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Studying China's experience in digitalizing agriculture: opportunities for Belarus

The article examines China's experience in implementing digital technologies in the agricultural sector within the framework of the "Digital Village" strategy. It analyzes the key components of the Chinese model (the use of big data, unmanned aerial systems, e-commerce platforms) and the possibilities of adapting these solutions in the Republic of Belarus. Based on a comparative analysis, directions for technology localization in the "Great Stone" Industrial Park are identified. A model of platform convergence is proposed, adapting the architectural principles of Chinese digital ecosystems to the Belarusian system of public administration and financing of the agro-industrial complex.

Keywords: digitalization of agriculture, innovative development, China's experience, Republic of Belarus, artificial intelligence, precision farming, Internet of Things.

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Изучение опыта Китая в цифровизации сельского хозяйства: возможности для Беларуси

Рассмотрен опыт Китая по внедрению цифровых технологий в агропромышленном секторе в рамках стратегии «Цифровая деревня». Проанализированы ключевые компоненты китайской модели (использование больших данных, беспилотных летательных аппаратов, платформ электронной коммерции) и возможности адаптации этих решений в Республике Беларусь. На основе сравнительного анализа определены направления локализации технологий в индустриальном парке «Великий камень». Предложена модель конвергенции платформ, адаптирующая архитектурные принципы китайских цифровых экосистем к белорусской системе государственного управления и финансирования агропромышленного комплекса.

Ключевые слова: цифровизация сельского хозяйства, инновационное развитие, опыт Китая, Республика Беларусь, искусственный интеллект, точное земледелие, интернет вещей.

Introduction

China occupies an important place in the global agricultural sector and plays a significant role in global food chains. The agricultural policy of the PRC has evolved over recent decades from centralized planning to a market economy, which has increased production volumes and stimulated private investment in agriculture. Currently, the country has over 17 million professional farmers working across all segments of the agricultural production chain. Increasing the competitiveness of the agricultural sector at the present stage is impossible without innovations based on digital technologies that enhance productivity, optimize costs, and ensure sustainable agricultural development.

In 2025, China is transitioning to the implementation of an updated "Digital Village" development plan, which focuses on smart agriculture, expanding 5G network coverage, e-commerce, and digital public services. Simultaneously, in Belarus, within the framework of the State Program "Agro-Industrial Complex of the Future" for 2026–2030, a digitalization subprogram is being implemented, including the introduction of precision farming technologies [1].

The purpose of this study is to examine the features of the digital transformation of agriculture in China, identify key technological components, and substantiate the possibilities of adapting Chinese experience in the Republic of Belarus.

Main Part

China, having only 8 % of the world's arable land, provides food for 20 % of the planet's population, making the agricultural sector strategically significant, despite its share of GDP being about 7.3 % [2, 3].

In the context of shrinking agricultural land, water scarcity, and an aging rural population (the average age of a farmer is 50–60 years), digital transformation becomes an unavoidable path to increasing efficiency.

Therefore, in 2024–2028, China is implementing the "National Action Plan for the Development of Smart Agriculture," aiming to achieve a digitalization level of production above 32 % by 2028 through the introduction of a unified big data platform, precision farming technologies, robotization, and automated monitoring.

The evolution of the agricultural sector has progressed from mechanization (Agriculture 2.0) to digitalization (3.0–4.0) and the current stage of "Agriculture 5.0," based on artificial intelligence and cobots for sustainable development [4, 5].

Examining the key technological components driving this progress, the creation of a national agricultural land monitoring platform should be noted. It integrates data from Beidou satellites, weather stations, and ground-based sensors. This allows for real-time tracking of soil moisture, crop growth stages, and yield forecasting [6].

In Guangdong and Zhejiang provinces, "Agriculture + Meteorology" systems are operational, transitioning production from "weather dependence" to "weather management".

