Prospects for the spatial development of agricultural production in the region

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Abstract. The relevance of the research topic is due to the need to improve the planning and forecasting of the spatial development of the region. State support of individual branches of agriculture has a great influence on the process of territorial and sectoral division of labor in agro-industrial production. Without planning and regulation of this process, providing certain opportunities to influence the location, specialization and concentration of production, as well as the development of cooperation in the industry, an unstable production system may develop in agriculture that does not provide the necessary socio-economic effect. In the course of the study, monographic, economic, statistical, and design-constructive methods, trend modeling, scenario forecasting, strategic analysis, and theoretical and practical developments of the authors were used. The study defines the spatial development of agricultural production, justifies the need to take into account and evaluate not only economic but also natural and climatic factors of production when planning the development and allocation of agricultural production, and also develops three scenarios of spatial development of the main branches of agriculture until 2035. The drafted project for the spatial development of agricultural production can be considered as an instrument of strategic planning and the basis for drawing up a strategy for the socio-economic development of the agro-industrial complex of the region.

Regions of the Russian Federation are traditionally characterized by a large variety of territorial, natural, social, and economic conditions for the production and sale of agricultural products, food and processing industries. The efficiency of agricultural production is largely determined by the territorial and sectoral division of labor. In turn, it can be viewed as a relationship between the specialization of individual regions and natural zones in the production of certain types of agricultural products and the size, intensity and direction of their commodity flows, due to, on the one hand, the supply and demand, and on the other hand, due to state regulation of the agri-food market and its individual product segments. The role of individual regions in solving the problem of spatial development of agricultural production in order to provide the population with food, agricultural enterprises with feed and seed, processors with raw materials, etc., reduce imports, as well as increase agricultural exports is not equal because of significant differences in socio-economic and natural conditions, the structure and level of production, food consumption, and other internal and external factors. Structural changes that occur in the placement of agricultural production are characterized by a deeper specialization of the regions, the natural and economic conditions of which are most favorable for their production [7-8].
Increased economic independence of economic entities and administrative territories, as well as the need to develop horizontal and vertical integration processes in the agro-industrial production, enhance inter-regional food and raw materials ties, eliminate the high dependence of the Russian Federation on the world food market due to import substitution policy, put forward a number of priority research areas to improve the spatial development of natural agricultural production [9].

The formation of specialized agro-industrial clusters in various regions of Russia in recent years has been caused by the need to increase the competitiveness of products. As a result of vertical and horizontal integration, the cluster combines various spheres of social production: industry, agriculture, trade, production, and financial infrastructure.

Thus, in the Voronezh Region, a regional dairy cluster has been formed and continues to develop, operating in a closed cycle from the production and processing of dairy products to its transportation to final consumers, including also the production of feed and breeding of pedigree cattle. In the period from 2009 to 2017, 17 dairy complexes with a total value of more than 19 billion rubles were built in the region. In 2016, milk production in the Voronezh region reached 829.3 thousand tons, because of which the region was ranked first in the Central Federal District in terms of gross milk production (15.3% of the total). In 2017, construction began on four more dairy complexes. By 2035, it is planned to increase milk production to more than 1,250 thousand tons.

The meat cluster on the basis of the Zarechnoye Group of Companies also received active development in the region. It also operates in a closed cycle from the production of genetic and breeding products and the development of commodity herds to the processing and sale of finished meat products. Zarechnoye Group of Companies also attracts farmers to raise calves and then takes them to feed and slaughter. A significant place in the meat cluster is occupied by the production of marble beef, which has become one of the trademarks of the Voronezh region. At present, the Voronezh region is in ninth place in the ranking of regions of the Russian Federation in livestock production, whereas five years ago it was only in seventeenth place.

At present, a pig cluster is being created in the Voronezh region, which will include a selection and genetic center, breeding reproducers, feed mills and pig farms, which will ensure the maximum independence of the participants of the integrated education from external factors and also remove the sanitary, epizootic, and other risks associated with interregional turnover of products.

