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ASSESSMENT OF THE INFLUENCE OF NEOINDUSTRIALIZATION FACTORS ON THE SUSTAINABLE DEVELOPMENT OF THE RUSSIA AGRICULTURAL SECTOR

Ivan SANDU, Vasily NECHAEV

Federal State Budgetary Scientific Institution «Federal Research Center of Agrarian Economy and Social Development of Rural Areas - All-Russian Research Institute of Agricultural Economics», 35, kor.2 sh. Khoroshevskoe, Moscow, 123007, Phone: +7499195-60-16, Mobile: +79032382618, +7(925)3514444; E-mails: anna_gu@mail.ru, vin981@yandex.ru

Corresponding author: anna_gu@mail.ru

Abstract

The article examines the factors of neo-industrialization and their impact on the functioning of Russian agriculture. The purpose of the work is to identify the key factors of neo-industrialization and assess their impact on the sustainable development of agriculture. The scale of technological changes has been studied, and a comparative analysis of neo-industrial trends in various sectors of the agro-industrial complex has been carried out. The specifics of neo-industrial processes in livestock farming are characterized in detail. A mathematical model of three-factor linear regression has been developed, characterizing the influence of parameters of technological development of Russian agriculture on changes in gross value added. The results of the empirical analysis allow us to conclude that there is a direct relationship between capital-labor ratio and gross value added, as well as between the number of highly productive workers and gross value added. It has been calculated that the investment component has the greatest influence. Thus, the increase in the share of investments in reconstruction and modernization in fixed capital affects the increase in gross value added by 223.7 billion rubles. The practical value of the results lies in the development of mechanisms to stimulate and support the introduction of innovations in agricultural production in order to accelerate neo-industrialization.

Key words**:** *neo-industrialization, factor analysis, investments, R&D, agricultural sector of the economy, gross value added, organizational and economic mechanism*

INTRODUCTION

In the context of global challenges, the growth of agricultural production and gross domestic product is based on the creation of an innovation and investment model of the agricultural sector that meets the challenges of neo-industrialization. In modern conditions, the task of assessing technological development and prospects for sustainable economic growth in agriculture and other sectors of the agro-industrial complex is becoming more urgent [1, 9]. In the research of domestic and foreign scientists, a stable idea has been formed of neo-industrialization as a process of development of productive forces, ensuring the creation of a fundamentally new scientific, technical and high-tech basis based on automation and computerization of the production process, taking into account balanced technological, socio-economic and environmental development [6, 27].

The effect of the neo-industrialization mechanism is the multiplicative growth of production and increased labor productivity in value chains [24].

The policy of neo-industrialization is aimed at creating conditions for increasing the efficiency of the knowledge-intensive and high-tech sector of the economy and implementing program solutions both for the modernization of main industries and the development of new industries in accordance with the requirements of scientific and technical progress [4, 22].

It is expected that the introduction of one of the breakthrough technologies of artificial intelligence will double the production volumes of the leading countries of the world by 2025 [10].

The strategic action plan in the field of high technologies, as a key direction of Germany's neo-industrialization policy, aims to achieve economic growth and improve the quality of life based on the formation of an innovative environment with the construction of industry 4.0. The key areas are the digitalization of science, education and living conditions [15].

In the UK, the neo-industrialization strategy is aimed at increasing the efficiency of resource use, optimizing production processes based on biotechnology; creation of innovative products based on composite materials; increasing the sustainability of value chains [21].

The neo-industrial concept of China's economy is focused on modernizing agriculture and developing the social sector [28].

The challenges of neo-industrialization are associated with changes in priorities in the hierarchy of competitiveness factors. The introduction of innovations and new knowledge leads to the growth of highly qualified personnel with higher education, an increase in the share of knowledge-intensive industries, and an increase in the output of innovative products, an increase in the scale of production and the development of digital skills of the workforce [7, 16]. Some authors explore the mechanisms of commercial interaction between industrial enterprises, considering such cooperation as one of the most important factors of structural changes in the labor market [8]. H. Kroll., R. Neuhausler identified factors of technological development and presented their contribution to increasing production efficiency [13]. For the Russian economy, the most important areas of transition to neo-industrialization are intersectoral interaction in value chains and the problem of updating the fixed capital of infrastructure sectors [17, 20, 29]. The scientific works of A.I. Tatarkin contain conceptual approaches to the formation of high-tech areas of economic activity and the modernization of traditional industries [25]. It should be noted that there is significant interregional differentiation in the production and use of innovative products, which results in a lack of demand for scientific research results and low capitalization of scientific developments [11,14]. To assess factors and identify neo-industrialization trends, it is recommended to use indicators of technological modernization, human capital, and inter-industry interaction [2, 26]. Positive trends in neo-industrialization are reflected in a stable increase in gross value added, innovative products, growth in labor productivity, growth in capital-labor ratio and capital-labor ratio [18, 19, 23].In developed countries, indicators of capital-labor ratio and capital-labor ratio are a constant object of research and monitoring in order to take appropriate measures of state regulation of innovation activity [3]. To measure labor productivity, the following indicators are used: GDP per hour worked and total factor productivity as the ratio of output to inputs of labor and fixed capital. If the growth of total factor productivity is significantly lower than the growth rate of labor productivity, this indicates a low level of use of innovations and advanced production technologies [12].

