

# Current state and prospects for the development of the material and technical facilities of agriculture

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**Abstract.** Modern agricultural production should be based on the reliable innovation-oriented material and technical facilities, which will create reliable prerequisites and guarantees for national food security. Until now, many sectors of the Russian economy and its agro-industrial complex, in particular, are significantly dependent on foreign supplies of equipment and innovative technologies. Given the specifics of agricultural production in Russia, an important role in solving the problem of technical and technological modernization of agriculture should be given to state support. In recent years, there has been a reduction in the number of agricultural machineries in the region under study and, as a result, at the same time, the operational load on it is growing, which leads to its intensive wear and tear, breakdowns, and, consequently, to frequent current and major repairs. As a result, the cost of production increases, the efficiency of agricultural production decreases. An important direction in the process of optimizing the operation of equipment is the correct ratio between the rate of its renewal and the efficiency of its use. At the present stage of development of the material and technical facilities of the regional agro-industrial complex, it is advisable to develop organizational and managerial measures in order to use the existing production potential effectively.

## 1 Introduction

The effective development of the material sphere of production of the national economy of the country should be based on reliable, innovative, digitalization-oriented, high-performance material and technical facilities. This is especially true for such areas of material production as industry and agriculture, where GDP, national income and surplus value are created. The state and level of development of the material and technical facilities of the agricultural sector in the country in recent years has had a positive trend towards the growth of quantitative indicators of the availability of fixed assets, primarily in monetary terms. However, there are many unsolved problems that are covered in scientific publications. Many works of domestic and foreign scientists [1-8] and our research as well

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[9-14] are devoted to issues of effective use of fixed assets. Some authors see the key directions for the development of the industry and its material and technical facilities in the direction of state support [15-18], others, in the innovation component [19, 20], as well as digitalization and digital transformation [21]. Many researchers are convinced that the solution to the problems of food independence and security of the country relies, first of all, on the material and technical facilities and the effectiveness of its organization. Today, according to a number of scientists [22] there is a high dependence of the country on foreign innovative technologies, technological equipment, seed and breeding material. When solving this important problem, it is proposed to improve the sectoral scientific and technological policy, to intensify the inflow of private domestic investment in the agro-industrial complex. In providing the country with new equipment and technologies and taking into account the difficult geopolitical situation, the authors of a number of publications [23] propose to carry out new industrialization of the agricultural sector of the national economy. An important role in this process should be given to state support for agriculture, given that it has an unequal impact on agricultural production in various forms of ownership and management, which means that a differentiated approach to this form of state assistance is needed. In the context of economic sanctions particular attention should be paid to risks present in the process of updating the machine and tractor fleet. Many experts recognize the key role and importance of fixed assets in the efficient agricultural production [24], on which important indicators of the financial and economic activities of agricultural enterprises depend, in particular, such as productivity and working conditions, product quality, and the achievement of food security of the state. It is proposed, for example, to choose the most rational form of reproduction, taking into account the grouping and classification of agricultural organizations, depending on the growth rates of fixed assets and the growth rate of capital productivity. The problems of technological sovereignty are discussed in works of a number of authors [25], in which the need to create national material and technical facilities based on domestic equipment and technologies is substantiated in order to remove dependence on foreign technologies. The work of T.Yu. Sushkova and N.A. Ivanova [26] is devoted to the productivity of regional fixed assets, where the role and importance of depreciation deductions as a legitimate source of reproduction of fixed assets is analyzed. At the same time, there is a decrease in the investment role and purpose of the depreciation fund, indicating the extensive nature of the process of reproduction of fixed assets. An important role in the effective use of modern equipment and technologies is assigned to productive forces, i. e. employees of agricultural enterprises servicing new equipment and technologies, who must have professional skills and competencies when working with it. The author believes [27] that the evolution of technology contributes to the formation of new technological structures in the state economy and changes in the development of productive forces affect changes in the technical and technological structure. Given that the country has a lot of obsolete equipment that cannot be restored, creates a threat to environmental safety and human health, so it becomes necessary to dispose of it. A number of researchers write about the harm to humans and nature caused by harmful substances in it, such as lead, asbestos, acids [28]. In order to eliminate the threat to environmental safety, such equipment should be disposed of, and not stored for many years in special parking lots because it also takes up a lot of space and territory, and requires large costs for its storage.

