

Features of the Impact of Digital Technology Implemented in the Regional Agriculture of Russia on Increasing the Industry's Investment Attractiveness

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Abstract: With the globalization of the food market, Russian agricultural production is under competitive bilateral pressure from the intensified implementation of high-intensity digital technology and increased environmental requirements of the market. The authors examine the prospects for improving the investment attractiveness of the regional agro-industrial complex (AIC) in the implementation of digital technology, taking into account the capabilities of the federal center and the features of the Russian regions. The research uses the method of synthesis of various theoretical approaches to determining the investment attractiveness of agribusiness. Additionally, the authors implement the simulation approach allowing them to build a model of the investment mechanism in the industry on a digital platform. The agricultural sector of the economy depends on the completeness and promptness of government subsidies. This sector is marked with significant financial risks that reduce its investment attractiveness. The authors note that digital technology influences agriculture and rapidly turns it into a kind of biotech business corporation. Therefore, gradual changes occur in the type of structure and features of attracting investment in innovative agriculture, which involves higher profitability and turnover of resources on a digital platform. The agricultural sector transforms in a strategic direction different from the traditional functioning of the industry. Moreover, the qualitative content of the food basket is also changing. In this regard, it seems reasonable to clarify the mechanisms of functioning of producers in the framework of digital technology, the implementation of which will increase the investment

attractiveness of the Russian agricultural sector for domestic and foreign investors. Principles and methods affecting the activation and increase in the inflow of investment resources in agriculture are presented on the example of the Ural Federal District. The authors believe that the investment mechanism in the agricultural sector should be transformed, taking into account the modification of the portfolio of financial instruments and the integration of the efforts of financial institutions to balance and optimize the flow of funds for the transition of the industry to a digital platform.

Keywords: Agribusiness; Infrastructure; Investment attractiveness; Region; Agriculture; Digital technology.

JEL codes: C89; D24; D81; E62.

1. Introduction

The intensive development of information technologies in agribusiness contributes to a significant increase in labor productivity, increase in the industry's investment attractiveness, improvement of the quality of products, and the optimization of more than 47% of the costs of agricultural organizations. In 1960–1980, the efficiency of agricultural production in the country increased only based on the active use of pesticides and mineral fertilizers and comprehensive irrigation of crops. Nowadays, there is a decline in the profitability of using traditional agricultural technologies [2]. In these conditions, the transition of the Russian agricultural sector to Industry 4.0 ensures the growth of investment attractiveness based on the new production capabilities, taking into account intelligent methods of processing land resources. At the same time, smart farming covers only 5%–10% of the land cultivated in Russia. According to Rosselkhozbank estimates, only 5% of the country's agricultural producers actively transform towards the digital trajectory [5]. Worldwide, the most significant emphasis is made on supply chain management technology, robotics, innovative food production, and food e-commerce [4]. In Russian practice, up to 75% of developments aim to develop biotechnology, bioenergy, biometrics, and alternative agriculture [7].

The peculiarity of Russian agriculture lies in the formation of a bipolar agricultural economy. These diametrically opposite functioning conditions include highly profitable large agricultural holdings with broad

access to effective information technology and medium and small agribusinesses operating under conditions of low solvency, debts, and traditional agricultural production technologies. More than 80% of information technology is implemented in large Russian agro-industrial companies. Such companies have already switched from local IT projects of robotization and automation of their divisions and now launch integration programs of multifunctional interaction in the agro-industrial complex (AIC) [9]. The proportion of representatives of large agribusinesses with the accessible broadband Internet is 59.3%, medium agribusiness – 47.1%, small businesses – 28%, and microbusiness – 25.9% [2]. Additionally, the digitalization of agriculture allows one to consider the increasing demands of the market since consumer preferences place increased demands on the organic composition of products, type of packaging, flexible pricing policy, compliance with labeling rules, and continuous monitoring of product delivery [3].

The research objectives are as follows:

- To clarify the content of the economic category “investment attractiveness” in the digitalization of the agrarian economy;
- To assess the dynamics and structure of the process of attracting investment resources in agriculture from various sources, taking into account the technological transformation of the industry on a digital platform;
- To develop tools for attracting investments in agriculture based on increasing its investment attractiveness, taking into account the impact of digital development of the industry.

