Chapter 67
Prospects for the Digitalization of Regional Agro-industrial Complex

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Abstract In accordance with the decrees of the President of the Russian Federation issued in May, the main goal of the agrarian policy for the medium term is to establish a highly productive export-oriented sector that would develop based on modern technologies and would be staffed with highly skilled personnel. According to the approved program measures, proactive use of digital technologies can become a huge driver for (by 3–5 times) performance of the Russian agricultural sector. To date, the share of the Russian digital economy in GDP is small. Russia ranks 15th in the world by the digitalization of the agricultural sector. Having a huge resource potential, Russia seeks to enhance its competitive positions in the agricultural market. In this regard, the authors put forward a hypothesis that the Volgograd region, being one of the leading manufacturers of agricultural products and having a huge production, resource, innovation and export potential, will be able to make a great contribution to the Russian agribusiness that will allow the Russian Federation to become a worthy competitor on the global agricultural market. To this end, the authors have identified forward-looking areas for the development of regional agribusiness in the context of digital transformation. In the course of the study, it has been found that the greatest effect from the introduction of digital tools and platforms in the agricultural sector of the region can be achieved through the formation of an industrial cluster composed of government bodies, leading enterprises, and academic institutions interested in digitalization of the industry. Valuable perspectives in this connection can be provided by the Volgograd State Agrarian University, which is capable of performing complex and knowledge-intensive development and transfer innovations at a high level, as

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well as training highly skilled personnel adaptive to the demands of the digital economy. Practical implications are determined by suggestions on altering the concept of regional management that assumes shifting from the process model of agribusiness to one which is an object-oriented, more stable and adaptive to transformations.

Keywords Regional economy · Agricultural economy · Digital economy · Digital tools · Management technologies in agriculture

JEL Classification Codes R11 · O13 · Q1 · Q16

67.1 Introduction

The innovative model of agricultural development in Russia is characterized by the formation of digital technological platforms, the expanded use of the knowledge-driven economy, the digital transformation of production and management systems. High-tech production is an innovative process of making competitive goods and services with a high share of added value on the target market on the back of advanced digital technologies, intellectualized instruments of labor and highly skilled labor [1].

As estimated by experts, the main constraints on the path of the digital transformation of the Russian agro-industrial complex are out-of-date technologies, unavailable specialists and teams with required competencies and skills, failure to integrate existing and new technologies, which results in dramatic transformation of the infrastructure, technology, scientific approaches, principles, methods of production arrangement [2–5].

Therefore, the digital transformation of agricultural enterprises should be based on fundamentally new high-tech approaches to production, i.e. using a multi-level matrix of target indicators and resource constraints, automation and a system of intelligent assistants to significantly reduce the time for testing and launching competitive products on the market [6].

Besides, we should note that the digital transformation of the organization of agricultural production has both pros (breakthrough digital technologies, big data analysis, unmanned vehicles, mass information services, labor robotization, etc.) and cons (dependence on borrowed technologies, the degradation of own competencies, job cuts, the elimination of particular specialties, unemployment, social tension, ambiguity in the legal field, fraud escalation, digital colonization and other negative factors arising out of the globalization of possible risks [7]).

Integrated consideration of the totality of these factors when introducing digital tools into agribusiness management will streamline state regulation of the economy by increasing its transparency and manageability, curtailing management costs and making more reasonable government decisions [8, 9]. However, according to the authors, regulatory mechanisms under consideration require independent scientific and practical conceptualization to design a digital model of regional agribusiness management.

For this purpose, by the example of the Volgograd Region the authors have explored the priorities for the establishment of a high-tech agricultural business in the region by laying conditions for higher transparency of agricultural markets, providing agricultural manufacturers with new IT business opportunities, reducing prime costs through digitization of business processes in the agro-industrial complex and transition to risk planning- and forecasting-based management that will ensure a positive economic effect and cut costs when using an integrated approach.

67.2   Materials and Method

The issues of the digital transformation of regional agriculture in this article are addressed from the perspective of examination of decrees of the President of the Russian Federation, Resolutions of the Government of the Russian Federation, information and statistical materials of federal authorities, Internet resources. The methodological background of the study has been proceedings of domestic and foreign scientists, which ensured a comprehensive and purposeful study of the problems and prospects of industry-specific digitalization.

