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# Modeling the Development Strategy of an Agricultural Technology Hub: A New Structural Economics Framework for Yukou Town

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**SUMMARY:** *Based on the theoretical framework of new structural economics, this study builds a strategic model and analyzes the development path of Yukou Town, Pinggu District, Beijing as an emerging agricultural technology center. The research adopts a mixed-methods approach, integrating in-depth field investigations covering government agencies, enterprises, research institutions, quantitative analysis of regional economic statistics, technological input-output data, and system dynamics modeling to comprehensively evaluate the efficiency of technological innovation, the progress of economic structure transformation, and the adaptability of the policy support system in the region. The research results show that the development strategy successfully fits with the local factor endowment, transforms comparative advantages into dynamic production capacity through targeted policy intervention, and promotes the integration of agriculture and advanced technology. This process has given rise to a multi-participatory innovative ecosystem, covering government agencies, enterprises, research institutions and local farmers. In addition, the study further put forward a complete set of strategic proposals aimed at overcoming the persistent development bottlenecks, so as to enhance the role and competitiveness of Yukou Town in the field of global agricultural technology.*

***KEYWORDS:*** *New Structural Economics; Rural revitalization; Resource allocation; New quality productivity*

## 1 Introduction

Under the background of China's national strategy of comprehensively promoting rural revitalization and deepening opening up to the outside world [1], the diversified transformation and high-quality development of the rural economy have become an important priority. In recent years, the development of new productivity through digitalization and intelligence [2] and green transformation [3] has been emphasized as a key path.

Yukou Town has unique natural conditions and a long agricultural foundation. It actively responds to the national innovation-driven development strategy and positions the "Agricultural Zhongguancun" plan as the core growth engine. Through the establishment of an agricultural technology innovation system - covering intelligent agricultural applications, special agricultural product development and agricultural talent training - Yukou, as the core area of Zhongguancun in agriculture, has significantly improved the intelligence and accuracy of agricultural production, while extending the industrial chain and improving added value.

Based on the new structural economics [4], the transformation of fishing mouth is based on its inherent element endowment and comparative advantages, and uses agricultural

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resources and technological innovation to promote the structural upgrading of local industries. By combining government guidance with market mechanism [5], Yukou has attracted many high-tech agricultural enterprises and research institutions, cultivated a closely connected innovative ecosystem, and built a bridge between industrial, academic and practical applications.

This study provides localized data analysis and case insights to support fishing policymakers and related parties. It pioneered the combination of the new structural economics framework with the three key dimensions of rural development - digitalization, intelligence and green transformation, and established a situation-specific assessment model for new productivity. This research aims to promote the optimization of the agricultural industry, accelerate the transformation of research and development results into market applications, and open up new sources of regional economic power. The study further emphasizes the importance of agricultural technology innovation, advocates the strengthening of talent development and introduction, and aims to improve the status of Yukou in the field of global agricultural science and technology. By promoting environmental protection and circular agriculture practices, the study also aims to expand public participation, strengthen international cooperation, and support China's broader strategy for the globalization of agriculture.

# 2 Research Method

This study puts its analysis into the theoretical framework of new structural economics, which believes that the coordination mechanism between an effective market and a capable government is the basis of economic development. The core proposition of the framework is that industrial transformation is mainly driven by the upgrading of the regional element endowment structure. Therefore, successful industrial development must dynamically adapt to the endowments of local land, labor, capital and technology, so as to realize the natural process from the use of comparative advantages to the establishment of sustainable competitive advantages. In this process, the role of the government is conceptualised as a promoter, having the responsibility of rectifying the market failure while prudently keeping away from the price signal distortion, which is fundamental to market efficiency.

This perspective is complemented by the market-creative state theory [6], which offers a deeper understanding of the role of government activity. The theory is that the state can improve not only market failures, but also actively create and shape new markets through strategic investment in infrastructure and general technology research and development. At the same time, the dynamic capability theory [7] offers an organisational-level analogy in the form of the dynamic capability for organisations to reorganise and reconfigure resources. This paper extends this idea to the institutional domain. It is thought that the most important role of the government is to establish a good institutional environment and lower the cost of transformation, so that enterprises can better develop and play their active capabilities to adapt to the changing economic environment.

In order to be empirically rooted in this comprehensive theoretical framework, the research adopts a dual method. Use the DEA-Malmquist model [8] to measure the evolution of total factor productivity and its components in Yukou Town, and provide a quantitative assessment for productivity improvement. At the same time, apply structural equation modeling [9] to solve the complex and often indirect relationship between government intervention, technological transformation capacity and industrial upgrading. Combined with this analysis strategy, the research can test the core proposition, that is, how to promote the

improvement of enterprise capabilities by readjusting the role of the government, so as to accelerate the process of industrial upgrading.

# 3 Current Industrial Landscape in Pinggu

In recent years, Pinggu District has focused on building a national agricultural technology innovation center, positioned it in a critical period of strategic opportunity, facing an important moment of acceleration and sustainable development.

The current industrial structure of the district is mainly based on agriculture, which provides a solid resource foundation for the development of the Yukou Agricultural Zhongguancun Plan(see Figure1). However, despite the scale and intensification to a certain extent, the agricultural production mode in Pinggu District and Yukou Town is still dominated by traditional methods. Although this method can ensure stable output, it leads to low added value of agricultural products and lack of brand recognition and market competitiveness. These restrictions stem from multiple factors, including insufficient integration of advanced agricultural technology, short industrial chain, and weak deep processing capacity of products.

In the industrial sector, Pinggu's manufacturing base is relatively backward, traditional industries dominate, and the existence of high-tech or strategic emerging industries is relatively limited. This industrial structure not only restricts the growth potential of the local industrial economy, but also inhibits the formation of effective industrial clusters, thus limiting the competitiveness of the overall economy of the region. Therefore, one of the main challenges facing the Yukou Agricultural Zhongguancun Plan is how to use technological innovation to promote the upgrading of the agricultural industry.