The purpose of the work is to identify the key factors of neo-industrialization and assess their impact on the sustainable development of agriculture.

MATERIALS AND METHODS

The methodological basis of the study was the regulatory documents of foreign countries, Russia, open statistical data from Rosstat, the National Research University Higher School of Economics, the Ministry of Agriculture of the Russian Federation, as well as regulatory documents and periodicals.

The conditions and factors of neo-industrialization have been scientifically substantiated, a comparative analysis of non-industrialization trends for various types of economic activity has been carried out, the profile of neo-industrialization of the agricultural sector has been identified, and the key factors of neo-industrialization that contribute to the growth of gross added value have been identified.

The study puts forward a hypothesis: The growth of gross value added occurs due to innovative structural changes as a

consequence of technological development. This hypothesis is confirmed by the results of regression analysis, which revealed a positive relationship between the dynamics of gross added value of agriculture and individual indicators of technological development characterizing the process of neo-industrialization.

RESULTS AND DISCUSSIONS

The agricultural sector of the Russian economy has a high level of resource and scientific potential necessary to achieve a scientific and technological breakthrough and ensure national security. The innovative scenario for the development of agriculture involves the wide spread use of resource-saving technologies and biotechnologies in agriculture, covering about 50% of the arable area. According to experts from the Ministry of Agriculture, about 30% of agricultural producers can use precision farming systems, multi-operational agricultural machines and tools, and also regulate high yields and animal productivity. In livestock farming, the main directions of technological development are related to the development of regional models of organic livestock and poultry farming for the production of products with specified quality parameters; introduction of a breeding system form and aging livestock genetic resources; development of complete feed mixtures with new nutritional properties; application of aerospace digital technologies in pasture farming [5].

Table 1 presents the ranking of factors necessary for the successful implementation of innovative new generation technologies.

Table 1. Assessment of the main factors for the introduction of innovative technologies in livestock farming, % of the total number of respondents.

MainFactors	Innovativetechnologies	
	Development of complete feed mixtures with new nutritional properties	Application of aerospace digital technologies in grazing livestock
Employeetraining	7.6	7.6
Development of material and technical base and infrastructure of science	6.2	7.0
Increased government funding	5.8	6.2
Raising business funds	7.1	7.0
Protection of intellectual property rights	6.5	6.6
Support for international cooperation	4.6	5.7

Source: Own calculations based on data [5].

The scale of neo-industrialization of the economy is characterized by the share of products from high-tech and knowledge-intensive industries in the gross domestic product (Fig. 1).

The dynamics of the indicator in the analyzed period were characterized by significant fluctuations: the highest values were achieved in 2020. This situation is associated with underfunding and insufficient government support for the development of high-tech and knowledge-intensive industries: the level of investment in R&D in the high-tech segment of the Russian economy was about 1% in 2022, and the level of patent activity decreased compared to 2021 by 13 percentage points.

The main indicator of sustainable development of the economy and individual industries is gross value added.

Comparison of this indicator for various sectors of the economy for 2012-2022. showed higher growth rates in agriculture (106.7% compared to 2021); in the economy as a whole there was a drop to 98.7% (Fig. 2).