Another crucial area is unmanned aerial systems (UAS). Chinese companies XAG and DJI Agriculture are leaders in developing agricultural drones for fertilizer and pesticide application. According to official data, comprehensive mechanization of cultivation and harvesting exceeded 75 %, and the contribution of science and technology to agricultural growth reached 63.2 % [7]. The use of drones allows for savings of up to 30 % in chemicals and reduces crop trampling.

The role of digital platforms and e-commerce is particularly important. Ecosystems like Alibaba, Pinduoduo, and JD.com integrate farmers into direct sales via streaming platforms (Taobao Live), eliminating intermediaries and increasing rural incomes. In 2023, the volume of China's digital agriculture market was estimated at 74.3 billion yuan, with a projected growth to 82.6 billion in 2025 [8].

Furthermore, the introduction of precision irrigation systems and variable rate fertilization has reduced nitrogen fertilizer application by 27 % by 2020 under the "Zero Growth Action Plan". A national soil accounting platform has been created, providing nutrient recommendations, which increased yields by 4.4 % and profitability by 5.8 %. Digital twins of low-carbon rice paddies demonstrate a reduction in CO_2 emissions by more than 20 % [9].

Despite the successes, certain challenges persist. Large agricultural holdings adopt innovations faster, while smallholder farmers (average farm size 3.3 hectares) face difficulties accessing expensive technologies. Regional disparities between coastal and inland provinces exacerbate the digital divide [9]. The aging rural population requires attracting "new-type young farmers" skilled in data handling and drone operation. These challenges are relevant not only for China but also for many countries, including Belarus.

Let us now turn to a comparison with the situation in Belarus. Here, agriculture accounts for about 6.9 % of GDP, and the State Program "Agro-Industrial Complex of the Future" for 2026–2030 is being implemented, including a digitalization subprogram [1]. Unlike China with its small-scale farms, the Belarusian agricultural sector is based on large organizations (producing about 80 % of output), which creates prerequisites for the centralized implementation of digital solutions.

The republic is actively developing digital field maps, parallel driving systems on MTZ and Gomselmash machinery, and automated milking parlors [10, 11].

However, the level of integration of digital platforms and access to Big Data still lags behind China's, as shown in Table 1.

Table 1. **Comparative characteristics of agriculture in China and Belarus**

Indicator	China	Belarus
Share of GDP, %	7.3	6.9
Average farm size	3.3 ha (smallholder farmers)	Large organizations (> 80 % of output)
Digitalization priorities	AI, robotics, 5G, platform-based trade	Precision farming, digital field maps, livestock automation
Innovation activity	Global leader (agri-robotics market by 2030: $2.93 billion)	Localization of developments, use of GPS/GLONASS
State support	"Digital Village" strategy, pilot zones	"AIC of the Future" program, "Digital Agriculture" project

Note. Compiled by the author.

The comparison confirms the feasibility of adapting Chinese experience in Belarus, but considering the structural differences. The most promising directions are: using Chinese platform solutions for producer cooperation, localizing the production of agricultural drones and IoT systems in "Great Stone," and implementing elements of predictive analytics into the state planning system. At the same time, Belarus can maintain its competitive advantages – large-scale production and developed agricultural machinery manufacturing – by integrating Chinese technologies selectively, rather than copying them entirely.

Studying China's experience allows us to identify specific directions for adaptation in Belarus. These opportunities are systematized in Table 2.

Table 2. **Directions for adapting digital technologies in the agroindustrial complex of Belarus**

Technology	Proposed Solution	Expected Effect
Unmanned Aerial Systems	Assembly and service of XAG/DJI agricultural drones in the "Great Stone" park; pilot training at BSATU	Reduction in pesticide use by 20–30 %; ability to treat fields with complex terrain
IoT and Sensors	Creation of standard "Smart Farm" solutions; integration of sensors into MTZ and Gomselmash machinery	Savings on fertilizers and fuel; transition to precision farming
E-commerce Platforms	Creation of a national B2B platform for exporting products to the Chinese market	Elimination of intermediaries; growth in export revenue
Big Data and AI	Implementation of regional decision support systems (DSS) for regional executive committees and the Ministry of Agriculture and Food	Increased planning accuracy and food security

Note. Compiled by the author.

