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Research on the Composition of Kiwifruit Production Costs and Strategies for Enhancing Economic Returns

YAN WANG[1]

[1] Hunan Bio-Mechanical and Electrical Vocational and Technical College Hunan Province 410127, China

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Abstract

Amid the ongoing structural reform of China's agricultural supply side and the push for rural revitalization, kiwifruit emerges as a pivotal player in the nation's high-value fruit industry. Its development is crucial for optimizing agricultural structures and boosting farmers' incomes. This paper employs cost-benefit analysis, industrial organization theory, and comparative advantage theory to assess the kiwifruit sector. Using panel data from 28 key kiwifruit-producing regions in China spanning 2020 to 2025, it examines production cost structures and imbalances, quantifying each cost element's impact on economic outcomes. Additionally, by comparing international competitors and assessing current industry conditions, the study identifies sustainable paths to enhance economic returns. Findings reveal that China's kiwifruit production is characterized by "high labor and material costs, with insufficient investment in cold chain and technology." Core factors impacting economic benefits include labor, fertilizer, pesticide, and post-harvest processing costs. While increased industrial concentration in major areas yields scale benefits, it also heightens price volatility risks. Furthermore, inadequate technological investment, weak brand value, and poor supply chain integration hinder benefit improvements. Therefore，to support the transformation of the Chinese kiwifruit industry from "scale expansion" to "quality and efficiency" ，targeted suggestions are proposed across three dimensions: optimizing elemental configuration, leveraging technological innovation, and reconstructing the supply chain. These strategies aim to enhance the industry's core competitiveness by *offering both theoretical insights and practical guidance.*

Keywords

Kiwifruit, Composition of production cost, Economic benefits, Cost-benefit analysis, Industrial upgrading, Core competitiveness

1. Introduction

Kiwifruit, celebrated for its rich nutritional content and significant economic value, has been identified as a key variety for development within China's distinctive fruit industry. Recently, both its cultivation scale and production have consistently increased. Data from the Bric Agriculture Database indicates that between 2020 and 2025, the market share of kiwi berries in China rose by 3.2 percentage points to 18.7%, with a growth rate 2.1 times higher than the average in the fruit industry. The output value per unit area is 1.8 times that of traditional citrus, and by 2025, the average income per mu (a Chinese unit of area) reached 21,000 yuan. This has established kiwi as a crucial industry for boosting farmers' income and promoting rural revitalization in central and western regions. Currently, the kiwi industry in China is concentrated in the core production areas of Shaanxi, Sichuan, Hunan, and Guizhou, with these regions accounting for over 60% of the planting concentration. Despite the industry's expansion, it faces challenges due to international competition and domestic industrial upgrading. Although the average income per mu from Chinese kiwi surpasses that of traditional citrus, it remains significantly lower than the 36,000 yuan per mu achieved by New Zealand kiwifruit, highlighting a competitive disadvantage internationally. Additionally, the industry grapples with rising production costs, inconsistent product quality, outdated cold-chain logistics, and low brand recognition, all of which hinder overall profitability and dampen farmers' enthusiasm for cultivation. Moreover, pests and diseases, such as bacterial canker, cause annual economic losses exceeding 100 million yuan, further compressing profit [1]margins. In this context, a systematic analysis of the production cost structure of kiwi from an economic standpoint, along with quantifying the relationship between cost factors and economic benefits, is crucial. Exploring scientific and reasonable strategies to enhance efficiency holds significant theoretical and practical value for advancing the high-quality development of China's kiwi industry and boosting its international competitiveness.

2. Research Methods and Data Sources

(1) Research Methods and Technical Route

① Research methods

a. Literature Review Method: Conduct a systematic review of relevant literature, including journal articles, government reports, and industry data, focusing on the cost-benefit analysis of the characteristic fruit industry and the development of the kiwifruit industry both domestically and internationally. This will establish the theoretical foundation and research framework for this paper.

b.The cost-benefit analysis method involves examining panel data from key kiwifruit-producing regions in China. This analysis breaks down production cost components and calculates essential benefit indicators, including the cost-profit ratio and return on investment. Additionally, it quantifies the correlation between production costs and economic benefits.

c. Comparative Analysis Method: This method involves examining the variations in production costs and economic benefits of kiwifruit across China's major production regions. Additionally, it entails comparing the cost structures and benefit levels of the kiwifruit industries in China and New Zealand. This analysis aims to pinpoint the strengths and weaknesses of the Chinese kiwifruit industry.

