Effective conditions for expanded reproduction of the agro-industrial complex in the region

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Abstract. The article examines the problems of development and reproduction of the agrarian sector of the economy of the Smolensk region, identifies trends in reproduction and problem points that determine the functioning of the industry. The authors identified the main directions for improving the reproduction of the resource potential of agriculture, taking into account external and internal factors. In addition, an econometric model of effective reproduction of agriculture has been developed and proposed, which determines the determinants of the progressive development of the agro-industrial complex in the region. Recommendations on the creation of effective conditions for conducting expanded reproduction in agriculture, taking into account investment activities, innovative development and the level of updating the material and technical base, are proposed.

1. Introduction
At the present stage, the Russian economy is in decline. Economic growth is slowing down; the index of changes in the physical volume of the country's GDP in relation to the previous year is decreasing, approaching zero. Therefore, if in 2018 the growth was in a comparable estimate of 2.5%, then in 2019 - 1.3%, and according to preliminary estimates in 2020, this indicator will be negative within 4-5%. All the aggravating problems associated with the spread of the pandemic and the introduction of quarantine measures of an economic nature do not stimulate the development of the economy [1-2]. In conditions of strong instability of the national and world economies, strengthening of anti-Russian sanctions, all mechanisms of state support for the main sectors of the national economy, including the agro-industrial complex, have been practically reduced to a minimum [3].

Under the current conditions, it is required to determine the dominant factors that make it possible to create effective conditions for expanded reproduction of the basic branches of the agro-industrial complex [4-6]. This will allow getting away from stagnation of production, to operate comfortably for agricultural producers in the difficult conditions of the spread of coronavirus infection. The formation of optimal conditions for expanded reproduction is especially important given the gradually growing budget deficit.

2. Materials and methods
The study was carried out using economic and statistical data characterizing the state of reproduction of the agrarian sphere of activity in the Smolensk region. The object of the research is the level of reproduction and development of the agro-industrial complex. In the course of the study, the factors
and conditions for effective reproduction were identified with the construction of deterministic econometric models.

The work used the data of statistical reporting of agricultural organizations of the Smolensk region and the Federal State Statistics Service for the Smolensk region, applied methods of econometric modeling, economic, and statistical.

3. Results and discussion
Experience shows that only a sufficient level of expanded reproduction allows sustainable development of agricultural production in the long term [7-8]. From a theoretical standpoint, expanded reproduction assumes a continuous production process, taking into account the renewal of the production potential of the enterprise, both in quantitative and qualitative terms. At the same time, these indicators should increase in dynamics, increasing the efficiency of production and the competitiveness of agricultural products.

The influence of factors on the level of reproduction processes and its boundaries can be assessed using dynamic econometric models. The studies carried out indicate that, taking into account the specifics of the agricultural sector, the indicator of "long money", the boundaries of the types of reproduction in agriculture have their own characteristics. Calculations show that the minimum level of profitability, which is required for expanded reproduction in the industry, is 40-45%; ensuring simple reproduction is possible at a level of at least 15-20%.

The assessment of the economic state of the development of agricultural production in the Smolensk region indicates a low level of reproduction processes in the agricultural sector of the region and the need to develop an effective economic mechanism that can overcome the existing problems in the region's agriculture.

The lack of favorable conditions for the reproduction of the labor force, the low prestige of agricultural labor in the region leads to the problems of a shortage of personnel. So, only for the period 2005-2019 the average annual number of people employed in agriculture and forestry decreased by 63.8%, if it speaks about agricultural organizations, then in 2018 less than 6 thousand people worked in them, which is 6 times less than in 2000 (table 1).

Table 1. Dynamics of the conditions for the reproduction of labor resources in agriculture of the Smolensk region.

| Name                                        | 2005  | 2010  | 2015  | 2017  | 2018  | 2019  | 2019 to 2005 as a percentage |
|---------------------------------------------|-------|-------|-------|-------|-------|-------|-----------------------------|
| Average annual number of employed by type of economic activity - agriculture, hunting and forestry, thousand people | 61.1  | 58.4  | 53.9  | 25.0  | 24.1  | 22.1  | 36.2                        |
| Average monthly nominal accrued wages of employees, rubles | 3025  | 7467  | 14898 | 16825 | 20964 | 22426 | 741.4                       |
| Real accrued wages as a percentage of the previous year | 112.6 | 105.2 | 90.9  | 99.9  | 108.7 | 101.7 | 90.3                        |
| Average monthly wages in relation to the average in the economy, percent | 48.9  | 51.5  | 63.5  | 64.0  | 71.3  | 71.7  | 146.7                       |
| The purchasing power of workers' cash income: Beef, kilogram | 49    | 78    | 68    | 66    | 63    | 63    | 128.6                       |
| Milk, liter                                  | 389   | 419   | 463   | 422   | 439   | 438   | 112.6                       |

The qualitative characteristics of the personnel potential of the agricultural sector are also decreasing, which entails the degradation of rural settlements and social infrastructure [9-10]. Despite
the fact that the level of wages in agriculture has grown by 51% over the past 4 years, the real wages of workers have hardly changed. Therefore, the index of change in real accrued wages over the past five years was significant only in 2018 - the growth was 108.7%.