The growth rate of agro-industrial production in the region in 2017 is significantly higher than the national average: 115% in the region versus 104% in the Russian Federation as a whole. The share of agricultural and processing enterprises of the agro-industrial complex in the gross regional product in 2016 amounted to more than 18% [1]. In turn, it is in agriculture that quantitative and qualitative parameters of development and competitiveness of agricultural products and food are formed [2]. The presence of favorable natural conditions and land resources creates good prerequisites for the rational distribution and specialization of agricultural production.

The spatial development of regional agricultural production should be understood as the rational spatial and temporal distribution of the process of agricultural production, occurring as a result of differentiation of the basic factors of the development of production sectors within administrative boundaries under the influence of market conditions, as well as government measures. Agricultural production must be placed in such a way that it gives maximum economic, social, and environmental effects and fully meets the national economic needs. Consequently, it is impossible to solve the problem of planning the spatial development of regional agricultural production on the basis of standard solutions. This problem should be considered in the whole complex of inter-branch, territorial and inter-farm relations, and the typical solutions should be formed under the influence of rational distribution, specialization and concentration of agricultural production.

The transition to a program-oriented method of management in the agro-industrial complex and a moderate increase in budget financing for the implementation of sectoral programs in agriculture ensured the dynamic development of most industries, but also revealed a significant differentiation in the level of utilization of the production potential of the regions. The main reasons for the uneven
development of regions in the country include the lack of regulation of the location of agricultural production in accordance with their competitive advantages.

In the system of improving the territorial-sectoral distribution of agricultural production, it is necessary to determine the rational directions of its development, for which the following steps should be taken, including substantiating the place of a particular region in the system of territorial-sectoral division of labor of a particular type of product: calculate the needs of the region in agricultural products and processing products, the possibilities and feasibility of their satisfaction at the expense of their own production, and the formation their commodity resources for export to domestic and foreign markets. More than that, it is highly necessary to substantiate the choice of regions-suppliers and buyers of products of their processing, the volumes and profitable directions of their inter-regional commodity deliveries. Also, one should develop a system of measures to improve state regulation of the processes of locating and deepening production specialization.

The location of agricultural production in the Central Black Earth macro-region is characterized by specific laws of its development and the current economic and social situation in the country. Among the factors affecting the location of production, the most significant are primarily the bioclimatic potential of a region and its degree of use, arable land security, zonal types of combination of industries, the level and structure of food consumption, distances and means of transporting food and raw materials for their production, on which the costs of their transportation depend.

In assessing the bioclimatic potential of a territory, its main components are the analysis of the provision of heat, moisture, and the level of soil fertility. Their influence on the distribution of different branches of agriculture varies.

In order to design the spatial development of agricultural production, it is necessary to predict the values of the productivity of agricultural production. In view of the fact that there is no universally accepted common set of specific methods and order of the forecasting process [3], increasing the scientific validity of forecasting the spatial development of agricultural production requires consideration and assessment of natural and economic conditions. The developed methodical approach to forecasting the spatial development of agricultural production takes into account when designing future states not only economic factors, but also soil and climatic conditions.

The design of the location of agricultural production for 2035 was carried out in the framework of three scenarios: conservative, basic, and target.

The conservative scenario of the spatial development of crop production in agricultural enterprises of the Voronezh Region is characterized by the preservation or slight decrease in the current level of production development, as well as a slight involvement in the turnover of abandoned or new arable land. The baseline scenario for the development and location of crop production is characterized by maintaining the current rates of production development, as well as more active involvement of unused arable land. The target scenario, in turn, implies active use of the achievements of scientific and technological progress: promising technologies of tillage, active use of plant protection products and mineral fertilizers, etc., as well as the maximum development of available arable land.

The projected placement of crop production in agricultural enterprises in natural and agricultural microzones of the Voronezh region is presented in Table 1.

In connection with the unfavorable forecast of grain yield under the conservative scenario, in our opinion, by 2035 it is necessary to increase the sown area of grain and leguminous crops (excluding maize) in the region by 177.1 thousand hectares or by 25.2% to 880 thousand hectares, including:

- By 31.8 thousand hectares or 27.4% in the North-West microzone;
- By 66 thousand hectares or 36.5% in the Central;
- By 18.9 thousand hectares or 15.4% in the East;
- By 25.4 thousand hectares or 16.5% in the South-East;
- By 35 thousand hectares or 27.1% in the South-West.

