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## SPATIAL DISPARITIES IN SUSTAINABLE AGRICULTURAL DEVELOPMENT

Research article

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**Abstract**

The article raises the problem of sustainable development of agriculture in the spatial aspect. The purpose of the article is to identify trends in the territorial placement of agricultural production, taking into account new challenges in the field of food security. The study is based on the provisions of the theory of placement and the theory of marginal cost efficiency. Information and analytical support for the study is the author's database characterizing the state of agriculture and the level of its socio-economic development in the context of constituent entities of the Russian Federation for 2017–2022. To process the data, methods of statistical grouping of constituent entities of the Russian Federation by the cadastral value of 1 hectare of agricultural land were used. It was determined that the investment activity of commodity producers is most pronounced in regions with favorable territories for growing crops and animals. These categories of constituent entities of the Russian Federation are basic in the process of forming the physical availability of products. It was revealed that the release of an additional unit of production in these regions will cost more than in entities with less favorable economic conditions. In this regard, new current and capital investments in production in areas with favorable natural and economic conditions may generate a tendency to reduce the economic availability of products. It is substantiated that additional investments from agricultural businesses, banks and the state should be linked to the competitive advantages of regions in ensuring a balanced formation of physical and economic availability to the level of rational consumption standards.

**Keywords:** spatial development; territorial distribution; capital intensity of production; spatial disproportions; availability of products.

## ПРОСТРАНСТВЕННЫЕ ДИСПРОПОРЦИИ В УСТОЙЧИВОМ РАЗВИТИИ СЕЛЬСКОГО ХОЗЯЙСТВА

Научная статья

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**Аннотация**

Поднимается проблема устойчивого развития сельского хозяйства в пространственном аспекте. Цель статьи — выявить тенденции территориального размещения производства продукции сельского хозяйства с учетом новых задач в сфере обеспечения продовольственной безопасности. В основе исследования используются положения теории размещения и теории предельной эффективности затрат. Информационно-аналитическое обеспечение исследования — авторская база данных, характеризующая состояние сельского хозяйства и уровень его социально-экономического развития в разрезе субъектов РФ за 2017–2022 гг. Для обработки данных применялись методы статистической группировки субъектов РФ по кадастровой стоимости 1 гектара сельхозугодий. Определено, что инвестиционная активность товаропроизводителей наиболее ярко выражена в регионах с благоприятными территориями для выращивания сельскохозяйственных культур и животных. Эти категории субъектов РФ являются базовыми в процессе формирования физической доступности продукции. Выявлено, что выпуск дополнительной единицы продукции в этих регионах обойдется дороже, чем в субъектах с менее благоприятными условиями хозяйствования. В этой связи новые текущие и капитальные вложения в производство на территориях с благоприятными природно-экономическими условиями могут породить тенденцию к снижению экономической доступности продукции. Обосновано, что дополнительные вложения со стороны аграрного бизнеса, банков и государства целесообразно увязать с конкурентными преимуществами регионов в обеспечении сбалансированного формирования физической и экономической доступности до уровня рациональных норм потребления.

**Ключевые слова:** пространственное развитие; территориальное размещение; капиталоемкость продукции; пространственные диспропорции; доступность продукции.

## Introduction

In recent years, the task of ensuring food security, sustainable development, and spatial organization in the agro-industrial complex has become a complex triune problem of agri-food policy. In this context, it is especially important to find relevant approaches, methods, and mechanisms for strategic planning that will promote the rational use of territorial resources and ensure the convergence of physical and economic accessibility, taking into account the norms of healthy nutrition.