A system approach relying on the basic methods of scientific knowledge, such as analysis and synthesis, has served a methodological background of the study. The study has been carried out with the help of a set of economic research methods, such as economic-statistical, monographic, comparative analysis, abstract-logical, computational-constructive. Depending on the problems to be solved, the authors have applied academic techniques of statistical, financial, trend data analysis, a benchmarking method, analogy, and systematization.

67.3   Findings

Nowadays, the agrarian sector of the economy in the Volgograd Region, as well as the whole Russia, is slipping into digital space and, therefore, have to form its ecosystems using digital technologies. Being one of the largest agricultural producers in the Russian Federation, the Volgograd region has a huge natural and climatic potential, which allows not only to satisfy domestic needs but also to have a rather strong effect on the formation of the food market in Russia. Volgograd region ranks 8th in the country by agricultural production output, its ratio in gross agricultural production is 2.6%. The Volgograd region has hit high and sometimes performances in particular sectors of agricultural production.

Over the past 5 years, the region has managed to dramatically transform the industry into an important sector of the region's economy. The foundation for this development was laid back in 2014 when agricultural development was defined as a priority area for the region. The Governor of the Volgograd Region A. I. Bocharov has set clear tasks on the disposal of the potential available in the agricultural sector.

Participation of science in devising the Strategy for the development of the agricultural sector of the region until 2020 played a major role in the progress. The basic provisions of the Strategy underlay the programs to be adopted and implemented [10]. The zone-based approach suggested by scientists of the agrarian university helped make government support more effective. The return on budgetary investments, in turn, allowed the region to participate in all federal programs. As a result, government support has increased.

The total amount of budget financing amounted to 22.8 billion rubles over 2014–2018. In 2014 3.5 billion rubles of government support funds were allocated to the agro-industrial complex, but in 2018 the figure was 5.9 billion rubles (1.7 times higher). The Volgograd region ranked 10th in Russia by the scope of direct government support (subsidies and grants) as of 2018 (4.2 billion rubles).

The governor's instructions on the engagement of additional funds into the region's economy through diversification of activities and growth of export supplies to foreign markets can be fulfilled through searching for new ways to raise labor productivity and reduce production costs using modern digital technologies.

Taking into account the priorities of the scientific and technological development of the agro-industrial complex of the region, the staff of the Volgograd State Agrarian University and authors commenced to develop the concept of the second stage of the Strategy for Development of the Agro-industrial Complex in the Volgograd region, the implementation of which will bring the region to a qualitatively new level thereby providing an integrated balanced solution of economic, social and environmental tasks, preserving the natural resource and historical-cultural potential of the rural settlement.

Within the national projects "International Cooperation and Export", "Digital Economy", "Small Business" and "Labor Productivity and Employment Support", scientists from the Volgograd State Agrarian University have already developed 8 project proposals for the digital transformation of the regional agro-industrial complex to be launched. In particular, the authors have taken direct participation in:

– studies on the development of digital technologies in livestock farming within the state assignment of the Ministry of Agriculture of Russia on the topic "Development of technical and economic parameters of experimental digital farms created in the basic farms of higher educational institutions";
– academic research works on the development of the Information system "Personal account of agricultural producer";
– calculation of technical and economic performances and an economic assessment of the risks of introducing digital models "Smart Field", "Smart Greenhouse" with regard to regional zoning and industry-based specialization by the example of the basic farms of the Volgograd State Agrarian University;
– joint development by the Pre-Caspian Consortium and authors of a platform for impersonal monitoring and management of transport-logistic infrastructure in the agro-industrial complex of the Volgograd region;

– joint development by the Federal Scientific Agro-Engineering Center "VIM" and authors of a distribution information and management system for command transmission to control robotic technical devices.

Within the implementation of the strategy, instructional guidelines for dispatching and aggregating data flows to create end-to-end chains from agricultural production to consumption with deep integration into related sectors of the digital economy will also be developed. Applied scientific research on the development of expert systems for control of water application rate under various irrigation methods have been carried out and digital technologies in precision farming have been planned.

