European Proceedings of
Multidisciplinary Sciences
EpMS

www.europeanproceedings.com

e-ISSN: 2421-826X

DOI: 10.15405/epms.2024.09.85

MTMSD 2022
I International Conference «Modern Trends in Governance and Sustainable Development of Socio-economic Systems: from Regional Development to Global Economic Growth»

DIGITAL TECHNOLOGIES IN THE RUSSIAN AGRO-INDUSTRIAL SECTOR: CURRENT SITUATION AND PROSPESCTS

Luka Ilich (a)*, Fedor Gorin (b), Irina Pankratova (c)
*Corresponding author

(a) Moscow State University of International Relations, Moscow, Russia, luka.ilich.dr@gmail.com
(b) Moscow State University of International Relations, Moscow, Russia, fedor.m.gorin@gmail.com
(c) Moscow State University of International Relations, Moscow, Russia, pankratova.irina8@mail.ru

Abstract

This study aims to analyze the current state and prospects of digital technologies in the Russian agro-industrial sector. The objective is to identify the main trends in the use of digital technologies in Russian agriculture and assess their impact on the industry's efficiency and sustainability. The urgency of attention to this matter becomes paramount if Russia aims to bridge the gap with developed countries in terms of robotization and the widespread adoption of AI technology. The research methodology includes the analysis of statistical data, interviews with representatives of agro-industrial enterprises, and a review of existing studies and expert opinions. Data were collected and analyzed, taking into account various aspects such as the implementation of digital technologies, the level of automation, and their impact on productivity and product quality. One significant result of the study is the identification that enterprises actively integrating digital technologies into their operations demonstrate higher efficiency and competitiveness. This underscores the importance of further development and integration of digital solutions in the Russian agro-industrial sector.

Keywords: 3nd industrial revolution, artificial intelligence, agro-industrial sector, Russian Federation

https://doi.org/ 10.15405/epms.2024.09.85
Corresponding Author: Luka Ilich
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2421-826X

1. Introduction

All over the world, the increasing use of robotics, intelligent and digital systems in the agro-industrial complex is determined by the objective needs of the modern economy. It reduces environmental pollution and wasteful use of water resources, improves the quality of agricultural products, increases productivity and contributes to overall technological development (Talaviya et al., 2020).

To be able to stay competitive on the global market, companies of the agro-industrial complex have to keep implementing the latest technologies in the industry. Russia has traditionally exported substantial amounts of products of the agro-industrial complex, which raises the need for automizing and optimizing the production process. However, it was not until the last decade that the Russian government began putting emphasis on it. As a result, the country is facing a low level of implementation of AI, robots and other digital technologies in the agro-industrial complex compared to other countries. Consequently, total output of the complex is lower than what it could have been with the use of those technologies.

The ultimate goal of the research is to demonstrate the possible benefits of greater use of digital technologies in the agro-industrial complex. This is accomplished by means of analysis of Russia's position in terms of implementation of the technologies in question in the sphere, situation on the corresponding market and the government's plans. Additionally, a forecast of the impact of the implementation of the aforementioned technologies is made.

2. Materials and Methods

This research employs a multi-faceted approach to investigate the digital technologies in the Russian agro-industrial sector. Initial data gathering involves the analysis of information and statistical data from diverse agencies and governmental institutions. A comprehensive review of pertinent scientific literature and relevant legal frameworks has been conducted to establish a foundational understanding.

Furthermore, a dual-method strategy encompassing both quantitative and qualitative research techniques has been adopted to assess the extent of technology integration within the agro-industrial sector. This includes evaluating the current state of implementation and its impact on various aspects of agricultural practices. Additionally, a forecasting method has been applied to project the potential implications and benefits of integrating these technologies into the sector.

This combination of methodologies provides a robust foundation for comprehensively understanding the present scenario, potential future developments, and the overall impact of digital technologies in the Russian agro-industrial sector.