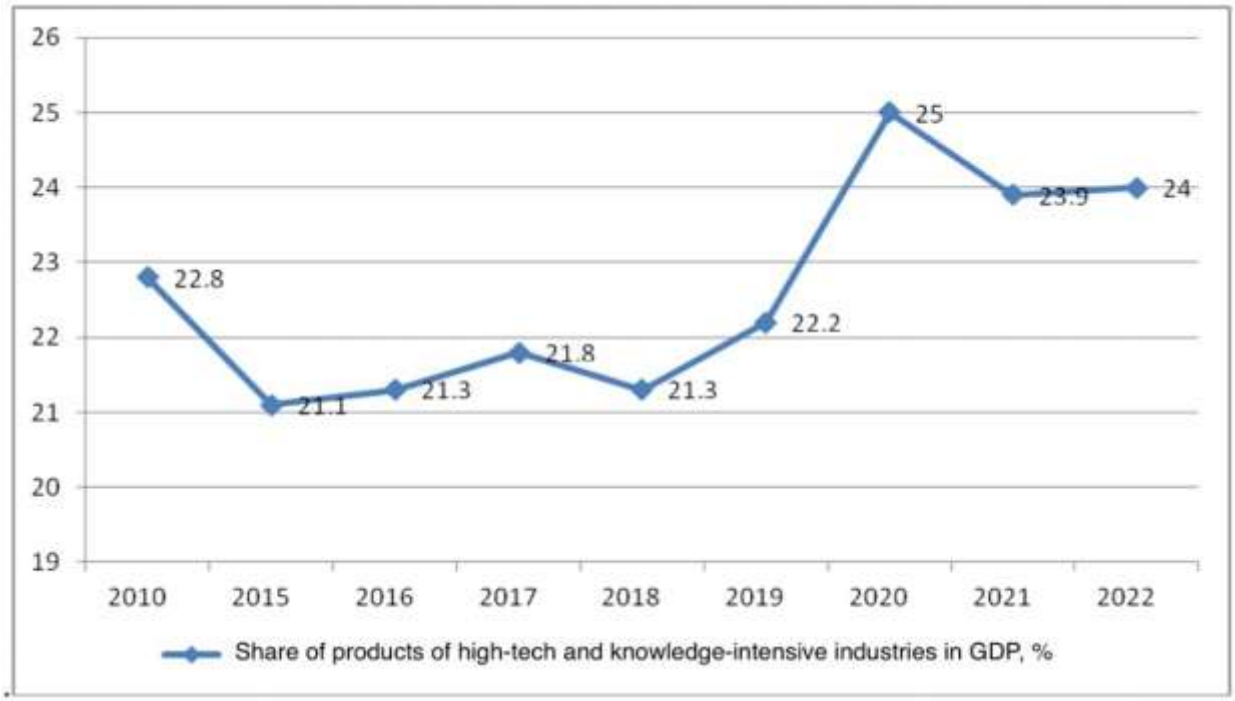

Fig. 1 Share of products from high-tech and knowledge-intensive industries in Russia's gross domestic product, %
Source: Own calculations based on data [5].

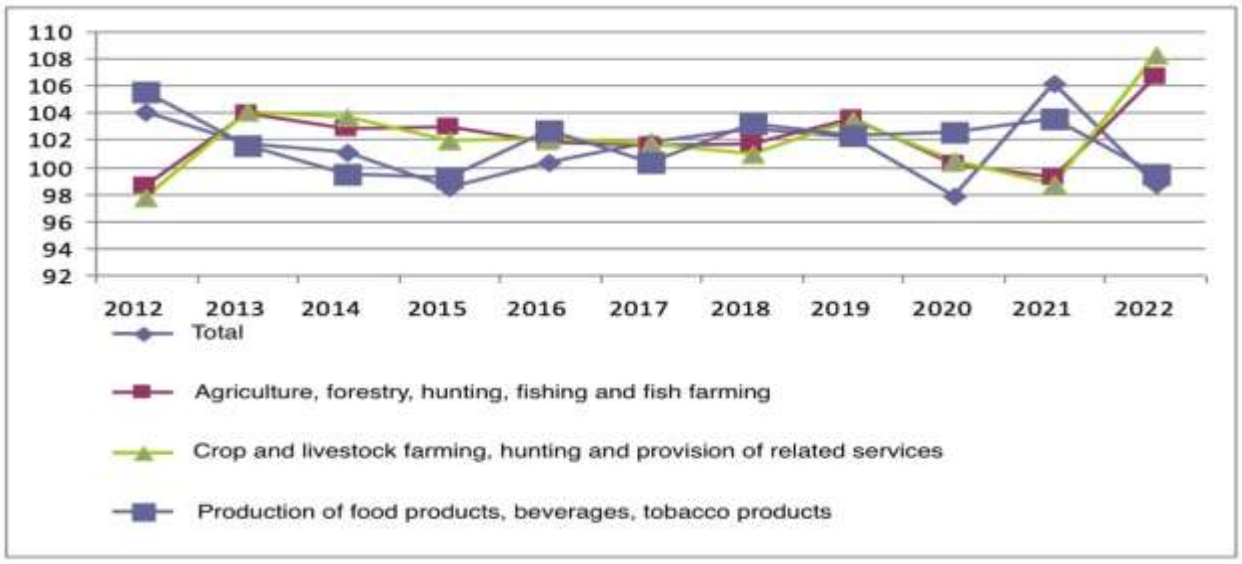

Fig. 2. Indices of physical volume of gross value added by economic sectors, %
Source: Own calculations based on data [5].