It is clear that not all groups of agricultural products can be effectively grown across the vast territories of our country with the same efficiency. However, the possibilities for socio-economic development concentrated solely in regions with the most favorable conditions are limited; their agrarian resources are clearly insufficient to address food security issues at the national level. To achieve the desired balance between supply and demand in the agri-food market, it is crucial to maximize the agricultural potential of most regions. In the scientific literature, researchers [1], [2] rightly emphasize that spatial development of the agro-industrial complex is the most effective factor for producing competitive products. As mentioned earlier, the efficiency of producing certain types of products varies significantly across different regions. Nevertheless, Academician G.V. Bspakhotny [3] rightly asserts that one cannot be limited solely to the agrarian opportunities of regions with favorable conditions. Research by foreign colleagues [4], [6], [7], [9] demonstrates that there are not only physical resource constraints (such as land, animals, labor, etc.), but also limits to the efficiency of new production expenditures. As we know from A. Marshall's theory, at certain stages of investment, the efficiency of additional expenditures begins to decline. A classic in economic science [10] notes that "the costs of producing a good start to increase faster than the production of that good itself." For example, Russian researchers [11], [12], [13] point out that to achieve potential growth from an initial grain yield of 20 c/ha and a milk productivity of 3000 kg/head, significantly fewer costs per unit of production are required than for a similar increase at a yield of 30 c/ha and a productivity of 5000 kg/head. This is because it is easier to achieve growth with lower initial figures, while at higher levels, each additional increase requires greater effort and resources.

To date, these principles are not reflected in the Strategy for Spatial Development and the Strategy for the Development of the Agro-Industrial Complex. Based on the theory of placement and its application in the agro-industrial sector [14], [15], [16], [17], the choice of territory for production is usually based on criteria such as maximizing production volumes, export opportunities, and profits, as well as minimizing costs while considering agrarian potential and climatic conditions. In this context, the authors of this article believe that when distributing agrarian resources and capital territorially, the principles of the theory of marginal efficiency of costs should be taken into account.

## Research methods and principles

The scientific basis of the study is based on the provisions of the theory of location and the theory of marginal cost efficiency. Based on these provisions, it follows that the agrarian potential of the subjects of the Russian Federation with the best natural and economic conditions is not unlimited. Therefore, it is important to maximize the use of the agrarian potential of regions with average and less favorable territories for production. The key method of the study is statistical grouping and clustering of regions. As part of the analysis of the resource potential, the regions of the Russian Federation are divided into five groups according to the level of favorable combination of natural and economic conditions for the development of agriculture. For the analytical expression of the factors of the natural and economic environment, the indicator of cadastral valuation of 1 hectare of agricultural land was used. Statistical grouping by this indicator was carried out for the purpose of categorizing regions, taking into account their bioeconomic potential and the achieved results of the strategic development of the agro-food sector. The regions differ significantly from each other in terms of the cadastral value of 1 hectare of agricultural land. The first group includes regions where the ratio of the named indicator to the average value of the indicator for the country varies within the range of up to 54.4%, in the fifth group — such ratio is from 198%. Subjects of the Russian Federation divided into groups (categories) depending on the cadastral value of 1 hectare of agricultural land differ significantly among themselves in the level of investments in basic production capacities, the output of gross output and costs for it, and the financial results obtained. The fifth category includes regions with the most optimal combination of rent factors and a high level of socio-economic development of agricultural production.

## Main results

At the initial stage of the study, the structure of resource provision was identified in terms of categories of subjects of the Russian Federation according to natural and economic conditions of management (Table 1).

Table 1 - Disproportions in the share of resources and results of agricultural development in groups of regions by cadastral value of 1 hectare of agricultural land

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| Groups of subjects of the Russian Federation | Share of agricultural land, % | Share of livestock, % | Share of energy capacity, % | Share of costs in gross output, % | Share of farms, % | Share of employed, % | Share of fixed assets, % | Share of investments in fixed assets, % | Share of state support, % |
|--|-------------------------------|-----------------------|-----------------------------|-----------------------------------|-------------------|----------------------|--------------------------|---|---------------------------|
| First  | 14                            | 14                    | 8                           | 7                                 | 9                 | 8                    | 9                        | 5                                       | 8                         |
| Second                                       | 20                            | 19                    | 17                          | 14                                | 18                | 16                   | 15                       | 10                                      | 12                        |
| Third  | 22                            | 20                    | 21                          | 21                                | 23                | 22                   | 19                       | 19                                      | 21                        |

| Groups of subjects of the Russian Federation | Share of agricultural land, % | Share of livestock, % | Share of energy capacity, % | Share of costs in gross output, % | Share of farms, % | Share of employed, % | Share of fixed assets, % | Share of investments in fixed assets, % | Share of state support, % |
|--|-------------------------------|-----------------------|-----------------------------|-----------------------------------|-------------------|----------------------|--------------------------|---|---------------------------|
| Fourth                                       | 22                            | 28                    | 20                          | 22                                | 26                | 25                   | 22                       | 22                                      | 24                        |
| Fifth  | 22                            | 19                    | 34                          | 36                                | 24                | 29                   | 35                       | 44                                      | 35                        |
| Total  | 100                           | 100                   | 100                         | 100                               | 100               | 100                  | 100                      | 100                                     | 100                       |

