

ЭКОНОМИКА РОССИИ И РЕГИОНОВ

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Conceptual issues of management of sectoral territorial differentiation of the region

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Abstract

The article presents the results of the study of theoretical and methodological aspects of the assessment of territorial differentiation of regional agricultural production, its essence and a set of conditioning indicators are clarified. The assessment of the functioning of agriculture in the Vologda region (26 municipal districts), including the results of a survey of heads of agricultural organizations, was carried out. In order to study the regional differentiation of agricultural production and determine growth points on the materials of the Vologda region for 2020, their typological groupings were performed (cluster analysis by the method of «averages» in the program package «STATISTICA 10») based on a set of 33 economic indicators characterizing the availability of resources and the results of production activities. As a result, four groups of districts were identified. The study, in general, deepens the systematic mapping of agricultural production development in rural areas, which will allow us in the future to develop a scientifically based set of directions, measures, tools of state management of agricultural production to smooth territorial differentiation, as well as to improve the logistics system. **The practical significance** of the conducted research is due to the empirical testing of its main provisions in terms of: development and implementation of a database (certificate of state registration of the database № 2021621269 dated 15.06.2021) for monitoring the level of territorial differentiation of agricultural production, designed for operational and objective decision-making in the management of regional sectoral policy. **Also, the obtained research** results, their scientific and practical significance, the universality of the methodological approaches and recommendations used were used as part of the adjustment of the State Program «Development of the agro-industrial complex and the consumer market of the Vologda Region» (certificate of implementation № 02-3783/21 dated 16.06.2021).

Keywords: *management, sustainable development, territorial differentiation, specialization, agro-industrial complex, agricultural production, production potential, region.*

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Концептуальные вопросы управления отраслевой территориальной дифференциацией региона

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Аннотация

В статье представлены результаты исследования теоретических и методологических аспектов оценки территориальной дифференциации регионального сельскохозяйственного производства, уточнены ее сущность и набор показателей. Проведена оценка функционирования сельского хозяйства Вологодской области (26 муниципальных районов), в том числе по результатам опроса руководителей сельскохозяйственных организаций. Для изучения региональной дифференциации сельскохозяйственного производства и определения точек роста по материалам Вологодской области за 2020 год проведена их типологическая группировка (кластерный анализ методом «средних» в программном комплексе «STATISTICA 10») по совокупности 33 экономических показателей, характеризующих обеспеченность ресурсами и результаты производственной деятельности. В результате были выделены четыре группы районов. Исследование, в целом, углубляет системную территориальную дифференциацию сельскохозяйственного производства, что позволит нам в дальнейшем разработать научно обоснованный комплекс направлений, мероприятий, инструментов государственного управления сельскохозяйственным производством для сглаживания территориальной дифференциации, а также совершенствования системы материально-технического обеспечения для перехода сельского хозяйства на интенсивный путь развития. **Практическая значимость** проведенного исследования обусловлена эмпирической апробацией его основных положений в части: разработки и внедрения базы данных (свидетельство о государственной регистрации базы данных № 2021621269 от 15.06.2021) для мониторинга уровня территориальной дифференциации сельскохозяйственного производства, предназначенной для принятия управленческих оперативных и объективных решений. **Также полученные результаты** исследования, их научная и практическая значимость, универсальность методических подходов и рекомендаций были использованы в рамках корректировки Государственной

программы «Развитие агропромышленного комплекса и потребительского рынка Вологодской области» (справка о внедрении № 02-3783/21 от 16.06.2021).

Ключевые слова: управление, устойчивое развитие, территориальная дифференциация, специализация, агропромышленный комплекс, сельскохозяйственное производство, производственный потенциал, регион.

Статья подготовлена в рамках государственного задания ИПР РАН: тема НИР «Институциональная трансформация экономической безопасности при решении социально-экономических проблем устойчивого развития национального хозяйства России»; тема НИР «Моделирование процессов обеспечения устойчивого и сбалансированного социально-экономического и пространственного развития России и стран ближнего зарубежья в целях формирования Большого евразийского партнерства».

