

# Taking Agricultural Products as the Core Lever: An Analysis of the Mechanism by Which Northeast China's Digital Economy Catalyzes New Quality Productive Forces in Agriculture

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**Abstract:** Driven by rural revitalization and smart agriculture policies, Digital economy has become a key force driving agricultural modernization and cultivating new-quality productive forces. This article takes Anshan Nanguo pear as an example, based on the current situation of agriculture and digital economy development in Northeast, PEST analysis and two-way fixed effect model are used to empirically test the impact of digital inclusive finance on agricultural output value. Research shows that For every 1 unit of digital inclusive finance, the average output value per mu has increased significantly by 8 yuan. The mechanism lies in the digital economy through such paths: production empowerment, circulation efficiency and brand value-added, to comprehensively empower new-quality productive forces in agriculture. Finally, countermeasures and suggestions are put forward for the shortcomings of digital infrastructure and scientific and technological resources to provide reference for the revitalization of agriculture in Northeast China.

**Keywords:** Northeast Region; Digital Economy; New Quality Productivity in Agriculture; Anshan Nanguo Pear

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## 1. The current situation of China's pear industry and the development of digital economy in Northeast China

### 1.1 The overall development situation of China's pear industry

From 2012 to 2024, due to reasons such as structural adjustment, the planting area of pear trees in China fluctuates year by year. However, overall, it showed a slight downward trend year by year, from 14.5458 million mu in 2012 to 13.5234 million mu in 2024. Especially since 2020, the downward trend of the planting area has been more obvious year by year. However, thanks to the development of science and technology, the optimization of varieties and the improvement of management levels, the annual output of pears in China has generally maintained a steady growth trend. It rose from 15.5044 million tons to 20.2045 million tons, with an average annual growth rate of 4.7 percent.

### 1.2 The development trend of the digital economy in Northeast China

The development of the digital economy in Northeast China is currently at a critical stage driven by policies and industrial transformation. Between 2012 and 2023, the digital inclusive finance index in Northeast China rose from below 100 points to

201.187 points. In Liaoning Province, the index performed particularly outstandingly, reaching 206.260 points. Meanwhile, Heilongjiang Province achieved the highest score in terms of digitalization, with an index of 243.426 points. However, the digital economy in Northeast China also faces problems such as lagging digital infrastructure and a lack of technological resource allocation.

## **2. Current Status of Integration Between Anshan Nanguo Pear Industry and Digital Economy**

Nan Guo Pear is a geographically distinctive specialty agricultural product from Anshan City, Liaoning Province. In 2024, the planting area of Nan Guo pears reached 410,000 mu (approximately 27,333 hectares), with 84,600 mu (approximately 5,644 hectares) designated as priority production zones. Annual output amounted to 410,000 tons, generating a total output value of 1.74 billion yuan and a comprehensive output value of 2.35 billion yuan. The city operates 1,256 temperature-controlled storage facilities capable of holding 50,000 tons of Nan Guo pears. It hosts one year-round trading market and three seasonal markets, and has been recognized as a “Second Batch of China’s Specialty Agricultural Product Priority Zones.”

Today, Anshan Nanguo pears have achieved deep integration with the digital economy. Leveraging meteorological data and AI models in production, they enable precision cultivation and climate-quality traceability across 410,000 mu of digital demonstration bases<sup>[1]</sup>. Rural e-commerce and live-streaming sales thrive at the distribution end, with typical villages processing over 4,000 daily orders and annual sales exceeding one million jin<sup>[2]</sup>. The brand leverages a digital ecosystem to establish the new “Aipinzhi” brand, implementing a membership system to enhance premium pricing and repeat purchases. However, the industry still faces challenges such as inconsistent standards across the entire supply chain, low levels of industry organization, and inadequate brand protection, which to some extent constrain the full realization of digital technology’s potential.

## **3. Industry Development Environment (PEST Analysis)**

### **3.1 Policy Environment**

The national rural revitalization strategy and the Ministry of Agriculture and Rural Affairs’ Guiding Opinions on Vigorously Developing Smart Agriculture provide policy support for digital agriculture development<sup>[3]</sup>. Anshan City has incorporated “digital economy + Nanguo Pear” into its rural revitalization priorities, implementing a strategy of “building industrial parks and strengthening leading enterprises” to support industrial chain extension.

