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Statistical estimation of agricultural resource potential and opportunities for rural development in Russia based on Census

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Abstract The census, which became the second in the recent history of the country, provided information on the real state of the resource base of the agricultural sector and gave an idea of the potential opportunities for expanded reproduction in the industry. The study of these issues is relevant in the context of the State Program development of agriculture and regulation of the market of food products, raw materials and foodstuffs for 2013-2020, aimed at ensuring food security of the population, developing rural areas and increasing the profitability of agricultural producers. The aim of the study were structural changes in Russian agriculture in 2006-2016. Comparative assessment of the resource potential of Russia's agrarian sector was carried out based on the statistical analysis of the data of the RAC 2006 and the RAC 2016: the size of land and labor resources has been studied, the changes in area and structure of crops have been assessed, the dynamics of the number and structure of livestock in Russia as a whole and in the context of farm categories has been examined. This made it possible to conclude that over the past decade agrarian reforms in Russia's agriculture have led to significant structural shifts, which manifested itself in the change in the composition of rural commodity producers and in the redistribution of resources between farm categories. The analysis of the data showed a trend of concentration and centralization of agricultural production, which was expressed in the size of the total area of land per household.

Keywords: agriculture, agricultural census, resource potential, farm categories, structural changes

1. INTRODUCTION

Under conditions of the policy of import substitution carried out by the state, an assessment of the possibilities of agriculture in ensuring the country's food security is required. Therefore, the All-Russian Agricultural Census (RAC 2016), conducted in 2016, was extremely necessary to get a full picture not only of the real state of the agricultural sector, but also its resource base, which determines the potential for expansion of production [1].

The preliminary results of the All-Russian Agricultural Census of 2016 [2], submitted by Federal State Statistical Service, although not final, however, according to the deputy head of the FSSS, K. E. Laikam, should not change significantly. Therefore, even now, the census data allow assessing the current resource potential of the industry, as well as the changes that have occurred in Russia's agrarian sector over the past 10 years. Comparison of these data with the results of the first agricultural census of 2006 (RAC 2006) provides valuable information on the structural changes that occurred during the implementation of state agricultural development programs (the Priority National Project "Development of the AIC",

the adoption of the Federal Law "On the Development of Agriculture", the State Program development of agriculture and regulation of the market of food products, raw materials and foodstuffs for 2008-2012, and then for 2013-2020, the Concept of long-term socio-economic development AIC of Russia for the period up to 2020).

2. RESEARCH METHODOLOGY

Since the beginning of the 1990s, the foundations of Russia's multi-structural economy have been laid, market relations are developing. New forms of large-scale production are appearing on the basis of the reorganized collective and state farms. In connection with the need for self-sufficiency in food, the production of the personal subsidiary and other individual households was expanding, the farming sector appeared [3].

According to the classification of agricultural census, legal entities and individuals who are owners, users, made the object of statistical research or tenants of land intended or used for agriculture, or has agricultural animals [4].

Agricultural producers of Russia are represented by three categories of farms:

- agricultural organizations (organizations that are not related to small business entities and small enterprises, including microenterprises) (AO);
- peasant farms (PF) and individual entrepreneurs (IE);
- personal subsidiary plots and other individual farms of citizens (PSP);
- gardening and non-profit associations of citizens.

In the course of the All-Russian Agricultural Census of 2016 AO used to be business partnerships, limited or additional liability company, closed and open joint-stock companies, production cooperatives, tribal communities, unitary enterprises, subsidiary agricultural enterprises of non-agricultural organizations.

Peasant farm is an association of citizens connected by kinship, having common property and jointly carrying out entrepreneurial, industrial and other economic activities.

An individual entrepreneur is a citizen (an individual) engaged in entrepreneurial activity without the formation of a legal entity from the moment of his state registration in accordance with Article 23 of the Civil Code of the Russian Federation and indicated in the Certificate of State Registration the types of activities relating to agriculture.

Personal subsidiary farming is a form of non-entrepreneurial activity in the production and processing of agricultural products carried out by the individual labor of a citizen and members of his family in order to meet personal needs on a land plot granted or acquired for the conduct of a personal subsidiary farm.

Gardening non-profit association of citizens is a non-profit organization established by citizens on a voluntary basis to assist its members in solving common social and economic problems of gardening and truck farming [5].

