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The impact of digital technologies on the effectiveness of management in the agricultural sector of the Kyrgyz Republic

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► **Abstract.** This study aimed to identify current trends in the use of digital technologies in the agricultural sector of the Kyrgyz Republic. It used theoretical approaches to study the global development of digital technologies and empirical methodologies to assess their implementation in Kyrgyz agricultural enterprises. The findings indicated the growing importance of digital agricultural technologies for improving the efficiency of agricultural operations worldwide, including in Kyrgyzstan. This progress increases the ability to more effectively meet consumer demand for the products produced by these enterprises. The integration of technologies such as artificial intelligence, database systems, robotics, smart sensors and automation into the management of Kyrgyzstan's agricultural enterprises is leading to cost optimisation, lower production costs, higher yields and the production of higher quality agricultural goods. Improving management efficiency is a key element of these reforms and is crucial for the successful operation of companies in the sector, especially in light of the current economic conditions. Modern digital technologies significantly increase the efficiency of management in the Kyrgyz agricultural sector by facilitating the rapid collection and processing of data.

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They also expand the possibilities for making the right management decisions, and thus increase the overall efficiency of enterprises in the country's agricultural sector

► **Keywords:** agriculture; innovative approach; administration; economic sector; quality of implementation of solutions; government regulation; management mechanism

► Introduction

Contemporary digitisation tendencies profoundly influence national economies in the context of persistent globalisation. In December 2023, the Ministry of Digital Development of the Kyrgyz Republic and the UN Development Programme proposed strategies to expedite digital advancement across many sectors, including agriculture (Promoting digital transformation..., 2023). The evaluation of Kyrgyzstan's digital readiness revealed consistent utilisation of digital technology and significant advancements in developing robust digital infrastructures for managerial efficacy. This highlights the significance of these solutions for managing agricultural operations and the necessity to analyse essential facets of digitisation in agriculture. Improving digital management is essential for augmenting the overall efficiency of the nation's agriculture sector.

The study by M.O. Amanalieva (2021) examined a broad spectrum of pressing challenges with the development and implementation of digital technological solutions across diverse areas and sectors of the Kyrgyz Republic's national economy. The researcher highlights that the digital economy is a paramount priority in the policy of the Kyrgyz Republic, as demonstrated by the government's adoption of documents outlining its key development prospects. The study indicates that the implementation of digital technological advancements in agriculture will enhance the efficiency of process management and yield measurable outcomes, namely in improving product quality and delivery timelines.

A.B. Karbekova & A.A. Abdykalykova (2023) examined the impact of contemporary technical innovations on enhancing the productivity of agricultural firms in the Kyrgyz Republic. The authors concluded that digital and "smart" technologies, including robotic equipment, unmanned aerial vehicles, high-precision instruments, onboard equipment and sensors, software, local meteorological stations, satellites, and digital data, are extensively utilised in Kyrgyzstan's economic sector, particularly in agriculture, significantly streamlining the management of economic activities.

Therewith, Y. Jiang *et al.* (2024) examined various aspects of the overall factor productivity of agriculture and the development of "digital" villages. According to the researchers, the emergence of technologies that allow the transferring accounting of settlement transactions in agriculture to a digital format opens up new opportunities in the entire field in a complex. There is a direct relationship between the productivity of agricultural production and the use of digital technologies in the agricultural sector.

The problems of strengthening agricultural enterprises through the introduction of modern digital technologies into their activities were discussed by D. Kumar (2024). The author points to the fact that agriculture plays a substantial role in the economy of an agrarian country since it provides a substantial amount of funds to its budget. There-

by, the success of the enterprises of this economic sector largely determines the current indicators of the standard of living in the country, which, in turn, determines the need to increase the efficiency of their activities through the introduction of advanced technological solutions.

Further investigation is necessary on the provision of trained specialists in digital technologies to agricultural firms in the Kyrgyz Republic, to enhance their management and operational efficiency. A comprehensive and systematic analysis of several critical factors for safeguarding corporate data is essential when integrating digital technology in the administration of agricultural firms. The aim of this study was to investigate the potential for optimising management processes within the agriculture sector of the Kyrgyz Republic through technology solutions.