The most significant reason for the low digitalization of Russian agriculture is the outdated structural and technological platform of the industry. By 1990, the share of capital investments in renovating the property complex of agricultural producers was 16%. By 2019, this figure has decreased seven-fold [7]. For 2010–2019, the profitability in agriculture, forestry, and hunting averaged 7.5%, compared to a national average of 12.6%. The return of production assets in agriculture was at 3.4%, while this criterion was 9.2% for the national economy.

In turn, the digitalization of the technical and technological platform of agriculture in the Ural Federal District (UFD) is still at the initial stage of smart farming – adaptive landscape, precision agriculture, and the

introduction of integrated remote control of agricultural technology. The results of our research reflected that an urgent need for external financial support for own research and development of agricultural producers is one of the priority issues for ensuring market sustainability of the agricultural economy in the UFD. Currently, only regional agricultural corporations have more possibilities to solve the problem of digital content of the industry in the conditions of concentrated information, financial, labor, and material resources. As a result, their activity in mastering digital technology and marketing innovation is 40% higher relative to the agricultural producers as a whole.

We believe that to increase the investment attractiveness of agriculture in the conditions of its large-scale digitalization, it is advisable to form a multi-level integrated zonal information space, taking into account the priorities and features of producers of various organizational and legal forms of farming in the UFD. The main tasks of such a digital space should include the following:

- Provision of financial capacity to introduce information technology through a harmonious combination of own funds, government support, and private investors;
- Filling the shortage of specialists in the digital content of agriculture. According to experts, Russia has four times fewer IT specialists specializing in agriculture than the world's leading countries. The industry currently requires more than 150000 digital experts;
- Creation of information network infrastructure in rural areas, especially in financially weakened regions;
- Improvement of normative and legal regulation of developing information technology in the AIC.

Based on the research results, the authors determined the following measures to improve agriculture's investment attractiveness:

- Incorporating the formation of human capital and environmental improvement into agricultural investments;
- Forming a system of systemic monitoring to identify a particular commodity producer by the structure of sources and the potential return on investment of funds based on the formation of investment passports of potential recipients;

- Developing interaction between science and technology on an applied basis to expand the action of digital technology in agriculture, taking into account the regional specifics of the industry;
- Development of expert diagnostics of efficiency of government financial support for digitalization of small and medium agribusiness;
- Development of methods for a comprehensive assessment of financial and investment potential of agricultural producers in the implementation of digital technology, taking into account the multi-component impact of the most real and significant risks, including the formation of a multi-channel system of financing innovative digital projects;
- Creation of a regional strategic program of digital development of agriculture involving the definition of stages and relevant objectives of innovative development of competitive agriculture under integration conditions.

2. Materials and Methods

The research methodology is based on the definition of the purpose and subject of the research and the substantiation of theoretical aspects, provisions, and methodological approaches. The authors substantiate and justify the close relationship and interdependence of digitalization and stimulation of investment processes in agriculture, as well as the qualitative change in the industry in the external market environment. The authors apply several general scientific methods and private methodological means of economic development of the industry at the stage of its digital transformation as methodological tools, including systematic approach, system and strategic analysis, synthesis, generalization, comparison, statistical observation, index and logical evaluation, monographic method, economic-statistical method, expert observations, and abstract-logical methods and observations.

3. Results

Currently, the branches of mixed agriculture (crop and livestock production combined without specialization in a particular type of activity) are marked with the most significant investment attractiveness in

the UFD. For instance, the value of investments in fixed capital of agriculture varied from 305.4 billion rubles in 2010 to 387.6 billion rubles in 2019 in current prices. In fact, there is no considerable increase in these investments according to comparable estimates (Table 1 and Table 2) [2].

Table 1 Index of physical volume of investment in fixed capital aimed at innovative renewal of agriculture (in comparable prices; as a percentage of the previous year).

Indicators	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Russia	105.28	85.83	108.93	77.66	95.95	90.87	118.87	104.8	105.4	101.7
UFD	109.1	114.2	106.4	101.4	101.3	101.6	107.1	102.0	105.8	100.5
Sverdlovsk Region	130.4	115.9	98.0	96.4	102.9	85.1	86.6	91.4	118.3	110.1
Tyumen Region	107.5	114.9	110.2	102.5	100.9	91.7	113.8	103.8	102.5	87.0
Chelyabinsk Region	99.2	107.6	100.1	104.7	101.8	78.9	105.0	124.3	112.8	80.3
Kurgan Region	73.1	108.1	115.1	84.7	95.9	77.2	103.2	77.4	109.2	138.4

Source: Compiled by the authors based on [2].