## **2 Materials and methods**

Thus, the problem of the effective use of non-current assets is multifaceted and its solution must be comprehensive and take into account the specifics of the agricultural mode of production in Russia. In statistical reporting, the availability of equipment and the size of

fixed assets by type of economic activity are among the key parameters that reflect the state of the material and technical facilities of all sectors of the national economy. In addition, the types of agricultural machinery used in the agro-industrial complex of the region and its structure reflect the regional areas of activity and specialization. But, as a rule, the monetary value of non-current assets and their positive dynamics creates the illusion of an increase in the value of fixed assets of agriculture, and this process proceeds mainly due to high prices for products of the engineering industry for the agro-industrial complex, but actually does not reflect the effect (result) of using this expensive machinery. Thus, in modern conditions, the economic assessment of the work of the agricultural sector with only one indicator characterizing the growth in the value of non-current assets is far from objectivity and does not reflect the essence of investment processes taking place there. From our point of view, important parameters in an objective assessment of the material and technical facilities of the agricultural sector is the assessment of the presence and dynamics of the number of equipment, its quantity per unit of cultivated land area (area of arable land, cultivated area, agricultural land).

Ryazan region is a major producer of agricultural products, which are consumed not only within the region, but also exported outside of it, as well as abroad. Table 1 presents data on the organization of the material and technical facilities of the agricultural sector of the region for 2005-2020, which shows the dynamics of changes in the amount of equipment. For a more objective assessment of current trends, the data were taken for a very long period of time - 15 years.

**Table 1.** Material and technical facilities of the agro-industrial complex of the region for 2005-2020, pieces.

Type of equipment	2005	2010	2015	2020	Change over the period
Tractors (including equipment on which earth-moving, reclamation and other machines are mounted)	6 976	4 376	3 496	3 289	-3 687
Change index	1.00	0.63	0.50	0.47	-0.53
Combine harvesters	1 778	1 111	957	997	-781
Change index	1.00	0.62	0.54	0.56	-0.44
Potato harvesters	122	37	40	40	-82
Change index	1.00	0.30	0.33	0.33	-0.67
Forage harvesters	524	334	237	205	-319
Change index	1.00	0.64	0.45	0.39	-0.61
Beet harvesters (without haulm harvesters)	106	51	35	21	-85
Change index	1.00	0.48	0.33	0.20	-0.80
Planters	2 249	1 331	966	688	-1 561
Change index	1.00	0.59	0.43	0.31	-0.69

As it follows from the presented analytical data, there is stable dynamics associated with reduction in the number of machines in the region. There is a negative trend for all nomenclature positions and types of agricultural machinery. A significant reduction in the number of tractors is observed, so during the study period, the number of tractor fleet decreased by 3 687 units or 53% compared to 2005. There is also a significant reduction in the number of grain harvesters, minus 781 units or 44%, forage harvesters have minus 319 units or 61%, beet harvesters have minus 85 units or 80%. Thus, according to our research data, the region has significantly reduced the size of the material and technical facilities of the agriculture by reducing the number of machines. Reducing the number of machineries

can be justified if they are replaced by more high-performance machineries. Given that the region is increasing the volume of agricultural production, especially grain, the process of reducing the number of machines (combines, tractors, planters, etc.) is not entirely justified. It is possible that this reduction is due to physical and moral depreciation of decommissioned machines, however, the rate of such decommissioning is very high, which may lead to the inability of the agricultural sector to carry out agricultural work in a timely manner in optimal agrotechnical terms and to receive the planned yields. This is confirmed by the data of Table 2, which presents the indicators of the share of agricultural machinery per unit (1 000 ha) of cultivated land in the region for 2005-2020.