► Materials and methods

This study employs a technique that encompasses both theoretical and empirical analysis of the current challenges associated with the use of contemporary digital technological solutions in the operational activities of firms within the agriculture sector of the Kyrgyz Republic. The theoretical study involved analysing the current state of modern digital technology implementation in the agriculture sector of the Kyrgyz Republic as of 2024 and evaluating the effectiveness of addressing pressing practical challenges in company management within this subject. The process entailed integrating analytical, synthetic, and generalisation methodologies to construct an objective study.

Through the application of the analysis method, the most important areas of application of digital technologies in individual countries were investigated (China and India, selected for analysis as the countries with the largest population in the world, in which agriculture accounts for a substantial part of gross domestic product (GDP) (8.9% and 17%, respectively, as of the beginning of June 2024) and at agricultural enterprises of the Kyrgyz Republic, as of the beginning of 2024, and their potential in the field of building effective management of companies in the agricultural sector of the economies of various states (National Statistical Committee..., 2023; Kumar, 2024; Li & Gao, 2024). The prospects of expanding the range of digital technologies implementation in the management system of the agricultural sector of the Kyrgyz Republic to solve practical problems of increasing the efficiency of agricultural companies were assessed. The evaluation criterion was the comparative performance indicators of the agricultural sector company Limited Liability Company (LLC) Korm-Service, Bishkek before and after the introduction of these technologies.

The synthesis method facilitated the identification of certain digital technologies that effectively operate within the management systems of firms in the agriculture sector of Bishkek and throughout Kyrgyzstan. An evaluation

was conducted regarding the current efficacy of initiatives aimed at integrating such technologies within the agricultural sector of the Kyrgyz Republic, set against the backdrop of the global adoption of digital and other innovative technologies (information and communication) in enterprise management. The generalisation approach was employed to assess the status of digital technology utilisation in the management systems of agricultural firms in the Kyrgyz Republic as of 2024 (National Statistical Committee..., 2023). This was crucial for evaluating the potential to enhance the efficiency of firms in this field, considering the expansion of their management's technical skills.

The research was carried out focussing on Korm-Service LLC, located in Bishkek, which specialises in the selling of animal feed and additives for entities within the Kyrgyz Republic. The empirical study consisted in the introduction of BigData technologies and artificial intelligence systems into the company's activities. In particular, artificial intelligence technologies have been introduced to improve the overall quality of tracking the supply chains of the enterprise's products and sending them to end consumers, which are agricultural enterprises of Kyrgyzstan. An IBM Watson computer system (USA) equipped with artificial intelligence was used to solve this kind of enterprise management task.

Big Data technologies have been implemented to monitor the overall performance of data management. As part of the organisation's activities, an analysis of the practical results from the use of digital technologies in the company's management system was performed and an assessment of the overall effect of the implementation was given, manifested in an overall improvement in the quality of enterprise management in general. In addition, the data obtained allowed for assessing the prospects for further use of technologies of this kind in the management of companies in the agricultural sector of the Kyrgyz Republic.

Big Data digital technologies performed the function of collecting and systematising large amounts of data, including information on various types of feed and feed additives already on the market of agricultural products and entering the market, and data on producers and potential consumers of these products (enterprises of the agricultural sector of the Republic of Kyrgyzstan). In addition, through the use of technologies of this kind, data were collected and analysed on the impact of various types of feed and feed additives on increasing the yield of certain crops, which allowed assessing the feasibility of using certain types of feed and feed additives in the future.

► Results

Every year, there is an ever-deeper integration of digital technological solutions into the agricultural industry. From mobile applications specifically tailored for farm management to robots that completely automate the milking process, as well as unmanned tractors and drones proficient in identifying soil diseases and layer disorders, digital technologies within individual agricultural enterprises, local start-ups, and government agencies provide and actively endorse the implementation of diverse solutions aimed at establishing smart farms and

digital enterprises. As a rule, digital technologies in the management of agricultural organisations are defined as objects of agricultural production, where management systems of this kind, along with Big Data technologies, are widely used as software-controlled systems (Pauschinger & Klauser, 2022).