The preliminary results of the RAC 2016 contain information on the number of agricultural producers, the availability, size, composition and distribution of labor, land resources, crop areas and perennial plantations, the number of farm animals in total and by farm categories, data on the production infrastructure and technical potential of the industry, sale of agricultural products and access of agricultural producers to subsidies and credits.

The statistical analysis is carried out according to the aggregated data for all categories of agricultural producers at the level of the Russian Federation, which makes it possible to estimate the distribution of resources by farm category as a whole throughout the country, the structure and condition of certain types of resources, and the industrial structure of production.

Since the methodology of the census was practically unchanged compared to the RAC 2006, the study compared paralleled data to assess the dynamics of the development of farm categories, types and forms of agricultural producers in the Russian Federation as a whole during the implementation of state programs.

Let us consider the main structural changes that occurred in the agrarian sector during the period of the implementation of state programs.

2.1 Number of agricultural producers.

The data in Table 1 show that the number of enterprises, mainly market-oriented, has significantly decreased: agricultural organizations by almost 40%, peasant farms - by 46%. At the same time, the structure of producers improved, as the share of enterprises engaged in agricultural activities increased by 7.7% for agricultural organizations and 16.0% for peasant farms. A slight increase in numbers is observed only for IE (19.1%) and for PSP (3.0%). Since the production of agricultural products is a source of additional income and money for 14.6%, and the main source of income for only 0.4% of all farms, the share of PSP engaged in agricultural activities fell by 9.0% to almost 80% that is, at present, every fifth farm does not carry out production activities.

2.2 Land resources.

The census recorded significant changes in the total land area (Table 2), which declined by more than 100 million hectares (or 22.5%).

This is due to a sharp reduction in land in agricultural organizations by 118.7 million hectares (28.9%). At the same time, in the farm sector and individual entrepreneurs the area of land, on the contrary, increased by almost 50% (13.9 million hectares) compared with 2006. The census data also indicate a 34.9% increase in the total land area in personal subsidiary and other individual households, primarily due to their growth in rural settlements. Note that the structure of growth of agricultural land has some differences in the categories of farms.

Thus, in the agricultural organizations, 41.2% of the land that has been abandoned is the most productive part of it - arable land, 47.7% of pasture land and hayfields, the reduction of which is associated with a reduction in the number of cattle.

Table 1. Dynamics of the number of agricultural producers in 2006-2016

	agricultural organizations				peasant farms				individual entrepreneurs				personal subsidiary plots (PSP) and other individual households				non-profit associations			
	2006	2016	Changes for 2006-2016		2006	2016	Changes for 2006-2016		2006	2016	Changes for 2006-2016		2006	2016	Changes for 2006-2016		2006	2016	Changes for 2006-2016	
			±	% to 2006			±	% to 2006			±	% to 2006			±	% to 2006				
Number of organizations - total, thousand	59,2	36,1	-23,1	61,0	253,0	137	-116,4	54,0	32,0	38,1	6,1	119,1	22799	23488	688,6	103,0	80,3	75,9	-4,4	94,5
of them engaged in agricultural activities	40,6	27,5	-13,1	67,7	126,2	90,1	-36,1	71,4	21,3	25,5	4,2	119,7	20219	18721	-1498,4	92,6	74,5	67,6	-6,9	90,7
as a percentage of the total	68,6	76,3	7,7	-	49,9	65,9	16,0	-	66,5	66,9	0,4	-	88,7	79,7	-9,0	-	92,7	89,0	-3,7	-

Table 2. Change in land area by farm categories for 2006-2016

	Farms of all categories		agricultural organizations		Peasant farms and Individual entrepreneurs		Personal subsidiary and other individual farms of citizens	
	±	%	±	%	±	%	±	%
Total land area, thousand hectares	-101,4	77,5	-118,7	71,1	13,9	147,5	3,4	134,9
of which agricultural land	-23,8	85,7	-42,2	68,1	15,4	163,9	3,4	138,9
including:								
arable land	-7,5	92,6	-17,4	78,9	10,1	160,4	-0,1	95,4
hay fields	-3,6	73,9	-5,1	49,8	1,1	198,1	0,4	114,4
pasture	-8,7	75,3	-15,0	50,3	5,3	240,6	1,1	189,4
perennial plantations	-0,1	84,1	-0,1	76,3	0,0	190,6	0,0	83,3
fallow land	-3,8	72,8	-4,6	50,4	-1,1	57,5	2,1	214,5

The use of land in the farm sector seems to be more rational, since opposite tendencies are observed: the share of arable land in the growth of agricultural land was 65.5%, pastures - 34.1%, while the fallow land was almost halved. The increase in the total area of households is explained by the increase in agricultural land by 3.4 million hectares (almost 40%), mainly by fallow land (by 62%), which increased more than 2 times (by 2.1 million hectares).