② Technical Route

Initially, the study organizes relevant theories and reviews current research both domestically and internationally to clarify research objectives and methodologies. Subsequently, it systematically analyzes the composition characteristics and regional differences in production costs, using data from China's primary kiwifruit-producing regions between 2020 and 2025. Following this, empirical analysis methods are employed to quantify the impact of each cost factor on economic benefits, identifying the constraints posed by cost-structure imbalances. Finally, by integrating international experiences with the specific context of the Chinese industry, the study proposes targeted strategies for enhancing economic benefits and formulates research conclusions and policy recommendations.

(2) Data sources and accounting instructions

① Data sources

This paper primarily utilizes data from the industrial monitoring records of the Ministry of Agriculture and Rural Affairs and the Bric Agriculture Database. Additionally, it references agricultural statistical reports from key kiwifruit-producing regions in China, including Shaanxi, Sichuan, and Hunan. The research group also conducted on-site surveys in the major kiwifruit-producing area of western Hunan.

② Accounting Notes

This paper presents a statistical analysis based on six years of kiwifruit production data. The production costs were categorized according to the kiwifruit life cycle into four distinct phases: orchard establishment, growth, fruiting, and post-harvest circulation. The orchard establishment phase encompasses the initial three years prior to planting, known as the non-fruiting stage, with primary expenses including land preparation, support structure construction, and seedling acquisition. The growth phase covers the first to third years following orchard establishment, focusing on tree shape cultivation, with key inputs such as agricultural materials, labor, and irrigation. The fruiting phase begins in the fourth year and continues thereafter, marking the stable fruiting stage, with essential inputs including agricultural materials, labor, pruning, and pest control. Finally, the post-harvest circulation phase spans from fruit harvesting to consumer delivery, involving costs for harvesting labor, grading and packaging, cold storage and preservation, transportation, and marketing.

The production cost accounting follows the "accrual basis" principle. Fixed costs encompass supports, seedlings, land transfer fees, and depreciation of fixed assets. Variable costs cover agricultural supplies, labor, irrigation, packaging, and transportation. To maintain data comparability, this paper standardizes cost data across various production areas and models. The accounting unit is consistently set as "per mu," eliminating the impact of regional price differences. After thorough compilation, the data are analyzed.

3. Analysis of the Composition Characteristics of Kiwifruit Production Costs

(1) Overall composition characteristics of kiwifruit production costs

The average total cost per mu for kiwifruit over a 6-year lifecycle, from orchard establishment to the fruiting period, amounts to 38,620 yuan. Of this, the fixed cost is 13,910 yuan, representing 36.0%, while the variable cost is 24,710 yuan, making up 63.98%. This indicates a pattern of "relatively high fixed investment and a steady increase in variable costs." Examining the cost distribution across different stages, the orchard establishment period incurs an average cost of 9,870 yuan per mu, accounting for 25.6% of the total lifecycle cost. During the growth period, the average cost is 8,250 yuan per mu, or 21.4%. The fruiting period sees an average cost of 12,630 yuan per mu, comprising 32.7%, and the post-harvest circulation period averages 7,870 yuan per mu, accounting for 20.4%. Notably, the fruiting and orchard establishment periods are the primary stages for cost input.

① Cost composition during the orchard establishment period

During the orchard establishment period, costs are predominantly fixed. The average fixed cost per mu is 7,620 yuan, comprising 77.2% of the total expenses, while variable costs amount to 2,250 yuan, representing 22.8%. Within the fixed costs, the most significant investment is in the support system, averaging 4,850 yuan per mu and constituting 63.6% of fixed costs. This includes items such as cement columns, steel strands, and iron wires. The next major expense is the purchase of seedlings, averaging 1,580 yuan per mu, or 20.7% of fixed costs. Land preparation costs average 1,190 yuan per mu, accounting for 15.6%. Variable costs primarily cover agricultural materials like fertilizers and pesticides, as well as labor for land preparation and seedling planting, with labor comprising 65.3% of variable costs.

② Cost composition during the growth period

During the growth period, costs are predominantly variable. The average variable cost per mu is 5,360 yuan, comprising 65.0% of the total growth period expenses, while fixed costs amount to 2,890 yuan, making up the remaining 35.0%. Within variable costs, agricultural supplies average 2,870 yuan per mu, representing 53.5% of these costs and covering items like fertilizers, pesticides, and irrigation water. Labor costs average 2,490 yuan per mu, accounting for 46.5%, and are primarily allocated to activities such as tree shape cultivation, weeding, and pest and disease control. Fixed costs mainly consist of land transfer fees and support maintenance expenses.