It is these projects designed to scale up domestic integrated digital agro-solutions, that are interesting for investors and promising a real breakthrough in the development of the Russian agro-industrial complex since the deep integration of agribusiness with digital technologies is forward-looking from the perspective of possible competitive advantages. Thus, application of IoT technology solely as a result of the analysis of accurate and timely data [11] opens up new opportunities for enterprises for expanding the range of their services, bring them closer to their customers, sophisticating business processes [12] and differentiating their offers on the market, while ensuring a real return on investment and payback [8, 9].

The rapid introduction of digital technologies in agribusiness will require a qualitatively new level of staff competence. The staff should be able to work effectively with information flows and know modern means of establishing useful ties on the Internet, use various Internet services and tools to examine analytical reports and reviews, search for effective ways of developing new resources and markets, quickly monitor the state of the enterprise and interact online with various partners and systems for real-time control.

In framework of the Strategy for the Development of Agro-Industrial Complex of the Volgograd Region until 2030 developed today, staff of the Volgograd State Agrarian University together with the Committee on Agriculture is devising a "Comprehensive Program for the Training and Retraining of Specialists of Agricultural Enterprises" that show the demand for staff able to successfully put into practice the main development vectors. First of all, a new generation of managers of agricultural organizations who can take the level of international cooperation and export of domestic products should be trained.

In the course of the study, the authors have distributed the number of managers of agricultural organizations in the Volgograd region by the level of education and have found out that:

– about 90% of managers of large agricultural enterprises have higher education, but only 58%—agricultural (field-specific) education; 9.9%—secondary vocational education.
– 78% of managers of small agricultural enterprises have higher education (including field-specific education—57%); 17%—secondary vocational education (9.6%—field-specific education), 1.1%—basic vocational education and 3.7%—secondary education. In recent years, the category "practitioners" mentioned until 2015 has almost disappeared from statistics.

The use of digital technologies in the agro-industrial complex demands the specialists to know information systems and electronic programs that ensure the competitiveness of agricultural enterprises and their products. Currently, the regional demand for such specialists is over 80%. This especially concerns working in the State Information System for Monitoring of Agricultural Lands of the Volgograd region "AGROPORTAL" with additional modules "Economics" and "Cadastre", as well as in the State Information System of the Volgograd Region "Regional Information and Analytical System of the Volgograd Region" (RIAS) and continuously upgraded modules and versions of 1C program for accounting documentation.

This requires continuous training of industry staff with the help of an information-oriented approach, relevant progressive training methods, and modern toolkit.

Such a toolkit is engaged in training new generation specialists for digital agribusiness at Volgograd State Agrarian University. So, modern software products of over 180 domestic and foreign vendors are used in the educational process of the university.

Additional educational programs in information technology are executed at the university academies of world-renowned vendors like Microsoft, Cisco, Oracle. Given the high importance and potential of IoT technology for the agro-industrial complex, Samsung is ready to establish soon an Internet of Things Academy in the Volgograd State Agrarian University [7].

Along with HR issues of the industry development, designing a management model in the digital economy has become particularly important in the context of digitalization. Based on theoretical research findings, the authors proposed a promising algorithm for the introduction of digital tools into the practical management of regional agribusiness.

We offer the concept of objects' interaction within the target connecting network typical for the IoT technology to adapt to the management system of the regional agro-industrial complex.

The difference is that IoT exists within a single technological network and the management of the agro-industrial complex of the Volgograd region—within a single management network. Goal-setting is common both for the Internet of things, where it is impossible to establish meaningful interaction of things in multi-branch and connected Internet without a clear understanding of the strategic goal and the tactical tasks that reveal it, and for a new concept of the regional agro-industrial complex management, which should precisely define the goals of its development and functional existence.

The introduction of digital technologies in the agro-industrial complex will lead to the transformation of management concepts thanks to departure from the process business model that assumes the management of interrelated functions model, to the object one. Shifting from a functional model to a process one allows strengthening a business only in terms of business processes to achieve tactical goals, while management of business objects lets to evolve business at the level of interrelated points to execute the strategic goals of the regional agricultural sector, providing flexibility and mobility of business processes.

