The influence of scale factor on the realization of natural potential of grain farming in the region

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Abstract. The development of grain farming is considered in the article as the backbone and the most important direction of agricultural production in Kursk region. The research has shown that since 2014 there has been a twofold increase in the share of large grain-sowing farms in the structure of sowing and gross grain harvest, exceeded 60%. The aim of the research is to identify the perspectives of the development of grain farming on the basis of the implementation of the concentration of sowing in a narrow list of large agricultural organizations’ holdfast. The clustering method has been used as the main analysis tool. Its results have made it possible to compare various groups of agricultural organizations formed according to the sowing size of cereal crops due to the main productive and economic indicators of efficiency of grain production. The features of functioning of large agricultural organizations are shown in the research. They determine as the generation of benefits and so they form the difficulties to provide the improvement of the results of grain production. The scale effect enables large business to provide more effective and resultative production, however, the results of the analysis testify that the largest organizations have a relatively lower efficiency of grain cultivation. In the research there has been a conclusion: in the current financial and economic conditions the concentration of land resources in large producers’ holdfast is not the best way to activize the processes of intensification and the increase of productivity and profitability of grain production. It will lead to the formation of an oligopoly in the regional grain market.

1. Introduction
Grain farming is the main and most profitable direction in agricultural production with a high share of the grain area in the structure of the cultivated area in many regions of Russia with agricultural specialization. The regions which are leadres due to gross grain harvest (Krasnodar krai, Rostov region, Stavropol krai) have export orientation (the share of grain export was 63.4% during 2015-2018). It is determined by the geographical proximity to the port infrastructure and comparatively better relative to other regions natural and climatic conditions. Despite of farness from sea export routes the regions of Chernozemic economic zone also have a significant export potential (11.3% in the structure of the grain export), however, the country's domestic demand forms the basis of grain demand there. Chernozemie is the basis of the development of pig breeding in Russia. Belgorod, Kursk and Voronezh regions are the leaders in terms of the number of pigs, Tambov region takes the 5th place and Lipetsk region takes the 7th place. In addition, the northern regions of the Central Federal District and the Northwestern Federal District have a low potential to produce grain and are not able to satisfy their needs through local production, therefore they are guided by the offer created.
in the domestic grain market by the regions of Chernozem region (the Black Earth region) and Povolzhye (the Volga Region). All this determines the search of the reserves to increase further grain production in Chernozem region as an opportunity to increase its export potential and satisfy the need in grain in the domestic market, which is growing due to the implementation of the policy of import substitution of agricultural products.

Kursk region due to gross grain harvest takes the 2nd place after Voronezh region in the Central Federal District and the 7th place throughout the country. Its grain harvest is about 5 million tons and the cultivated area is slightly above 1 million hectares. The region has a significant overproduction of grain. It is one of the leaders due to the indicator of grain harvest per capita. It forms the export potential, which has been 4.9% on average since 2015, it provides a dynamic development of animal husbandry in the region and it also satisfies grain requirements in the other regions of the country. In the structure of revenues from the sale of crop production the share of grain sales is almost 50%, i.e. grain farming is a system-forming element of the agro-industrial complex in Kursk region. That is why most of the region's farmers are engaged in grain cultivation. A stable increase of the harvest of cereal crops is considered in the region, however, it is important to estimate the factors and production processes which become the key and the consequence of this.

One of the argumentative issues of the development of grain farming in terms of increasing grain harvest is the enlargement of grain sowing farms. On the one hand, such farms have large administrative, technical, financial, scientific and labor capabilities to activize the intensification and to increase the profitability of grain production. On the other hand, in the context of a constant increase of prices for industrial products and tariffs of natural monopolies, including a customized almost double devaluation of the rouble after 2014 it has become much more difficult to attract the necessary financial resources to ensure intensified production, taking into account the rational nature management. For this reason the effectiveness of the use of the cultivated area in such organizations can fall and is not rarely lower than that in smaller farms.