③ Cost composition during the fruiting period

During the fruiting period, costs peak, marking the most significant investment phase in the lifecycle, with variable costs rising sharply. The average variable cost per mu is 9,870 yuan, comprising 78.2% of the total cost, while fixed costs amount to 2,760 yuan, or 21.8%. Labor costs dominate the variable expenses, averaging 5,060 yuan per mu, which is 51.3% of the variable costs. These expenses cover activities such as pruning, thinning flowers and fruits, pollination, picking, and pest control. As rural labor becomes scarcer, labor costs are increasing annually. Agricultural material costs average 3,820 yuan per mu, accounting for 38.7%, and include fertilizers, pesticides, and pollination supplies. Other variable costs, such as irrigation and support maintenance, average 990 yuan per mu, making up 10.0%. Fixed costs primarily consist of land transfer fees and depreciation of fixed assets.

④ Cost composition during the post-harvest circulation period

During the post-harvest circulation period, costs are predominantly variable. The average variable cost per mu is 7,230 yuan, comprising 91.9% of the total post-harvest circulation expenses, while fixed costs amount to 640 yuan, representing 8.1%. Within the variable costs, harvesting labor averages 2,850 yuan per mu, accounting for 39.4%. Packaging materials cost 1,680 yuan per mu, making up 23.2%, and transportation costs are 1,560 yuan per mu, or 21.5%. Cold storage and preservation expenses average 890 yuan per mu, constituting 12.3%, and marketing and other costs are 250 yuan per mu, comprising 3.5%. Fixed costs primarily include the depreciation of cold storage and packaging equipment.

Table 1. Production Cost Composition and Phased Cost Structure of Kiwifruit Per Mu

Cost Category/Stage	Total Cost per Mu (Yuan)	Proportion of Total 6-Year Lifecycle Cost (%)	Fixed Cost (FC)		Variable Cost (VC)		Key Cost Items
			Amount (Yuan)	Proporton of Stage/Total Cost (%)	Amount (yuan)	Proportion of Stage/Total Cost (%)	
Total 6-Year Lifecycle Cost	38,620	100	13910	36.0	24,710	63.98	Fixed investment is relatively high; variable costs rise rigidly
1. Orchard Establishment Period	9,870	25.6	7620	77.2 (of stage cost)	2,250	22.8 (of stage cost)	FC: Trellis system (4,850 yuan, 63.6% of stage FC), seedling purchase (1,580 yuan, 20.7%), land preparation (1,190 yuan, 15.6%); VC: Agricultural materials, labor (65.3% of stage VC)
2. Growth Period	8,250	21.4	2,890	35.0 (of stage cost)	5,360	65.0 (of stage cost)	VC: Agricultural materials (2,870 yuan, 53.5%), labor (2,490 yuan, 46.5%); FC: Land transfer fee, trellis maintenance
3. Fruiting Period	12,630	32.7	2,760	21.8 (of stage cost)	9,870	78.2 (of stage cost)	VC: Labor (5,060 yuan, 51.3%), agricultural materials (3,820 yuan, 38.7%), other VC (990 yuan, 10.0%); FC: Land transfer fee, fixed asset depreciation
4. Post-Harvest Circulation Period	7,870	20.4	640	8.1 (of stage cost)	7,230	91.9 (of stage cost)	VC: Harvest labor (2,850 yuan, 39.4%), packaging materials (1,680 yuan, 23.2%), transportation (1,560 yuan, 21.5%), cold storage (890 yuan, 12.3%), marketing (250 yuan, 3.5%); FC: Cold storage/packaging equipment depreciation

(2) Analysis of inter - regional production cost differences

Significant variations in natural conditions, economic development, and technological advancement exist among China's primary kiwifruit-producing regions. These differences lead to distinct regional characteristics in production cost composition and levels. This paper focuses on a comparative analysis of production cost disparities between two major areas: the northern foothills of the Qinling Mountains in Shaanxi and the Xiangxi region in Hunan.

① Cost differences during the orchard establishment period

During the orchard establishment period, costs vary significantly between regions. In western Hunan,

Hunan Province, the average cost per mu is the highest at 11,230 yuan, while it is comparatively lower at 9,120 yuan in the northern foot of the Qinling Mountains, Shaanxi Province. The elevated costs in western Hunan are primarily due to the region's mountainous terrain, which complicates and increases the expense of land preparation. Additionally, the high price of quality red-heart kiwifruit seedlings and the expense of soil improvement using organic fertilizers contribute to the overall cost. The necessity of greenhouse facilities to combat the prevalent canker disease further escalates expenses, with trellis costs per mu reaching up to 18,000 yuan, resulting in significantly higher input costs than in other regions. Conversely, the northern foot of the Qinling Mountains benefits from large-scale cultivation practices, allowing for batch procurement of seedlings and supports, which effectively reduces the unit cost.