In this situation, enterprises of the regional agro-industrial complex will be presented as a network of interacting objects united on mutually beneficial terms into

a dynamic process model under an agreed strategy to achieve a common goal. Thus, the tasks of designing and reengineering business processes are being replaced by a complicated management approach with a higher level of abstraction, which, nevertheless, is more stable and adaptive.

This fact will make it possible to develop various models of interaction between much-differing objects, for example, producers and potential customers, producers, and logistics companies, agricultural enterprises and academic institutions, competing agricultural producers. Thus, the producer can involve potential customers in designing and promoting the product; exploration of market trends and preferences by the trial-and-error method is replaced by the acquisition of big data for multi-factor intelligent analysis of market responses, and market competitors agree on issues of shared production and adoption of general industry standards.

67.4 Conclusion

The research findings allowed making a conclusion on the need for a new model to be developed to manage the regional agro-industrial complex of the Volgograd region in the context of digitalization. The success of the transition to a digital economy in the agro-industrial complex of the Volgograd Region depends on the development of its digital ecosystem based on a platform that provides the opportunity for all interested parties to work together through a single system of interconnected technologies, methods, protocols, standards, and procedures.

The industry-specific cluster established as an independent unit that unites leading enterprises and academic institutions interested in the development of the digital industry can become a cornerstone in developing an ecosystem of digital agro-industrial complex in the Volgograd region. Volgograd State Agrarian University can perform the most complex and high-tech processes of developing, operating and testing digital services, as well as procure a transfer of innovative solutions at agricultural enterprises of the Volgograd Region and digital transformation of business processes.

References

1. Amelin SV (2017) Digitalization of production as a factor of raising its efficiency. In: Proceedings of the international research and practice conference theory and practice of organizing industrial production, efficiency of organizing and managing industrial enterprises: problems and solutions. Series "theory and practice of industrial production organization (Voronezh, 14–15 Nov 2017). Voronezh State Technical University, Voronezh, pp 12–17
2. Popova LV, Lata MS (2015) Analysis of innovation risk management when implementing agricultural innovations. Scientific review. series 1: economics and law, vol 6. Economic Education, Moscow, pp 57–65

3. Kamble SS, Gunasekaran A, Parekh H, Joshi S (2019) Modeling the internet of things adoption barriers in food retail supply chains. J Retail Consum Serv 48:154–168. https://doi.org/10.1016

4. Ognivtsev SB (2019) Digitalization of the economy and economy of the agro-industrial complex digitalization. Int Agric J 2(368):77–80

5. Amelin SV, Shchetinina IV (2017) Organization of high-tech production of competitive products. FES Financ Econ Strat 12(137):25–36

6. Karabekova AB, Osmonalieva DA, Sadyraliev ZH, Urmatayim AK (2019) The main directions of digital modernization of the agro-industrial complex of a modern region. In: Studies in computational intelligence, vol 826, pp 949–955

7. Ivanov VV, Ovchinnikov AS, Kochetkova OV (2019) Conceptual basis of digital transformation of the agroindustrial complex of the Volgograd region. In: Proceedings of the Lower Volga Agrarian University Complex, vol 2, no 54, pp 18–25

8. Popova LV, Korobeinikov DA, Korobeinikova OM (2016) State regulation in the organizational-economic mechanism of agriculture. Bull Low Volga Agro-Univ Complex Sci High Educ 4(44):292–299

9. Popova LV, Lata MS, Mitrofanova IA (2016) Innovation potential of small businesses in the agro-industrial complex. Econ Yesterday, Today, Tomorrow 9:353–364

10. Ovchinnikov AS, Balashova NN, Ivanova NV (2014) Strategy for the Integrated development of rural areas and the effective performance of the agroindustrial complex of the Volgograd region in the context of the WTO. Econ Agric Proc Enterp 1:16–20

11. Choudhary S, Thomas I, Bahrami M, Sumioka M (2019) Accelerating the digital transformation of business and society through composite business ecosystems. In: Advances in intelligent systems and computing, vol 926, Matsue, Japan, pp 419–430

12. Shchutskaya AV, Afanas'eva EP, Kapustina LV (2019) Digital farming development in Russia. Regional Aspect. https://www.scopus.com