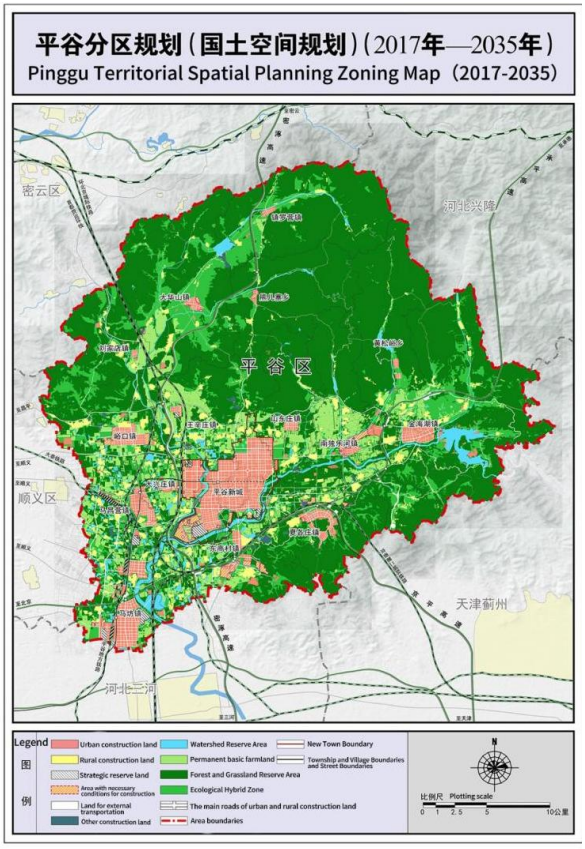


*Figure1: Pinggu Territorial Spatial Planning Zoning Map (2017-2035)*

*Table 1: Comparison of the Proportions of the Three Major Industries in Pinggu District and Beijing (2022)*

| Industrial category | The proportion of Pinggu District | The average level of Beijing |
|---|---|---|
| The primary industry (agriculture) | 8.5% | 0.3% |
| The secondary industry (industry) | 25.6% | 16.5% |
| The tertiary industry (service industry) | 65.9% | 83.2% |

Regarding talent retention, Pinggu's economic development level lags behind the Beijing municipal average (Table 1), resulting in limited local employment opportunities. This has led to significant outmigration of working-age adults, exacerbating population aging. In the Table 2, we can see that the aging situation in Pinggu District is intensifying. A shortage of high-skilled and technical professionals further constrains socio-economic development. According to the Beijing Pinggu District Rural Revitalization Strategic Plan (2018-2022) and related research, the primary drivers of youth outmigration include:

Limited Employment Opportunities: The local economy's reliance on agriculture and traditional manufacturing, coupled with a scarcity of high-tech and modern service industries, fails to provide high-quality jobs that attract and retain young talent.

Lower Income Levels: Disposable income per capita in Pinggu is below the Beijing average, incentivizing young workers to seek employment in urban centers with higher wages.

Inadequate Public Services: Gaps in the quality and availability of public services—particularly in education and healthcare—compared to urban areas make other locations more attractive for long-term settlement.

***Table 2:*** *Comparison Table of Population Age Ratios in Pinggu District, Beijing (2021)*

| Population proportion (%) | Pinggu | The average level of Beijing |
|---|---|---|
| 60 years old and above | 22.3% | 19.6% |
| Aged 15 to 59 | 63.5% | 68.5% |

# 4 Technology-Driven Development Advantages in Yukou: The "Agricultural Zhongguancun" Initiative

As the core zone of Pinggu's Agricultural Zhongguancun, Yukou represents a model of agricultural technology innovation in Beijing's Pinggu District. Its development approach vividly reflects the core tenets of New Structural Economics. This section analyzes Yukou's high-end agricultural technology development model by integrating it with the theory of New Structural Economics, examining its practical application in areas such as factor endowment dynamics, the synergy between an effective market and a capable government, and the dynamics of industrial upgrading.

(I) Factor Endowment-Driven Agricultural Development

New Structural Economics posits that an economy's development path must be based on its local endowment conditions—land, labor, capital, and technology—prioritizing industries with comparative advantages. Yukou Town, building upon Pinggu District's rich agricultural resources and favorable geographical location, has fully leveraged its factor endowments to focus on agricultural technology innovation. According to Table 3, Yukou Town has prioritized the development of high-tech agricultural industries such as biological breeding,

smart agriculture, and food nutrition and health. These industries not only align with Yukou's factor endowment structure but also possess significant comparative advantages, laying a solid foundation for the Agricultural Zhongguancun.

*Table 3: Data Statistics Table of Core Science and Technology Industries in Agricultural Zhongguancun, Yukou Town (2023)*

| Industrial category | Representing enterprises/institutions | Key indicators | Data |
|---|---|---|---|
| Biological breeding | Yukou Poultry Industry | Domestic market share of laying hens and breeding chickens | 33% |
| | | Annual research and development expenditure | 120 million yuan |
| Intelligent agriculture | Jingwa Agricultural Science and Technology Innovation | Transaction amount of technology contract | 80 million yuan |
| | | The number of implemented smart agriculture projects | 8 |
| | Beijing Wodebochuang Intelligent Technology | Digital greenhouse tomato yield per unit area | 45kg/m² |
| | | Energy-saving efficiency | 35% |
| Food Nutrition and health | Shounong Food Group Pinggu Industrial Park | Annual processing volume of fresh corn | 12,000 tons |
| | | The output value of low-GI peach products | 50 million yuan |

The high-tech agricultural field in Yukou Town has also shown remarkable technological innovation strength and industrial cluster effect [10]. Its R&D investment continued to grow, reaching 650 million yuan in 2023, with an annual compound growth rate of 19.4%, which strongly supported the breakthrough of core technologies such as biological breeding and intelligent equipment. The cumulative number of patent applications has reached 436, including 15 PCT international patents, highlighting its potential for technological output.