According to the data in Table 1, it is evident that agricultural land is distributed among categories of regions in approximately equal shares starting from the second group of subjects of the Russian Federation. There are also no significant deviations between the categories of regions regarding the share of livestock. However, explicit disproportions are noted in the structure of the allocation of labor, financial, and other material and technical resources. It is clear that there is a direct dependence on the optimal combination of economic and geographical conditions. For example, in regions classified as the fifth category of subjects of the Russian Federation compared to the first category, the share of energy production capacities is higher by 4 times, labor resources by 3.5 times, fixed assets by 4 times, state support by almost 4.5 times, current expenditures by more than 5 times, and investments in fixed capital by almost 9 times.

At this stage of the research, it can be concluded that there is a shift in the structure of territorial resource distribution in favor of regions with favorable conditions [18], [19]. This may create prerequisites for the superiority of these regions in social and economic development of the agri-food sector (Table 2).

Table 2 - Disproportions in the conditions of agricultural development in groups of regions by cadastral value of 1 ha of agricultural land

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| Indicators  | First | Second | Third | Fourth | Fifth |
|---|-------|--------|-------|--------|-------|
| Funding, thousand rubles/ha   | 29.1  | 32.2   | 32.9  | 35.8   | 65.3  |
| Capital-labor ratio, thousand rubles/person   | 10.4  | 10.6   | 10.8  | 11.2   | 14.1  |
| Energy supply, hp/ha  | 0.4   | 0.5    | 0.6   | 0.6    | 1.0   |
| Investments in fixed capital per 1 ha of agricultural land, thousand rubles/ha                            | 1,1   | 1.3    | 1.9   | 2,3    | 5.3   |
| Amount of state support per 1 ha of agricultural land, thousand rubles/ha                                 | 0.7   | 0.7    | 1,1   | 1.3    | 1.9   |
| Ratio of wages in agriculture to the regional average, %  | 60    | 69     | 69    | 72     | 87    |
| Producer price index, %   | 102   | 100    | 99    | 99     | 96    |
| Ratio of prices for main types of products on average for the region to the average level for the country | 118   | 100    | 95    | 88     | 95    |

| Indicators          | First | Second | Third | Fourth | Fifth |
|---------------------|-------|--------|-------|--------|-------|
| (geometric mean), % |       |        |       |        |       |

The assessment of the conditions for the formation of physical and economic accessibility of products shows that rent-generating factors have a significant impact on these processes. For instance, in regions of the fifth category, the level of asset provision exceeds the value observed in regions of the first group by more than two times. A similar trend is seen in indicators such as capital intensity, energy intensity, and other key metrics.

An interesting fact is the influence of natural and economic conditions on the producer price index and average prices for various types of raw materials and food products. The values of these indicators are also at a higher level in groups of subjects of the Russian Federation with favorable territories. This highlights the importance of the geographical and economic environment in shaping market prices and the level of accessibility of goods.

From this, it can be concluded that the natural and economic potential of regions creates conditions for achieving higher economic and financial results. In turn, this contributes to improving the physical and economic accessibility of products (Table 3). This underscores the need for further research and optimization of resource distribution among regions to maximize existing advantages and achieve impressive outcomes in food security and sustainable development of the agro-industrial complex.

