

# Digital Transformation in Agriculture: Goals, Tasks, and Main Development Paths



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**Abstract** Currently, domestic agriculture has great potential. Under the current conditions of the food embargo and, as a consequence of the need for import substitution of a significant share of products, it shows noticeable positive dynamics and growth rates. The most significant successes were achieved primarily in the crop production sectors, which, ultimately, allowed Russian agriculture to enter the global agricultural food markets decades later. However, it is impossible to deny the fact that, for several developments and efficiency indicators, domestic agricultural production lags significantly behind the leading economies, which will not allow us to reveal our export potential fully. In the long term, the end of “counter-sanctions” will negatively affect the results of fierce competition with external producers and food imports. Based on the preceding, it is proposed to consider the possibility of introducing elements of the digital economy in the field of agriculture, through digital technologies in crop production and animal husbandry, storage, and processing of products, the management system in the agricultural sectors, as the main direction for increasing the efficiency of agricultural production. The focus is made on smart digital networks.

**Keywords** Digital transformation · Digital agriculture · Competitiveness · Digital technology

## 1 Introduction

The growth of grain yields, in 2019, relative to 2000, amounted to more than 60%, due to government support measures in terms of high costs for the preferential purchase of agricultural equipment and significant technical re-equipment of the industry. However, it is still inferior to the levels of technologically and innovatively developed economies (Germany (3 times), the USA, and Canada (4 times)), while the cost of production per employee is lower than that of the US and Canada by 22 times.

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Consequently, the potential for growth, development, and modernization of agricultural production is great, and the realities of export and the need to ensure food security indicate the necessity to transform domestic agriculture into a high-tech industry with the integration of the latest innovative developments, including in the field of management decisions, which will increase production efficiency at all stages of the agro-industrial complex redistribution.

## 2 Materials and Methods

According to expert estimates, the heads of agricultural enterprises, managers of various levels, and farmers, within the calendar year and production cycles, have to make more than 40 critical management decisions in concise and limited periods. Almost all of them significantly affect the efficiency and economy of agricultural production and are associated with the need to quickly search, obtain, and process large amounts of information. However, a significant number of subjects may encounter difficulties and limitations in access to this information. The lack of necessary information and loss of time is very expensive for Russian agricultural producers and the industry as a whole. This study was based on a systemic and logical approach. In the process of preparing the study, methods of analysis, synthesis, induction, and deduction, as well as descriptive techniques, were used.

## 3 Results

In order to increase the competitiveness of the economy, to bridge the gap in labor productivity and the efficiency of the main technological processes of agricultural production, as well as to increase the effectiveness of government support measures and governance mechanisms, elements of a digital transformation system for agriculture are being developed and implemented, which should become one of the primary and essential links in the domestic digital economy.

From the point of view of digitalization, agriculture has several characteristic features that determine the potential and effectiveness of IT innovations. Firstly, this is a large number of external factors that influence the results of production processes. Moreover, they, as a rule, can have multidirectional dynamics, both in space and in time. This, in turn, causes high costs even within the framework of a specific economic entity [2].

Secondly, the adoption of timely and effective management decisions is negatively affected by a large number of interaction subjects within the framework of various production chains, their spatial remoteness, and dispersal.

Thirdly, there is a complex system of the totality of inter-industry relations within agricultural production and with subjects of other sectors of the agro-industrial

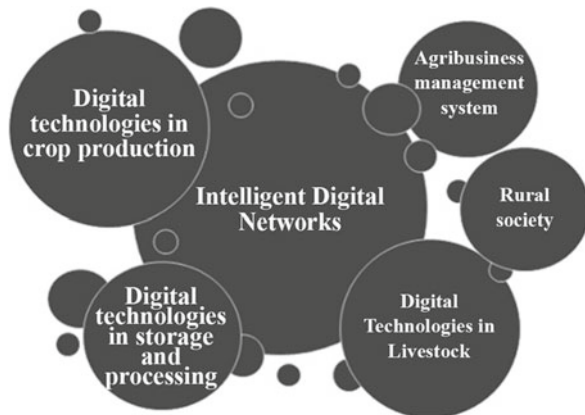
complex as a whole (resource suppliers, buyers, and processors of finished products), which leads to a considerable number of transaction costs.

The studies carried out within the framework of the departmental project “Digital Agriculture” (Fig. 1) indicate deficient current levels of digitalization of its industries, insufficient supply of knowledge and best practices in the field of innovative technological processes, unsatisfactory level of provision of agricultural producers with information, technical means, and equipment. A high level of costs is often caused by the low level of development of logistics, storage, and delivery systems. A very limited part of the entities has sufficient resources for the acquisition and implementation of modern IT solutions, equipment, and platforms. The situation is complicated by the low level of agricultural production with IT specialists, and their number is two times lower than the relatively more developed agricultural sectors of the EU economies. According to the Ministry of Agriculture of the Russian Federation, about 90,000 employees with competencies “Digital Economy” are required in the industry.

