChat, and paper forms each went their own way, and manual transcription inevitably led to errors. Now it is different: regardless of whether the customer places an order through the mini-program, or a government canteen calls in an order, or even a long-time restaurant owner sends a handwritten order via WeChat, the system automatically captures and integrates all orders into the same management platform. After an order enters, the system performs an "intelligent routing" like a navigation system: it looks at what vegetables are in the order, how much quantity, which address to deliver to, and what time the customer requires delivery, and then automatically determines – which vegetables need to be sent to the workshop for processing into fresh-cut vegetables, which can be shipped directly from the warehouse – and generates corresponding task orders, accurately assigned to the production and distribution departments. The sorter holds a handheld terminal, and the screen directly displays instructions: which shelf to go to, how much to pick, and what type of basket to use. The system also calculates the optimal picking path to save employees from running back and forth. At the same time, each time the sorter picks an item, the terminal compares the actual picked quantity with the order requirements in real time, and alarms immediately if there is a discrepancy. The enterprise calculated: after implementing this process, the average time for order processing was reduced by about 30%, and the sorting error rate dropped from the previous 1.3% to below 0.5%. From a management perspective, this shift from "manual order assignment" to "intelligent routing" essentially transforms order processing from experience-driven to rule-driven, automating task decomposition and resource matching through system-embedded business logic, significantly reducing the variability and delay caused by manual operations.

3.3. Inventory Management: Dynamic Counting and Early Warning Mechanism

Many fresh food enterprises still use old methods – counting inventory once a week or once a month, and usually guessing the accuracy of inventory. Shishilian completely changed its approach, no longer using periodic counting, but adopting a "dynamic batch management" method. In short, each batch of raw materials is assigned a unique traceability code upon inbound, like an ID card. The system simultaneously records the product name, quantity, origin, inbound date, and shelf life – nothing missing. Then things go smoothly: scan when processing, scan when sorting, scan again when outbound – each scan operation automatically updates the real-time status of inventory.

Whether goods are reduced, moved, or nearing expiration, all are reflected in real time. No need for someone to go to the warehouse with a notebook to count. In addition, the system has several inventory early warning "firewalls": when inventory falls below safety stock, it reminds procurement to restock; when inventory exceeds the upper limit, it reminds sales to push the product; when the shelf life is approaching, it pushes an abnormal alert to management several days in advance. This mechanism has achieved obvious results: the enterprise's operational data shows that the loss rate of fresh products is controlled within 4%. You may not know what this figure means – the average loss rate in the agricultural product distribution industry is generally between 6% and 10%, sometimes higher. 4% is quite competitive in the industry. From the perspective of inventory management theory, dynamic batch management essentially realizes "event-driven" updating of inventory information. Compared with traditional periodic counting, it eliminates information lag, enabling inventory decisions to be based on near-real-time data, thereby effectively curbing expiration losses and stockout losses caused by information delay in fresh categories.

3.4. Traceability System: Digital Control and Transparency

The food traceability system of Shishilian does not simply paste a QR code to cope with inspections, but truly embeds digitalization into every link of production and circulation, building a complete traceability chain from field raw materials to table finished products. You can check in the system which base the vegetables came from, when they were harvested, which processing line they went through, who sorted them, when they left the warehouse, and which customer they were delivered to – every step is recorded, and each step is confirmed by scanning a code. What's more, this traceability system is not only for internal management but also opens query permissions to customers. Whether it is institutional customers or ordinary residents buying fresh-cut vegetables in the community, they can scan the QR code on the package to see the "life history" of the ingredients in their hands. This open and transparent practice is rare in the fresh food industry. Many enterprises do traceability to cope with supervision or keep a record for themselves, but Shishilian turned it into a tool to build trust with customers – customers see for themselves which base it came from, when it was processed, and how much shelf life is left, so they naturally feel at ease. The traditional self-operated model and the "company + farmer" model have some defects and must be innovated upon [4]. From a research perspective, this externally open traceability mechanism essentially transforms internal quality control information into market signals. In the field of fresh agricultural products with high information asymmetry, it can effectively reduce consumers' perceived risk, thereby translating into brand trust and repurchase intention. At the same time, open traceability also forms a reverse binding on internal operations – since customers can check at any time, everyone in each link must take every scan and record seriously, which is itself a low-cost, high-efficiency management supervision tool.

4. Implications from the Shishilian Case

4.1. Reference Value for Enterprises

Shishilian has achieved preliminary results by optimizing backend management processes through digital empowerment. There are three points of reference. First, backend management optimization is more important than front-end function construction. While it is good to focus on interface aesthetics and interaction experience when building a mini-program, the construction of backend management capabilities cannot be ignored. Second, digital empowerment should be based on process standardization. Enterprises need to standardize operating procedures uniformly, and then the integrated management system can play its role. If offline processes are chaotic, digital

empowerment will only have a counterproductive effect. Third, data collection should be synchronized with processes, not entered afterward.

4.2. Promotable Optimization Framework

Based on observation and reflection on Shishilian, the author summarizes a systematic management framework.

First, centralized order processing: integrate orders from multiple channels such as telephone, email, WeChat, and enterprise websites, centrally enter them into a unified system, and perform order review and confirmation.

Second, dynamic inventory counting: don't wait until the end of the month to count; manage inventory by batch. Every time the front end sells an order, the backend inventory changes accordingly, and early warnings for restocking or stockout are automatically triggered.

Third, collaborative operation platform: use the ERP system as the chassis, with procurement, processing, sorting, and distribution all synchronizing information and sending/receiving tasks on it, instead of relying on WeChat group messages.

The basic idea of this framework is to let data run according to rules in the system, so that people do not have to deal with trivial details but can focus on handling exceptions and making timely judgments.

5. Conclusion

The digital transformation of agricultural product processing enterprises cannot stop at the "facade project" of mini-programs; it must also deeply cultivate the "inner project" of backend management. The case of Jiangsu Shishilian shows that through the deep coupling of ERP system and traceability platform, reengineering order processing, inventory management, and operation collaboration is an effective path to improve operational efficiency and reduce loss costs. Regional logistics itself is a large integration of many industries and departments, depending on the coordinated development and dynamic evolution of multiple key elements [5]. The enterprise's practice verifies the feasibility of the design concept of "front-end lightweight, back-end integrated".

Of course, this study also has certain limitations. At present, the Shishilian project is still in the early stage of operation, and the validity of some data needs to be tracked and verified over a longer period. At the same time, agricultural product processing enterprises of different scales and different business models have different backend management requirements, so whether the optimization framework proposed in this paper has wide applicability remains to be tested by more cases. Future research can be deepened in two directions: first, explore how small and medium-sized agricultural enterprises can achieve gradual optimization of backend management under resource-constrained conditions; second, pay attention to the potential application value of artificial intelligence technologies in demand forecasting, route planning, and other links.

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