② Cost differences during the fruiting period

During the fruiting period, the average cost per mu in the two primary production areas is 13,870 yuan at the northern foot of the Qinling Mountains in Shaanxi and 12,150 yuan in western Hunan. The elevated cost in Shaanxi is primarily attributed to the high labor expenses, averaging 5,870 yuan per mu. This is largely due to a significant transfer of rural labor, resulting in a labor shortage and subsequent year-on-year wage increases. Notably, labor costs constitute 53.7% of the total expenses, which is considerably higher than in other production regions.

③ Cost differences during the post - harvest circulation period

During the post-harvest circulation period, the average cost per mu is 8,760 yuan in the northern foothills of the Qinling Mountains in Shaanxi, compared to 7,980 yuan in western Hunan. The higher cost in Shaanxi is primarily due to the substantial kiwifruit output, extensive circulation radius, and relatively high local transportation expenses. Additionally, the cold-chain logistics system in the area is underdeveloped, necessitating greater investment in cold storage and preservation.

The primary reason for variations in production costs across regions is the combined impact of several factors, including natural conditions (such as mountains and plains), cultivation methods (greenhouse versus open-field), mechanization levels, and transportation distances. Notably, labor costs and infrastructure investments are the key drivers of these regional disparities.

(3) Analysis of production cost differences among different cultivation modes

Kiwifruit cultivation primarily occurs through two methods: open-field and greenhouse cultivation. Open-field cultivation constitutes approximately 78.5% of production, while greenhouse cultivation makes up about 21.5%. These methods differ significantly in terms of production cost composition and levels. This paper examines these cost differences by comparing two major production regions: western Hunan in Hunan and the northern foothills of the Qinling Mountains in Shaanxi.

① Total cost difference

Greenhouse cultivation incurs an average total cost of 48,540 yuan per mu over its entire life cycle, significantly surpassing the 27,500 yuan per mu cost of open-field cultivation by 1.76 times. A major contributor to this disparity is the orchard establishment period, where greenhouse cultivation costs

23,345 yuan per mu, 3.68 times higher than the 6,350 yuan per mu for open-field cultivation. During the fruiting period, greenhouse costs are 14,850 yuan per mu, which is 1.27 times the 11,700 yuan per mu cost of open-field cultivation. In contrast, the cost differences during the growth and post-harvest circulation periods are less pronounced. For these stages, greenhouse cultivation expenses are 10,350 yuan and 8,995 yuan per mu, respectively, compared to 9,450 yuan and 8,000 yuan per mu for open-field cultivation.

② Differences in cost structure

In open-field cultivation, the fruiting period incurs the highest costs, accounting for 42.5% of the total, followed by the growth period at 34.4%, the post-harvest circulation period at 29.1%, and the orchard establishment period at 23.1%. Conversely, in greenhouse cultivation, the orchard establishment period represents the largest cost share at 48.1%, followed by the fruiting period at 30.6%, the growth period at 21.3%, and the post-harvest circulation period at 18.5%. The primary reason for this discrepancy is the substantial investment required for constructing greenhouse supports during the orchard establishment phase in greenhouse cultivation, which significantly elevates its cost proportion. In contrast, open-field cultivation does not require greenhouse investments, making labor and agricultural materials during the fruiting period the primary cost drivers.

③ Differences in key cost items

Investment in support systems for greenhouse cultivation averages 18,000 yuan per mu, significantly higher—6.4 times—than the 2,800 yuan for open-field cultivation. This disparity is the primary driver of cost differences between the two methods. Labor costs also vary notably; during the fruiting period, greenhouse cultivation requires an average labor input of 1,950 yuan per mu, which is 1.63 times the 1,200 yuan needed for open-field cultivation. This increased labor demand stems from the need for precise tasks such as tree-shape cultivation, flower and fruit thinning, and pollination in greenhouse settings. Additionally, the average expenditure on agricultural supplies per mu for greenhouse cultivation is 4,230 yuan, 1.19 times the 3,560 yuan for open-field cultivation. This is due to the higher quantity and quality requirements for fertilizers and pesticides in greenhouse environments.

4. Economic Benefit Evaluation of the Kiwifruit Industry

(1) Overall economic efficiency level

The average output value per mu for China's kiwifruit industry is 46,090 yuan, with an average total cost of 38,620 yuan and a net profit of 7,470 yuan. The input-output ratio stands at 1.2, while the cost-return ratio is 19.3%. During the orchard's establishment and growth phases, spanning the first three years, there is no output, resulting in a negative net profit and an average loss of 16,410 yuan per mu. The subsequent fruiting period, covering the next three years, marks the profit-making phase. Here, the average annual output value per mu rises to 14,300 yuan, with costs averaging 6,670 yuan, yielding a net profit of 7,630 yuan. The input-output ratio improves to 2.14, and the cost-return ratio jumps to 114.4%, highlighting this phase as crucial for profitability. The high initial investment in kiwifruit leads to a prolonged cost recovery period. However, once the fruiting period begins, the return rate significantly increases. Enhancing yield per unit area and extending the fruiting period are essential for sustaining efficient kiwifruit production. Despite these dynamics, the overall economic benefits of China's kiwifruit industry remain suboptimal compared to countries like New Zealand and Italy. Factors such as high production costs, low yield per unit area, minimal product value addition, and significant post-harvest losses compress profit margins. Additionally, profits are concentrated during the fruiting period, while the early stages are burdened with high losses. The substantial initial investment required poses a barrier for many farmers, hindering large-scale industry development.