The national project and state program for the development of the agro-industrial complex envisages bringing the level of wages to the average for the economy, but, unfortunately, in 2018 it was just over 70% of its value (in 1985, the level of wages was 99% of the average for national economy). Not all this contributes to the influx of personnel into the industry and the growth of young specialists. Even the measures envisaged for graduates of educational institutions of an agricultural profile within the framework of the State Program for the Development of Agriculture and Regulation of the Markets of Agricultural Products, Raw Materials and Food for 2014-2020 do not yet give a tangible effect.

Thus, there is a narrowed reproduction of personnel - the most important active factor in agricultural production, which negatively affects the efficiency of the industry.

The conducted studies show the unsatisfactory condition of land resources, the presence of negative factors for their expanded reproduction (table 2).

**Table 2.** Analysis of the state and development of land resources in agriculture of the Smolensk region.

| Indicators                                                   | 2000  | 2005  | 2010  | 2013  | 2018  | 2018 to 2000 as a percentage |
|--------------------------------------------------------------|-------|-------|-------|-------|-------|-----------------------------|
| Total agricultural land, thousand ha                        | 1851  | 1726  | 1658  | 1666  | 1261  | 68.1                         |
| Of which arable land                                        | 1321  | 1256  | 1209  | 1216  | 844   | 63.9                         |
| Including in agricultural organizations                      | 1093  | 1051  | 790   | 759   | 359   | 32.8                         |
| Sown area                                                   | 782   | 547   | 476   | 454   | 304   | 38.9                         |
| Including in agricultural organizations                      | 689   | 478   | 392   | 380   | 211   | 30.6                         |
| The utilization rate of arable land in agricultural organizations | 63.0  | 45.5  | 49.6  | 50.1  | 58.8  | 93.2                         |
| Application per 1 hectare of sowing:                        |       |       |       |       |       |                              |
| - mineral fertilizers, kg                                   | 17    | 9     | 13    | 11    | 47    | 276.5                        |
| - organic fertilizers, tons                                 | 1.2   | 1     | 2     | 2.4   | 1.6   | 133.3                        |
| The specific weight of the fertilized area with mineral fertilizers in the entire sown area, percentage | 30    | 18    | 24    | 25    | 48    | 160.0                        |

Thus, the size of agricultural land used in production during the study period decreased by 21.8%, including arable land by 26.1%. Currently, various types of erosion have destroyed more than 40% of agricultural land in the region, including at least 20% of arable land and 30% of pastures. According to experts, the unused agricultural land in Russia in 2018 was from 40 to 80 million hectares. Taking into account this estimate, such an area can fit the territories of many countries - 2.2 areas of Germany, 1.2 the size of France, almost 9 areas of Portugal. According to the priorities of state policy, through the implementation of targeted programs and national projects, it is planned to reintroduce 12 million hectares of land into circulation by 2030. Taking this into account, in 2018, in the Smolensk region, about 30 farms put into circulation more than fifty thousand hectares of agricultural land.

In Central Russia - Smolensk, Tver, Vologda, Yaroslavl, Kirov regions - up to half of the arable land is not used. All this reduces the possibilities for conducting expanded reproduction and increasing the efficiency of the financial and economic activities of farmers.
In agricultural organizations, the sown area decreased by 69.4% to 211 thousand hectares in 2018, and the utilization rate of arable land did not exceed 60%. All this leads to degradation of the land potential of agricultural production, to the withdrawal of high quality and fertile land from circulation. An increase in the level of application of organic and mineral fertilizers to the soil should be noted as a positive trend. So, in 2018, 47 kg of mineral fertilizers were applied per hectare of sowing (277% of the 2000 level) and the specific weight of the cultivated area was 48% of the total sown area (against 30% in 2000). However, this is largely due to the sharp decline in cultivated agricultural land.

A reduction in the fodder base leads to a decrease in the number of livestock of different types of livestock. For the period 2000-2018 the decline in the number of cattle in all categories of farms was 2.8 times, including cows - 3.4 times, sheep and goats - 1.9 times, poultry - 1.7 times. As of January 1, 2019, there were only 112 thousand head of cattle in the region, including 54.1 cows.