Problem statement

The Strategy of Spatial Development of the Russian Federation for the period up to 2025¹ presents an expanded list of problems of sustainable development of Russia, among which it is possible to single out separately:

- high level of interregional socio-economic cooperation;
- insufficient number of economic growth centers to ensure acceleration of economic growth of the Russian Federation;
- a significant lag in key socio-economic indicators from the average Russian level of a part of the subjects of the Russian Federation that have geostrategic significance, including a number of subjects of the Russian Federation located in the Far East, from which a significant migration outflow of the population continues;
- significant intra-regional differences in the level of socio-economic development, including the lag in the standard of living of a significant part of the population of rural areas from the standard of living of urban residents;
- unbalanced spatial development of large urban agglomerations and the largest urban agglomerations, etc.

The pointed problems demand scientifically grounded working out of measures of administrative influence on the basis of specification of a set of the factors forming and strengthening territorial differentiation of agricultural production; the construction of the map of territorial differentiation of municipal areas on the basis of the specified complex set of indicators.

It should be noted that in the conditions of aggravated systemic problems in the economy, global challenges and threats, Russian economic scientists are paying increasing attention to the multiple differences in Russia's regions in terms of socio-economic development. According to their estimates, the high differentiation of territories is due to the different «reactions» of organizations to these global challenges and threats, which directly affects the volume of production, and ultimately – the formation of incomes of the population, the development of territories as a whole.

Recognizing the severity of the current situation, the federal authorities continue to focus on the development and implementation of sectoral projects and strategies that contribute to achieving the planned values of macroeconomical indicators. The development of individual territories, the smoothing of existing imbalances in the development of industries becomes the main task of the bodies of the subject of management of Russia.

For example, in the agricultural sector of the Vologda Oblast the differentiation of territories by the level of agricultural production is manifested in the consistent concentration of activity in limited areas with competitive advantages (usually, these are suburban areas), large areas of the region, where the rural population continues to live, degrade economically and turn into depressed areas. However,

¹ Decree of the Government of the Russian Federation dated February 13, 2019 № 207-R «Strategy of Spatial Development of the Russian Federation for the period up to 2025», available at: <http://static.government.ru/media/files/UVA1qUtT08o60RktoOXI22JjAe7irNxc.pdf>.

among the implemented target programmes of the sector there are none directly aimed at reducing the territorial differentiation of agricultural production. Thus the measures of the State Programme of Agricultural development and regulation of markets of agricultural products, raw materials and foodstuffs for 2008-2012 and for 2013-2020 do not have a clearly expressed direction of smoothening the territorial differentiation taking into account the state of territorial heterogeneity in the levels of consumption and production of agricultural products as well as the regional specifics of agricultural production. Indirectly this fact confirms the low priority of this problem for the regional authorities.

In this connection, the investigated problematics is actual both from the practical and theoretical point of view.

The theoretical and methodological basis of the conducted research was the provisions of the fundamental works of domestic and foreign scientists in the field of management analysis of the agro-industrial complex, improving the efficiency of its functioning, as well as smoothening territorial differentiation and specialization of industrial sectors. The study is based on the use of the principle of objectivity and the principle of consistency (the object and subject of the study are considered in connection with all elements). General scientific research methods were used (abstract-logical, systematic approaches, generalization method, economic-statistical, sociological, etc.), statistical (grouping, sampling, comparison and generalization), graphical and tabular methods of data visualization.

The information base of the research includes: the results of previously conducted research by domestic and foreign scientists, presented in monographs, periodicals, electronic Internet resources; regulatory legal acts; materials of state statistics bodies, data of departmental statistics of the Department of agriculture and food resources of the Vologda region, as well as the results of questionnaires surveys of heads of agricultural organizations in the region.

The review of the literature on the topic of research

The study of the patterns of agricultural location has developed simultaneously within different scientific disciplines, mainly economic, agronomic and geographical. In modern conditions the importance of economic geography and regionalistics has not diminished, and the structural qualities of the phenomenon under study (territorial structure of economic sectors, sectoral structure of the economy of districts) are usually considered as the location features.

A.G. Granberg, A.N., Zubarevich, A.I. Kostyaev, V.N. Leksin, P.A. Minakir, S.A. Suspitsyn and other scientists (Granberg, 2006; Zubarevich, 2010; Kostyaev, 1986, 2006; Leksin and Shvetsov, 2001; Minakir and Demyanenko, 2014) have been engaged in the spatial dimension of productive forces, state regulation of spatial development and regional policy in general.

The problems of territorial differentiation of agriculture have been directly addressed in economic science to a greater or lesser extent since the late 17th century. Initially, these were works on the theory of land rent, which dealt mainly with the differentiation of localities by the amount of income received from agriculture, due to differences in land fertility and location (W. Petty, A. Smith, D. Ricardo, K. Marx, etc.).