Under the current conditions, scenarios of digitalization and substantial innovative transformation of the industry, as well as its integration with other vectors of the accelerated development of digital economy, without incentive mechanisms and direct participation of the state, will, at least, require long implementation and will not be complex and structured. This means that the obtained result would be less effective. This predetermined the decision on the formation of the National Platform for Digital State Administration of Agriculture, as well as the departmental project “Digital Agriculture” as part of the program “Digital Economy of the Russian Federation” (July 28, 2018 No. 1632-r) approved by the Government of the Russian Federation. The main goal of these measures is the transformation of agricultural industries based on innovative digital technologies and platforms for leveling technological gaps in the agricultural sector, ensuring significant productivity growth and lower costs [1].

Such an ambitious project requires significant investment. According to the Ministry of Agriculture, 300 billion rubles will be attracted and financed within

**Fig. 1** Digital agricultural environment. *Source* Developed by the authors



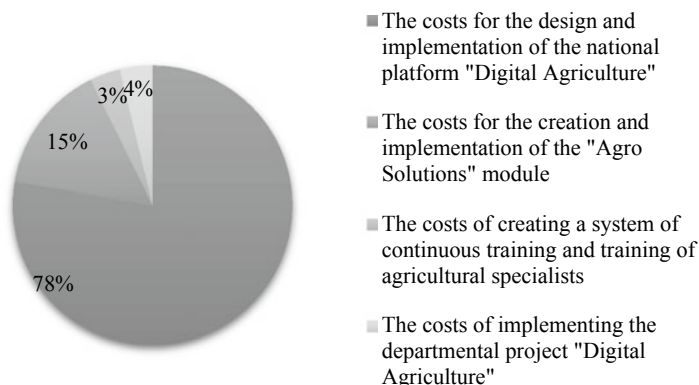


**Fig. 2** Total expenses for the implementation of the “Digital Agriculture” project, million rubles. *Source* Developed by the authors

the framework of a departmental project for the development and implementation of digital technologies until 2024. (Fig. 2). At the same time, 152 billion rubles will be financed from the federal budget. (50.66%). Eight billion rubles will be financed from regional budgets (2.66%), and another 140 billion rubles (46.68%) will be attracted from extrabudgetary sources, as part of a public–private partnership.

Digitalization will take place in stages in a system of four main blocks, within the framework of which both common strategic goals and tasks of the national and regional level, as well as tactical applied tasks, located at the levels of individual economic entities, will be solved. One of the main and fundamental elements will be the national platform “Digital Agriculture,” which will be the basis for data processing and analysis on the resource potential of the industry.

At the same time, the specific gravity (Fig. 3) of agricultural areas and data on their structure, bonitet, and other agro-climatic features “digitized” within the platform will increase from 50 to 100% by 2024, the share of digitally processed and analyzed information on farm animals (data on the structure of livestock, productivity) will increase from 25 to 100%. At the same time, the proportion of data on the composition and structure of the tractor fleet, agricultural machinery, and equipment available in



**Fig. 3** The structure of costs for the project “Digital Agriculture.” *Source* Developed by the authors

the digital platform system for the period of implementation of digital systems will increase from 45 to 100%.

The development and implementation of the “Digital Agriculture” platform will take 78% or 118.08 billion rubles of the project’s financial resources [3].

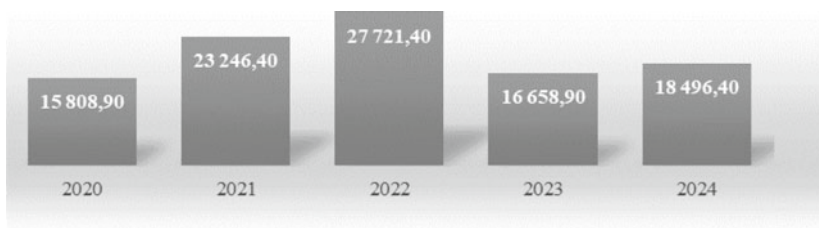
## 4 Discussion

As part of this block, the following list of key events will be carried out and implemented:

- The concept of a digital platform with an integrated system of processes and mechanisms was developed. Conceptual, technical, and parametric requirements for ensuring agricultural production were systematized. Standards and regulations have been developed for the collection, transfer, storage, analysis, and interpretation of the necessary information to ensure their accounting, monitoring, and analytics at the regional levels. The rules for interdepartmental and intersectoral interactions are defined and implemented.
- Information and telecommunications infrastructure of a digital platform with integrations of all levels and links of agricultural production were designed and deployed. Specialized dedicated servers will be allocated to deploy the digital system.
- The elements of a regulatory reference documentation management system were developed and implemented; regulatory reference books were registered and filled out, a mechanism for their continuous updating was implemented, data were synchronized with tools using artificial intelligence. A system of data mining and calculating possible scenarios will be formed.
- Government support measures were implemented in the framework of financial incentives to fill the digital platform with the data of the primary links of the system through regulated digital products.