2. Materials and methods
The research covers the period of time characterized by the structural crisis in the Russian economy and the introduction of food import embargo in response to the financial and political sanctions of several Western European and North American countries. The research of the influence of the size of grain crops on the results and the efficiency of their cultivation has been carried out within Kursk region which has a significant number of agricultural organizations involved in this field. It enables to form a representative sample to conduct complex mathematical and statistical analysis. The qualitative transition in case of clusters’ formation of agricultural organization has been realized due to the algorithm for calculating the grouping step based on geometric progression. As a result of this approach diminishing marginal utility of the land and financial resources’ usage is taken into account, it provides the validity of comparing indicators by groups. The cluster method has been based on the conclusions presented in the research of the group of scientists led by E. Zaksevskaya [1]. They are aimed at the development of the recommendations on anti-crisis management strategies and at monitoring the financial condition of enterprises in the region. The clustering method has been successfully used to establish the influence and relationship between the regressor factor which reflects the action of the process or occurrence and productive indicators which characterize the production and economic efficiency of grain production [2].

3. Results and Discussion
Chetvertakov I.M. and Chetvertakova V.P. find business enlargement and the growth of production concentration as one of tendencies to develop agricultural production [3]. This tendency is clearly observed in the grain farming in Kursk region, where the share of sowing of huge farms with a crop area of more than 10 thousand hectares has doubled in comparison with 2011 (from 30.8% to 60.4%). It has been done due to decrease of the share of large farms (with an area of grain sowing from 4 to 10
thousand hectares) by 15.4% and medium-sized farms (with an area of grain sowing from 1 to 4 thousand hectares) by 11.4%. However, the share of small farms with an area of grain sowing less than 1 thousand hectares has decreased slightly, as it was also 7.5% in basic year (figure 1).

![Figure 1](image)

**Figure 1.** The distribution structure of grain sowing in the groups of agricultural organizations depending from their size in Kursk region in 2011-2018, %.

One of the factors to activate the enlargement of grain farming organizations was the structural crisis in the Russian economy, which also affected the agro-industrial complex, including its grain-product subcomplex. It demonstrates convincingly that the concentration of grain sowing has begun to grow dynamically after 2014, whereas during the same period since 2011 the structure of grain sowing has had minimal changes. Small commodity production of grain in Kursk region has always had a low share, but there was equality among the other groups during 2011-2014 in the structure of sowing distribution and gross grain harvest. However, in the context of the crisis due to a number of factors, including non-market ones, a number of companies could significantly enlarge the size of the cultivated area due to the absorption of the other organizations and adoption of unused arable land. As a result, 10 agricultural organizations had 465 thousand hectares of grain sowing or 60.3% of the total value of gross grain harvest in the region.

Such a dynamic change in the structure of production and distribution of grain sowing has economic, organizational, agrotechnological consequences that should be taken into account when forming a strategy for the development of the grain product subcomplex. One of the consequences of such process has become the strengthening of oligopolistic influence on the local grain market, it badly influences smaller competitors, though before the grain production has always been close to perfect competition.

In Kursk region there is a significant grain proficit in domestic market, for this reason enterprises diversify the distribution area, including export. It enables to sanitize the local market from grain excess, providing a stable and favorable price conjuncture and at the same time it is one of basic elements of the development of any plant-growing subcomplex. [4]. However, none of large regional producers is engaged in the grain export in bulk independently, they only get a wider range of opportunities for promotion and cooperation with large grain processors and consumers and trading houses involved in export, creating more favorable financial conditions for grain sale.
Table 1. The influence of the size of cultivated area on the efficiency of grain production in agricultural organizations in Kursk region in 2015-2018