The extensive implementation of distributed digital data registry technologies by agricultural companies in various countries, including China and India, and particularly in the Kyrgyz Republic (Korm-Service LLC, Bishkek), facilitates comprehensive transaction recording while entirely obviating the necessity for centralised regulatory authorities and databases. In the economic conditions that have formed in the world by 2024, the existing supply chains of agricultural products were created specifically to ensure effective interaction between regional agricultural enterprises and the external agricultural environment. This necessitates the coordination of efficient interaction among all operational components of the current supply chain, encompassing those engaged in the production, processing, and distribution of agricultural products to the final customer. One of the key reasons for the inability to objectively assess the effectiveness of the coordination system of companies in the agricultural sector is the lack of complete transparency in the supply line (Stender *et al.*, 2024). Agricultural enterprises that do not have an adequate level of transparency in the supply and management system risk losing funds, substantially reducing the volume of the customer base, and witnessing a decrease in the value of their own brands. A number of improvements should be made to the general principles of building the supply chain of an agricultural enterprise (Panigrahi *et al.*, 2024) to stimulate increased efficiency and confidence in the trading environment.

As of the beginning of 2024, the expansion of the range of applications of digital technologies to solve the tasks of increasing the efficiency of the agricultural sector in Kyrgyzstan should enable farmers to use modern information platforms and digital innovations for mutually beneficial cooperation of agricultural enterprises within the framework of interaction between the member states of the European-Asian Economic Union. The presence of a favourable market environment will ensure high growth rates of agricultural products, which, in turn, is evidence of an increase in the efficiency of agricultural companies. This will facilitate a smooth and gradual transition from complex and expensive operations to continuously automated processes, which, ultimately, will result in an increase in agricultural production volumes by providing the ability to constantly monitor the entire production cycle. The use of technological solutions of this type provides producers of agricultural and food products with the opportunity to obtain objective data in real-time, affecting a variety of factors that have a direct impact on their productivity. These include: plant health, soil condition, the nature of changes in weather conditions in a certain area, and the presence/absence and nature of exposure to pests and various diseases (Abiri *et al.*, 2023). Table 1 provides data regarding the utilisation of digital technology in the management of firms within the agriculture sector of the Kyrgyz Republic.

Table 1. Distribution of the volume of use of digital technologies by agricultural companies in Kyrgyzstan (number of units)

Region	2017	2018	2019	2020	2021	2022	2023
Kyrgyz Republic	11,863	12,128	12,670	11,478	11,710	11,820	12,014
Batken region	811	613	645	642	658	644	662
Jalal-Abad region	1,210	1,277	1,291	1,258	1,311	1,312	1,355
Issyk-Kul region	711	724	745	738	774	772	780
Naryn region	619	620	622	580	601	598	604
Osh region	1,171	1,168	1,202	1,129	1,186	1,182	1,190
Talas region	414	477	492	445	521	522	530
Chui region	1,640	1,701	1,722	1,556	1,618	1,624	1,633
Bishkek	4,287	4,351	4,761	4,135	3,881	3,875	3,882
Osh	1,201	1,197	1,190	985	1,158	1,291	1,378

Source: compiled by the authors based on National Statistical Committee of the Kyrgyz Republic (2023)

According to Table 1, the largest number of enterprises in the agricultural sector of the economy using the technologies in question in the management system falls on the city of Bishkek. In addition, the leading positions in the country in this area are also occupied by the Chui, Jalal-Abad Regions, and the city of Osh. Low rates of application of these solutions in the management of companies' activities were noted in the Naryn region, where livestock enterprises are mainly concentrated. Expanding the range of applications of digital technologies in the management of companies in this field in

the future will increase their production volumes and achieve higher quality indicators of livestock products. Table 1 shows that the distribution of these technologies in the management of agricultural sector enterprises in the whole country is very uneven, which is evidence of the insufficient development of infrastructure necessary for the introduction of technological solutions of this kind in various regions of the state. Table 2 presents data on key indicators of the use of digital systems in the activities of enterprises in the agricultural sector of the Kyrgyz Republic.