3. Results and Discussion

The analysis of the current state and future prospects of digital technologies in the Russian agro-industrial sector revealed several key findings. Firstly, the comprehensive review of information and statistical data from various agencies and state institutions provided a nuanced understanding of the sector's technological landscape. The literature study and examination of legal acts contributed valuable

https://doi.org/ 10.15405/epms.2024.09.85
Corresponding Author: Luka Ilich
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2421-826X

insights into the regulatory framework and scholarly discourse surrounding digital technologies in agriculture.

The research employed a combination of quantitative and qualitative methods to assess the level of technology implementation in the agro-industrial sector. The findings elucidated a multifaceted scenario, highlighting both advancements and challenges in adopting digital technologies. Quantitative metrics underscored the increasing prevalence of certain technologies, while qualitative assessments delved into the intricacies of their impact on agricultural practices, productivity, and sustainability.

The discussion section delved into the nuanced aspects of the results, exploring the implications of digital technology adoption on various facets of the agro-industrial sector. This involved an in-depth analysis of how technologies such as precision agriculture, data analytics, and automation are transforming traditional farming practices. The discussion also addressed potential challenges, including issues related to data privacy, infrastructure limitations, and the need for skill development within the agricultural workforce.

The results and ensuing discussion collectively contribute to a comprehensive understanding of the current state and future trajectories of digital technologies in the Russian agro-industrial sector. These insights are pivotal for stakeholders, policymakers, and industry participants in navigating the evolving landscape of agricultural technology, fostering informed decision-making, and promoting sustainable development in the sector.

According to Rosstat (Figure 1), the average profitability for the agricultural market has always been higher than that of the Russian economy as a whole (Russian Federal State Statistic Centre, 2021; StraitsResearch & Smart Agriculture, 2022). In 2021, this indicator for the agricultural market was more than 2 times higher than that for the Russian economy (20.3% and 9.4%, respectively).

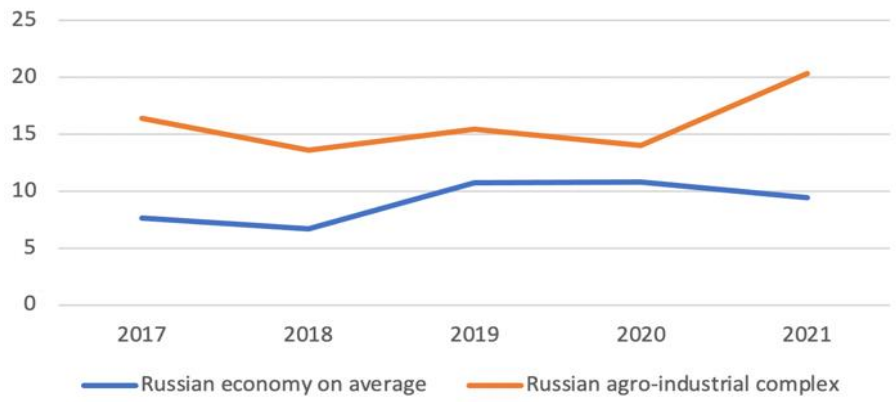

Figure 1. Profitability of the Russian economy and the Russian agro-industrial complex, %

The favorable situation in the agro-industrial market, low labor costs and numerous subsidies from the state (Interfax, 2022) have a positive effect on the agricultural market in general, which leads both to an increase in the capitalization of existing agricultural companies and to the emergence of new companies. Thus, it is possible to trace the dynamics that the total production of agro-industrial products increased by USD 18 bln from 2016 to 2022 (Figure 2) at a 5% CAGR (author's calculations; Russian Federal State Statistic Centre, 2021).

https://doi.org/ 10.15405/epms.2024.09.85
Corresponding Author: Luka Ilich
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2421-826X