In the writings of J. Thunen. He justified the belt differentiation of market prices, land rents and farming systems. Subsequently, these ideas were developed by A. Chayanov and A. Granberg. Under the conditions of the planned Soviet economy this direction was developed in the works on agricultural zoning (A. Chelintsev, V. Nemchinov, A. Shutkov, I. Khitskov, A. Libkind, etc.) (Nemchinov, 1967; Chayanov, 1989; Chelintsev, 1919; Obolensky, 1963; Shutkov, 2019); closely related are the studies devoted to specialization and optimization of agricultural production location (A. Kostyaev, V. Miloserdov, E. Krylatych, etc.) (Kostyaev, 1986, 2006; Adukov and Adukova et al. 2013; Adukov and Adukova 2016; Altukhov, 2005; Anisimov, 1990; Malysh, 2002; Malozemov, 2016).

Systematization of the views of the founders of economic theory, representatives of Soviet economics, Russian scientists since the XVII century and up to the present time on the problem under study has revealed that there has not yet been a clear idea of the essence of territorial differentiation of agricultural production, including with regard to the peculiarities of its current state. From our point of view, territorial differentiation should be understood as a phenomenon reflecting significant

differences between territories in the levels of agricultural production development, taking into account natural, socio-economic, as well as biological factors.

As part of the study of the territorial differentiation of agricultural production it is also necessary to note a complex, steadily developing economic process – the specialization of agriculture, the depth of which depends largely on the influence of a set of conditions of economic, social, demographic nature, as well as factors determined by the characteristics of agricultural production itself.

We consider it expedient to consider the specialization of agriculture as a complex and versatile process that includes the rational placement of production in natural and economic zones, individual industries and sub-sectors, agricultural enterprises and their production units. As a form of social division of labor, the specialization of agriculture is expressed in the predominant production of certain types of products, and sometimes in the performance of a separate stage in the production of the finished product.

The results of the study

For a comprehensive and objective assessment of the territorial differentiation of agricultural production, in our opinion, a system of indicators should be used that characterize the use of the main factors of agricultural production – land, labor and funds in parallel comparison with indicators of production efficiency. A set of 33 qualitative and quantitative indicators presented in Table 1 is proposed. It should be noted that the above factors affecting the placement of agricultural production and approaches to their definition are not exhaustive.

Table 1 / Таблица 1

**System of indicators for assessing the territorial differentiation of agricultural production /
Система показателей оценки территориальной дифференциации
сельскохозяйственного производства**

Quantitative indicators	Qualitative indicators
Cropland area, ha	Availability of cattle per 100 hectares of farmland, heads
Area under crops, ha	Presence of cows per 100 hectares of arable land, heads
Area of cereals, ha	Cattle availability per 100 hectares of arable land, heads
Area of forage lands, ha	Cows per 100 hectares of arable land, heads
The number of population permanently living in rural areas, thousand people	Average milk yield from 1 cow, kg
Average monthly income of one worker, rubles	Production of poultry and cattle per 100 hectares of arable land, kg
Number of cattle, heads	Yield capacity of leguminous crops and cereals from arable land, kg/ha
Heads of cows	Efficiency (gross agricultural output in comparable prices per 100 rubles of fixed assets), rub.
Gross milk yield, tonnes	Equipment density (fixed assets per 1 hectare of farmland)
Gross harvest of cereals, tonnes	Equipment capacity (fixed assets per one employee)
Availability of energy capacity, thousand hp	Labour productivity (in comparable prices,) rub.
	Labour inputs for production of 1 centner of milk, man/hour.
	Labour costs to produce 1 quintal of grain, man/hour.
	Cost of production of 1 tonne of milk, roubles.
	The cost of production of 1 ton of grain, rub.
	Material intensity of the agricultural production, rub.
	Energy availability (energy capacity per 100 hectares of agricultural land), hp.
	Energy capacity (energy capacity per employee in the agricultural sector), HP.
	Profitability of the whole business (including subsidies), %
	Current liquidity ratio

Source / Источник: developed by the authors / разработано авторами.

On the whole, the proposed methodological approach for assessing the territorial differentiation of territories in terms of agricultural production is presented in figure 1 (Anishchenko and Usmanov, 2020, 2021).