### **3.2 Economic Environment**

In 2024, Anshan City’s per capita disposable income reached 38,980 yuan, with a growth rate of 4.0%. Urban residents’ per capita disposable income reached 45,036 yuan, increasing by 3.6%. Digital empowerment yielded remarkable results: fruit farmers in Qianshan District achieved an average selling price of 24 yuan per kilogram through live-streaming sales, while financial institutions’ digital approval processes accelerated industrial capital turnover.

### **3.3 Social Environment**

The people of Anshan hold high regard for the Nanguo Pear industry, with a deep-rooted tradition of cultivation. The region actively promotes the integration of agriculture, culture, and tourism by hosting events like the Pear Blossom Festival and Harvest Festival, attracting large numbers of tourists and enhancing the industry’s influence. Meanwhile, returning college students are contributing their efforts by leveraging new media platforms for live-streaming sales, expanding distribution channels. For instance, Tangjiafang Town achieved online sales of southern pears exceeding 750,000kg<sup>[4]</sup>.

### **3.4 Technical Environment**

The 2025 No. 1 Central Document explicitly states that science and technology should be leveraged to drive the aggregation of advanced production factors, developing new-quality productive forces in agriculture based on actual conditions<sup>[5]</sup>. The Anshan Municipal Government has consistently provided technological support for digital and smart agricultural initiatives. By successfully integrating 5G technology with the BeiDou Navigation System, it has achieved precision management through a “one tree, one code” approach, enhancing both agricultural management efficiency and production output.

## **4. Empirical Analysis**

### **4.1 Research Design**

This study employs a two-way fixed effects model for empirical testing based on panel data from 2018 to 2022 across three core Nanguo pear production areas in Anshan City (Haicheng City, Xiuyan County, and Qianshan District). The dependent variable is output value per mu, with the core explanatory variable being the Peking University Digital Inclusive Finance Index. Mechanical power input is controlled to mitigate omitted variable bias. The study employs a fixed-effects model to account for unobservable factors that do not vary over time or across individuals, and utilizes robust standard errors to address heteroskedasticity. All data are sourced from the Anshan Statistical Yearbook and the Digital Finance Research Center at Peking University. The final sample comprises 15 observations, forming a balanced panel data structure.

## 4.2 Empirical Findings

Table 1 reports the regression results of the digital economy on the per-mu output value of Nan Guo pears. Column (1) presents the fixed-effects model incorporating the digital inclusive finance index and the mechanization variable. Although the coefficients of the core explanatory variables are positive, their statistical significance falls short of conventional levels due to the limited sample size of county-level observations.

To address the issue of insufficient degrees of freedom, the simplified model results in Column (2) indicate that the coefficient for the Digital Inclusive Finance Index is significantly positive at the 10% level ( $\beta=0.0008$ ,  $p<0.1$ ). This finding suggests that a one-unit increase in the index leads to an average significant increase of 8 yuan in the output value per mu of southern pear cultivation. The mixed OLS regression results in Column (3), serving as a comparative reference, exhibit consistent sign for the core variable coefficient with the fixed effects model, further enhancing the robustness of the aforementioned conclusion. Although statistical significance is limited, all model coefficients consistently exhibit positive signs, and Figure 1 clearly demonstrates a positive trend between the two variables, indicating that the digital economy exerts a positive influence on output value enhancement. This finding aligns with theoretical expectations, and its insufficient statistical power may stem from factors such as sample size limitations, lagged effects, and the inadequate capture of complex mechanisms by quantitative indicators.

Figure 1: Positive Relationship Between Digital Inclusive Finance Index and Output Value per Mu

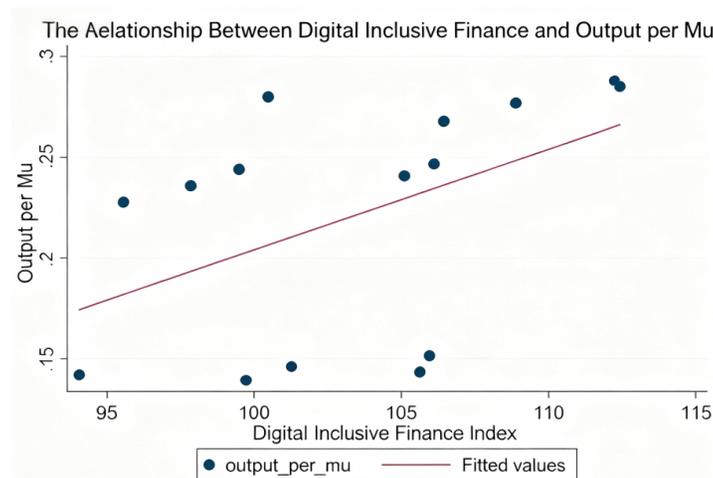


Table 1: Regression Results on the Impact of the Digital Economy on the Average Output Value per Mu of Southern Pear