Due to this change, the gross grain harvest will increase in 2035 by 22.4% if compared to the base period (2016), reaching 2,784.6 thousand tons.
According to the baseline scenario, while maintaining the current pace of development, by 2035, an increase in the sowing area of grain and leguminous crops is projected to be 299.6 thousand hectares or 42.6% to the level of 1002.5 thousand hectares, including by increasing the cultivated area:

- By 52.8 thousand hectares or 45.4% in the North-west microzone;
- By 100.5 thousand hectares or 55.5% in the Central;
- By 38.8 thousand hectares or 31.5% in the East;
- By 49.9 thousand hectares or 32.5% in the South-East;
- By 57.5 thousand hectares or 44.6% in the South-West.

This measure, along with an increase in the average yield of 15.7% to a value of 37.5 centners per hectare, will ensure an increase in the gross grain harvest to 3,761.2 thousand tons, which would be 65.3% higher than the value of this indicator in 2016.

The target scenario for the placement of grain production allows to plan the area of sowing of this type of crops in the region at the level of 1125 thousand hectares. With the intensification of production, the average level of crop yields of this species will reach 43.4 c / ha by 2035. The gross grain harvest will more than double to 4882.1 thousand tons.

The increase in the concentration of grain crops in the North-Western and Central microzones is associated with an insufficient level of soil moisture and, as a consequence, a low grain yield in the South and East of the region.

Scenarios for the placement of sunflower production were developed based on the need to bring the structure of the region’s sown areas in accordance with agrotechnical requirements and reduce the share of sunflower to 14-17% and ensure the development of production by intensifying production. According to the conservative scenario, an increase in the sown area to 250.8 thousand hectares is projected, which would increase the gross yield of sunflower by 2035 and increase by 50.5 thousand tons or by 9% compared to 2016 to a value of 609.6 thousand. without changing the ratio of acreage between microzones.

While maintaining the current rates of production development (baseline scenario), the average yield of sunflower by 2035 will be 28.9 centners per hectare; therefore, it is proposed to increase the sown area by 10% relative to the level of 2016, which would reduce the share of sunflower in the structure. This development rate will allow to ensure the gross yield at the level of 760.4 thousand tons of seeds in the mass after processing.

Placing sunflower production in the target scenario by 2035 suggests an increase in the sown area by 15% from the 2016 level to a value of 274.7 thousand hectares, which, along with an increase in crop yields by 43.6%, will achieve the gross collection of 922.2 thousand tons. This is 1.65 times higher than the level of the base period.

In designing the spatial development of the plant industry, we took into account not only the yield but also the degree of development of the corresponding production and processing infrastructure, especially oil-extraction and sugar factories in the microzones of the region, which also affected the distribution of newly introduced areas between them.

It is proposed to place the production of sugar beet more evenly in the territory of the Voronezh region. In order to compensate for the possible reduction in yield according to the conservative scenario, we propose to project an increase in the area under crops in the region almost twice to a value of 90 thousand hectares, including:

- By 8.5 thousand ha or 3.9 times in the North-West;
- By 3.2 thousand hectares or 12.9% in the Central;
- By 9.4 thousand hectares or 1.7 times in the East;
- By 7.3 thousand hectares or 2.1 times in the South-East;
- By 9.2 thousand hectares or 3.1 times in the South-West microzones. It will allow to increase the production of sugar beet up to 1356.9 thousand tons or by 52.6% if compared to 2016.
### Table 1. The projected placement of the production of basic products on natural and agricultural microzones of the Voronezh region until 2035.