**Table 2.** Provision of regional agricultural organizations with machinery.

Indicator	2005	2010	2015	2020	Deviation
Tractors per 1 000 hectares of arable land, pcs.	8	6	4	3	-5
Change index	1.00	0.75	0.5	0.4	-0.6
Machines per 1 000 hectares of crops, pieces:	5	4	3	2	-3
combine harvesters	1.00	0.8	0.6	0.4	-0.6
Change index	17	15	10	12	-5
potato harvesters	1.00	0.9	0.6	0.7	-0.3
Change index	12	9	7	6	-6
beet harvesters	1.00	0.8	0.6	0.6	-0.5

Thus, Table 2 shows a steady downward trend in the proportion of all important types of agricultural machinery per unit of land in the region. As a rule, a reduction in the number of tractors and combines leads to an increase in the intensive operation of equipment and machinery. For example, the number of tractors per 1 000 hectares of arable land in the region decreased by 3 units or 40%, the number of combines per 1 000 hectares of grain crops decreased by 3 units or 40%, the number of potato harvesters decreased by 70% and the number of sugar beet harvesters by 50%. All these indicators show that, with a stable area of agricultural land, including arable land and land with crops, which has been preserved in the region for many years, the specific load per unit of machinery is growing exactly at the level of machineries reduction, which leads to its rapid physical wear and tear, provokes frequent maintenance and overhauls, and as a result, increases the cost of production. Decommissioned machineries should be replaced with more high-performance, innovative machines and modern progressive technologies. A serious obstacle to this process is the high cost of new machineries and technologies for the agricultural sector. Many agricultural producers, especially medium and small farms, cannot afford to buy such expensive equipment, the cost of which is equal to more than one annual harvest, therefore, more than ever, state support for the industry, especially small and medium farms, is important, which cannot be limited only to providing loans for low-interest investment goals, but farmers also need a targeted state program for the development of the material and technical facilities of the agricultural sector, which should provide for a system and mechanisms for stimulating and intensifying investment activities in the creation of a new material and technical facilities by providing interest-free loans, and sometimes direct state subsidies for the purchase of new machineries and technologies, primarily for small and medium-sized enterprises. This is especially true for Russia, as a country with different patterns and methods of production, where large-scale and small-scale production takes place.

Evaluation of the productivity of non-current assets, from our point of view, should be carried out according to such key parameters as capital productivity and capital intensity. If the first indicator reflects the productivity of the material and technical facilities in terms of the industry's gross output in current prices per unit value of non-current assets, then the second one reflects the level or degree of participation of non-current assets in the production of a unit of gross agricultural output. Both indicators are interconnected, and if the first should tend to increase, the second one is inversely proportional, which means that the effect is manifested in its steady decline, i. e. the less the value of fixed assets is "bogged down" in the value of gross output, the better and higher the result (economic effect) from the productivity of non-current assets is. Table 3 shows an analytical study of regional indicators of the productivity of non-current assets and presents the dynamics of changes in key parameters of this productivity for 2005-2020.

**Table 3.** Regional performance indicators for the use of non-current assets for 2015-2020

Indicator	2010	2015	2019	2020	Change over the period
Agricultural products, million rubles	24 622.0	47 946.0	65 647.0	64 688.0	+50 879
Change index	1.00	1.95	2.67	2.63	+1.63
Fixed assets of agriculture (at the end of the year at book value), million rubles	22 856.9	38 660.0	63 608.0	69 086.8	+54 296.8
Change index	1.00	1.69	2.78	3.02	+2.02
Return on assets, rub.	1.08	1.24	1.03	0.94	-0.14
Change index	1.00	1.15	0.95	0.87	-0.13
Capital-output ratio, rub.	0.93	0.81	0.97	1.06	+0.13
Change index	1.00	0.87	1.04	1.13	+0.13