Leading enterprises in the field of agricultural technology in Yukou, such as Yukou Poultry Industry and Jingwa Center, have not only set innovative benchmarks in terms of market share and technology transactions, but also promoted the coverage of the entire industrial chain. From biological breeding to intelligent agriculture and food processing, a closed loop has been formed and economies of scale have been realized. As a leading poultry breeding enterprise in China, Yukou Poultry Industry has established a modern seed industry system based on long-term technical accumulation, covering breeding, breeding and promotion. Its core breakthrough is reflected in the industrial application of biological breeding technology. Through genome selection [11] and molecular marker auxiliary selection, the precise improvement of laying hens and broiler breeds has been realized, and the breed performance and production efficiency have been improved. Its comprehensive strategic layout on the whole industrial chain covers germplasm research and development, feed processing, breeding management, disease prevention and control to final product processing and brand marketing, forming a closed-loop industrial ecosystem. This model not only reduces market risks, but also promotes the coordinated development of supporting industries such as feed processing and cold chain logistics in the region through the technology spillover effect, and achieves the dual benefits of economies of scale and economies of scope.

As a public platform for regional agricultural technology innovation, Jingwa Center

focuses on promoting the deep integration of "industry, academia, research and use", and has built a full-chain service system from "technology research and development - experimental testing and transformation - industrial incubation" to promote the intelligent and green transformation of agriculture. Its landmark achievements include breakthroughs in digital facility agricultural technology. Through precise environmental control and integrated water and fertilizer systems [12], the unit yield of greenhouse tomatoes has been increased by 80%, while reducing the use of fertilizers and pesticides by more than 30%. The center also emphasizes the independent research and development and promotion of intelligent agricultural machinery. The unmanned tractor [13] based on Beidou navigation and machine vision technology has improved the cultivation efficiency by 40% and achieved standardized control of operation quality. It actively develops an agricultural big data platform, integrates multi-source data such as meteorology, soil and market information, provides decision-making support for all links of the industrial chain, and significantly improves the efficiency of resource allocation.

At the same time, Yukou's green transformation strategy has begun to show results. The application of energy-saving technology is particularly remarkable. Intelligent greenhouses have achieved 35% energy saving and reduced the use of pesticides by 30% through AI plant protection [14]. The development of high value-added products, such as peaches with hypoglycemia index, has promoted the upgrading of traditional agriculture to a healthy food industry. Overall, the region has shown a comprehensive positive development trend of technological innovation, cluster development, policy coordination and green transformation.

Based on its element endowment, Yukou Town focuses on agricultural technology innovation, gives priority to the development of high-tech industries such as biological breeding and intelligent agriculture, and consolidates the foundation of Zhongguancun in agriculture through comparative advantages. Its high-tech agriculture field has shown outstanding innovation and clear aggregation effect, and has made remarkable achievements in R&D investment and patent output, achieving economies of scale.

(II) Synergy Between Effective Market and Capable Government

New structural economics emphasizes that the market plays a decisive role in resource allocation, but the government must also solve market failures and provide the necessary infrastructure and institutional support. In the development of Yukou Agricultural Zhongguancun, the market mechanism has played a crucial role, attracting many agricultural technology enterprises and talents, and promoting the transformation and application of agricultural technology achievements. At the same time, government departments actively support their development through preferential policies, strengthening infrastructure construction and improving the business environment, and provide strong support. The synergy of an effective market and a capable government has promoted the rapid rise of Zhongguancun in Yukou Agriculture. We can see some data from 2021 to 2023 in Table 4.

*Table 4: Statistical Table of Public Policy Measures and Effectiveness of Agricultural Zhongguancun in Yukou Town (2021-2023)*

| Policy field | Specific measures | Input/Standard | Effect | Data source |
|---|---|---|---|---|
| Financial support | Special funds for agricultural science and technology | The annual investment is no less than 200 million yuan | In 2023, the R&D investment of enterprises in the park reached 650 million yuan | Pinggu District Government |
| | Agricultural Science and Technology Risk Compensation Fund | The government contributed 100 million yuan | It leveraged 480 million yuan of social financing | Beijing Financial Regulatory Bureau |
| Land use | Point-based land supply model | In 2023, 300 mu of new land for scientific research was added | Integrate 12,000 mu of contiguous cultivated land | Beijing Municipal Bureau of Agriculture and Rural Affairs |
| | Digital platform for land transfer | Reduce circulation costs by 20% | Attract Wodebo to create a 50,000-square-meter smart greenhouse | Beijing Municipal Bureau of Agriculture and Rural Affairs |
| Talent policy | Subsidy for Academician workstations | The maximum is 5 million yuan per station | 43 high-end talents were introduced (2023) | Human Resources and Social Security Bureau of Pinggu District |
| | Master's Program in Smart Agriculture | About 120 people are trained annually | The proportion of R&D personnel has increased from 15% to 22% | Human Resources and Social Security Bureau of Pinggu District |
| Green agriculture | Subsidy for Smart Irrigation | 200 yuan per mu | The coverage rate of water-saving irrigation reached 55% (2023) | Beijing Municipal Ecology and Environment Bureau |
| | Restrictions on the intensity of chemical fertilizer use | ≤265kg/ha(2023) | Pollution indicators have decreased by 7% compared with 2021 | Beijing Municipal Ecology and Environment Bureau |
| Market synergy | The "triple play" infrastructure of Jingwa Center | The fiscal investment was 180 million yuan | Sixty percent of the revenue from enterprise technology contracts comes from private enterprises | Jingwa Center's "2023 Operations Report" |
| | International cooperation Subsidy for Yukou Poultry Industry | Cumulative 32 million yuan | The market share of egg-laying chicken breeding industry is 33% (2023) | Science and Technology Commission of Pinggu District, Ministry of Agriculture and Rural Affairs |

*Table 5: Comparison of Agricultural Science and Technology Input and Output in Yukou Town (2021-2023)*

| Year | Research and development investment (in billions of yuan) | Transaction volume of technology contracts (in billions of yuan) | Patent authorization volume (pieces) |
|---|---|---|---|
| 2021 | 3.8 | 0.9 | 112 |
| 2022 | 5.2 | 1.1 | 187 |
| 2023 | 6.5 | 1.2 | 236 |

(1) Financial support to activate the momentum of agricultural technology innovation

Financial support plays a key role in the field of agricultural technology [15]. In Table 5, we can find Yukou Town invests no less than 200 million yuan in special funds every year, and successfully leveraged 650 million yuan of enterprise R&D investment in 2023, with a leverage ratio of 1:3.25. The data fully proves the remarkable effect of financial funds in stimulating the innovation drive of market entities, and injects strong momentum into the development of agricultural technology. In Figure 2, we can see that the fiscal investment in science and technology in Yukou Town has significantly activated the innovative momentum. Meanwhile, the growth rate of patent output far exceeds that of research and development investment, demonstrating the amplification effect of fiscal funds.In addition, Yukou also set up a risk compensation fund of 100 million yuan, leveraging social financing of 480 million yuan, increasing the proportion of social capital from 12% to 28%. This risk-sharing mechanism not only effectively shares innovation risks, but also further verifies the role of government credit in boosting market confidence and provides a solid financial guarantee for the continuous innovation of agricultural technology.