| Name microzone | Actual values for 2016 | Projected values for 2035 |
|----------------|------------------------|--------------------------|
|                | Sown area, thousand hectares | Yield, kg / ha | Gross yield, thousand tons | Sown area, thousand hectares | Yield, kg / ha | Gross yield, thousand tons | Sown area, thousand hectares | Yield, kg / ha | Gross yield, thousand tons |
| **Grain and leguminous crops (without corn)** | | | | | | | | |
| Northwest      | 116.2                   | 36.5                   | 424.4                   | 148.0                   | 36.2                   | 535.7                   | 169.0                   | 44.8                   | 758.0                   | 190.0                   | 53.5                   | 1016.5 |
| Central        | 181.0                   | 35.8                   | 647.7                   | 247.0                   | 35.6                   | 879.0                   | 281.5                   | 44.1                   | 1241.2                  | 316.0                   | 52.6                   | 1662.2 |
| East           | 123.1                   | 28.9                   | 356.1                   | 142.0                   | 28.2                   | 400.7                   | 162.0                   | 32.9                   | 532.3                   | 182.0                   | 37.5                   | 682.5 |
| Southeast      | 153.6                   | 30.1                   | 461.8                   | 179.0                   | 27.8                   | 498.5                   | 203.5                   | 29.7                   | 604.9                   | 228.0                   | 31.6                   | 720.5 |
| Southwest      | 129.0                   | 29.8                   | 384.8                   | 164.0                   | 28.7                   | 470.7                   | 186.5                   | 33.5                   | 624.8                   | 209.0                   | 38.3                   | 800.5 |
| Total in the region | 702.9                   | 32.4                   | 2274.8                   | 880.0                   | 31.6                   | 2784.6                   | 1002.5                   | 37.5                   | 3761.2                   | 1125.0                   | 43.4                   | 4882.1 |
| **Sunflower**  | | | | | | | | |
| Northwest      | 23.0                     | 25.8                   | 59.3                   | 24.1                     | 26.4                   | 63.7                   | 25.3                     | 33.2                   | 84.0                   | 26.4                   | 40.0                   | 105.8 |
| Central        | 58.2                     | 150.7                   | 61.1                   | 26.7                     | 163.4                   | 64.0                     | 32.9                   | 210.8                   | 67.0                   | 39.1                   | 261.8 |
| East           | 52.7                     | 102.5                   | 55.3                   | 22.7                     | 125.8                   | 57.9                   | 27.2                     | 157.5                   | 60.6                   | 31.6                   | 191.4 |
| Southeast      | 60.2                     | 137.3                   | 63.2                   | 23.2                     | 146.8                   | 66.2                   | 26.8                     | 177.2                   | 60.3                   | 30.3                   | 209.7 |
| Southwest      | 44.8                     | 109.3                   | 47.0                   | 23.4                     | 109.9                   | 49.2                   | 26.6                     | 130.9                   | 51.5                   | 29.8                   | 153.4 |
| Total in the region | 238.9                   | 23.4                   | 559.1                   | 250.8                   | 24.3                   | 609.6                   | 262.7                   | 28.9                   | 704.4                   | 274.7                   | 33.6                   | 922.2 |
| **Sugar beet** | | | | | | | | |
| Northwest      | 2.9                      | 125.9                   | 11.4                   | 141.7                   | 475.9                   | 16.5                     | 51.7                   | 853.4                   | 23.5                   | 61.0                   | 1449.9 |
| Central        | 24.8                     | 1206.0                  | 28.0                   | 465.1                   | 1302.3                  | 40.4                     | 560.1                   | 2262.8                  | 47.5                   | 655.1                  | 3111.5 |
| East           | 13.5                     | 725.2                   | 22.9                   | 466.8                   | 1069.0                  | 33.2                     | 556.9                   | 1848.9                  | 40.2                   | 647.0                  | 2600.9 |
| Southeast      | 6.9                      | 305.6                   | 14.2                   | 387.3                   | 550.0                   | 20.5                     | 417.7                   | 856.4                   | 29.2                   | 448.1                  | 1308.5 |
| Southwest      | 4.3                      | 217.5                   | 13.5                   | 399.9                   | 539.9                   | 19.4                     | 443.0                   | 859.5                   | 27.6                   | 486.1                  | 1341.7 |
| Total in the region | 52.3                   | 2580.3                  | 90.0                   | 437.5                   | 3937.2                  | 130.0                    | 513.9                   | 6680.9                  | 168.0                   | 584.1                  | 9812.6 |
The baseline scenario of locating the production of sugar beet in the region implies a gross yield of 6,680.9 thousand tons due to an increase in the area under crops by 2.5 times, and also due to an increase in yield by 4.2% (513.9 c / ha on average in the region).