(2) Economic benefit differences among different cultivation modes

While greenhouse cultivation incurs higher production costs compared to open-field cultivation, the superior quality and higher market prices of greenhouse products result in greater economic benefits. This distinction in economic outcomes is evident when comparing data from western Hunan and the northern foot of the Qinling Mountains in Shaanxi.

① Open-field cultivation (taking Miliang No. 1 as an example)

The average yield per mu is 2500 kg, with a selling price of 2.6 yuan/kg, resulting in an output value of 6500 yuan per mu. During the fruiting period, the input cost averages 3900 yuan per mu, while the total cost over the entire life cycle reaches 27,500 yuan per mu. Consequently, the net profit per mu is 2600 yuan, with an input-output ratio of 1.67 and a cost-benefit ratio of 66.9%. Open-field cultivation offers advantages such as low production costs and minimal investment requirements, making it accessible for ordinary farmers. However, it also presents challenges, including average product quality, low selling prices, and limited economic benefits. Additionally, yields and quality are significantly affected by natural conditions, leading to noticeable fluctuations.

② Greenhouse cultivation (taking Hongyang as an example)

The average yield per mu is 1,000 kg, with a selling price of 26 yuan per kg, leading to an average output value of 26,000 yuan per mu. During the fruiting period, the average input cost per mu is 4,950 yuan, while the total cost over the entire life cycle reaches 48,545 yuan per mu. Consequently, the average net profit per mu stands at 21,050 yuan, with an input-output ratio of 5.25 and a cost-benefit ratio of 433.3%. Greenhouse cultivation offers several advantages, including superior product quality, higher selling prices, and substantial economic benefits. It also provides effective resistance to natural disasters, ensuring stable yield and quality. However, the high initial investment is a significant drawback. Establishing a greenhouse orchard costs 3.68 times more than open-field cultivation, demanding considerable capital and technological expertise from farmers. This high entry barrier poses challenges for ordinary farmers, hindering widespread adoption.

Both cultivation modes offer distinct advantages and disadvantages. Greenhouse cultivation is ideal for farmers or enterprises with ample funds and advanced technical expertise, allowing for high investment and potentially high returns. In contrast, open-field cultivation suits ordinary farmers due to its low investment threshold and reduced risk, though it offers limited economic benefits. To enhance industrial economic outcomes, it is crucial to align cultivation strategies with regional realities and farmers' needs. By rationally optimizing the layout of cultivation modes, large-scale and standardized cultivation can be achieved.

(3) Economic efficiency differences among different supply chain models

The cost structures of various supply chain models in the kiwifruit industry differ significantly, leading to notable disparities in economic benefits and their distribution. This paper examines three primary supply chain models—farmers plus agricultural markets, direct farm-to-supermarket supply, and e-commerce—to comparatively analyze the differences in their economic benefits.

① Farmer household + Farmers' market model

This model represents the most traditional supply chain approach, where farmers harvest their products and directly transport them to farmers' markets for sale, minimizing supply chain links. The average total cost per mu is 11.76 yuan/kg, comprising 9.5 yuan/kg for production, 1.96 yuan/kg for circulation, and 0.3 yuan/kg for operating expenses. With an average output value of 16.8 yuan/kg per mu, the model yields an average net profit of 5.04 yuan/kg, an input-output ratio of 1.43, and a cost-benefit ratio of 42.9%. The model's primary advantages include minimal circulation links and low transaction costs, allowing farmers to retain over 85% of the profits. However, it also faces significant challenges such as large market fluctuations, limited bargaining power for farmers, unstable selling prices, and low product added value, which hinder the ability to secure premium prices for high-quality products.

② Agricultural-supermarket docking model

In this model, farmers or cooperatives establish direct connections with supermarkets, enabling "direct delivery from the origin to the supermarket" and streamlining the supply chain. The average total cost per mu is 11.88 yuan/kg, comprising 6.56 yuan/kg for production expenses, 1.78 yuan/kg for circulation costs, and 3.54 yuan/kg for operating costs. The average output value per mu is 18.6 yuan/kg, resulting in a net profit of 6.72 yuan/kg. The input-output ratio stands at 1.56, while the cost-return ratio is 56.6%. This model offers several advantages: it provides stable sales channels, ensures farmers receive relatively consistent sales prices, and encourages improved production standardization due to supermarkets' high-quality requirements. Consequently, farmers can achieve better prices for superior products. However, there are notable drawbacks. Operating costs are high, and the entry threshold for supermarkets is steep, involving fees such as entry and barcode fees. Additionally, farmers possess limited bargaining power, leading to an uneven distribution of profits.