Table 2. Key parameters of the use of digital technologies in the management system of enterprises in the agricultural sector of the Kyrgyz Republic

Parameter	2017	2018	2019	2020	2021	2022	2023
The number of business entities using digital technologies in the management system (units)	185	187	189	165	172	175	182
The number of employees employed in enterprises using digital technologies in the management system (people)	8,352	7,775	7,665	7,287	7,205	7,320	7,622
The total number of specialised professionals of business entities engaged in the maintenance of digital peripherals (people)	155	168	144	145	175	185	196
The amount of the salary fund of business entities using digital peripheral devices in the management system (million soms)	13.2	14.5	14.6	13.8	17.1	17.6	18.4
Production costs of business entities for the introduction, development, and operation of digital technologies in the enterprise management system (million soms)	8.5	6.5	6.2	5.8	5.4	5.5	6.1
The total volume of information and computing services provided, infrastructure design, and software development (million soms)	-	-	0.1	0	0.1	0.1	0.1
The number of web resources owned by enterprises (units)	11	12	9	9	9	10	11
Total number of Internet access points (units)	192	176	201	195	216	215	226

Source: compiled by the authors based on National Statistical Committee of the Kyrgyz Republic (2023)

According to Table 2, the agriculture of the Kyrgyz Republic uses an insufficient amount of computer equipment in business management systems. This means that expanding the range of implementation of these technological solutions in the activities of enterprises in the agricultural sector of the country is a very complex and step-by-step process involving substantial investment of financial resources and high-quality training of specialised professionals in the field of digitalisation who are able to quickly and effectively solve all the tasks assigned to them. It should also consider that the infusion

of financial resources from the state budget of the Kyrgyz Republic requires proper control of the appropriateness of their use by the Government of the country. The introduction of such systems will contribute to improving the rationality and efficiency of the use of all resources, which in the future opens up opportunities for the Kyrgyz Republic to occupy a certain niche in the global agricultural production system, and to better satisfy consumer demand in the food market.

Artificial intelligence systems provided the organisation of supply chain management for the products of

Korm-Service LLC, in particular, the choice of optimal ways of product delivery and distribution to warehouses, and the chain of delivery of feed and feed additives to the end user. An IBM Watson computer system equipped with artificial intelligence was used to solve this kind of

enterprise management task. Table 3 includes data on the results of the implementation of the mentioned digital technologies in the management system of the company Korm-Service LLC (changes in a number of indicators for the period 2020-2023 are presented).

Table 3. The results of the practical use of digital technologies in the management of the activities of the company Korm-Service LLC for the period 2020-2023

Digital technology	The volume of supplies of agricultural products to consumers	Supply chain management	Managing the sequence of trading operations	Automation of technological processes
BigData	Maintaining and accounting for current supply volumes, (improving the quality of accounting by 10-15%)	Accounting for the number of chains and the accuracy of the direction of products along them (increasing the accuracy of accounting by 15-20%)	Accounting for the volume of operations performed and the results achieved (improving the quality and accuracy of accounting by 10-15%)	Accounting for automation systems and facilities (improving the quality of accounting operations by 12-15%)
Artificial intelligence	Ensuring quality control of the supplied products and the timeliness of procurement and supply processes (improving the quality of control operations by 20-25%)	Providing control over the compliance of products supplied to consumers with the requests put forward (increasing the accuracy of operations performed by 30-35%)	Determination of measures to improve the efficiency of concluded trade transactions (increase the overall level of control by 25-30%)	Search for optimal ways to manage the company's activities (optimisation in the range of 40-45%)

Source: compiled by the authors based on the Introduction of digital technologies into agriculture in Kyrgyzstan (2021)

As follows from the data shown in Table 3, the introduction of digital innovations in the organisation and systematisation of the activities of Korm-Service LLC has objectively increased the overall level of all processes that determine the efficiency of the enterprise. Subsequently, this allowed planning the organisation of a fully automated process of accounting for the volumes of products shipped to consumers and supply chain management. In addition, the necessary conditions have been created to expand the range of use of digital technologies in the management of the activities of this enterprise in the agricultural sector, which will ensure objective competitive advantages in the agricultural market and substantially increase the overall level of management of the enterprise.