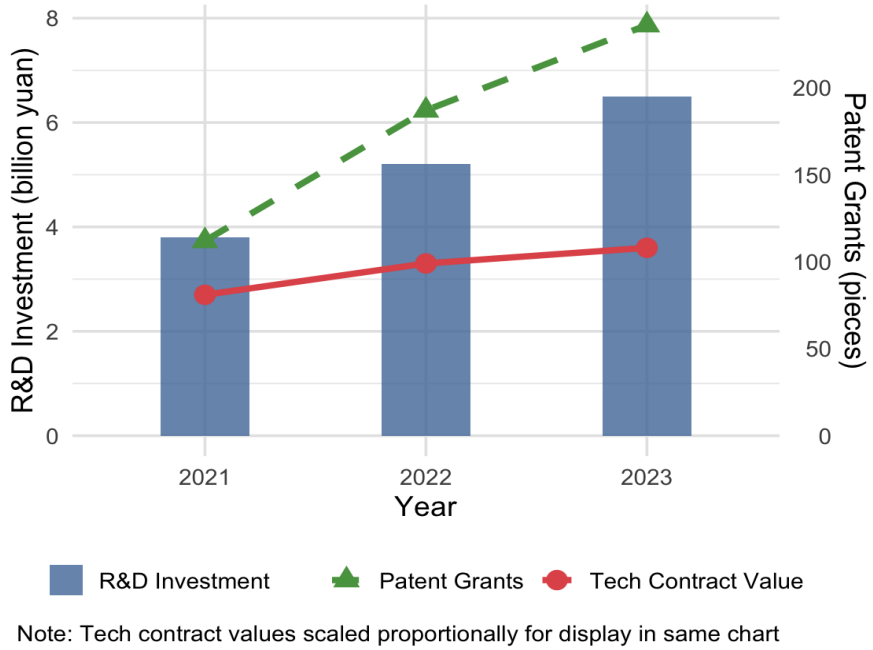


*Figure 2: Statistics on Agricultural Science and Technology Input and output in Yukou Town*

(2) Land use innovation promotes the efficient development of agricultural scientific research

In terms of land use, Zhongguancun in agriculture has successfully implemented the "targeted land supply" model through intensive land use innovation, increasing more than 300

mu of scientific research land. This model promotes the accurate site selection of scientific research projects such as the Jingwa Central Laboratory, and effectively avoids the waste of resources caused by large-scale development. At the same time, by optimizing the land transfer mechanism, the cost of land transfer has been reduced by 20%, attracting Wonder Bochuang and other enterprises to invest in intelligent greenhouses, and the output value per unit area has increased by 80%, which reflects the importance of institutional factors in land development [16]. This land use innovation not only improves the efficiency of land use, but also provides strong support for the efficient development of agricultural scientific research.

(3) Talent policies promote the gathering of agricultural technical talents

Talents are crucial to the development of agricultural technology. Through a series of talent policies, Zhongguancun in agriculture has successfully attracted a large number of high-end professionals [17]. In 2023, a total of 43 personnel with doctoral degrees and above were recruited, increasing the proportion of R&D personnel from 15% to 22%, close to the average (25%) in the suburbs of Beijing. In addition, a master's program in intelligent agriculture has been set up to train 120 technical personnel every year, which has effectively alleviated the shortage of front-line agricultural operators.

The implementation of these talent policies not only improves the overall talent level in the field of agricultural technology, but also provides continuous talent support for its sustainable development.

(4) Green agriculture promotes sustainable agricultural development

In Yukou Agricultural Zhongguan Village, green agriculture has also achieved remarkable results. By strengthening pollution prevention and control, the intensity of fertilizer use in 2023 was reduced to 265 kg/ha, a decrease of 7% compared with 2021, exceeding the average annual reduction target of 5% in Beijing. At the same time, the wide application of water-saving irrigation technology, the coverage rate reached 55%, improving the efficiency of agricultural water utilization by 22% [18]. The popular application of these green agricultural technologies not only reduces agricultural pollution, but also improves the efficiency of agricultural resources utilization, laying a solid foundation for sustainable agricultural development.

(5) Market coordination to improve the international competitiveness of agricultural technology

Market coordination is the key guarantee for the development of agricultural technology. By strengthening the response to market demand, Yukou Agricultural Zhongguancun has achieved a high degree of docking between technology supply and market demand [19]. About 60% of the technology contract revenue of Jingwa Center comes from private enterprises, fully demonstrating the market competitiveness and application value of its technological achievements.

In addition, Yukou Agricultural Zhongguancun has cultivated a number of internationally competitive agricultural science and technology enterprises. Yukou Poultry Industry occupies 33% of the market share (ranking first in the country) in the field of laying hen breeding, breaking the monopoly of imported breeds. These achievements have not only enhanced the status and influence of Zhongguancun in the field of international agricultural technology, but also made important contributions to promoting the sustainable development of China's agricultural technology and enhancing international competitiveness.