The directions presented in the table form a comprehensive roadmap for the digital transformation of the Belarusian agroindustrial complex. Their implementation will allow not only adapting best global practices but also creating a national "smart agriculture" ecosystem, ensuring increased efficiency, cost reduction, and strengthened export potential. A key condition for success is close cooperation between machinery manufacturers, agricultural universities, the IT sector, and government bodies within the framework of the proposed platform convergence model.

For the systematic implementation of technologies, it is necessary to adapt not only technical solutions but also the institutional environment, as shown in Table 3. In our view, the most promising approach is what can be called "institutional adaptation of platform architectures." It includes three interrelated directions that will make the system transparent and beneficial for both the state and agribusiness.

Table 3. **Directions for institutional adaptation of platform architectures in the Belarusian agroindustrial complex**

Direction	Implementation Mechanism	Result
1. Synchronization of public procurement and financial technologies	A agricultural producer's victory in a state tender automatically becomes a "digital pledge" for Belagroprombank. The bank opens a credit line secured by the guaranteed future state payment, solving the problem of lack of liquid assets	The agricultural producer receives financing for development, the bank gets a reliable borrower, and the state gets a guarantee of contract fulfillment
2. Dynamic indicative planning based on AI	Predictive analytics algorithms are integrated into the "Digital Agricultural Management Platform." The system analyzes satellite imagery (soil condition) and global market quotes, providing recommendations on which crops are more profitable to sow in the current season	Transition from directive planning to flexible forecasting, increased efficiency of land use and food security
3. Unified digital borrower profile (agri-scoring)	A unified database is created for each farm: satellite field monitoring, payment history, supply volumes. Based on this data, a computer automatically calculates an "agri-scoring" (reliability score) and automatically approves microloans	Banks reduce risks and verification costs; agricultural producers gain quick access to loans for seeds and fuel; the turnover of funds in the agricultural sector accelerates

Note. Compiled by the author.

The three directions presented in the table form a coherent system of institutional transformations aimed at the digital transformation of the financial and managerial support for the Belarusian agricultural sector.

The first direction addresses the fundamental problem of agricultural producers' access to credit resources, turning a state contract from a simple document into a working financial instrument. This removes the main obstacle for small and medium-sized farms – the lack of liquid collateral.

The second modernizes the planning system, replacing outdated directive methods with flexible forecasting based on big data and market signals. This increases the adaptability of the agricultural sector to market changes.

The third direction creates a transparent and objective system for assessing the reliability of agricultural producers, allowing for the automation of the microloan issuance process and reducing bank credit risks.

Together, the three mechanisms form a closed loop: state order (incentive) → planning (optimization) → financing (provision). This approach creates a synergistic effect where each direction reinforces the other two, creating conditions for sustainable development of the agricultural sector based on the principles of transparency, efficiency, and resource accessibility.

Conclusions

As a result of the research, it has been established that the Chinese model of agricultural digitalization, based on the integration of big data, unmanned technologies, and platform solutions, demonstrates high efficiency: a 27 % reduction in fertilizer use, a 4.4 % increase in yields, and a 5.8 % increase in profitability. Key success factors are systematic state support, the development of rural infrastructure, and personnel training.

It has been revealed that for Belarus, where agriculture is based on large organizations, the most promising directions for adaptation are the localization of agricultural drone and IoT sensor production in the "Great Stone" Industrial Park, the creation of a national B2B platform for product export, and the implementation of decision support systems based on satellite data. The proposed "platform convergence" model allows adapting Chinese institutional solutions to Belarusian practices of public administration and financing of the agroindustrial complex.

The implementation of these measures can ensure a 15–20 % reduction in production costs, increased market transparency, and strengthened export potential, which aligns with the goals of the State Program "Agroindustrial Complex of the Future" and the objectives of import substitution. Further research should be directed towards developing roadmaps for implementing specific technologies in pilot farms.

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