The positive trend for 2006-2016 is that the share of enterprises engaged in agricultural activities increased from 75.6% to 87.8% in all categories of farms. The greatest increase is observed for non-profit associations of citizens (18.4%) and agricultural organizations (14.8%). In the farm sector, the growth rate of the share of farmland was lower, but in absolute terms it is close to 100% (92.3%), which indicates the dynamic development of this form of management.

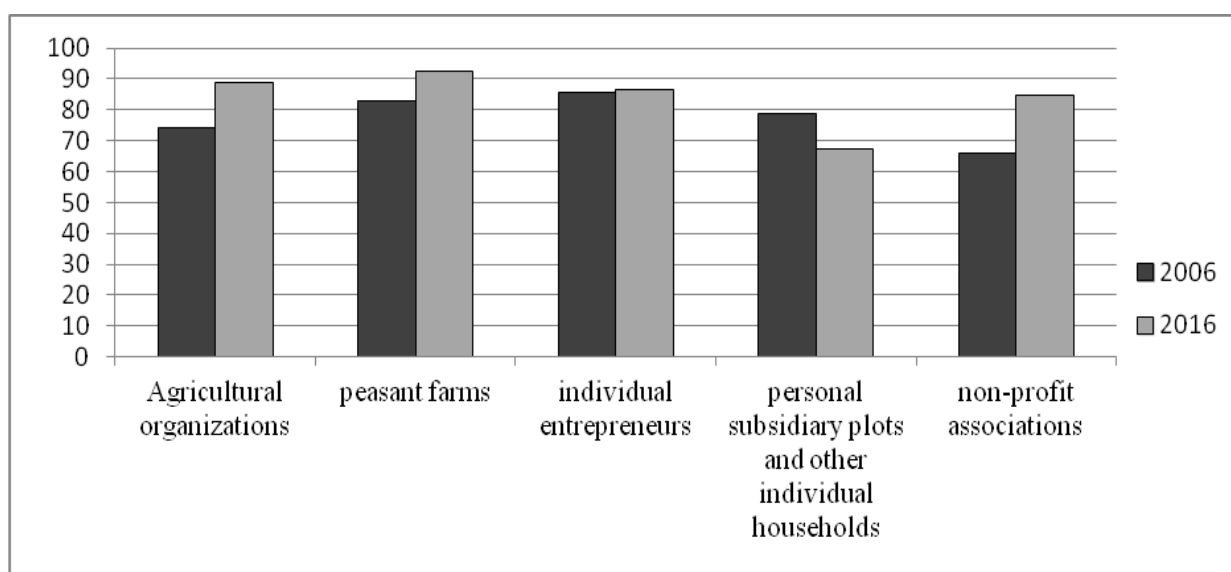


Fig. 1. Dynamics of the share of the agricultural land used by farm categories

The growing integration processes in the agrarian economy determine a clear trend towards the enlargement of enterprises with a reduction in their number (Table 3). This indicates the continuing processes of concentration and centralization of production.

Table 3. Dynamics of the size of land for 1 enterprise

Type of land	Agricultural organizations			Peasant farms			Individual entrepreneurs			Personal subsidiary and other individual farms of citizens		
	2006	2016	deviation %	2006	2016	deviation %	2006	2016	deviation %	2006	2016	deviation %
Total land area, thousand hectares	6930	8077	116,6	102,6	277,1	270,0	106,2	142,6	134,3	0,43	0,56	130,9
Of which agricultural land	2235	2496	111,7	85,3	256,4	300,6	79,8	118,9	148,9	0,38	0,52	134,8
Including arable land	1389	1797	129,4	59,2	173,0	292,0	54,7	84,0	153,7	0,12	0,11	92,6

The most significant changes occurred in the farming sector, in which the total area of land occupied by 1 peasant farm increased by 2.7 times (up to 277 hectares per farm), while the share of agricultural land in the total area was 92,4% of which 67.5% are arable land. If in 2006 the total area of land belonging to 1PF and IE was approximately equal, then with the start of state support of the farm sector, the size of land for 1 enterprise here has almost doubled. Nevertheless, land in the small-scale sector is not enough to compete with the agricultural organizations, since the area of land per 1 Peasant Farm is 3.4% of the average area of the agricultural organizations. The area of private household plots and other individual households increased by one third, while the area of arable land declined, as the decline in the number of household plots continues to decline, for which they are the main source of income, as well as a decrease in the size of cultivated land.