To implement the target scenario, it is proposed to increase the acreage to 168 thousand hectares, including:

- By 20.6 thousand hectares or by 8.1 times in the North-West;
- By 22.7 thousand ha or 1.9 times in the Central;
- By 26.7 thousand hectares or 3 times in the East;
- By 22.3 thousand hectares or 4.2 times in the South-East;
- By 23.3 thousand hectares or 6.4 times in the Southwest microzones, with an average yield of 584.1 c / ha, which will increase the gross yield of sugar beet to 9,812.6 thousand tons.

At the same time, it is proposed to introduce most of the land in the Eastern and Central natural-agricultural microzones of the region, where, the highest crop yield levels in the region are observed namely 655.1 c / ha and 647 c / ha against 448.1 c / ha and 486, 1 t / ha in the South-East and South-West zones, respectively.

Taking into account the projected trends in the spatial development of the production of the main types of crop production in the region, as well as other factors: the world and interregional market conditions, the macro-economic situation, etc., the most likely to implement, in our opinion, are the target scenario for the development of production of grain and leguminous crops and sunflower, and the baseline scenario for the development of sugar beet production, since the construction of sugar factories requires significant investments. There are factors constraining the growth of innovative activity in the agro-industrial complex. In particular, these include: the lack of a balanced state innovation strategy, supported by the necessary resources, an insufficient level of funding for scientific and technical programs.

One of the important factors determining the spatial development of livestock production is the ratio between the number of the resident population in the region and the size of agricultural land, as the potential to meet regional food needs and export of processed products or the need to import them. Regions with relatively large sizes of farmland per capita have a higher potential for increasing production and its rational distribution, which determines the specificity of their economic opportunities for exporting raw materials and food.

Assessment of the influence of factors in the design of the placement of the livestock industry is determined by the degree of their impact on the efficiency of production of certain types of products and the possibility of regulating this effect.

The design of the spatial development of livestock production was also carried out under three scenarios, involving an increase in animal productivity and a change in the number of animals. The planned placement of livestock production in agricultural enterprises in natural climatic zones and in the Voronezh region as a whole is presented in Tables 2 and 3.

Dairy production is located in the Voronezh region everywhere; however, depending on animal breeds, methods of keeping and milking, the presence of hayfields and pastures and other natural, climatic and economic conditions, the food base and the level of feeding in different territories on which directly depends milk production productivity.

The identified negative trends in the dynamics of the number of cows in the forest-steppe natural-agricultural zone indicate the need for its stabilization. For the conservative scenario, we propose to stabilize the number of cows at the level of the base period throughout the region. While maintaining the current rates of development of production, an increase in the average annual milk yield from 1 fodder cow in the forest-steppe natural-agricultural zone is expected to increase by 546 kg or 12%, in the transitional zone – by 582 kg or 12.7%, in the steppe zone – by 537 kg or 12.9%. As a result, the predicted value of the gross milk yield in the Voronezh region by 2035, according to the conservative development scenario, will be 855.5 thousand tons, which is 12.6% higher than the average value for 2013-2015.
Table 2. The projected placement of milk production in agricultural enterprises in natural and climatic zones of the Voronezh region in 2035.