Table 2 Index of agricultural production (in comparable prices; as a percentage of the previous year).

Indicators	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Russia	88.7	123.0	95.2	105.8	103.5	102.6	104.8	107.8	107.6	71.40
UFD	102.9	102.9	103.1	102.7	101.9	103.0	101.1	103.5	99.7	103.0
Sverdlovsk Region	106.4	101.4	105.3	104.1	103.9	99.3	97.9	102.1	105.8	105.0
Tyumen Region	103.0	102.4	100.5	98.9	99.7	99.0	99.1	105.2	100.1	101.8
Chelyabinsk Region	99.8	104.9	104.1	105.6	106.5	107.7	98.5	105.2	100.0	102.7
Kurgan Region	104.5	101.3	99.6	98.7	88.2	107.1	104.5	106.1	92.9	101.9

Source: Compiled by the authors based on [2].

According to the authors' calculations, the annual need of agriculture for investment in fixed capital is 2.5–3.0 times higher. Additionally, the practice of Russian agricultural production has an uneven distribution of government support for investment projects between the regions of Russia, on the one hand, and, on the other hand, different dynamics of investment by categories of agricultural producers [1]. For 2010–2019, the

agricultural sector saw a growth of investments in fixed assets by about 9% per year due to an increase in the share of agricultural enterprises operating mainly at the expense of their own funding sources. In the current economic conditions, most agricultural producers in the district cannot use exclusively their own funds to stimulate the development of activities and reinvestment, which is associated with the problem of budget deficit (Table 3).

During the study period, the share of domestic loans received by agricultural organizations in the UFD has increased more than three times. In 2021, foreign investment in agriculture declined by an average of 9%, while domestic investment declined to about 41%. Given the absolute volumes of Russian and foreign investment, we can conclude that the decline is proportional. The proposed model of investment mechanism in the industry on a digital platform results from the research conducted in 2010–2019 in agricultural organizations of Kurgan, Sverdlovsk, Tyumen, and Chelyabinsk Regions of the UFD.

Table 3 The structure of investment in fixed capital in agriculture in Russia by type of financial sources of financing, %.

Investments in fixed capital	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
including own funds	51.0	51.9	54.5	56.9	67.0	59.2	58.5	56.3	52.1	53.6
attracted funds	49	48.1	45.5	43.1	33.0	40.8	41.5	43.7	47.9	46.4
of which: budgetary funds	10.5	10.2	10.5	10.3	7.6	1.8	2.5	2.8	2.2	2.1
including funds from the federal budget	5.6	5.3	5.1	5.0	3.3	0.7	1.2	1.1	1.0	0.8
funds from the budgets of constituent entities of the Russian Federation	3.1	2.9	3.4	3.3	2.7	1.0	1.2	1.6	1.0	0.1
funds from the local budgets	1.8	2.0	2.0	2.0	1.6	0.1	0.1	0.1	0.2	0.2

Source: Compiled by the authors based on [2].

The obtained indicators of the real level of use of the factors and the rating values of their importance were used to calculate the values of current and maximum possible investment attractiveness. The calculations were carried out according to the following methodology:

$$INA_n = Ef_n / (1 - R_n) \quad (1)$$

where:

INA_n – investment attractiveness of the subject;

Ef_n – efficiency of using the n^{th} factor of the subject's resource potential;

R – level of risk of using the n^{th} factor of the subject's resource potential.

Our basic statistical analysis using the correlation and regression analysis method revealed a strong positive correlation between the efficiency of the factors limiting the investment attractiveness of the business entity and the level of efficiency with delayed impact (depending on the factors) in one and two years. In all cases, there was an indirect effect by using the factors of higher-level (let us call them secondary factors). Such a system of dependencies formed the basis for the construction of a predictive model. This model allows us to calculate future results of the economic entity in terms of growth to the maximum possible level of efficiency of using secondary factors. Moreover, it allows us to determine the recommended values of the efficiency of primary factors, leading to achieving the maximum level of efficiency. At the same time, management should aim to improve the use of primary factors to ensure the achievement of the desired results (Table 4).