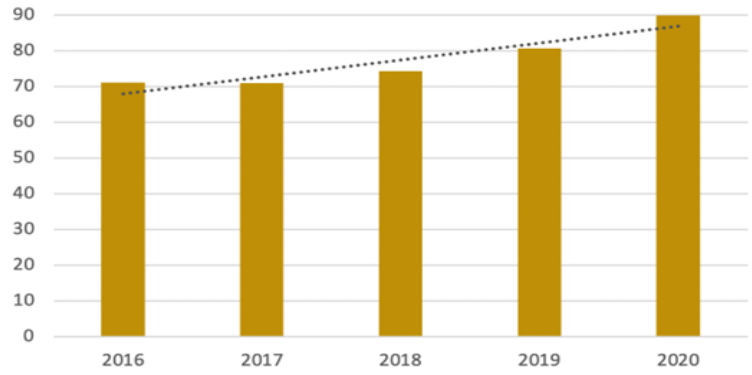

Figure 2. Total output of the agro-industrial complex in Russia, USD bln

The level of monopolization in the agribusiness market is quite low. For example, the top 10 players owned only 7.87 million hectares of Russia's 77.7 million hectares of sown area in 2020. The low level of market monopolization prevents large players from using their influence on the market, which keeps the market healthy by motivating companies to use competitive methods to gain win greater share (Forbes, 2022; Russian Federal State Statistic Centre, 2021).

3.1. Prospects for the implementation of modern technologies in the Russian agro-industrial complex

According to the Ministry of Agriculture of the Russian Federation, the Russian market of digital technologies in the agro-industrial complex is estimated at about RUB 360 bln, and by 2026 it is expected to increase fivefold (Balaboshina, 2020). In view of the global market value of more than USD 36 bl., the low development of this market in Russia is obvious (GlobeNewswire, 2022). A special emphasis in Russia is placed on the implementation of AI technologies in the sector. However, since the full-scale digitalization of the agro-industrial complex began just about 10 years ago, the process is still at one of the initial stages, with robotization of the sector being the main trend. Let us analyze it in greater detail.

In 2017, robots were used in 28 regions of Russia in 103 agricultural organizations. Between 2006 and 2016, 393 units of robotics were introduced (Skvortsov et al., 2018). Robots were most actively implemented in 2011-2015, but after that the rate of their implementation dropped significantly. Since almost all robots were imported, the sanctions imposed on Russia led to changes in currency exchange rates and an increase in the price of robots which made them difficult to purchase.

In Russia, the insufficient level of robotization is typical not only for agriculture, but also for the entire manufacturing. This is clearly demonstrated by robot density – an indicator calculated as the number of robots in the industrial sector per 10,000 employees.

In 2016 the leaders in terms of this indicator were South Korea (631), Singapore (488), Germany (309), and Japan (303). The global average was 74. At the same time this indicator was at the level of 3 in Russia, substantially behind not only the leaders, but also the world average (International Organization of Robotics, 2018).

A possible way to measure the intensity of use of technology in the agro-industrial complex is by calculating robot density in the agro-industrial complex. It is calculated as the number of robots used in

https://doi.org/ 10.15405/epms.2024.09.85
Corresponding Author: Luka Ilich
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2421-826X

agriculture per 10,000 people employed in it. Robot density in the agro-industrial complex for 2006-2016 is shown in Figure 3 (Skvortsov et al., 2018).