The results of the study presented in Table 3 indicate that there has been a trend in the region associated with a decrease in the productivity of non-current assets in agriculture. Specifically, the rate of return on assets for 2010-2020 decreased by 0.14 p.p., while the capital-output ratio increased by 0.13 p.p. This result was strongly influenced by two parameters, the value of gross agricultural output and the value of the industry's fixed assets (at book value). Moreover, the increase in the production of gross agricultural output over a ten-year period by 50 879 million rubles was ensured by the increase in fixed assets of the agro-industrial complex at the level of 54 296.8 million rubles. Thus, the growth rates of non-current assets significantly outpaced the growth rates of production volumes, which reduces the productivity of non-current assets in the industry.

### 3. Results and discussion

For a more objective assessment of the productivity of non-current assets in the agro-industrial complex of the region, through the parameter of capital-output ratio, we take the most typical period with a five-year interval, namely 2015 and 2020.

**Table 4.** Analytical assessment of the productivity of non-current assets of the region through the indicator of capital-output ratio of manufactured products

Indicator	2015	2020	Changes over the period, (+/-)
Gross agricultural output of the region in actual prices, million rubles	47 946.0	64 688.0	+16 742.0
Fixed assets of agriculture (at the end of the	38 660.0	69 086.8	+30 426.8

year at book value), million rubles			
Productivity of fixed assets (capital-output ratio), rub.	0.81	1.06	+0.25
Conventional indicator "conventional capital-output ratio in the agricultural sector of the region", rub.	1.44		
Determining the degree of influence of factor "fixed assets of agriculture (at the end of the year at book value) (annual average)", rub.	+0.63		
Determining the degree of influence of factor "gross agricultural output of the region (in actual prices)", rub.	-0.38		
Compliance check	1.06-0.81=+0.25; +0.63-0.38=+0.25 Complies		

When efficient operation of the agro-industrial complex, the parameter of capital-output ratio should decrease, in our case, in 2020 it increased by 0.25 p.p. compared to 2015, which is a negative trend indicating a decrease in the level of productivity of non-current assets in the region and deterioration of the process of using the fixed assets of agriculture. So, the processes associated with a decrease in the productivity of non-current assets go on in the region. This trend can be traced over a fairly long period, namely, from 2015 to 2020. As a rule, an increase in the value of non-current assets leads to an increase in the capital-output ratio, which is shown in an analytical study and decomposition of this indicator into factors affecting it (Table 3), but the main goal of increasing the size of the material and technical facilities is to stimulate the growth of agricultural production, in our case, the growth in the value of fixed assets ensured an increase in the volume of agricultural production at the level of 16 742 million rubles, which allowed to reduce the capital intensity of the products received by 0.38 p.p. At the same time, the growth in the value of non-current assets for the specified period by 30 426.8 million rubles led to the fact that the capital-output ratio of products increased significantly by 0.63 p.p. As a result, the growth rate in the valuation of the material and technical facilities of the region significantly outpaced the rate of return on these investments and reduced the productivity of non-current assets by almost 2 times.

## 4 Conclusion

Thus, according to calculations, an increase in the value of non-current assets by 0.63 p.p. ensured an increase in gross agricultural output by only 0.38 p.p. which has led and may lead to a more significant decrease in the productivity of the regional fixed assets. The key goal and task at the present stage of the economic development of the regional industry is to operate the already created fixed assets most correctly and efficiently and master the already invested financial resources, more rationally use the existing material and technical facilities, equipment, technologies. In this case, an urgent problem arises related to the development and implementation of an effective organization and management of production in the agro-industrial complex. It is advisable to improve the existing system for managing the production process, non-current assets, conduct a critical analysis of the organizational structure of production and, if possible, eliminate unnecessary elements and links in the management chain, increase the responsibility of the managerial personnel in the industry for the results of their work and professionalism. It is these areas that are priority at the present stage of economic development of the regional agro-industrial complex and its material and technical facilities. Increasing the value of non-current assets

in monetary terms at the present stage of development of the regional industry is an inefficient and inappropriate process.

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