| Microzone        | Actual values (on average for 2013-2015) | Projected values for 2035 | Conservative scenario | Baseline scenario | Target scenario |
|------------------|------------------------------------------|---------------------------|-----------------------|-------------------|-----------------|
|                  | Livestock of cows, thousand heads | Annual productivity, kg | Gross production, thousand tons | Livestock of cows, thousand heads | Annual productivity, kg | Gross production, thousand tons | Livestock of cows, thousand heads | Annual productivity, kg | Gross production, thousand tons |
| Forest-steppe    | 45.6                                     | 4 558                     | 207.8                 | 45.6              | 5 172           | 235.7           | 51.6              | 5 602           | 289.3           | 56.8              | 5 971           | 339.2           |
| Transitional     | 69.3                                     | 4 586                     | 317.7                 | 69.3              | 5 243           | 363.2           | 88.8              | 5 987           | 531.6           | 88.8              | 6 692           | 594.2           |
| Steppe           | 56.4                                     | 4 163                     | 234.6                 | 56.4              | 4 683           | 263.9           | 75.2              | 5 722           | 430.4           | 75.2              | 6 177           | 464.6           |
| Total in the region | 171.2                                 | 4 439                     | 760.0                 | 171.2             | 5 040           | 821.8           | 215.7             | 5 802           | 1 251.3          | 220.8             | 6 331           | 1 398.0          |

Table 3. The projected placement of the production of increase in live weight of animals in agricultural enterprises on natural and climatic zones of the Voronezh region in 2035.

| Microzone        | Actual values (on average for 2013-2015) | Projected values for 2035 | Conservative scenario | Baseline scenario | Target scenario |
|------------------|------------------------------------------|---------------------------|-----------------------|-------------------|-----------------|
|                  | Livestock of cows, thousand heads | Daily productivity, kg | Gross production, thousand tons | Livestock of cows, thousand heads | Daily productivity, kg | Gross production, thousand tons | Livestock of cows, thousand heads | Daily productivity, kg | Gross production, thousand tons |
| Forest-steppe    | 120.7                                    | 458                      | 20.2                  | 120.7             | 551            | 24.3            | 148.9             | 554            | 30.1            | 148.9            | 570             | 31.0            |
| Transitional     | 182.3                                    | 595                      | 39.6                  | 182.3             | 634            | 42.2            | 278.1             | 651            | 66.1            | 278.1            | 684             | 69.4            |
| Steppe           | 129.4                                    | 472                      | 22.3                  | 129.4             | 602            | 28.4            | 157.1             | 495            | 28.4            | 157.1            | 508             | 29.1            |
| Total in the region | 432.4                                 | 520                      | 82.1                  | 432.4             | 601            | 94.9            | 584.0             | 585            | 124.6           | 584.0            | 608             | 129.5           |

Production increase in live weight of cattle

| Microzone        | Production of pigs' live weight gain | Gross production, thousand tons |
|------------------|-------------------------------------|---------------------------------|
| Forest-steppe    | 226.0                               | 473                             | 75.5               |
| Transitional     | 160.4                               | 457                             | 133.4              |
| Steppe           | 163.3                               | 417                             | 52.6               |
| Total in the region | 549.7                               | 452                             | 261.5              |
The basic scenario in the development and deployment of milk production in the Voronezh region is characterized by an increase in milk productivity, number of livestock and the level of intensification of the livestock industry. According to this scenario in the Voronezh region by 2035, it is proposed to increase the number of livestock of cows in the forest-steppe zone by 6 thousand.

The target scenario assumes the most complete use of the achievements of scientific and technological progress, an increase in the level of intensification, and productivity while maintaining the number of livestock at the level of the baseline scenario. The implementation of this scenario implies an additional increase in the number of cows in the forest-steppe zone by 5.2 thousand heads, which will increase the gross milk yield in the Voronezh region by 83.9% to a value of 1,398.0 thousand tons with an average annual milk yield from 1 fodder cows in 6331 kg, which is 42.6% higher than the actual level. According to the target scenario of the spatial development of milk production, the majority (47.6%) of gross production will be located in the transition zone of the region, which has both developed production infrastructure and milk processing facilities.

The production of cattle meat in the Voronezh region is closely related to the location of milk production, since the means of production are animals of the same biological species. In connection with the planning of the spatial development of the production of cattle meat, the trends in the number of livestock animals adjacent to dairy production were applied.

When designing values within the conservative scenario while maintaining the actual growth rate of productivity, the average daily increase in live weight of cattle in the forest-steppe natural-agricultural zone will increase to 551 g or 20.35%, in the transition – up to 634 g or 6.5 %, in the steppe – up to 602 g or by 27.5% by 2035. As a result, the gross increase in live weight of cattle in the Voronezh region according to the conservative scenario is 94.9 thousand tons with a constant number of livestock.