Cultivated area of crops. In farms of all categories, with an overall increase in the acreage of agricultural crops by 5.8% (Table 4), which in absolute terms is 4.4 million hectares, the most significant increase was noted in industrial crops (by 54%), including areas of sunflowers - by 23.2%, sugar beet - by 11.1%. This is even higher than the growth of grain and leguminous crops, the area of which has grown by 8.5%. Sown areas of other crop groups during this period decreased, and planting of potatoes decreased by one third.

Table 4. Changes in acreage in 2016 as a percentage of 2006

Group of crops	All categories	Agricultural organizations	Peasant farms	household enterprises
Total area under crops	105,8	92,9	170,2	85,4
Cereals and legumes	108,5	93,6	164	139,7
Industrial crops	154,0	150,1	164,2	143,3
Potatoes	67,4	125,8	190,4	58,8
Vegetables and melons	95,8	88,6	142,1	88,8
Fodder	82,5	71,1	228,8	139,4

In the context of the categories of farms, considerable changes occurred in the size of crops. The farmer sector demonstrates the greatest dynamics, where not only crop production, marked by the growth of all crop groups, but also livestock, thanks to which the area of fodder

crops has increased more than 2 times. This led to an increase in their share in the total area of crops by 3% (Figure 1). And in the households there is a multidirectional trend. On the one hand, the total area of crops (by 14.6%) decreased due to the largest share of potatoes (by 41.2%), vegetables and melons (11.2%), on the other - areas under grain and fodder crops (about 40%), which is observed in farms, which in essence are already peasant farms. Thus, the area was redistributed in favor of fodder (+ 8.9%) and grain crops (+ 7.8%) due to a reduction in the specific weight of planting potatoes by 18%. In agricultural organizations, the share of industrial crops increased due to a decrease in fodder crops.

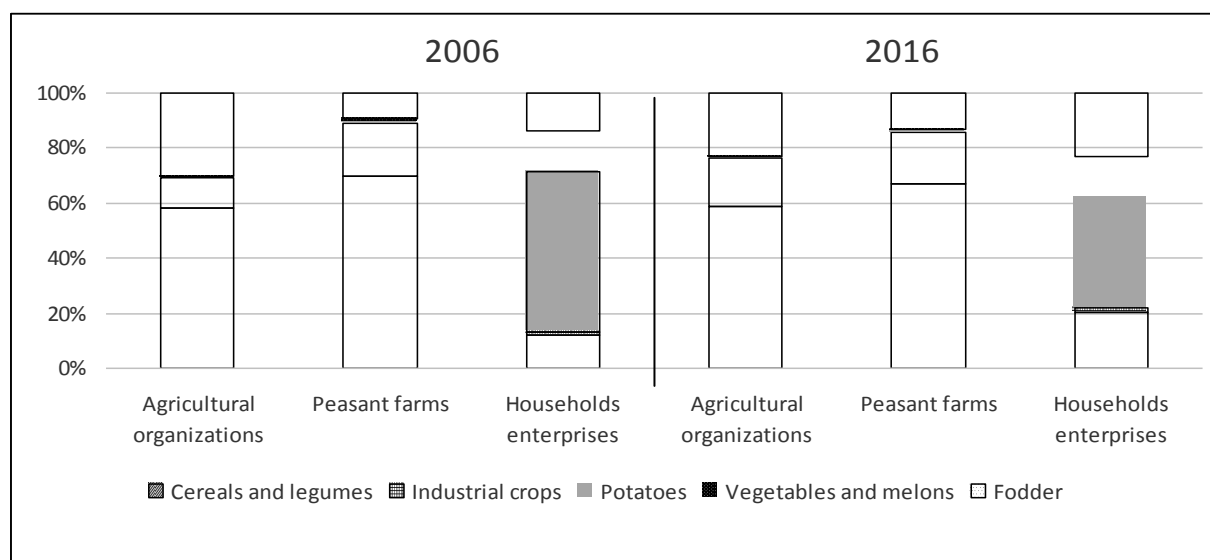


Fig. 2. The structure of acreage by crop group in different categories of farms in 2006 and 2016.