Table 4 Dynamics of renovation of the material and technical base in Russian agriculture

Indicators	2013–2016 in average	2017–2020 in average
New agricultural equipment purchased by agricultural producers		
including: tractors	12876	10740
harvesters:		
thresher harvesters	5602	5356
forage harvesters	762	656
Energy supply, hp per 100 hectares of cultivated land	153.5	149.4
Loans issued by Rosselkhozbank JSC for the purchase of machinery	10.3	12.7

Volume of financing of constituent entities of the Russian Federation under the “Program to support the renovation of equipment,” bln. RUB	8.2	12.3
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Source: Compiled by the authors based on [2].

A systematic approach to improving and updating the investment attractiveness of agriculture in the context of the introduction of digital technology involves the formation of a portfolio of documents of agricultural producers, including the following:

- Characteristics of the agricultural producer (sown area and arable land, availability and suitability of machinery and equipment, livestock quality, staffing, and key financial results);
- Final cost of the digital project (cost of design work, project implementation costs, infrastructure maintenance, upkeep costs, maintenance costs, and frequency of repair work);
- profitability of the digital project (added value, cost savings, and increased sales of agricultural products).

4. Discussion

Based on the works of Russian and foreign economists, we believe that, under the conditions of innovative transformation of the country’s economy, the economical category of “investment attractiveness” in relation to agriculture can be defined as the creation of optimal conditions for agribusiness on a digital technical and technological platform, allowing to reduce investment risks, increase capital turnover, and encourage priority investment of information, intellectual, technical, technological, and financial resources [6]. The attraction of investment and financial resources in agricultural production in the UFD is due to the need to create additional jobs in the agricultural sector and the food and processing industry, which indeed becomes an essential tool for their further social and economic development. External investors are less valuable than local ones, received from people (locals) ready to associate agribusiness and their lives with the village.

The authors believe that the “exclusion of direct villagers” from agricultural production is a highly undesirable economic phenomenon that can cause social tension in the federal district. Hiding this problem and not solving it in time can lead to extremely serious consequences.

Generalizing the proposals of scholars and researchers, the author proposes to use the following mechanisms of agricultural development in the regions of the UFD (in addition to the existing ones):

- Drawing a roadmap of priority information projects requiring government support;
- Forming an automated database of information projects in the regions by organizational and legal forms;
- Forming standard models of strategic documents of digital development of agriculture in the region to assess the market sustainability of producers;
- Providing preferential government support for digital projects of small agribusiness;
- Forming an innovative and technological platform to integrate science, business, and government to implement digital business projects in regional agriculture;
- Improving the qualifications of personnel working in agriculture;
- Organizing grant competitions at the level of public authorities aimed at stimulating the digital renewal of agribusiness;
- Expanding and deepening interregional cooperation to promote digitalization of agriculture in the region;
- Implementing the system of targeted budgetary places and targeted allocation for universities.

5. Conclusion

The problems of determining new directions of digital development of agriculture and the search for sources of investment and mobilization of existing investment resources for the revival of innovation are relevant to form a competitive agricultural system functioning in conditions of direct dependence on natural and climatic conditions, seasonality, and features of the technological process. These problems can be solved only with the close interaction of investment and innovation processes in agriculture. This fact predetermines the need for a systematic approach to considering investment and innovation in an organic unity and complementarity. The achievement of investment attractiveness in agriculture should be seen as the main result of the practical implementation of the innovative policy of updating the material and technical base on the information platform.

The current approach of the so-called patchwork digitalization (i.e., solving the most pressing problems of implementing information systems using simple solutions and algorithms) reduces the potential of digitalization and does not allow sufficiently assess the resulting economic effect [8]. This research allows us to present a register of factors affecting the level of economic efficiency and investment attractiveness of the economic entity as the first stage of implementing the model of investment mechanism in the industry on the digital platform. This analysis can be useful for management and chief specialists of a particular agricultural organization. In our opinion, the formation of this set of factors should be carried out considering the natural, climatic, and socio-economic characteristics, as well as the available information infrastructure for the implementation of digital projects. Next, it is necessary to conduct an expert survey of employees of the business entity and interview the specialists to establish the level of importance and real use of the system of indicators, taking into account the excess of the importance indicator over the indicators measuring the use of factors.

The proportional and balanced relationship of industries and sub-sectors of the AIC of the UFD implies dividing subsidized entities into two groups. The first group is the Tyumen, Chelyabinsk, and Sverdlovsk Regions of the UFD, which are more attractive to private investors and where the mechanism of public-private partnerships is applicable. The second group includes less attractive territories with a special investment regime from centralized sources (e.g., the Kurgan Region).

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