Rural firms in nations such as China and India exhibit a sluggish adoption of digital technological improvements in agricultural management (Addison *et al.*, 2024). Digital transformation is crucial for optimising agricultural practices and improving managerial capacities. As of early 2024, around 767 million individuals were employed in agriculture worldwide, predominantly in the Asia-Pacific area (Mwangakala *et al.*, 2024). The implementation of digital technologies enhances agricultural productivity, fortifies infrastructure, and broadens market access. Contemporary digital instruments enhance supply chain management, as evidenced by Korm-Service LLC's performance prior to and following the implementation of these technologies. Table 3 indicates that digital solutions improved supply chain management quality by 10-15%, supplier quality control by 20-25%, and product compliance monitoring by 30-35%. Furthermore, the efficiency of trade operations and general management improved by 25-30% and 40-45%, respectively.

The implementation of contemporary digital and information communication technologies, including "smart" and "precision" agriculture, markedly enhances

the efficiency and productivity of agricultural systems, so ensuring their sustainable long-term development (Pidubna *et al.*, 2024). Technologies such as remote sensing, intelligent sensors, Internet of Things devices, and AI-driven algorithms establish new frameworks for agricultural management, improving decision-making processes. These innovations enhance management quality by augmenting yields, preserving soil health, mitigating pests, and facilitating real-time operations (Shahini *et al.*, 2023). The implementation of digital technologies in Kyrgyz agricultural firms is constrained by constraints, including a deficiency of qualified management professionals and specialists proficient in ICT (Kaparbekov *et al.*, 2024). Resolving these challenges through superior training can improve supply chain management, encompassing crop delivery, storage, sorting, packing, and distribution. Minor agricultural firms are integral to this supply chain, rendering the proficient use of digital technology essential for comprehensive efficiency. The influence of digital technology on managerial efficiency within Kyrgyzstan's agriculture industry is seen in the heightened adoption and utilisation of these solutions. This can be accomplished by improving specialised training and broadening the scope of jobs addressed by contemporary technical advancements in the nation's agriculture industry.

The activities of enterprises in the agricultural sector play an extremely important role in the Indian economy. As of the beginning of 2024, almost half of the total available labour force was involved in the country's agriculture. Therewith, agriculture accounts for 18.1% of India's GDP. Over the past few decades, the sectors of production and services to the population have made an increasing contribution to the growth of the country's economy, however, the contribution of the agricultural sector has undergone a substantial drop from more than 50% of GDP in the 1950s to 15% in 2020-2023 (considering the constant

prices of goods and services provided). India has seen steady annual growth in food grain production, while the country is among the main producers of certain agricultural crops, in particular: wheat, rice, legumes, sugar cane, and cotton. In addition, the country is one of the world's largest milk producers and the second-largest producer of vegetables and fruits. Food grain production in India reached a record 323.55 million tonnes during the 2022-23 fiscal year, according to the second preliminary estimate, which was published by the "Department of Agriculture, Cooperation, and Farmer Welfare under the Government of India" (Kumar, 2024).

By the beginning of 2024, India had significantly advanced its agricultural development by shifting the food system paradigm. Although agriculture receives less financial investment than industry and services, digitalisation became essential for improving sector efficiency, which had lagged behind other industries (Kumar, 2024). Previously, priorities included mechanisation, chemical agriculture, and genetic advancements. By 2024, the focus shifted to Agriculture 4.0, incorporating Big Data, robotics, AI, and IoT to enhance operations and the entire food supply chain. Digital technologies played a crucial role in India's agricultural and social development by optimizing resource allocation and increasing production efficiency. They also changed production behaviors and lifestyles, enhancing well-being. For example, digital maps of soil properties enabled optimal sowing and harvesting by considering weather and soil conditions. These maps revealed spatial patterns in soil nutrients (Reddy & Das, 2023), showing that soil data had a greater impact on secondary parameters than climate. From

2021 to 2023, the use of digital technologies in soil analysis allowed better management of sowing and harvesting, boosting soil productivity.