With the material and technical potential in agricultural production, there are also problems associated with the reproduction and movement of fixed assets (Table 3).

| Name                                      | 2000 | 2005 | 2010 | 2013 | 2015 | 2018 | 2018 to 2000 as a percentage |
|-------------------------------------------|------|------|------|------|------|------|-----------------------------|
| Renewal rate, percent                     | 1    | 4.1  | 28.9 | 10.7 | 6.1  | 7.9  | 7.9                         |
| Retirement rate, percent                  | 3.1  | 5.4  | 4.9  | 6.3  | 3    | 4.8  | 154.8                      |
| Depreciation of fixed assets, percent     | 50.1 | 52.7 | 33.6 | 33.2 | 38.7 | 46.0 | 91.8                       |
| Funding capacity per 100 hectares of agricultural land, thousand rubles | 1031.3 | 1014.9 | 1587.9 | 2148.1 | 2232.0 | 3658.1 | 354.7                      |
| Capital-labor ratio, thousand rubles      | 232.8 | 286.7 | 450.8 | 640.2 | 688.3 | 2087.3 | 8.9                        |

The degree of renewal and modernization of fixed assets increased over 2000-2018 8 times. The renewal rate was 7.9%, which became possible thanks to the permanent State Program for the Development of Agriculture for 2013-2020, and the Federal Scientific and Technical Program for the Development of Agriculture for 2017-2025. The capital-provision and capital-labor ratio increased by 3.5 and 8.9 times, which is largely due to inflationary processes and a sharp reduction in cultivated agricultural land.

At the same time, it should be noted that the degree of depreciation of fixed assets has increased over the past few years and reached 46% in 2018. This negative trend suggests that even taking into account the growth rate of the material and technical base, the pace of modernization and replacement of production potential is insufficient. If it speaks about the degree of wear of the active part (machinery, equipment, transport) of fixed assets, then here the indicator is even higher - almost 50%. The technical and energy security of agricultural production has worsened.

The growth of investments in fixed assets has a beneficial effect on the level of development of the material and technical base of the agro-industrial complex, makes it possible to carry out a deep modernization of production potential.

In recent years, the Russian Federation has seen a steady increase in investment in fixed assets both in the economy as a whole and in the agricultural sector. However, this trend is unstable. So, if in 2005 and 2016 the annual growth in a comparable estimate was 109.5 and 113.3%, respectively, then in 2010 and 2015 there was a decline rate with indicators of 89.1 and 91.2%, respectively. At the same time, in actual prices, their volume for the study period increased by 5.3 times. The decline in the growth rate of investment activity in recent years is alarming. If in 2016 the growth rate of investment
activity in the Russian Federation was 13%, and in the Smolensk region in 2017 by 2.6 times, then in 2019 these indicators fell to 1.7 and 21.2%, respectively.

Negative tendencies in the dynamics of investment activity in the agricultural sector hinder sustainable development and do not create conditions for conducting expanded reproduction in the industry. It should be recognized that the material base of agriculture is developing unevenly and at a low rate.

Positioning profitability as the main indicator of the optimal conditions for expanded reproduction in the agricultural sector of the economy, we have built an econometric model of the dependence of the indicator of the efficiency of the functioning of the industry in conditions of expanded reproduction on indicators of the development of the material and technical base, factors of investment and innovation activity.

The indicators of the development of the industry for 1990-2019 were used as primary data. The economic and mathematical model takes into account that a number of factors (the coefficient of renewal of the resource potential, investment activity) have an impact with a certain delay, with a certain time lag. In this regard, the developed model is dynamic, which takes into account the value of the variables both at the current and to the previous moments of time, thereby reflecting the dynamics of the studied phenomena at each moment of time. We used distributed lag models, in which the values of a variable for past periods of time (lagged variables) are directly included in the model. Because of the research carried out, a model of the following type (1) was built:

\[
Y_t = -6.53 + 2.34 \times x_{1,t-1} + 0.53 \times x_{2,t} + 0.08 \times x_{3,t-1} \quad R^2 = 0.74
\]

where \( x_1 \) - is the level of investment in fixed assets in a comparable estimate, as a percentage of the previous year;
\( x_2 \) - is the level of innovative activity of the industry enterprises, percent;
\( x_3 \) - coefficient of renewal of production potential, percent;
\( Y \) - the level of production profitability, percent.

This model shows that almost 75% of the changes associated with the efficiency of functioning and the creation of conditions for expanded re-production of the industry are determined by indicators of updating the material and technical base, investment activity in the industry, as well as the level of development of resource potential on an innovative basis.

Calculations show that with an increase in the level of innovative activity by 1%, the profitability of production grows by an average of 0.53%, and an increase in the level of investment in production potential by 1% allows for an increase in profitability of 2.34%.

4. Conclusion

The assessment of the economic state of the functioning of agricultural organizations made it possible to identify the dominant development factors and the creation of effective conditions for expanded reproduction. The growth of the level of innovative activity, the use of scientific and technical innovations makes it possible to increase the efficiency of the industry and to conduct expanded reproduction in agriculture. To support this economic effect, it is advisable to increase the size of investments in the base capital, which to a certain extent is a protective function from economic sanctions, and on the other hand, increases the competitiveness of the industry's products. Econometric modeling and calculations show that the creation of effective conditions for expanded reproduction is possible by increasing the level of investment and innovation activities, constantly updating the material and technical base based on new technologies and scientific and technological progress.

The number of systemic measures that contribute to the dynamic development of the industry and the growth of the level of expanded reproduction include an increase in the network of ICS services, the creation of conditions for increasing the profitability of agricultural organizations, effective management of the modernization of production potential, the development of agricultural consumer cooperation, and the strengthening of the digitalization of the agricultural economy.
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