Table 3 - Disproportions in the results of activities in groups of regions by cadastral value of 1 ha of agricultural land

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| Groups of subjects of the Russian Federation | Profit share, % | Profit size per organization, million rubles. | Increase in gross output, thousand/ha | Increase in costs for gross output, thousand/ha |
|--|-----------------|---|---------------------------------------|---|
| First  | 7.5             | 7.9   | 870                                   | 459   |
| Second                                       | 12.7            | 6.8   | -737                                  | 181   |
| Third  | 12.2            | 5.2   | 636                                   | 794   |
| Fourth                                       | 8.5             | 3.2   | 621                                   | 1438  |
| Fifth  | 59.1            | 23.8  | -1170                                 | 2214  |

Despite the fact that a significant share of gross production (over one-third of total output) comes from subjects of the Russian Federation with favorable territories, they receive an unjustifiably large share of profits (almost 60%), even though only 20% of the subjects of the Russian Federation are concentrated here, where 24% of agricultural organizations operate. On average, each organization here earns over 59 million rubles in profit per year, compared to 7.5–12.5 million rubles in other groups of regions. This means that due to differentiated rent in these subjects of the Russian Federation, more favorable conditions are created for new investments.

Meanwhile, gross production growth is observed in the first, third, and fourth groups of regions. In the fifth group, there has been a decrease in this indicator, despite the fact that the increase in costs for gross production here has been the largest among all groups. Investments per ruble of profit increase from group to group. This indicates signs of a tendency towards increased capital intensity in agricultural production in regions with favorable operating conditions. This is partially supported by the following data (Table 4).

Table 4 - Disproportions of resource intensity of agricultural products in groups of regions by cadastral value of 1 ha of agricultural land

DOI: <https://doi.org/10.60797/IRJ.2025.155.38.4>

| Indicators                                    | First | Second | Third | Fourth | Fifth |
|---|-------|--------|-------|--------|-------|
| VP per 1 hectare of farmland, million rubles. | 20.7  | 25.5   | 32.2  | 34.2   | 59.2  |
| VP per 1 hp, million rubles.                  | 48.9  | 48.6   | 55.6  | 62.2   | 70.1  |
| VP per 1 person, billion rubles               | 0.86  | 0.91   | 0.99  | 1.05   | 1.29  |
| Capital intensity of production, rub./rub.    | 1.33  | 1.25   | 1.05  | 1.07   | 1.10  |

| Indicators   | First | Second | Third | Fourth | Fifth |
|--|-------|--------|-------|--------|-------|
| Cost intensity of production, rub./ruble.          | 0.89  | 0.87   | 0.89  | 0.90   | 0.88  |
| Investment intensity of production, kopecks/ruble. | 5.00  | 5.21   | 6.33  | 7.25   | 8.62  |
| Investment intensity of profit, rub./rub.          | 1.4   | 1.3    | 1.5   | 1.9    | 2.1   |

Note: VP – volume of gross output

With the increase in cadastral value, there is a noticeable rise in the volume of production per unit of resources used. For example, in the fifth category of regions, the volume of gross production per hectare of agricultural land is almost three times greater than that in first-category regions. Significant differences are also evident in the volumes of gross production between categories when calculated per unit of energy capacity, fixed assets, and labor resources.

It is important to emphasize that the level of current production costs remains comparable across different categories of regions, even considering their diverse natural and economic conditions. At the same time, there is a decrease in the return on capital investments with the increasing category of regions when assessing the cost of each ruble of production. It is well known that after a certain stage, increasing investments leads to diminishing returns on efficiency. This means that subsequent investments in regions with favorable conditions may, on the one hand, increase the risks of slowing down the national growth of the physical accessibility of products and, on the other hand, contribute to rising prices and decreasing economic accessibility of goods.

To support these conclusions, the subjects of the Russian Federation are regrouped based on the level of government support per hectare of agricultural land, and each group is divided into two subgroups based on the median level of costs for gross production. This categorization allows for the determination of the growth indicators (gross production, current costs, and fixed assets) in the groups as the difference between the second and first subgroups. This approach visually demonstrates the effectiveness of the increase in current costs and capital investments as investment per unit of resources increases (Figure 1).