To identify the key factors of neo-industrialization, a number of indicators of technological development were used (Table 2).

In the analyzed period, the number of highly productive jobs in agriculture increased significantly (176.1%), which contributed to the rapid growth of production volumes of innovative goods (438.8%).

During the study, the following hypothesis was implemented: the growth of gross added value is realized through the growth of gross added value and structural changes, which justifies the acceleration of the process of neo-industrialization.

To confirm this hypothesis, a relationship was identified between the dynamics of gross value added in agriculture and individual indicators of technological development characterizing the process of agrarian neo-industrialization.

Table 2. Main indicators of neoindustrialization of Russian agriculture

Indicators	2017	2018	2019	2020	2021	2022	2022 as%of 2017
Number of highly productive jobs, thousand units.	438.8	516.6	593.8	653.5	704.2	772.6	176.1
Gross value added, billion rubles. at current prices*	2,896.8	3,101.3	3,390.6	3,811.0	45,490.1	5,317.3	183.6
Share of investments aimed at reconstruction and modernization in the total volume of investments in fixed assets, %*	10.3	9.2	6.3	6.0	7.1	7.3	70.9
Share of investments in machinery, equipment, vehicles in the total volume of investments in fixed capital aimed at reconstruction and modernization %*	12.9	20.3	17.1	19.0	18.4	14.3	110.9
Availability of fixed production assets at full accounting value, billion rubles.	5,791.6	6,462.3	6,575.3	6,908.5	8,006.3	8,502.7	146.8
Volume of innovative goods, works, services, million rubles.	28,446.0	33,829.1	69,559.2	57,832.9	67,339.5	124,824.1	438.8

Source: Own calculations based on data [5].

During the research, a mathematical model of three-factor linear regression was built, characterizing the influence of the parameters of technological development of Russian agriculture on changes in gross value added:

$$Y= -3,810.2+0.546\ X1+9.184\ X2+223.7\ X3 \quad .....(1)$$

$R^2= 0.94$;

where:

Y –gross added value of agriculture, billion rubles.

X1 – capital-labor ratio in agriculture (the ratio of the average annual cost of fixed assets to the average number of workers), thousand rubles.

X2 – number of highly productive jobs in agriculture, thousand units.

X3 –share of investments aimed at reconstruction and modernization in the total volume of investments in fixed capital, %

The coefficient of determination R2 indicates a high degree of connection between the function and the independent variables being studied, which confirms the significance of the developed model.

The database is presented with open statistical data for 2017-2022 on gross value added and indicators of innovative and technological development.

The results of the empirical analysis allow us to conclude that there is a direct relationship between capital-labor ratio and gross value added, as well as between the number of highly productive workers and gross value added.

It has been calculated that the investment component has the greatest influence.

Thus, an increase in the share of investments in the reconstruction and modernization of fixed capital affects the increase in gross value added by 223.7 billion rubles.

The organizational and economic conditions for the development of neo-industrialization of the agricultural sector are associated with institutional transformations, government participation and the development of innovation infrastructure.

CONCLUSIONS

Theoretical and methodological approaches to identifying the most important factors of neo-industrialization are substantiated and an assessment of their impact on the sustainable development of the agricultural sector is presented.

During the research, the following hypothesis was implemented: the growth of gross value added occurs due to innovative structural

changes, which reflects the process of neo-industrialization. To confirm the hypothesis put forward, the relationship between the influence of innovative and technological factors on the dynamics of gross value added was assessed. An empirical assessment of the scientific and technological development of agriculture in the context of branches of the agro-industrial complex was carried out. A typical profile of neo-industrial development in livestock farming has been constructed.A mathematical model of three-factor linear regression has been constructed to characterize the influence of the parameters of technological development of Russian agriculture on changes in gross value added. The calculations show that with an increase in the capital-labor ratio by 1 thousand rubles. the gross added value of agriculture also increases by 0.546 billion rubles, and with an increase in the number of highly productive jobs - by 1 thousand units. the increase in gross value added will amount to RUB 9.184 billion.

The results of the empirical analysis allow us to conclude that there is a direct relationship between capital-labor ratio and gross value added, as well as between the number of highly productive workers and gross value added. It has been calculated that the investment component has the greatest influence. Thus, the increase in the share of investments in reconstruction and modernization in fixed capital affects the increase in gross value added by 223.7 billion rubles. The practical value of the results lies in the development of mechanisms to stimulate and support the introduction of innovations in agricultural production in order to accelerate neo-industrialization.

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