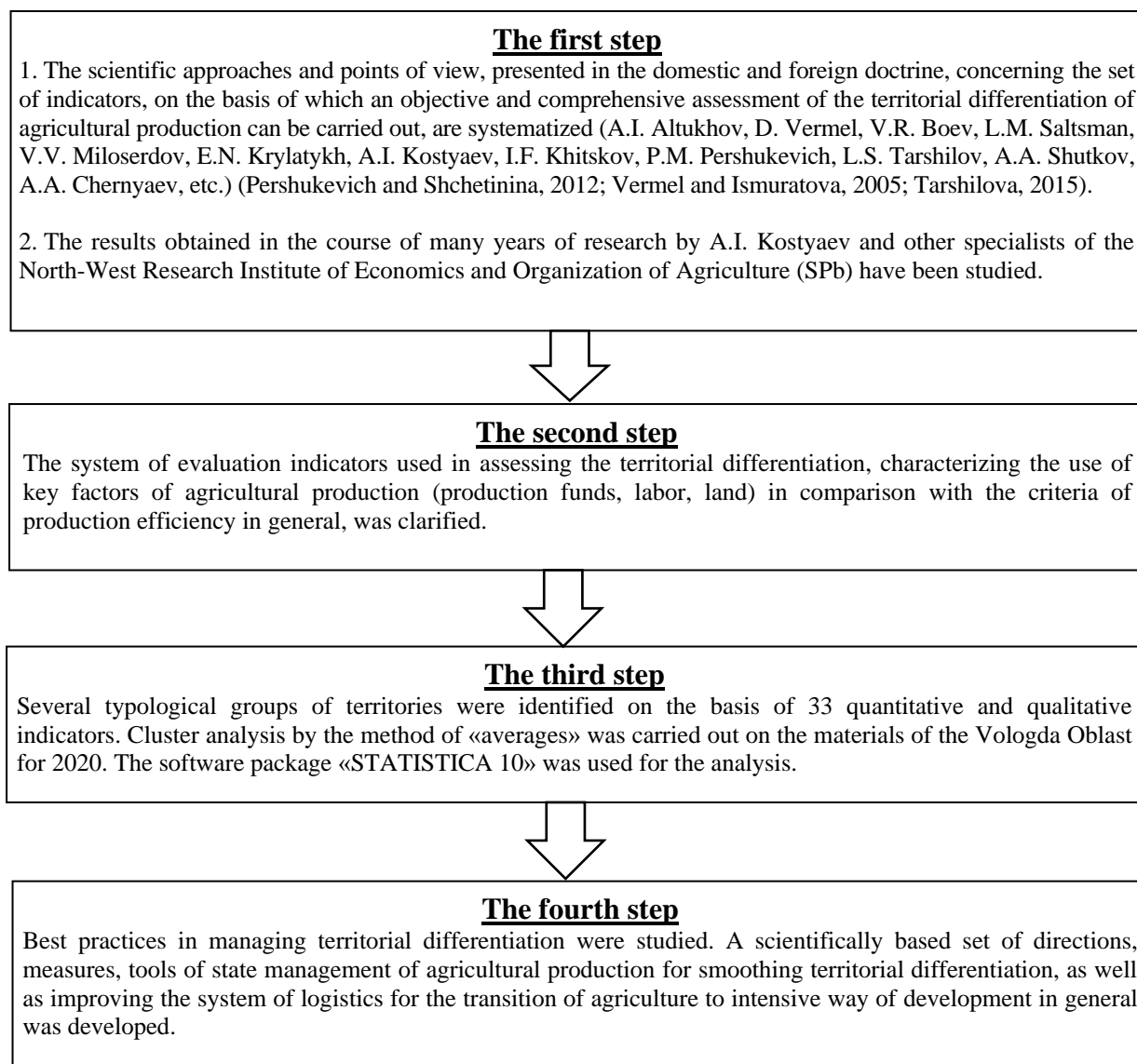


Fig. 1. / Рис. 1. Methodology for assessing territorial differentiation by level of agricultural production agricultural production / Методология оценки территориальной дифференциации по уровню сельскохозяйственного производства сельскохозяйственной продукции

Source / Источник: compiled by the authors / составлено авторами.

Note that at this stage of the study, the article presents results from three phases.