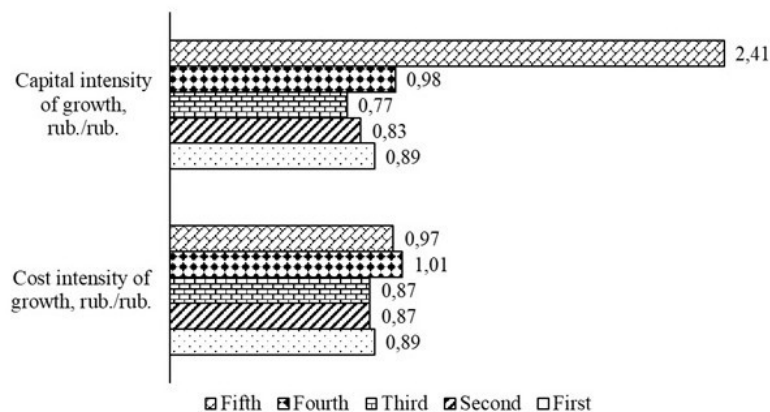


Figure 1 - Disproportions in capital intensity of gross output growth in groups of subjects of the Russian Federation by the level of state support per 1 hectare of agricultural land  
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Analysis of costs and the use of funds shows that economically viable increases in production volume can primarily be achieved in regions of the first, second, and third categories. In these regions, there is a minimal increase in costs and investments in fixed assets required to obtain an additional unit of product. This indicates that these regions still have potential for enhancing efficiency and further development.

However, in regions of the fourth and fifth categories, any further increase in production requires significantly higher expenses. This indicates that a limit has been reached in the efficiency of current and capital investments in these regions. Increasing production under these conditions may lead to decreased profitability, escalating risk costs, and even economic losses. Therefore, to maintain competitiveness and sustainable development in these groups of regions, it is necessary to reassess investment approaches and optimize resource utilization. Focusing on innovative solutions, improving technical efficiency, and quality management can be the key to overcoming these challenges.

## Conclusion

Thus, the conducted research demonstrates the existence of significant disparities in the spatial distribution of production and resource potential in agriculture in the Russian Federation. Currently, the tasks of providing the population with affordable products are mainly solved by regions with optimal conditions for growing agricultural crops and livestock. It is here that a significant volume of production capacity, fixed assets, current assets, and labor resources is concentrated. These regions also receive the majority of investments in fixed capital, government subsidies, and profits.

There is a clear trend towards the concentration of new investments in regions that belong to the subjects of the Russian Federation with the best natural and economic conditions. Against the backdrop of this trend, in more successful regions, the level of current and capital costs per unit of agricultural resources (such as land and livestock) significantly exceeds the indicators of less favorable areas. This leads to the fact that in the subjects of the Russian Federation with the best rental conditions, the share of investments for every ruble of profit is higher than in regions with less favorable characteristics. The same can be said about the share of investments for every ruble of production. As a result, the growth of production volumes and profits is accompanied by an increase in costs per unit of production. This confirms many conclusions of scientists that the opportunities for further increasing the volume of agricultural products in regions with the most favorable natural and economic conditions are largely exhausted.

Subsequent investments in subjects of the Russian Federation with natural investment attractiveness may lead to an increase in the capital intensity of production per unit and an increase in the cost of the produced products, raw materials, and food. This problem significantly complicates achieving physical and economic accessibility at the required rational consumption level on a balanced basis.

In this regard, the task of strategic planning is to enhance the investment attractiveness of regions with less favorable conditions. Within the framework of the Spatial Development Strategy, it is necessary to consider the issue of prospective agricultural specialization of regions. This will be reflected in the establishment of a range of productions of those types of products within a specific region, determined by the optimal combination of competitive advantages to ensure physical and economic accessibility. Thus, each region, possessing its own competitive capabilities in the production of certain types of goods, will be able to ensure the maximum return on each unit of new investments, reduce production costs, and make a significant contribution to solving the strategic task of providing the population with affordable food.

## Конфликт интересов

Не указан.

## Рецензия

Все статьи проходят рецензирование. Но рецензент или автор статьи предпочли не публиковать рецензию к этой статье в открытом доступе. Рецензия может быть предоставлена компетентным органам по запросу.

## Conflict of Interest

None declared.

## Review

All articles are peer-reviewed. But the reviewer or the author of the article chose not to publish a review of this article in the public domain. The review can be provided to the competent authorities upon request.

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