| Farm groups, cultivated area, thous. ha | A number of farms in the group | It accounts for 1 ha of sowing of cereal crops: | Profitability of sales, % |
|----------------------------------------|-------------------------------|-----------------------------------------------|--------------------------|
|                                        |                               | revenue, RUB, in thousands, | profit, RUB, in thousands, | expenses, RUB, in thousands, | harvest, dt, |                               |
|                                        |                               |                              |                            |                            |                |                               |
| 2018 year                              |                               |                              |                            |                            |                |                               |
| more than 16                           | 10                            | 38.9                         | 12.6                       | 26.3                       | 48.7           | 32.4                         |
| from 8 to 16                           | 10                            | 44.7                         | 13.3                       | 31.4                       | 52.9           | 29.8                         |
| from 4 to 8                            | 15                            | 52.2                         | 15.9                       | 36.5                       | 59.0           | 30.4                         |
| from 2 to 4                            | 45                            | 44.2                         | 14.9                       | 29.4                       | 49.9           | 33.7                         |
| from 1 to 2                            | 35                            | 37.2                         | 10.5                       | 26.8                       | 40.7           | 28.3                         |
| from 0.5 to 1                          | 35                            | 31.4                         | 9.0                        | 22.5                       | 37.6           | 28.5                         |
| from 0.25 to 0.5                       | 17                            | 32.5                         | 9.8                        | 22.7                       | 37.3           | 30.2                         |
| less than 0.25                         | 23                            | 27.3                         | 0.2                        | 27.1                       | 34.6           | 0.9                          |
| in the region                          | 190                           | 41.7                         | 13.1                       | 28.6                       | 49.6           | 31.5                         |
| 2017 year                              |                               |                              |                            |                            |                |                               |
| more than 16                           | 10                            | 32.2                         | 7.9                        | 25.6                       | 52.4           | 24.4                         |
| from 8 to 16                           | 12                            | 37.1                         | 9.7                        | 29.3                       | 59.2           | 26.1                         |
| from 4 to 8                            | 16                            | 35.6                         | 7.3                        | 29.1                       | 56.1           | 20.4                         |
| from 2 to 4                            | 44                            | 29.1                         | 5.0                        | 28.2                       | 53.4           | 17.0                         |
| from 1 to 2                            | 42                            | 26.5                         | 0.9                        | 23.6                       | 47.2           | 3.4                          |
| from 0.5 to 1                          | 32                            | 21.3                         | 4.4                        | 33.8                       | 41.5           | 20.5                         |
| from 0.25 to 0.5                       | 21                            | 22.8                         | 0.2                        | 19.2                       | 34.0           | 0.8                          |
| less than 0.25                         | 18                            | 19.8                         | 2.3                        | 19.7                       | 32.0           | 11.8                         |
| in the region                          | 195                           | 32.1                         | 6.9                        | 27.1                       | 53.3           | 21.6                         |
| 2016 year                              |                               |                              |                            |                            |                |                               |
| more than 16                           | 6                             | 25.5                         | 8.1                        | 20.2                       | 33.6           | 31.7                         |
| from 8 to 16                           | 9                             | 38.7                         | 12.9                       | 25.4                       | 44.3           | 33.3                         |
| from 4 to 8                            | 15                            | 51.5                         | 17.5                       | 24.2                       | 44.1           | 34.1                         |
| from 2 to 4                            | 47                            | 32.3                         | 7.7                        | 24.0                       | 38.5           | 23.8                         |
| from 1 to 2                            | 49                            | 30.1                         | 7.5                        | 21.7                       | 34.7           | 25.0                         |
| from 0.5 to 1                          | 39                            | 24.0                         | 5.9                        | 17.9                       | 29.8           | 24.7                         |
| from 0.25 to 0.5                       | 21                            | 25.6                         | 4.7                        | 18.6                       | 28.2           | 18.3                         |
| less than 0.25                         | 19                            | 23.9                         | 4.2                        | 17.0                       | 25.2           | 17.6                         |
| in the region                          | 205                           | 32.7                         | 9.8                        | 22.3                       | 37.6           | 29.9                         |
| 2015 year                              |                               |                              |                            |                            |                |                               |
| more than 16                           | 5                             | 30.6                         | 11.8                       | 18.5                       | 32.4           | 38.7                         |
| from 8 to 16                           | 14                            | 40.4                         | 16.4                       | 19.1                       | 35.6           | 40.7                         |
| from 4 to 8                            | 11                            | 47.4                         | 17.9                       | 21.2                       | 34.1           | 37.7                         |
| from 2 to 4                            | 42                            | 37.7                         | 11.6                       | 19.3                       | 33.4           | 30.8                         |
| from 1 to 2                            | 47                            | 25.1                         | 8.7                        | 17.0                       | 28.9           | 34.7                         |
| from 0.5 to 1                          | 48                            | 23.8                         | 6.2                        | 15.8                       | 27.1           | 26.0                         |
| from 0.25 to 0.5                       | 17                            | 45.8                         | 12.0                       | 17.4                       | 30.8           | 26.3                         |
| less than 0.25                         | 21                            | 35.1                         | 7.9                        | 16.9                       | 26.6           | 22.6                         |
| in the region                          | 205                           | 35.6                         | 13.0                       | 18.8                       | 32.9           | 36.4                         |
Big business is traditionally considered as more suitable for mass distribution of innovations in terms of agrotechnical methods of grain cultivation, the introduction of more advanced equipment, the creation of its own grade testing closes to produce high-quality planting material taking into account peculiar properties of regionalization. On the other hand, a more difficult organizational structure has both positive aspects in terms of the possibility to create and finance the individual project of the adoption of innovations and on the contrary. For this reason huge grain producers in comparison with large producers do not have significant preferences in terms of scale factor to activate innovative processes, but they lose without the right regularize of hierarchy of the organizational structure of the flexibility of management and control.