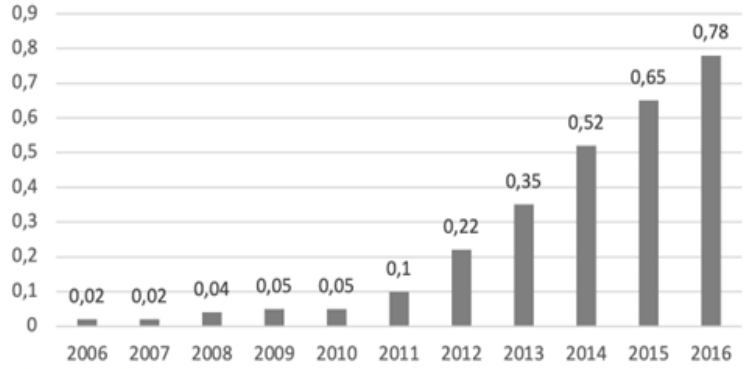

Figure 3. Robot density in the agro-industrial complex in Russia

The graph shows that the robot density the agro-industrial complex in Russia has gone up over the past 10 years from 0.02 to 0.78 units of robotics per 10,000 workers. Despite the general upward trend, it is impossible not to note its low level. Robotic systems are still not widely used, hindering effective development of the industry and reducing its productivity (Zagazheva & Berbekova, 2021).

But even the existing scant experience of using robots the agro-industrial complex in Russia has proven its effectiveness. In 2019 more than 660 thousand hectares of arable land in Altai Krai, which is about 10% of its total area, had advanced digital technologies used on them. On the farm “Rodinsky”, thanks to the use of such technologies as satellite navigation of equipment, elements of precision farming and weather stations, the yield of several crops had increased threefold over the preceding four years. Similarly, as a result of the introduction of some elements of precision farming system in the previous five years, the yield of winter crops in “Agrofirm “Urozhay” had increased by 25%, exceeding 54 centners per hectare (Svetich News Agency, 2019).

4. Regulatory Aspect

4.1. Development of agro-industrial complex without AI

Realizing the need to use artificial intelligence in the agro-industrial complex more widely, the government of the Russian Federation began to develop a number of regulations in order to regulate the process of its introduction. It is worth noting that the previously existing national project "Development of Agro-industrial Complex", which came into force back in 2008, did not take into account the use of artificial intelligence in this sector of the economy. It gave priority to the following main indicators:

i. Index of agricultural production on farms of all categories (in comparable prices).

ii. Index of food production, including beverages and tobacco (in comparable prices).

iii. Production index of food products including beverages and tobacco (in comparable prices).

iv. Index of physical volume of investment in fixed capital in agriculture.

https://doi.org/ 10.15405/epms.2024.09.85
Corresponding Author: Luka Ilich
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2421-826X

v. Profitability of agricultural organizations.

4.2. Appearance of AI in national programs

Although the idea of using artificial intelligence in the agro-industrial complex in the Russian Federation appeared not long ago, its strengthening in this sector of the economy can already be observed. One of the goals of the federal project "Artificial Intelligence" of the national program “Digital Economy of the Russian Federation” is to ensure the introduction of artificial intelligence technology in the agricultural sector. The project implementation period is from 01.01.2021 to 31.12.2024 (RFRIT, 2022).

Table 1. Share of fields using precision farming tools/proportion of farms monitoring and analyzing livestock behavior and health using AI technologies (relative to 2019)

2021	2022	2023	2024
0%	5%	10%	25%

Table 1 shows that the program implies a gradual increase in the proportion of AI in livestock monitoring. In addition, the Ministry of Agriculture has developed a federal science and technology program until 2025, which is expected to increase the licensing agreements of agricultural producers with scientific organizations by 50%. At the same time the share of high-tech agricultural enterprises is to increase to 30%. These changes should lead to an increase in agricultural production of 25% by 2025 (Zagazheva & Berbekova, 2021).

Additionally, the Ministry of Agriculture of the Russian Federation developed a departmental project "Digital Agriculture" back in 2019. It contains an extensive action plan for the implementation of digital technologies and platform solutions to ensure a technological breakthrough in the agricultural sector and to achieve a doubling of productivity in digital agricultural enterprises by 2024 (Ministry of Agriculture of the Russian Federation, 2019).

4.3. Introduction of the new standards

The regulatory aspect of the industry continues to develop dynamically, as the need to regulate and monitor the operational safety of automated traffic control systems for agricultural machinery is becoming increasingly clear. In this regard, the Federal Agency for Technical Regulation and Metrology (Rosstandart) approved the national standard of the Russian Federation GOST "Artificial Intelligence (AI) Systems in Agriculture" in 2022 (Rosstandart, 2022).