By early 2024, the effectiveness of digitalization of Chinese agriculture will depend heavily on funding for advanced technologies. Remote rural regions face significant financial barriers, limiting farmers' ability to utilise technologies that improve agricultural practices. Since 2016, China has combined digital technology with inclusive finance, formulating a new model of inclusive digital finance (Jiang *et al.*, 2024). The 2021 strategic policy "Developing Inclusive Digital Finance in Rural Areas" aims to enhance inclusive finance, alleviate rural financial exclusion, and improve agricultural productivity (Cao & Wang, 2024). This strategy enhances the convenience, efficiency, adaptability and accessibility of financial services by addressing the last-mile challenges of digitalization of agricultural activities. Digital inclusive finance strengthens rural financial systems and promotes sustainable rural economic growth (Chungfang *et al.*, 2024; Gavkalova *et al.*, 2024).

F. Lee *et al.* (2023) point out that digital technology has markedly improved the efficiency of agriculture in China, primarily due to Taobao, a leading e-commerce platform established in 2003. A multitude of farmers set up stores on Taobao to showcase and sell their products. Villages are classified as "Taobao villages" if the number of Taobao stores exceeds 10% of households and the annual e-commerce transaction volume exceeds 10 million yuan. From 2009 to 2023, the number of Taobao Villages increased from 3 to 8,023, indicating the widespread integration of e-commerce among farmers. Figure 1 shows the expansion of Taobao Villages in China from 2009 to 2023.

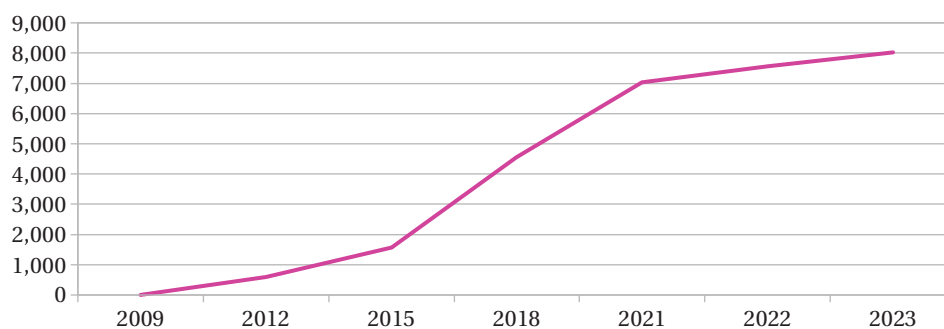


Figure 1. Dynamics of changes in the number of "Taobao villages" in China over the period from 2009 to 2023

Source: compiled by the authors based on data of F. Li *et al.* (2023)

Figure 1 shows a marked increase in the number of Taobao Villages in China from 2009 to 2023, indicating the widespread adoption of digital technology in the agricultural sector. This expansion has led to an improvement in the quality of consumer services and goods. Over the past 15 years, the increasing use of digital solutions shows their popularity and promise. The effectiveness of these technologies depends on the training and technical skills of the staff. In the eastern regions of China, digital technologies are developing most rapidly due to the availability of technology experts and their skilful use by agricultural producers (Li *et al.*, 2023). This emphasises the need to improve staff skills to implement digital management systems in the agricultural sector.

► Discussion

This study revealed the significant impact of new digital technologies in agricultural enterprises globally and inside the Kyrgyz Republic. Information regarding the extent of their integration into the management systems of enterprises in the Kyrgyz Republic, existing challenges in their application, and potential for broadening the utilisation of digital technology advancements was acquired.

In a joint study by H.A. Mwangakala *et al.* (2024), the prospects for using the potential of modern digital technologies in building supply chains for agricultural producers were discussed. Therewith, the authors note that modern digital technologies are very effective in solving the problems of increasing the productivity of agricultural

companies by creating supply chains of products and reducing the cost of delivery to the consumer. According to researchers, this creates optimal conditions for solving problems of food security and the development of agricultural enterprises, through the use of modern digital solutions in their activities. Such an opinion corresponds to the results obtained during the performance of this study since the introduction of technologies of this kind substantially increases the efficiency of agricultural companies, which has been practically proven.