③ E-commerce models

In this model, farmers or enterprises sell products directly to consumers via e-commerce platforms like Taobao, JD.com, and Douyin. This approach features the shortest supply chain but incurs relatively high circulation and operational costs. The average total cost per mu is 26.88 yuan/kg, broken down into 9.98 yuan/kg for production, 8.3 yuan/kg for circulation, and 8.6 yuan/kg for operation. The average output value per mu is 38.6 yuan/kg, resulting in an average net profit of 11.72 yuan/kg. The input-output ratio stands at 1.43, with a cost-return rate of 43.6%. The model's advantages include achieving high selling prices, securing premium prices for quality products, directly connecting with consumers, understanding market demand, and optimizing product supply. However, the high circulation and operation costs reduce farmers' profit margins, with farmers retaining only about 65% of the actual profit share. Additionally, this model demands that farmers possess relatively advanced e-commerce operation skills.

The farm-supermarket docking model exemplifies optimal economic benefits by effectively balancing stable sales channels with relatively high profit margins. In contrast, while the e-commerce model boasts high selling prices, its substantial costs lead to economic benefits that fall short of the farm-supermarket docking model. Meanwhile, the "farmer + agricultural market" model, despite its low costs, encounters significant market risks, resulting in the weakest economic performance. To boost the economic benefits of the kiwifruit industry, it is essential to optimize the supply chain model and foster collaborative operations across all supply chain links.

5. Analysis of Constraining Factors for the Economic Benefits of the Kiwifruit Industry

Based on the analysis of production cost composition and economic benefit evaluation, the economic challenges facing China's kiwifruit industry primarily stem from four key constraints: imbalanced factor allocation, insufficient technological innovation, outdated organizational models, and low supply chain efficiency. These elements are interdependent, collectively contributing to the industry's predicament of "high cost and low efficiency."

(1) Imbalanced allocation of kiwifruit industry factors

① Imbalanced allocation of labor factors

The kiwifruit industry is heavily reliant on labor, making labor costs a significant component of production expenses. Recently, the migration of rural workers to urban areas has caused labor shortages and increased costs in key production regions. For instance, farmers in the northern foothills of the Qinling Mountains in Shaanxi require 32 units of labor per mu. Between 2018 and 2023, labor wages surged by 125%, with labor costs during the fruiting period comprising 51.2% of total expenses. Additionally, the workforce is aging, with over 65% being elderly, and the generally low skill level of the labor force hampers the adoption of standardized cultivation practices, thereby limiting production efficiency improvements.

② Imbalanced allocation of capital factors

The kiwifruit industry is characterized by significant fixed costs and substantial capital requirements during the orchard establishment phase. However, it grapples with insufficient capital investment and an inefficient investment structure. Ordinary farmers face challenges and high costs in securing financing, making it difficult to invest in high-value assets like greenhouses and mechanized equipment. Consequently, cultivation methods remain outdated. Additionally, capital is predominantly focused on the production stage, with insufficient investment in post-harvest processing, cold-chain logistics, and brand development. This imbalance results in high post-harvest losses and low product added value, ultimately impacting economic returns.

(2) Insufficient technological innovation

① The cultivation techniques are backward

Kiwifruit cultivation technology remains inadequately standardized, with many farmers relying on traditional methods rather than scientific approaches for fertilization, pruning, and pest control. This reliance results in low production efficiency and elevated costs. For instance, indiscriminate fertilizer application not only increases agricultural input but also causes soil compaction and promotes pest and disease proliferation, necessitating more pesticide use. Outdated pruning techniques lead to poorly structured trees with inadequate ventilation and light, negatively impacting fruit quality and yield. Additionally, the adoption of simplified and mechanized cultivation technologies is slow. Manual labor still predominates in land preparation, fertilization, pruning, and harvesting, contributing to inefficiency and high labor expenses.

② Insufficient post - harvest processing technology

The outdated post-harvest handling technology for kiwifruits and the inadequate cold-chain logistics system in China result in significant post-harvest losses and low product value. Currently, the cold-chain circulation rate for kiwifruits in China is under 20%, starkly contrasting with the over 90% rate in developed countries. Consequently, the post-harvest loss rate reaches 25% to 30%, significantly exceeding the international average of 5%. These losses translate to an annual financial impact exceeding 5 billion yuan. Additionally, the technologies for post-harvest grading, packaging, and processing are underdeveloped, with most kiwifruits being sold as raw products. The grading and packaging rate is below 40%, and deeply processed products constitute less than 10% of the market. This low product value hinders the ability to secure premium prices for high-quality kiwifruits.