*Table 6: Key synergy effect data comparison table*

| Indicator | Government investment (A) | Market response (B) | Synergistic leverage ratio (B/A) |
|---|---|---|---|
| Research and development of biological breeding | 32 million yuan | 120 million yuan | 1:3.75 |
| Intelligent agricultural infrastructure | 180 million yuan | 414 million yuan * | 1:2.3 |
| Incubation of technology enterprises | 200 million yuan per year | The proportion of social capital is 28% | 1:0.56** |
| * 414 million yuan = enterprise technology income (20 million yuan/year ×3 years) + derivative market income (such as equipment sales) | | | |
| **The ratio of the increase in the proportion of social capital (16 percentage points) to government investment | | | |

The analysis of key collaborative data has been carried out (see Table 6). In the field of high-tech research and development of biological breeding, the government has effectively reduced the risk of enterprises to bear technical challenges by providing a certain amount of R&D subsidies, forming a division of labor model of "risks behind the government - enterprise-led innovation". Under the guidance of the market, enterprises continue to increase their investment, resulting in a leverage ratio of 1:3.75 in this field. This model is consistent with Lin Yifu's view in new structural economics, that is, government subsidies should focus on the positive externality that enterprises cannot internalize, which provides an empirical basis.

In terms of intelligent agricultural infrastructure, Yukou Town has invested in the construction of the "three-zone integration" infrastructure, covering the Internet of Things, cold chain and data network, reducing the cost of technology application for enterprises. The enterprise made a profit by providing services and selling equipment. This model is in line with the theory of "market-creating countries". The government creates new markets through infrastructure investment and achieves a leverage ratio of 1:2.3.

However, some areas currently show low leverage ratios. For example, in terms of technology enterprise incubation, Yukou Town invests nearly 200 million yuan in special funds every year, and the proportion of social capital has increased from 12% to 28%, but the leverage ratio is still low, only 1:0.56. This reflects the high-risk nature of agricultural technology investment, which leads to a wait-and-see attitude in the market. According to the Food and Agriculture Organization of the United Nations (FAO), the average return period for agricultural technology projects is 8-10 years, which conflicts with the short-term pursuit of profit characteristics of capital. Therefore, this shows that the development of the field of agricultural technology requires the long-term guidance of the Yukou Town Government to dynamically adjust the leverage to attract more social capital into the field of agricultural technology.

Yukou Agricultural Zhongguancun has practiced the principle of "effective market and capable government coordination" in new structural economics. The market mechanism attracts science and technology enterprises and talents to promote the transformation of achievements; the government provides support through five policy areas of finance, land, talent, green and market coordination. Fiscal policies have leveraged enterprise research and development and social financing, intensive land use innovation has improved output value, and green measures have reduced the intensity of pollution and water use. However, the incubation of technology enterprises faces the problem of low leverage, mainly due to the

long return period and high risk, and still needs the government's continuous guidance to optimize capital investment. Only in this way can Yukou move steadily on the road of "science and technology to revitalize agriculture" and go further.

(III) The driving force of industrial upgrading - technology accumulation and factor endowment structure upgrading promote agricultural transformation

The transformation of Zhongguancun in Yukou Agriculture reflects the dynamic process of promoting industrial upgrading through element endowment restructuring described in New Structural Economics [20]. In the course of its development, Yukou Agriculture Zhongguancun emphasizes technological innovation and industrial upgrading. By introducing and cultivating high-end agricultural technical talents, we will strengthen cooperation and exchanges with international advanced agricultural technical institutions, and continuously improve our technical level and innovation ability. At the same time, with the continuous upgrading of the element endowment structure in recent years, Yukou Agricultural Zhongguancun has gradually transformed from labor-intensive agriculture to technology-intensive agriculture, which has promoted the high-quality development of the agricultural industry.

Remarkable results have been achieved in the upgrading of technological innovation-driven element endowment. In terms of human capital, from 2021 to 2023, Yukou introduced a total of 67 talents with a doctoral degree or above, involving agricultural big data, biological breeding and other fields, increasing the proportion of R&D personnel from 15% to 22%, significantly optimizing the human capital structure [21] In terms of technology capital, relying on 3 academician workstations and 12 technology enterprises, the park has applied for a total of 436 patents, including 15 PCT international patents, forming an independent technology reserve with biological breeding and intelligent equipment as the core [22]. In addition, Yukou has strengthened international cooperation, established four joint laboratories with institutions such as Wahenningen University in the Netherlands and Netafim in Israel, and successfully promoted the localization of six technologies, including layer chicken genome editing [23].

The upgrading of the element structure has in turn promoted the leapfrog development of the industry. The investment in agricultural technology research and development increased from 380 million yuan in 2021 to 650 million yuan in 2023, promoting an average annual growth of 4.3% in total factor productivity (TFP) [24]. The adoption of intelligent agricultural machinery has increased the area of labor management per unit from 50 mu to 120 mu, and the land output rate has increased by 80% [25]. At the same time, the industrial structure has been optimized. The proportion of output value of technology-intensive industries has increased from 28% in 2020 to 47% in 2023, while the proportion of traditional crop cultivation has decreased by 19 percentage points [26].

The transformation path of Yukou shows the three-stage characteristics of the theory of "comparative advantage evolution" in new structural economics: element reorganization, technological internal chemistry and industrial refinement. First of all, through the guidance of policies, primary elements such as land and labor are transformed into scientific research land and technical human capital. Secondly, relying on platforms such as Jingwa Center, the transition from technology introduction, digestion and absorption to independent innovation has been completed. Finally, a high-value-added and high-tech industrial cluster with biological breeding and intelligent agriculture as the core has been formed.

Through the analysis of the fishing case, its theoretical contribution and practical enlightenment are mainly to show that the upgrading of the agricultural industry needs to follow the co-evolutionary logic of "element structure-technical structure-industrial structure". The effectiveness of the market mechanism has been fully reflected in the Zhongguan Village

of Yukou Agriculture, demonstrating the market's ability to choose high-tech paths. This model provides a replicable theoretical paradigm for breaking the "low-end lock" of agriculture and verifies the application value of new structural economics in the field of agriculture.s.

# 5 Risk Response Measures and Strategies

Currently, on the path towards becoming the "Agricultural Zhongguancun" and the "Premier Agricultural Science Town," Yukou Town still possesses considerable room for development.

(I) Risk Analysis

Within the theoretical framework of New Structural Economics, industrial upgrading is viewed as a process that must dynamically align with the factor endowment structure. However, at the empirical level, Yukou Town faces significant obstacles in upgrading its factor endowment structure.