In turn, N.N. Reddy & B.S. Das (2023) considered a number of issues related to the implementation of the latest achievements of digitalisation in agriculture in India. According to the authors, the productivity of traditional agricultural systems can be substantially improved through the use of technologies such as mapping key secondary soil properties using the function of transferring soil data from digitised database archives. However, the effectiveness of the implementation of such technological solutions will be substantially higher if there are highly qualified personnel in agricultural production who are able to quickly adapt these solutions to the real situation in the sector and get the necessary result. The opinion expressed is fully confirmed by the results of the conducted study due to the fact that the effectiveness of the implementation of the solutions in question in the activities of companies in the agricultural sector in the presence of qualified personnel has been practically proven.

E.A. Kitole *et al.* (2024) examined the obstacles associated with the integration of digital technology in the agricultural sectors of several developing nations. They emphasise that without digital breakthroughs, sustaining high production efficiency and cultivating value chains for rural enterprises is exceptionally challenging. The researchers contend that the incorporation of digital technologies in corporate management can substantially increase agricultural productivity and improve the overall appeal of the agriculture industry. The findings align with this study, which illustrates that the successful application and appropriate use of digital technology in contemporary agriculture management enhance production for both individual enterprises and the industry overall.

The advancement of digital technologies in agriculture necessitates specialised training. M. Bampasidou *et al.* (2024) emphasise the difficulties in educating digital specialists for agricultural enterprises, observing that technology innovations have transformed the industry. Superior professional training is crucial for improving the efficacy of agricultural enterprises, particularly in the implementation of more efficient business management methods (Zelisko *et al.*, 2024). This study corroborates their findings, highlighting that enhancing corporate management via digital technology relies on proficient digital experts. G. Sara *et al.* (2024) performed comprehensive research on many digital technologies in agriculture, noting that historical agricultural changes are propelled by contemporary technological advancements. Augmented and virtual reality technologies offer real-time information, allowing farmers to make prompt modifications and efficiently manage their operations (Ismayilzada *et al.*, 2023). Nevertheless, the efficient implementation of augmented reality in agriculture management

necessitates skilled, qualified individuals to proficiently oversee these technologies.

A wide range of problematic issues of regulation by the current legislation of the principles of the introduction of digital data storage systems in the management of agricultural companies was considered in the paper of C. Atik (2023). According to the researcher, the developing agricultural sector of any state inevitably faces the problem of ensuring the necessary level of preservation and protection of personal data. In this context, the adoption of a legislative act within the framework of the existing system regulating the rules for the protection of private data will help streamline the process of expanding the use of digital technological innovations in the agricultural sector and ensure increased efficiency of agricultural management in individual states. The opinion expressed by the researcher seems controversial on the grounds that for the effective introduction of digital technologies into the management of the agricultural sector of the state economy, in addition to the specified legislative act, it is also necessary to introduce a set of measures to comply with current legislation, since otherwise

The study by L. Liu *et al.* (2024) examined the implementation of digital technological innovations in managing the digital finances of firms within the agriculture sector. Researchers assert that quantifying the volume of detrimental emissions from agricultural enterprises into the external environment is a crucial element in managing the operations of entities within the agricultural sector, wherein the implementation of digital accounting systems is significant. Between 2011 and 2019, these systems were empirically evaluated across 30 provinces in China, and the resultant data served as a foundation for the advancement of more sophisticated systems for the digital accounting of harmful emissions and the management of agricultural enterprises in China. The researchers' data and conclusions are corroborated by the results of this study, providing clear evidence of the efficacy of integrating modern digital technologies into the management systems of agricultural enterprises in the state.