Variable	(1) Fixed effects	(2) Fixed effects	(3) Mixed OLS
Digital Inclusive Finance Index	0.0001 (0.0003)	0.0008* (0.0002)	0.0032 (0.0030)
Mechanical Power (10,000 kW)	0.0046 (0.00200)		0.0008 (0.0009)
Constant term	0.539 (0.0571)	0.1332** (0.0217)	-0.1424 (0.2865)
observed values	15	15	15
Within R-squared	0.321	0.311	
Adjust R-squared			0.138

Note:

1. “\*\*\*, \*\*, \*\*” indicate significance at the 1%, 5%, and 10% levels, respectively.
2. Values in parentheses represent robust standard errors.
3. Columns (1) and (2) report the within-group R-squared (Within R-squared) for the fixed-effects model.

### 4.3 Analysis of Impact Mechanisms

From the perspective of factor allocation, taking the Anshan Nanguo pear industry as an example, the digital economy leverages intelligent technologies such as AI models and drone remote sensing to propel agricultural production from experience-driven to data-driven approaches. By precisely regulating factors like light, heat, water, and fertilizers, it enhances total factor productivity, laying a solid efficiency foundation for new-quality productive forces.

At the distribution level, e-commerce platforms and digital payment systems are reshaping the agricultural product market. Leveraging these platforms, the southern pear industry has reduced intermediary links and lowered transaction costs. By harnessing the demand-side aggregation effect, it has broken geographical constraints, achieved efficient production-to-sales matching, and increased farmers' income.

On the brand side, the digital traceability system establishes quality trust for Nanguo pears. New media marketing unlocks their cultural significance, while membership programs and other models target specific consumer groups. These strategies help Nanguo pears break free from homogeneous competition, achieve differentiated and premium brand value, and complete a leap in value.

In short, the digital economy synergistically drives production, distribution, and branding, fostering new productive forces in agriculture and propelling the development of Northeast China's agricultural sector.

## 5. The current problems existing in the market

### 5.1 The synergy between northeast agriculture and digital finance is weak

The lagging digital infrastructure in Northeast China has led to a relatively low level of development in digital inclusive finance, which has restricted the sales market of Nanguo pear. Due to insufficient network coverage and digital tools, it is impossible to break down information barriers through live-streaming sales and online promotion, which has prevented Nanguo pear from penetrating the southern market.

### 5.2 The shortage of scientific and technological resources restricts the development of both fields

The investment in scientific and technological resources and the number of patent authorizations in Northeast China lag significantly behind those in developed regions, Liaoning's R&D expenditure of 67.64 billion yuan is far lower than that of Guangdong's 480.2 billion yuan. This not only makes it difficult to enhance the technological level of agricultural products but also hinders digital financial innovation, greatly limiting the application value and industrial upgrading of the Nanguo pear.

## 6. Development suggestions

### 6.1 Strengthen technological innovation and investment in research.

At the heart of the digital economy is information technology. The government and enterprises should increase investment in technological innovation and research and development and promote the transformation of scientific and technological achievements into productivity. Establish an integration platform between digital technology and traditional industries and promote industrial upgrading and efficiency improvement. We should also pay attention to the construction of digital infrastructure and provide efficient and low-cost technical support.

### 6.2 Promote the sharing and circulation of data resources

Data is a “new factor of production” in the digital economy. In order to improve the level of new quality productivity, we should promote cross-industry and cross-field data sharing by optimizing the data circulation mechanism. Strengthen data privacy protection and security management to ensure the legality and security of data. The government can introduce relevant policies to encourage enterprises to open data platforms and promote the circulation of data between primary, secondary and tertiary industries.

## 7. Research Conclusion

The digital economy has injected new-quality productive forces into Anshan's Nanguo Pear industry through production empowerment, circulation efficiency gains, and brand value enhancement. Moving forward, Anshan should leverage technological advantages like 5G and BeiDou to enhance the Nanguo Pear "digital ID" system, enabling full-chain traceability and quality control from cultivation to consumption. By deeply integrating data elements, Anshan Nanguo Pear have the potential to become a model for digital agriculture development in Northeast China, Provide reproducible pathways to success for agricultural modernization.

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## Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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