A human capital gap is a key factor constraining Yukou's industrial upgrading. According to 2023 data from the Pinggu District Human Resources and Social Security Bureau, only 38% of the agricultural technology workforce in Yukou Town hold a bachelor's degree or higher, a proportion far lower than the 72% in Beijing's Haidian Zhongguancun Science Park. This deficiency in the human capital structure directly limits the introduction and application of high-tech agricultural technologies, thereby hindering the pace of industrial upgrading.

The lag in the transformation of technology capital is another major reason that restricts the upgrading of the element endowment structure in Yukou Town. The patent conversion rate in Yukou Town is only 30%, and the value of technology transaction contracts is less than 20% of R&D investment, which shows that the knowledge spillover effect has not been fully realized. The inefficiency of technological capital transformation not only wastes valuable research and development resources, but also hinders the role of technological innovation in promoting industrial upgrading.

In order to further verify the above analysis, the DEA-Malmquist model was used to measure the growth of the total factor productivity (TFP) of Yukou Town, which further confirmed that technological transformation is the main bottleneck restricting the industrial upgrading of the town.

**DEA-Malmquist index calculation formula:**

$$M_t^{t+1} = \sqrt{\frac{D^t(x_{t+1}, y_{t+1})}{D^t(x_t, y_t)} \cdot \frac{D^{t+1}(x_{t+1}, y_{t+1})}{D^{t+1}(x_t, y_t)}}$$

**Control variable:**

Capital investment: Fixed asset investment of agricultural science and technology enterprises (billion yuan)

Labor input: Number of agricultural science and technology practitioners (persons)

R&D investment: Internal expenditure on R&D funds (in billions of yuan)

**Output variable:**

Economic output: Agricultural science and technology output value (billion yuan)

Technical output: Number of patent applications (pieces)

**Operation process:**

Using DEAP 2.1 software, select the input-oriented VRS (Variable Returns to Scale) model

**Result presentation:**

| Year | TFP | EC | TC |
|---|---|---|---|
| 2020-21 | 3.8% | 1.02 | 1.036 |
| 2021-22 | 4.1% | 0.98 | 1.063 |
| 2022-23 | 4.3% | 0.95 | 1.085 |

**Argumentative interpretation:**

*New structural economics holds that industrial upgrading should be dynamically matched with the factor endowment structure. The growth of TFP mainly relies on technological progress (TC>1), but for the actual situation of Yukou Town, its technological efficiency (EC<1) has continued to decline.*

The risk of government "excessive intervention" is manifested in policy dependence and price signal distortion. Although the government's goal is to promote technological innovation, it may cause enterprises to choose a technical path that deviates from market demand and pay excessive attention to policy-oriented areas. This, in turn, aggravates the market failure, which is reflected in the long technology investment cycle (usually 8-10 years) in the core agriculture Zhongguancun region, the social capital participation rate is only 28%, and the dependence of enterprises on government subsidies. In addition, the land transfer price is 15% lower than the market equilibrium price, which inhibits the enthusiasm of farmers to participate, resulting in a land transfer rate of only 34%. The direct effect of government support (GOV) on industrial upgrading (IU) is only 0.12, while the indirect effect of technological transformation capacity is 0.23, which further shows that excessive government intervention may weaken the market's self-regulation ability.

However, Yukou Town is still facing the pressure of green transformation. Ecological carrying capacity is an important part of the element endowment structure. On the one hand, land resources are limited, and some arable land has the problem of fragmented management, which makes it difficult to achieve economies of scale and intelligent applications. On the other hand, problems such as water shortage and environmental pollution are increasingly prominent, seriously affecting agricultural production.

(II) Coping Strategies

Element endowment structure upgrading: Based on the analysis of the DEA-Malmquist model, the strategy to solve the obstacles to the upgrading of the element endowment structure is focused on the effective path of high-tech transformation.

In order to effectively solve the obstacles to the transformation of "technology-industry", two key measures can be implemented: the establishment of a blockchain platform for agricultural technology transactions and the promotion of the "technology custody and revenue sharing system". The blockchain platform will ensure the efficient execution of property rights verification, transaction transparency and smart contract revenue sharing [27]. Under the revenue-sharing system, the research team retains 40% of the future revenue, and the enterprise pays 30% of the advance payment and retains 30% of the sales revenue, which can significantly reduce the risk of technology transfer [28]. The pilot data shows that this model increases the technology adoption rate of small farmers in Pinggu from 35% to 62%.

In order to fill the talent gap of "high-end skills", the "second-track talent incentive plan" can be implemented to optimize the human capital structure. For high-end talents, equity incentive strategies can be passed, such as granting company shares to the introduced academicians and leading talents, aiming to ensure their long-term commitment [29]. For technical talents, a skill certification system [30] can be developed to enable farmers to obtain professional qualifications through evaluation, and cooperate with the government's moderate tuition subsidies to reduce learning costs. Drawing on the "new farmers" apprenticeship model successfully practiced in the Yangtze River Delta, enterprises can provide monthly

allowances and retention bonuses to apprentices to promote the reserve of agricultural talents and the development of sustainable industries. In order to better match the talent demand, a dynamic talent demand matching model can be established, and in response to policy requirements, the "intelligent agriculture" master's program of China Agricultural University and other institutions can be increased, and subsidies can be provided to institutions according to the number of enrollments.

We should continue to pay attention to the activation of "land-capital" liquidity. In terms of land elements, Yukou can cooperate with the Beijing Rural Property Rights Exchange to establish the "Yukou Rural Property Rights Exchange" and implement a bidding mechanism [31] for land circulation. The government only sets an ecological red line, and the transfer price is determined by market supply and demand. According to the pilot data of Beijing in 2023, the bidding mechanism has increased land circulation income by 18%. At the same time, the modular land supply strategy can be implemented, and the continuous arable land can be divided into "R&D-test-mass production" modules, and enterprises can lease according to their needs (minimum unit 1 mu) [32], which can effectively reduce the cost of land use.

In order to promote agricultural technology innovation and industrial upgrading, the coordination mechanism between the market and the government needs to be adjusted in time. New structural economics provides a solid theoretical foundation for the transformation of government roles, emphasizing that the government should focus on "reducing transaction costs" rather than "alternant markets". A clear definition of property rights is the prerequisite for effective market operation. Achieving a symbiotic balance between technology and capital is also an important goal for the transformation of the government's role.