The basic and target scenarios for the placement and development of cattle meat production, in addition to increasing productivity, imply a significant increase in the number of cattle stocks. According to this scenario, it is proposed to increase the number of fattening livestock by 23.3% to a value of 148.9 thousand heads in the forest-steppe natural-agricultural zone, by 52.6% in the transition zone (278.1 thousand) and by 21.4% in the steppe zone (157.1 thousand), which will increase the gross production in live weight of cattle by 42.5 thousand tons (or 51.8%) when implementing the baseline scenario. It would be 47.4 thousand tons (or 57.7%) according to the target scenario.

At present, the pig breeding of the Voronezh region as a whole is one of the most dynamically developing branches of animal husbandry.

According to the conservative scenario of the location and development of the production of pig meat in the region, an increase in the average daily weight gain of pigs is expected with a constant number of livestock. By 2035 in the forest-steppe natural-agricultural zone, it is planned to increase the average daily gain in live weight by 219 g or 46.3%, by 286 g or 62.6% in the transition zone, by 229 g or 54.9% in the steppe. This increase in productivity in the region as a whole will provide an increase in the gross increase in live weight of pigs by 48.4 thousand tons or 53.4% compared to the base period.

According to the baseline and target scenarios for the development of production of pig meat, an increase in the number of pigs by 53.7% to 844.9 thousand goals is proposed, including by 23 thousand goals (or 10.2%) in the forest-steppe zone, by 249.4 thousand goals (in 2.5 times) in the transition, by 22.8 thousand goals (or 14%) in the steppe. In the baseline scenario in the Voronezh region by 2035, the gross gain in live weight of pigs will increase by 149 thousand tons or 2.6 times, with an average daily increase in live weight of 777 g, which is 71.9% higher than the average level for 2013-2015. The target scenario, based on the large-scale intensification of production in all branches of agriculture in the region using innovative factors, suggests bringing the average daily weight gain of pigs to 848 g, which is 87.6% higher than the actual value. The gross increase in live weight of pigs in the Voronezh region by 2035 will reach 261.5 thousand tons in the implementation of this scenario, which is 2.9 times higher than the actual production level.
Taking into account active state support for the livestock industry, in our opinion, the basic scenario for milk production and the target scenario for the production of cattle meat and pig meat become the most relevant for implementation. Calculations show that more than half of the region’s pork production will be located in the territory of the transition zone, where the most favorable not only natural but also organizational and economic conditions have been established. The forest-steppe and steppe zones will have approximately comparable shares in the gross production of the region, equal respectively to 28.9% and 20.1%.

Summing up the development of perspective scenarios for the spatial development of agricultural production in the region, the following should be noted.

Placing the main branches of agriculture in selected zones / microzones allows taking into account not only economic but also natural and climatic conditions and concentrates production where the use of production factors is necessary. The bioclimatic potential of territories, material, technical, financial and labor resources will give the greatest effect [10].

The territorial and sectoral division of labor in accordance with the proposed scheme is aimed at solving the problems of ensuring food security, eliminating the lack of own production of certain types of agricultural products in the region, increasing its economic efficiency, competitiveness and affordability for the population of the region. In turn, the possibilities for the implementation of the proposed scenarios for the spatial development of agriculture in the region will largely depend on the agrarian policy pursued by the state, as well as the economic feasibility of the activities undertaken. Taking into account the current trends in the industry, the external and internal economic situation in the country, the conjuncture of the global, domestic, and regional agri-food markets, for most of the considered agricultural sectors in the Voronezh region, the target scenario for the spatial development of agricultural production seems most likely. The main factor hindering the transfer of the agro-industrial complex to the innovative path of development in the region is the need to build new facilities for processing agricultural raw materials.

The drafted project for the spatial development of agricultural production can be considered as an instrument of strategic planning and a basis for composing a strategy for the socio-economic development of the regional industrial complex.

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