Proceeding directly to the methodology of assessing the territorial differentiation by the level of agricultural production, we should mention that the Vologda region was chosen to study the territorial differentiation of agricultural production, because agriculture makes a significant contribution to socio-economic development of the region and is one of the basic sectors of the economy. Having 0,43% of sown areas and 0,79% of the population of the Russian Federation in 2020, the enterprises of the agrarian sector of the region produce about 0,55% of the total agricultural production of the country (12,6% of gross agricultural production of NWF; figure 2), including: flax fiber – 4,35%, milk – 1,82%, eggs – 1,38%, potatoes – 0,70%, etc.

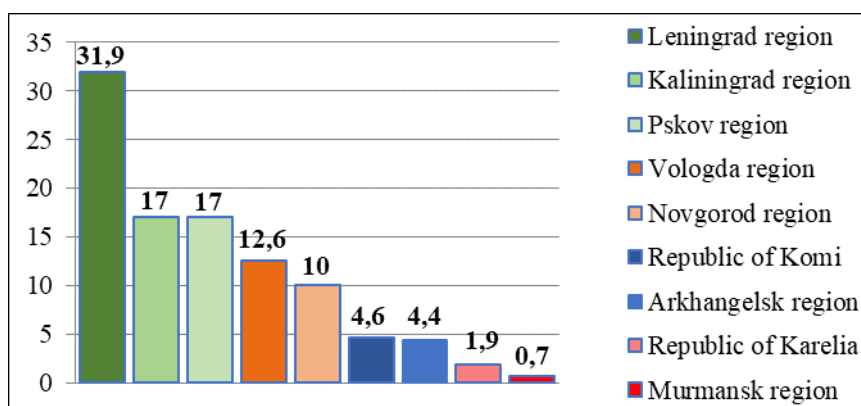


Fig. 2. / Рис. 2. The share of regions in the gross agricultural production of the North-Western Federal District in 2020, % / Доля регионов в валовом производстве продукции сельского хозяйства Северо-Западного федерального округа в 2020 году, %

Source / Источник: calculated on the basis of data from the official website of the Unified Interdepartmental Information and Statistical System (EMISS), available at: www.fedstat.ru / рассчитано на основе данных официального сайта Единой межведомственной информационно-статистической системы (ЕМИСС), доступно по адресу: www.fedstat.ru.

In the rating of the subjects of the North-Western Federal District in 2020, the Vologda region ranked first in terms of sown areas of agricultural crops (25,2%); second in terms of cows (23,7%) and gross milk yield (29,3%), as well as egg production (13,9%). In terms of cow productivity, the region is in third place (7969 kg) after Leningrad (9045 kg) and Kaliningrad (8552 kg) regions. Due to its own production, the population of the region is provided with basic foodstuffs (with the exception of meat and vegetables) in accordance with medical standards.

The volume of agricultural production in 2020 amounted to 33,7 billion rubles, the index of agricultural production compared to the level of 2019 – 100,2% (seventh place in the value of the indicator in the district; table 2), while agricultural organizations sold milk – 531,9 thousand tons, meat – 45,2 thousand tons, grain – 15,1 thousand tons. Meat was mainly supplied to the Bryansk and Ryazan regions, milk to Moscow and the Moscow region.

Table 2 / Таблица 2

**Index of agricultural production in all categories of farms, in comparable prices
in % to the previous year / Индекс производства продукции сельского хозяйства
во всех категориях хозяйств, в сопоставимых ценах в % к предыдущему году**

Territory *	2015	2016	2017	2018	2019	2020
Republic of Komi	101,6	104,4	92,5	103,3	96,3	114,8
Kaliningrad region	110,1	94,9	101,0	105,9	114,0	109,4
Pskov region	113,3	119,8	112,0	110,9	118,7	108,9
Murmansk region	77,0	76,2	103,5	102,6	95,8	104,0
Arkhangelsk region	84,6	100,5	84,2	109,0	96,7	101,3
Republic of Karelia	97,2	89,9	91,0	102,9	93,2	100,4
Vologda region	103,7	106,2	88,9	104,5	109,4	100,2
Leningrad region	101,8	95,7	99,8	103,9	101,6	100,1
Novgorod region	114,4	104,8	93,2	102,6	99,4	94,8
NWFD	104,0	100,9	98,0	105,0	105,9	103,0
RUSSIAN FEDERATION	102,1	104,8	102,9	99,8	104,0	101,5

* The ranking of territories was done by the authors in descending order of values for 2020 / Ранжирование территорий произведено в порядке убывания значений за 2020 год.