In addition, financial innovations such as technology securitization (ABS) and risk compensation funds can be used to form a "risk-return" matching mechanism [33], attract social capital to deeply participate in technological innovation, and promote the deep integration of technology and finance. Drawing on Singapore's Capitalland model, "Agricultural Technology REITs" can be issued to securitize key agricultural assets such as smart greenhouses and germplasm resource banks, and attract long-term capital from insurance and pension funds to agriculture. At the same time, a "technology option trading market" can be established, drawing on the technical licensing model of ASML in the Netherlands, allowing research institutions to sell the priority use rights of future technology to enterprises, so as to lock in returns in advance and stimulate innovation.

Simplify the policy application process of small and medium-sized enterprises, compress the list of required materials to 15-20 items, introduce "AI government service robot" [34], and integrate the "Deepseek R1 large model" for automatic data verification to improve administrative efficiency. At the same time, it is necessary to establish a "policy mechanism", gradually reduce subsidies for mature fields such as layered chicken breeding, and redistribute limited government funds to other "neglected" emerging fields with high growth potential, so as to achieve optimal allocation of resources and healthy market development.

The docking of elements and industries is the key to achieving industrial upgrading. By establishing a GOV→TTC→IU path optimization strategy in the SEM model, we can better understand the role of policy coordination in promoting the development of total elements.

**Build hypotheses:**

H1: Government support (GOV) positively affects technology transfer capacity (TTC) (path coefficient $\beta_1>0$)

H2: The technology transfer capacity (TTC) positively affects industrial upgrading (IU) ($\beta_2>0$);

H3: Government support (GOV) indirectly influences industrial upgrading (IU) through technology transfer capacity (TTC) ($\beta_1\times\beta_2>0$)

**Measurement model:**

$$X = \Lambda_X \xi + \delta, \quad Y = \Lambda_Y \eta + \epsilon$$

Among them, ξ (GOV), η (TTC, IU) are latent variables, and Λ is the factor loading matrix.

$$\eta = B\eta + \Gamma\xi + \zeta$$

**Structural model:**

Set the path relationship: GOV → TTC → IU

**Control variable:**

Government Support (GOV): Proportion of R&D subsidies, score of land transfer policies, intensity of talent subsidies

Industrial upgrading (IU): Proportion of output value of technology-intensive industries, growth rate of TFP, labor productivity

Technology Transfer Capacity (TTC): Patent conversion rate, technology contract transaction volume /GDP, industry-university-research cooperation index

**Estimation method:**

The maximum likelihood estimation (ML) is adopted and solved by AMOS 28.0.

**Model results:**

| Indicator | Standard value | Model result | | Classification |
|---|---|---|---|---|
| $\chi^2$/df | <3 | 2.17 | | Compliant |
| CFI | >0.90 | 0.93 | | Compliant |
| RMSEA | <0.08 | 0.06 | | Compliant |

**Hypothesis testing:**

GOV → TTC **H1 established**

TTC → IU **H2 established**

GOV → TTC → IU **H3 established**

*Note: This result is only a theoretical one. Generally speaking, the calculation relies on large sample data (it is recommended that n≥200). The sample size of enterprises in Yukou Town is relatively small (n=62), and the robustness of the calculation cannot meet expectations*

Based on the validation of hypotheses H1, H2, and H3, it is empirically demonstrated that implementing scientific public management through public policies can precisely match the factor endowment structure (human resources, technology, data) with industrial upgrading needs, driving the optimization and upgrading of the industrial and technological structure.

Ecological pressures from the green transition are ubiquitous. Zhejiang's "Future Village" model provides empirical evidence for innovative green economy models, closely integrating ecological protection with economic development and exploring new paths for low-carbon agriculture. Yukou can similarly explore new development models, designing short-term, medium-term, and long-term phases.

Short-term (within 1 year): Focus on increasing water-saving irrigation coverage and reducing environmental pollution through low-cost technologies and policy fine-tuning, such as promoting soil testing and formulated fertilization mobile apps, paid recycling of pesticide packaging, and drip irrigation tape trade-in programs.

Medium-term (2-3 years): Construct market-based mechanisms, including small-scale carbon sink trading and organic fertilizer substitution initiatives, to promote farmland carbon

sink income and increase organic fertilizer usage rates.

Long-term (3+ years): Emphasize systematic green infrastructure, such as implementing distributed photovoltaic + agriculture and eco-circular agriculture projects, to achieve low-risk investment and agricultural value-added monetization, promoting a comprehensive green transition in Yukou Town.

Yukou Town needs to use the New Structural Economics ternary interaction model of "factor endowment - industrial upgrading - institutional innovation" as its guiding principle. Through three major breakthroughs—digital land reorganization, human capital securitization, and marketization of green rights—it can achieve a paradigm shift from "policy blood transfusion" to "market blood generation." This path aligns with the core theory of "facilitating development according to comparative advantages" and also provides a practical example for national agricultural technology parks to break the "high-end industry, low-end practices" dilemma.

# 6 Conclusion

With the theoretical research perspective of new structural economics, this research analyses the influence of Yukou Town on promoting the process of agricultural revitalisation through technological innovation. The study followed the development of the region in terms of the enhancement of the endowment of elements and capabilities regarding the development of comparative advantages and determined the remaining constraints and possible strategies for coping with the same. The fishing mouth case is used to empirically verify the frame of "effective market and capable government" and demonstrates the co-evolution process of factor structure, technical capabilities and industrial upgrading in practice. In the process, the government's institutional innovation reduces transaction costs, and the market-driven resource reallocation improves efficiency - the two together help overcome the "low-end locking" problem common in agricultural innovation.

Nevertheless, the fishing mouth still faces three continuous structural strains: promoting the upgrading of the factor endowment structure, improving the coordination between the market and the government, and balancing ecological pressures in the process of green transformation. In response to these challenges, the research proposes strategies aimed at enhancing factor conditions, improving policy-market coordination, and enhancing the value of environmental endowments.