This issue is indeed becoming increasingly relevant for the Russian Federation in today's realities, so in mid-May of the same year, the Russian financial conglomerate Sber and the Ministry of Agriculture decided to introduce digital solutions in the agricultural sector. Active discussions are underway regarding the use of:

1) Cognitive Agro Pilot, an AI-enabled autonomous farm machinery control system that is already in use for harvesting across the country.

2) AI-agronom and AI-field estimator services, which make it possible to estimate and predict the yield of a field, identify abnormal deviations from the actual yield value, etc.

https://doi.org/ 10.15405/epms.2024.09.85
Corresponding Author: Luka Ilich
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2421-826X

3) Geomir's cloud-based Field History service, which allows for remote monitoring of the condition of cultivated areas and operation of machinery on the fields, planning agricultural operations, keeping field logs and more.

4) The Digital Clone service from Mustang Feed Technology for dairy farm management, and others (SberPress, 2022).

4.4. Future investment projects

On August 15, 2022, the Ministry of Agriculture said it was ready to allocate RUB 400 mil for artificial intelligence for the agro-industrial complex and announced the opening of a relevant tender. It is necessary to develop a multifunctional service which, using AI algorithms, will identify vegetation types for the territory of selected Russian regions, automatically calculate the percentage of field area covered by each type of vegetation, and determine the presence of crop sprouts and the fact of their harvesting using a satellite image (GlavAgronom, 2022).

Active work is underway in the Russian Federation to develop a regulatory component for the introduction

5. Break-even Point for Investments in AI in the Agro-industrial Complex

Taking into account the data in paragraph 2 of chapter 2 of this paper, it can be assumed that the application of AI increases the efficiency of agriculture by 15%. At an average cost of equipping a farm with the necessary machinery of USD 790 per hectare of land (AgEagle, 2022; Lahakx, 2022), its implementation over the entire crop area (77.7 million hectares by 2020) would cost USD 61.4 bln.

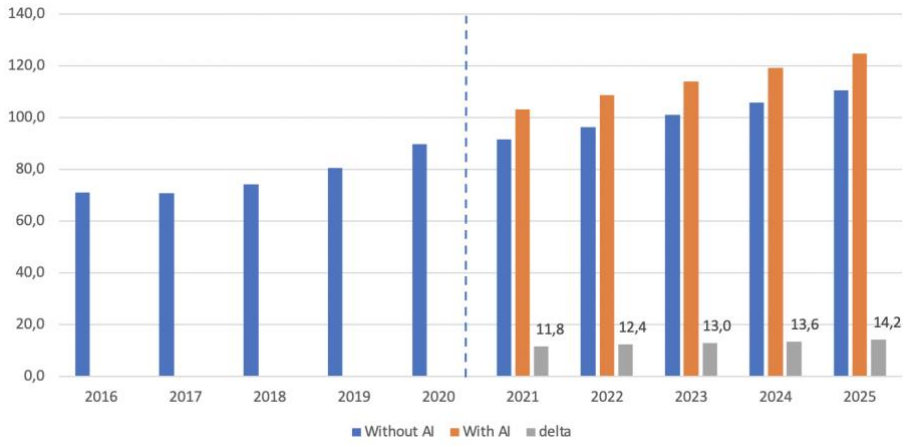

Figure 4. Total output of agriculture if AI technologies were implemented in 2020, USD bln

As can be seen in Figure 4, the investments are expected to break even within 5 years. It is important to note that these calculations take into account only the value of grown products, ignoring the reduction in costs of fertilizer, irrigation, labor and other costs offset by the introduction of these technologies. Additionally, as technology advances, the cost of introducing artificial intelligence will also

https://doi.org/ 10.15405/epms.2024.09.85
Corresponding Author: Luka Ilich
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2421-826X

decrease over time. Thus, the point of return on investment will come earlier than calculated in this article.