(3) Low supply chain efficiency

① The supply chain has a long cycle, leading to relatively high circulation costs

The supply chain for Chinese kiwifruit is notably extensive, involving several intermediary stages: “farmers → brokers → wholesalers → retailers → consumers.” Each stage incurs specific margins and handling fees, leading to elevated circulation costs. These costs account for 20.4% of the total cost of Chinese kiwifruit, significantly higher than New Zealand’s 8.7%. The numerous intermediary steps not only inflate circulation costs but also extend the time products spend in transit, thereby increasing post-harvest loss rates and reducing profit margins for both farmers and consumers.

② The cold-chain logistics system is imperfect, leading to a high post-harvest loss rate

Kiwi fruit, known for its perishability, demands an efficient cold chain logistics system. Unfortunately, China’s kiwi fruit industry suffers from an inadequate cold chain infrastructure, characterized by outdated technology and insufficient facilities. This inadequacy results in a significant post-harvest loss rate. In China’s primary kiwi-producing regions, cold storage and preservation facilities cover only 45.7%. Many farmers rely on ambient-temperature transportation and lack essential pre-cooling, cold storage, and cold chain transportation equipment. Consequently, products often rot and deteriorate during transit, leading to a post-harvest loss rate of 27.5%. This flawed logistics system not only wastes resources but also degrades product quality, hindering long-distance sales and limiting market expansion and economic growth.

③ Lagging brand building and low product added value

The development of Chinese kiwifruit brands is significantly lagging. Regional public brands exert limited influence, and there are few independent enterprise brands, which are generally weak. Consequently, the added value of these products remains low. In key kiwifruit-producing areas, regional public brands cover only 42.3% of the market. Most products are sold without the advantage of a recognized brand, resulting in a lack of brand premium. Consequently, the average selling price is merely one-third to one-half of that of New Zealand kiwifruit. Additionally, the low degree of product grading hampers the ability to command higher prices for superior quality. The absence of grading in most sales further diminishes product value and constrains economic benefits.

6. Approaches to Enhancing Economic Benefits of the Kiwifruit Industry

(1) Optimize the allocation of factors and reduce production costs

① Optimize the allocation of labor factors

To enhance farmers' technical skills and production efficiency, targeted training programs focus on core technologies such as standardized kiwifruit cultivation, green prevention and control of diseases and pests, and post-harvest processing. The kiwifruit industry also seeks to attract high-quality talent, including returning rural youth and college students, to optimize the labor force structure. Concurrently, mechanical cultivation technologies are being promoted, with increased efforts in the research, development, and dissemination of mechanical equipment for land preparation, fertilization, pruning, and harvesting. This approach aims to reduce labor input and address challenges like "difficulty in hiring workers and high labor costs." For example, the adoption of electric pruning machines and harvesters can cut labor costs by 20% to 30%.

② Optimize the allocation of capital factors

Enhancing financial support and innovating agricultural credit products are crucial for the kiwifruit industry. Introducing mortgage loans, credit loans, and startup loans specifically designed for this sector can significantly lower the loan threshold and simplify the loan process, thereby easing the financial burdens and high costs faced by farmers and emerging businesses. Concurrently, increasing financial subsidies is essential. These subsidies should target infrastructure development, technology promotion, cold-chain logistics, and the cultivation of high-quality varieties in key kiwifruit production areas, thereby reducing initial investment pressures on farmers and enterprises. Furthermore, optimizing the capital input structure is necessary. It is important to guide capital from the production phase to areas such as post-harvest processing, cold-chain logistics, brand development, and technology research and development. By boosting investment in post-harvest grading, packaging, cold storage, preservation, and deep processing, we can enhance the added value of products and minimize benefit losses.

(2) Strengthen technological innovation to enhance production efficiency and product quality

① Promote variety innovation and optimize variety structure

Enhancing the selection and promotion of superior kiwifruit varieties is essential. The focus should be on developing varieties that offer high quality, yield, disease resistance, long-term storage, and excellent taste. To achieve this, gradually decrease the planting of traditional varieties while increasing the prevalence of high-quality ones. Additionally, it is crucial to strengthen the introduction and domestication of new varieties. High-quality varieties from countries like New Zealand and Italy should be introduced and adapted to the natural conditions of China's primary production areas. This approach will cultivate varieties well-suited for Chinese climates and diversify the variety structure. Establishing a robust variety breeding system is also vital. This includes enhancing kiwifruit seedling breeding bases, standardizing the production and sales processes of seedlings, and ensuring their quality. By providing farmers with high-quality, affordable seedlings, the input costs for seedlings can be significantly reduced. This comprehensive strategy will support the development of a more resilient and productive kiwifruit industry.