2.3 Livestock of farm animals

Over the past decade, in all types of households, the number of cattle decreased by 4.2 million head (17.8%) (Table 5).

Table 5. Changes in the number of livestock in livestock, thousand head

Type of armanimals	Farms of allcategories		Agricultural organizations		PF and IE		Household enterprises	
	±	%	±	%	±	%	±	%
Cattle - total	-4196	82,2	-2630	76,6	1585	261,8	-3143	72,2
of which cows	-1586	83,4	-863	79,6	774	296,5	-1491	69,8
Milk cattle	-6935	69,4	-3663	65,9	627	173,8	-3892	64,8
Beaf cattle	2741	421,7	1035	317,0	958	843,8	748	404,5
Pigs	6177	136,1	11021	238,8	-101	83,1	-4732	44,6
Sheep and goats - total	4756	121,2	0	100,0	5040	206,4	-266	97,9
Poultry - total, one million units	166	142,4	190	177,5	8	366,7	-32	77,8
Horses	6	100,5	-139	70,9	257	303,2	-112	84,9
Honey bees (families), thousand pieces	-676	81,9	-76	57,8	105	284,0	-686	80,2

The largest losses were suffered by dairy cattle breeding, which lost almost 7 million head (30%), while the number of beef cattle increased more than 4 times (by 2.7 million.). If in 2006 the share of dairy cattle was 96.3%, then in 2016 it decreased to 81.4%. Different tendencies are observed in the categories of farms. Thus, the decline in the number of cattle, with the exception of beef cattle, is registered in agricultural organizations by almost a quarter and in PSP (by 27.8%). The farming sector is also showing a tendency to increase the number of cattle, which increased by 2.6 times, the number of cows - almost 3 times. Even in the dairy herd there is an increase of 73.8%, the number of beef cattle, having increased 8.5 times, determined the contribution to the total number of livestock by more than a third. It is important to note the increase in the number of poultry by 42% and pigs by more than a third in all categories of farms, except for private plots due to the growth of their livestock in the agricultural organizations.

The change in the number could not but affect the structure of the livestock (Table 6). As part of ensuring food security in recent years, an active state policy is being pursued to accelerate the development of livestock, the highest return received in pigs and poultry [6]. The increase in the number of pigs in the agricultural organizations increased their specific weight from 46.4 to 81.5% with a decrease in the role of private subsidiary plots from 50.0 to 16.4%. The specific weight of the poultry also increased in the agricultural organizations by 15.5% due to other categories of farms. The contribution of the farming sector is evident in stopping the negative trends that have been observed over the last 25 years in the number of livestock. During the period of implementation of state programs, the share of peasant farms in the cattle increased from 4.2 to 13.3%, including for cows from 4.1 to 14.6%. The number of beef cattle increased to 30%. The importance of PSP is still great, despite the general tendency to reduce their share in the number of livestock.

Table 6. Dynamics of the structure of livestock population in 2006-2016

Type of animals	Agricultural organizations		PF and IE		household enterprises	
	2006	2016	2006	2016	2006	2016
Cattle - total	47,7	44,5	4,2	13,3	48,1	42,2
of which cows	44,2	42,2	4,1	14,6	51,6	43,2
Milk cattle	47,4	45,1	3,8	9,4	48,8	45,5
Beef cattle	56,0	42,1	15,1	30,2	28,8	27,7
Pigs	46,4	81,5	3,5	2,1	50,0	16,4
Sheep and goats - total	22,9	18,9	21,1	35,9	55,8	45,1
Poultry - total, one million units	62,5	78,0	0,8	2,0	36,6	20,0
Horses	35,4	25,0	9,4	28,4	55,2	46,6
Honey bees (families), thousand pieces	4,8	3,4	1,5	5,3	92,8	90,9

2.4 Agricultural machinery

Changes in the technical potential of various categories of farms are considered to be interesting (Table 7). Thus, the number of tractors and trucks in the households of the population has increased over the past 10 years, while in the agricultural organizations, on the contrary, it has decreased: more than 45% of tractors, grain harvesters and potato harvesters, trucks and forage harvesters - more than twice. And, as a consequence, the workload per unit of equipment has increased.