6. Conclusion

In conclusion, the integration of Artificial Intelligence (AI) into the agro-industrial sector has demonstrated a clear potential to enhance production efficiency. However, the realization of these benefits necessitates substantial financial investments, often on a scale comparable to the budget of an entire country. While the advantages are evident, it is crucial to recognize that the implementation of AI technologies is a complex and time-consuming process, requiring a sustained commitment over several years.

The urgency of attention to this matter becomes paramount if Russia aims to bridge the gap with developed countries in terms of robotization and the widespread adoption of AI technology. Initiatives by the Ministry of Agriculture to support agricultural companies in the implementation of these technologies are commendable, yet there is a call for an increase in the magnitude of this support.

Notably, the low level of competition within the industry presents a favorable environment for foreign companies to invest. This underscores the need for strategic measures to bolster domestic competitiveness and retain control over the sector's technological trajectory.

In essence, the conclusion emphasizes the imperative for timely and comprehensive action. The trajectory towards AI integration in the agro-industrial sector demands sustained financial backing, enhanced government support, and proactive measures to fortify domestic competitiveness. By addressing these factors, Russia can position itself as a significant player in the global landscape of AI-driven agricultural innovation.

References

AgEagle. (2022). Drones, sensors and software for automated aerial intelligence. https://ageagle.com

Balaboshina, D. (2020). The future of the agribusiness sector: digitalisation after the coronocrisis. plus.rbc.ru

Forbes. (2022). Russia's largest landowners. www.forbes.ru

GlavAgronom. (2022). The main site for Russian agronomists. glavagronom.ru

GlobeNewswire. (2022). Smart Agriculture Market Size is projected to reach USD 36.24 Billion by 2030, growing at a CAGR of 10.80%. *Straits Research*. www.globenewswire.com

Interfax. (2022). The profitability of agriculture of the Russian Federation in 2022 decreased to 20.9%. https://www.interfax.ru/business/881252

International Organization of Robotics. (2018). *Robot density rises globally*. ifr.org

Lahakx. (2022). Autonomous Agricultural Spraying. www.lahakx.com

Ministry of Agriculture of the Russian Federation. (2019). *Governmental project Digital agriculture*. mcx.gov.ru

RFRIT. (2022). Russian Information Technology Development Fund. https://rfrit.ru/

Rosstandart. (2022). Federal Agency for Technical Regulation and Metrology. rst.gov.ru

Russian Federal State Statistic Centre. (2021). Agriculture in Russia 2021. https://rosstat.gov.ru/storage/mediabank/S-X_2021.pdf

SberPress. (2022). SberPress — Sber official news. press.sber.ru

Skvortsov, E. A., Skvortsova, E. G., Sandu, I. S., & Iovlev, G. A. (2018). Transition of Agriculture to Digital, Intellectual and Robotics Technologies. *Economy of Region, 14*(3), 1014-1028. https://doi.org/10.17059/2018-3-23

StraitsResearch & Smart Agriculture. (2022). Press Release Distribution. www.globenewswire.com

Svetich News Agency. (2019). Digital transformation of the agro-industrial complex: the experience of Siberian regions. svetich.info.

Talaviya, T., Shah, D., Patel, N., Yagnik, H., & Shah, M. (2020). Implementation of artificial intelligence in agriculture for optimisation of irrigation and application of pesticides and herbicides. *Artificial Intelligence in Agriculture, 4*, 58-73. https://doi.org/10.1016/j.aiia.2020.04.002

Zagazheva, O. Z., & Berbekova, M. M. (2021). *Major trends in the development of robotic technology in agriculture*, 15-16. https://cyberleninka.ru/article/n/osnovnye-trendy-razvitiya-robotizirovannyh-tehnologiy-v-selskom-hozyaystve/viewer