However, there is a downside. The indicators of production and economic efficiency for each group of agricultural organizations depending on the size of the sown area have been identified and compared in the cluster analysis. According to the results of the cluster analysis the group of the largest farms due to the studied indicators is the best during the whole period of the structural crisis. Large farms with a crop area of 4 to 8 thousand hectares and from 8 to 16 thousand hectares have higher production and economic efficiency of grain cultivation. Moreover, the largest farms are inferior in all indicators of production and economic efficiency with the exception of the profitability of sales to the average level in the region (table 1).

Thus, the concentration of sowing in huge organizations’ holdfast, including due to the other large and medium-sized organizations does not contribute to increasing the efficiency of grain production. From the direction of agrotechnical point it is necessary to estimate relatively low productivity, which is the consequence of the inability to provide full intensification of production as evidenced by the lower level of production costs per 1 ha of grain sowing. The increment of the sowing size requires corresponding increase of financial resources. In the conditions of the structural crisis it has become more difficult to attract financial resources through the credit mechanism. Moreover, in the conditions of the fast price increase the money is required to maintain the current agrotechnical level. It means it is necessary to find another strategy of the financial management of agricultural enterprises [5] and it makes look critically at stimulating of the enlargement of business as the way to increase gross grain harvest and the efficiency of its production.

Source: It has been calculated by the author according to the materials of the committee of agro-industrial complex in Kursk region.

4. Conclusion
The development of the grain-food subcomplex directly has an influence on the solution of the problems of food supply and import substitution, as it is a system-forming element of the agro-industrial complex, determining the forage supply of the population. In a number of regions of the country, including Kursk region, grain farming is the basis and the most profitable direction of agricultural production, it is the driver of the development of the whole regional agroindustrial complex. However, the ways of the further increase of gross harvest and the increase of the efficiency are still controversial, even in spite of the developed strategy for the long-term development of the grain product subcomplex. Today there is a tendency of the concentration of the land resources in inner circle’s holdfast, its share of sowing and gross grain harvest is more than 60%. Such processes can be comparable to the strategic goals of the development of the grain product subcomplex only in conditions of matter-of-course market nature of reasons caused pronounced change. Otherwise, a wide range of negative consequences is generate, which will prevent the balanced functioning of the grain market due to the appeared oligopoly.

According to the cluster analysis huge farms are inferior to the other farm groups due to all production and economic indicators of grain cultivation (they were inferior significantly in some years), that is why it is impossible to determine them as locomotive of the increment of gross grain harvest. Additionally, in the current financial and economic conditions, it is more difficult to provide the intensification of production in the largest organizations; therefore they are not able to provide an appropriate level of production costs and high productivity. The inaccessibility of finance along with a
less flexible organizational structure also does not contribute to the effective implementation of innovative potential in the grain farming, which due to resource and administrative capabilities is available for large businesses. Thus, for government control of the development of grain product subcomplex and the realization of its natural and economic potential it is necessary to include the observation of market instruments in the context of the concentration of land resources in huge business’ holdfast, as this cluster of farms is not the most effective example of intense pursuit of activities.

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