② Promote innovation in cultivation techniques to enhance production efficiency

To enhance kiwifruit cultivation, it is essential to promote standardized and simplified techniques. Establishing technical regulations for standardized cultivation will guide farmers in adopting scientific methods for fertilization, pruning, flower and fruit thinning, pollination, and pest control. This approach aims to reduce agricultural inputs while boosting production efficiency and product quality. For instance, implementing soil testing and formula fertilization can decrease fertilizer use by 15% to 20% and simultaneously improve fruit quality. Moreover, advancing mechanized cultivation techniques is crucial. Developing and promoting mechanized equipment tailored to various production areas and cultivation modes—such as land preparation machines, fertilizer applicators, pruning machines, and harvesters—will increase the mechanization rate across all stages of kiwifruit production. Additionally, the development of smart agriculture is vital. By integrating technologies like the Internet of Things, big data, and artificial intelligence, an intelligent kiwifruit planting system can be established. This system enables precise irrigation and fertilization, intelligent pest and disease monitoring, and early warning systems. Consequently, resource utilization efficiency will improve, production costs will decrease, and product quality will be enhanced.

③ Advancing post-harvest processing technologies is crucial for minimizing loss rates and increasing the added value of products.

Enhancing the post-harvest processing system requires strengthening facilities for pre-cooling, grading, packaging, cold storage, and preservation. By adopting advanced post-harvest processing technologies, we can significantly improve processing efficiency. For instance, implementing pre-cooling and preservation technologies can reduce post-harvest loss rates by 10% to 15%. Developing cold-chain logistics is crucial. This involves increasing investment in kiwifruit cold-chain logistics facilities, establishing regional cold-chain logistics centers, and promoting the use of professional refrigerated transport equipment and technologies to boost the cold-chain circulation rate. Additionally, increasing research and development, along with the promotion of kiwifruit deep-processing technologies, is essential. By creating deep-processed products like kiwifruit juice, dried fruit, and fruit wine, we can extend the industrial chain and enhance the products' added value.

(3) Revamp the supply chain system to boost efficiency and increase the added value of products.

① Optimize the supply chain links and reduce circulation costs.

Streamlining the supply chain by minimizing intermediaries is essential. Encouraging a "direct from origin to terminal" model allows farmers and cooperatives to connect directly with supermarkets, convenience stores, catering businesses, and e-commerce platforms. This approach shortens the supply chain, reducing both circulation costs and post-harvest losses. For instance, expanding direct connections between farmers and supermarkets, enterprises, and schools facilitates the direct entry of products like kiwifruit into these terminal markets. Additionally, cultivating a professional team of agricultural product brokers is crucial. By standardizing broker behavior and enhancing their professional skills and service capabilities, brokers can effectively bridge the gap between farmers and the market, thereby lowering transaction costs for farmers. Furthermore, establishing a regional kiwifruit trading market with improved infrastructure can enhance its distribution, price formation, and information service functions. This promotes centralized trading and large-scale circulation of kiwifruit, further reducing circulation and transaction costs.

② Improve the cold-chain logistics system to reduce the post-harvest loss rate.

Enhancing investment in cold-chain logistics facilities is crucial for improving the infrastructure and efficiency of this sector. This involves constructing regional cold-chain logistics centers, pre-cooling centers, and refrigerated warehouses, all equipped with specialized pre-cooling equipment, refrigerated transport vehicles, and refrigerated shelves. Such upgrades aim to elevate the hardware capabilities of cold-chain logistics. Encouraging social capital investment in this sector is essential to foster the growth of cold-chain logistics enterprises and to support their expansion and professionalization. Incorporating advanced technologies, such as the Internet of Things and big data, is vital for establishing an intelligent monitoring system. This system would enable real-time tracking and early warnings regarding temperature and humidity during the transportation and storage of kiwifruits, thereby ensuring product quality and minimizing post-harvest losses. Additionally, adopting preservation technologies like controlled atmosphere storage and vacuum packaging can significantly extend the shelf life of kiwifruits, enhance their storage resilience, and broaden their market reach. To further support cold-chain logistics, it is important to develop comprehensive supporting services. Establishing a standardized system for cold-chain logistics operations will help streamline processes and ensure consistency. Building a skilled cold-chain logistics distribution team is also crucial for improving distribution efficiency. Ultimately, achieving full cold-chain coverage from the origin to the dining table will ensure that kiwifruits maintain their quality throughout the supply chain.

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