H. Wu *et al.* (2023) examined the application of digital technologies to manage harmful emissions in agricultural companies. Several Chinese provinces have effectively implemented digital management systems, improving the efficiency of emission accounting and operational control. These findings are consistent with the results of this study, emphasising that modern digital technologies can solve certain production problems and improve the effectiveness of corporate governance in general. T. Quan *et al.* (2024) studied the impact of innovative technologies on agricultural management, emphasising their contribution to improving economic sustainability and promoting high-quality development. Digital technologies represent effective tools for managing agricultural practices and improving decision-making (Yudina *et al.*, 2024). This paper supports this view by demonstrating that digital technologies improve data storage and quality management, benefiting both individual companies and the agricultural industry as a whole. T. Dibbern *et al.* (2024) highlighted the main drivers and barriers to the adoption of digital technologies in agricultural management. They emphasised the complexity of this transition, noting the importance

of privacy, security and effective data management in the face of external developments. The authors of this study agree, emphasising that the protection of personal data is essential for the effective and secure use of digital technologies in agriculture.

► Conclusions

The impact of digital technologies on the management efficiency of agricultural companies in the Kyrgyz Republic lies in the manifestation of a whole range of new management opportunities for agricultural enterprises through the introduction of these technologies. In particular, the increase in the use of digital database technologies allowed effectively managing large amounts of information, making the necessary management decisions in a timely manner, based on objective and verified data. With regard to the activities of Korm-Service LLC, the introduction of digital database technologies into the company's activities has led to an increase in the quality of accounting for the volume of agricultural products supplied to the end consumer by an average of 10-15% over the period 2020-2023. The number of employees employed in this field increased from 7,287 to 7,622 people over the period 2020-2023 to improve the quality of solving production issues at agricultural enterprises of the Kyrgyz Republic using digital technologies. During the same time period, the number of specialised professionals in enterprises in this field increased from 145 to 196 people.

Therewith, digitalisation processes in the agricultural sector of the Kyrgyz Republic's economy will contribute to the development and improvement of state policy in

related areas, such as information and communication technologies, the manufacture of innovative samples of agricultural machinery, equipment for agricultural work, and optimisation of the use of biological preparations in agriculture, such as fertilisers and minerals. The introduction of these technologies into the management of enterprises in the agricultural sector of the Kyrgyz economy leads to an increase in the efficiency of tracking production and logistics chains, and to the full automation of this process.

The limitations of this study are related to the need to objectively consider the real level of technical training of employees of companies in the agricultural sector, in the management of which modern technological solutions are being introduced. Often, the insufficient level of training of personnel of agricultural enterprises is a serious obstacle to the introduction of technologies of this kind into enterprise management, and this circumstance is very difficult to objectively analyse within the framework of a single study. The prospects for subsequent study in the direction determined by the chosen subject are the possibility of their practical use in the field of management of companies in the agricultural sector of the Republic of Kyrgyzstan, to increase the practical effectiveness of the selected management methods.

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► Conflict of interest

The authors of this study declare no conflict of interest.

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► **Анотація.** Це дослідження мало на меті визначити сучасні тенденції у використанні цифрових технологій в аграрному секторі Киргизької Республіки. У ньому використовувались теоретичні підходи для вивчення глобального розвитку цифрових технологій та емпіричні методології для оцінки їх впровадження в сільськогосподарських підприємствах Киргизстану. Отримані результати свідчили про зростаюче значення цифрових сільськогосподарських технологій для підвищення ефективності сільськогосподарських операцій у всьому світі, зокрема в Киргизстані. Цей прогрес підвищує здатність більш ефективно задовольняти споживчий попит на продукцію, вироблену цими підприємствами. Інтеграція таких технологій, як штучний інтелект, системи баз даних, робототехніка, інтелектуальні датчики та автоматизація в управління сільськогосподарськими підприємствами Киргизстану призводить до оптимізації витрат, зниження собівартості, підвищення врожайності та виробництва сільськогосподарських товарів вищої якості. Підвищення ефективності управління є ключовим елементом цих реформ і має вирішальне значення для успішного функціонування компаній у цьому секторі, особливо у світлі нинішніх економічних умов. Сучасні цифрові технології значно підвищують ефективність управління в аграрній галузі Киргизстану, сприяючи швидкому збору та обробці даних. Вони також розширюють можливості для прийняття правильних управлінських рішень, а отже, підвищують загальну ефективність підприємств в аграрному секторі країни

► **Ключові слова:** сільське господарство; інноваційний підхід; адміністрування; економічна галузь; якість впровадження рішень; державне регулювання; механізм управління