Reducing transaction costs and increasing the level of interaction of agricultural production entities, including with contractors of other sectors of the agro-industrial complex, as well as increasing the efficiency of production processes, will be implemented in the structure of activities of the digital module “Agro Solutions” for the implementation of which 22.8 billion rubles will be allocated (15% of the financial resources of the project) (Fig. 4). The following measures will be implemented until 2024:

- The development and implementation of the technical requirements of the specialized module “Agro Solutions” and its integration into the domestic system of the digital economy.
- Design and implementation of a system that ensures effective interaction of entities of the agricultural market. The “Electronic Marketplace” and the subsystem “Personal Accounts of Agricultural Producers” will be implemented, as well as the



**Fig. 4** State support in the framework of subsidizing digitization of data, million rubles. *Source* Developed by the authors

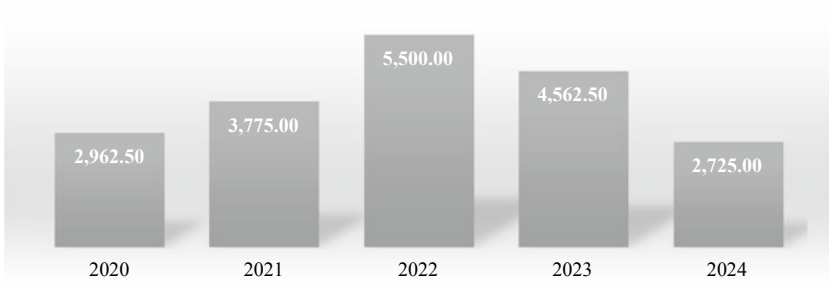
subsystem “Finance,” which will include electronic document management tools, government support, and financing measures, digital lending service “Business Modeling,” basic federal and regional digital services.

- The tools for the continuous support of the operational activities of agricultural entities within the framework of integrated digital solutions, including “Smart Field,” “Smart Flock,” “Smart Farm,” “Smart Garden,” “Sharing of Capacities and Equipment,” etc. will be developed and implemented.

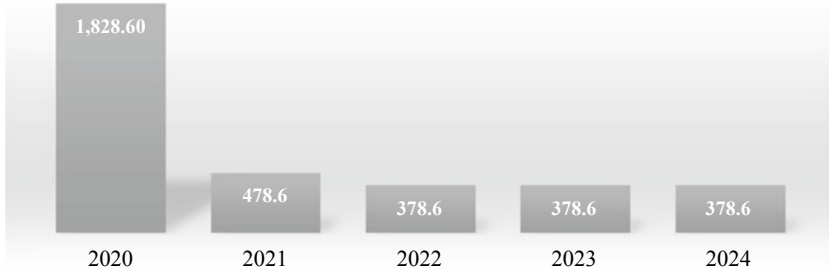
A shortage of personnel with the necessary qualifications will be solved by organizing a system of continuous training of specialists with competencies in the fields of Digital Agriculture and Digital Economy. Agrarian universities will become representative offices of the “Center of Competencies “Digital Agriculture.” Based on the studies, the needs for the necessary specialists in the digital transformation of the industry will be determined, and the necessary institutional environment will be formed. Within the framework of this block of measures, the educational environment “Land of Knowledge” will be developed, which will provide qualified distance training for agricultural specialists. Additionally, an institutional subsystem of professional retraining of specialists will be formed, including those released as a result of digital transformations in the industry. Mechanisms for the professional orientation of schoolchildren to study in the necessary specialties of professional education will be initiated.

The practical implementation of the activities of the digital transformation personnel support unit will require 5.368 billion rubles - vocational guidance of students to study in the vital areas of education (Fig. 5). The practical implementation of the activities of the digital transformation personnel support unit will require 5.368 billion rubles.

Undoubtedly, domestic agriculture (Fig. 6) has significant reserves for increasing efficiency (3–5 times relative to the leading economies of the EU, USA, and Canada) and significant potential for growth in the industry’s turnover through the introduction of digital processes and technologies, increasing labor productivity.



**Fig. 5** The costs for the design, creation, and implementation of the “Agro Solutions” module, million rubles. *Source* Developed by the authors



**Fig. 6** Expenses for the formation of systems for continuous training of agro-industrial complex specialists in the competencies of the digital economy, million rubles *Source* Developed by the authors

## 5 Conclusion

The digital transformation of the industry should result in a general decrease in the share of material costs in the structure of the cost of agricultural products from 60 to 43% by 2024 and the achievement of a growth rate of labor productivity of 200% relative to 2018. At the same time, the gross product of the industry should reach a value of 5.9 trillion rubles; export revenue will grow to \$45 billion, which will have a beneficial effect on the socio-economic development of rural areas.

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