Table 7. Dynamics of availability of agricultural machinery and load by categories of farms for 2006-2016, thousands

Indicator	Agricultural organizations		PF and IE		household enterprises	
	2006	2016	2006	2016	2006	2016
Tractors	530,9	294,8	158,8	190,5	413,0	558,3
Combine-harvester:						
grain harvesting	138,0	75,1	54	63	x	x
potato harvesting	4,7	2,7	2,0	2,1	x	x
fodder harvesting	31,1	15,3	2,7	3,4	x	x
Trucks	315,8	135,7	57,1	67,9	506,6	644,6
The number of tractors per 1000 hectares of arable land	6,5	4,5	9,5	7,1	146,7	207,9
Load of arable land per 1 tractor, hectares	155	220	105	141	7	5
The number of grain harvesters per 1000 hectares of grain crops	4	2	6	4	x	x

Unfortunately, the preliminary results of the census do not show the composition and structure of the machines and equipment in the enterprises, but it is well known that the machinery in PSP is of low power, unable to process the land on an industrial scale, and in the presence of significant potato areas, there is no potato harvesting equipment at all, is carried out using machines of agricultural organizations. The processes of modernization of production, which take place in agricultural organizations, are replacing obsolete equipment with more sophisticated machines that surpass the outgoing material and technical base in capacity.

2.5 Labor resources

As a result of the census, a significant reduction in the number of workers employed in agricultural production was noted (Table 8). So, in agricultural organizations, their number has decreased more than twice, to a greater extent due to permanent employees, which declined by 53.5%. In the farming sector, a similar trend is also observed, but the rate of decline in numbers is not so rapid, and the reduction is associated with a decrease in the number of temporary and seasonal workers (from 93.2 to 50.1 thousand people). For individual entrepreneurs, with a slight decrease in the total number of labor resources involved in agriculture, the number of permanent employees has even increased by 2.3%.

CONCLUSION

It is important to note that the expansion and deepening of the study of the state of agriculture, its structure, the effectiveness of using the resource potential of the census data is clearly not enough. There is no data on agricultural land used for hayfields and pastures and their condition due to non-use, availability of crop rotations. In animal husbandry there is no characterization of groups of animals by breed composition, as well as data on the reproduction of the herd. There is no data on the reproduction of labor, the cost of working time for assessing labor productivity. It is necessary to improve the program of the agricultural census taking into account the multifaceted nature of Russia's agriculture, the existence of small business, which impact to the production of agricultural products remains significant. Since there are qualitative differences within the agricultural organizations of different sizes, peasant farms and individual entrepreneurs, personal subsidiary households, to deepen the analysis of structural changes, the

estimation of the state and dynamics of the level of intensification, productivity and efficiency of activities of different categories of farms, it is necessary to involve data from current statistics, and also supplement the census program with cost indicators that characterize the incomes of the agricultural producer [7].

Table 8. Dynamics of labor resources in agricultural organizations, PF and IE for 2006-2016

Category of farms	Year	Number of employees engaged in agricultural production, thousand persons.	including	
			Permanent employees	Temporary and seasonal workers
Agricultural organizations	2006	2613,9	2447,2	166,7
	2016	1232,8	1137,2	95,6
	% of growth	47,2	46,5	57,3
PF	2006	470,2	377	93,2
	2016	293,9	243,8	50,1
	% of growth	62,5	64,7	53,8
IE	2006	83,3	53,3	30
	2016	73,5	54,5	19
	% of growth	88,2	102,3	63,3

The study of the resource potential will make it possible to assess the potential for production of gross agricultural products and the saturation of the market with food, and will also provide an opportunity to analyze rural areas in terms of the possible level of production and the state of the domestic market [8].

Thus, during the last decade of economic and agrarian transformations in Russia, there have been significant changes that led to significant structural shifts in agriculture, which manifested itself in the change in the composition of rural commodity producers and in the redistribution of the resource potential between farm categories. At the same time, there are clearly traced trends in the concentration and centralization of agricultural production, clusters are formed as a set of interrelated producers of a separate type of products, providing a closed cycle in a certain territory, starting from the production, storing and processing them to selling finished products on the market. The expected results of the census in the context of the subjects of the Russian Federation and municipalities on the resources of agricultural producers can be the basis for possible subsequent clustering for individual territories, starting with the municipal district.

The results of the census require further processing, including a detailed study of the variation and distribution of its indicators, the characteristics of not only the categories of farms, but also production types, as in Europe and the US, with the aim of developing differentiated agrarian policies and the development of rural areas.

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