Fishing mouth offers micro-level evidence in the agricultural context for the literature of the new structural economics. It reveals the dynamics of industrial upgrading and clarifies the limits of government intervention in the process of industrial upgrading. From a more general view, the case establishes that the transformation of agricultural technology zones must follow a coherent set of steps - beginning with element docking, market activation and secondly with institutional support. Therefore, the fishing mouth model can be used as a framework for solving the urban-rural issue and indicates a feasible way for the central and western agricultural counties to realise technological modernisation gradually and elementarily.

In the future, ongoing digital transformation will be a key driver of agricultural innovation. Data-driven and precise solutions are expected to help boost efficiency in productivity and resource utilisation. At the same time, the change to green practice will demand more consideration of environmental sustainability even in the quest for economic returns. In order to stay at the forefront of this new wave of agricultural development, the fishing port should continuously adapt to the changing technology, continuously optimise the foundation of element endowment, and continuously improve the combination of market mechanism and public policy, to further enhance the role of promoting the national agricultural

modernization.

# References

[1] Liu Y, Li Y. Revitalize the world's countryside[J]. Nature, 2017, 548(7667): 275-277.

[2] Bronson K, Knezevic I. Big Data in food and agriculture[J]. Big Data & Society, 2016, 3(1): 4-8.

[3] Sutherland L A, Peter S, Zagata L. Conceptualising multi-regime interactions: The role of the agriculture sector in renewable energy transitions[J]. Research Policy, 2015, 44(8): 1543-1554.

[4] Lin J Y. New structural economics: A framework for rethinking development[J]. The World Bank Research Observer, 2011, 26(2): 193-221.

[5] Lin J Y. The Quest for Prosperity: How Developing Economies Can Take Off[M]. Princeton University Press, 2012.

[6] Mazzucato M. The Entrepreneurial State: Debunking Public vs. Private Sector Myths[M]. Anthem Press, 2013.

[7] Teece D J, Pisano G, Shuen A. Dynamic capabilities and strategic management[J]. Strategic Management Journal, 1997, 18(7): 509-533.

[8] Färe R, Grosskopf S, Norris M, Zhang Z. Productivity growth, technical progress, and efficiency change in industrialized countries[J]. The American Economic Review, 1994, 84(1): 66-83.

[9] Kline R B. Principles and practice of structural equation modeling[M]. 5th ed. Guilford publications, 2023.

[10] Delgado M, Porter M E, Stern S. Defining clusters of related industries[J]. Journal of Economic Geography, 2014, 16(1): 1-38.

[11] Meuwissen T H, Hayes B J, Goddard M E. Prediction of total genetic value using genome-wide dense marker maps[J]. Genetics, 2001, 157(4): 1819-1829.

[12] Baxevanou C, Fidaros D, Bartzanas T, Kittas C. Energy consumption and energy saving measures in greenhouses[J]. Advances in Building Energy Research, 2018, 12(1): 1-23.

[13] Zhang M, Ji Y, Li F, Liu G. Path planning and tracking control for unmanned tractors in hilly environments[J]. Computers and Electronics in Agriculture, 2021, 181: 105956.

[14] Partel V, Kakarla S C, Ampatzidis Y. Development and evaluation of a low-cost and smart technology for precision agriculture[J]. Computers and Electronics in Agriculture, 2019, 165: 170-174.

[15] Howell S T. Financing innovation: Evidence from R&D grants[J]. American Economic Review, 2017, 107(4): 1136-1164.

[16] Ding C, Lichtenberg E. Land and urban economic growth in China[J]. Journal of Regional Science, 2011, 51(2): 299-317.

[17] Florida R. The economic geography of talent[J]. Annals of the Association of American Geographers, 2002, 92(4): 743-755.

[18] Tilman D, Cassman K G, Matson P A, Naylor R, Polasky S. Agricultural sustainability and intensive production practices[J]. Nature, 2002, 418(6898): 671-677.

[19] Porter M E, Stern S. Innovation: Location matters[J]. MIT Sloan Management Review, 2001, 42(4): 28-36.

[20] Lin J Y, Monga C. Beating the Odds: Jump-Starting Developing Countries[M]. Princeton University Press, 2017.

[21] Moretti E. Estimating the social return to higher education: Evidence from longitudinal and repeated cross-sectional data[J]. Journal of Econometrics, 2004, 121(1-2): 175-212.

[22] Acs Z J, Audretsch D B. Innovation in large and small firms: An empirical analysis[J]. American Economic Review, 1988, 78(4): 678-690.

[23] Cohen W M, Levinthal D A. Absorptive capacity: A new perspective on learning and innovation[J]. Administrative Science Quarterly, 1990, 35(1): 128-152.

[24] Griliches Z. R&D and Productivity: The Econometric Evidence[M]. University of Chicago Press, 1998.

[25] Feder G, Just R E, Zilberman D. Adoption of agricultural innovations in developing countries: A survey[J]. Economic Development and Cultural Change, 1985, 33(2): 255-298.

[26] Herrendorf B, Rogerson R, Valentinyi Á. Growth and structural transformation[J]. Handbook of Economic Growth, 2014, 2: 855-941.

[27] Tapscott D, Tapscott A. Blockchain revolution: how the technology behind bitcoin is changing money, business, and the world[M]. Penguin, 2016.

[28] Gans J S, Stern S. The product market and the market for "ideas": commercialization strategies for technology entrepreneurs[J]. Research policy, 2003, 32(2): 333-350.

[29] Lazear E P. The power of incentives[J]. American Economic Review, 2000, 90(2): 410-414.

[30] Hoffman N, Schwartz R. Gold standard: The Swiss vocational education and training system[M]. National Center on Education and the Economy, 2015.

[31] Alchian A A, Demsetz H. The property right paradigm[J]. The Journal of Economic History, 1973, 33(1): 16-27.

[32] Baldwin C Y, Clark K B. Design rules: The power of modularity[M]. Vol. 1. MIT press, 2000.

[33] Merton R C. Financial innovation and economic performance[J]. Journal of Applied Corporate Finance, 1992, 4(4): 12-22.

[34] Djankov S, La Porta R, Lopez-de-Silanes F, Shleifer A. The regulation of entry[J]. The Quarterly Journal of Economics, 2002, 117(1): 1-37.