Source / Источник: Calculated based on data from the official website of the Unified Interagency Information and Statistical System (UMISS), available at: www.fedstat.ru / рассчитано на основе данных официального сайта Единой межведомственной информационно-статистической системы (ЕМИСС), доступно по адресу: www.fedstat.ru.

Consider the main trends in the livestock and crop production sectors in the region for 2015-2020, which account for 75,5% (72,5% in 2019; 66,9% in 2015) and 24,5% respectively (27,5% in 2019; 33,1% in 2015).

One of the negative and most significant trends in agriculture in the region during the study period is the reduction of the resource base. Thus, in the crop sector, the sown area in all categories of farms decreased by 8,1% in 2015-2020, and by more than 50% since 2000. At the same time, the sown area of cereal crops fell by 25,9%, cereal crops by a third, potatoes by 44,4%; vegetables by 20% and flax by a third (table 3).

Table 3/ Таблица 3

**Area under crops by category, in all categories of farms, thousand ha /
Посевная площадь в разрезе сельскохозяйственных культур,
во всех категориях хозяйств, тыс. га**

Indicator	2015	2016	2017	2018	2019	2020	2020 / 2019, %	2020 / 2015, %
Area sown (total), incl.	372,4	365,0	355,1	355,8	350,8	342,3	97,6	91,9
– forage crops	229,2	228,0	224,4	234,6	229,7	238,5	103,8	104,1
– grain crops	116,6	116,4	111,3	103,8	103,3	86,4	83,6	74,1
– potatoes	18,7	12,8	12,1	11,0	11,0	10,4	94,5	55,6
– vegetables	2,0	1,8	1,9	1,7	1,7	1,6	94,1	80,0
– flax	5,8	5,8	5,3	4,7	4,7	3,8	80,9	65,5

Source / Источник: calculated on the basis of data from the official website of the territorial body of the Federal State Statistics Service in the Vologda Oblast, available at: www.vologdastat.ru / рассчитано на основе данных официального сайта территориального органа Федеральной службы государственной статистики по Вологодской области, доступно по адресу: www.vologdastat.ru.

In the livestock sector, the number of pigs decreased by 50,4% and the number of sheep and goats by 38,6% in all categories of farms in 2015-2020. The number of cattle, including cows, increased slightly (by 1,5% and 1,2%, respectively), but it is premature to talk in a positive way in the current economic conditions (table 4). This is mainly due to the new types of state support introduced in 2015-2016: subsidies are allocated from the regional budget for cow herd growth (for one head – 50000 roubles, one breeding head – 100000 roubles) and for partial reimbursement of costs for the purchase of cows by private subsidiary farms.

Table 4 / Таблица 4

**Livestock and poultry, in all categories of farms, thousand heads /
Поголовье скота и птицы, во всех категориях хозяйств, тыс. голов**

Indicator	2015	2016	2017	2018	2019	2020	2020 / 2019, %	2020 / 2015, %
The number of cattle	163,7	166,0	166,1	165,8	166,1	166,2	100,1	101,5
– including cows	75,8	75,7	76,4	77,0	76,3	76,7	100,5	101,2
Pigs	103,2	63,1	51,1	51,8	53,9	51,2	95,0	49,6
Poultry	2933	3287	3271	3275	3647	3676	100,8	125,3
Sheep and goats	16,6	16,9	14,3	12,9	11,8	10,2	86,4	61,4

Source / Источник: calculated on the basis of data from the official website of the territorial body of the Federal State Statistics Service in the Vologda Oblast, available at: www.vologdastat.ru / составлено на основе официальных статистических данных Территориального органа Федеральной службы государственной статистики по Вологодской области, доступно по адресу: <http://vologdastat.gks.ru>.

One more relevant for both industries during 2015-2020 there is a problem of outdated material and technical base, shortage of machinery and equipment in a number of farms in the region, and not the latest modern equipment, but already tested and used in standard production operations (table 5).

Table 5 / Таблица 5

**Provision of agricultural organisations with tractors and combines, pcs. /
Обеспеченность сельскохозяйственных организаций тракторами и комбайнами, шт.**

Type of machine	Year						2020 / 2019,	2020 / 2015,
	2015	2016	2017	2018	2019	2020	%	%
Tractors	2988	2776	2618	2529	2544	2505	98,5	23,9
Ploughs	671	597	574	540	542	543	100,2	22,1
Cultivators	518	498	485	466	454	291	64,1	20,3
Seeders	469	432	328	293	284	152	53,5	9,9
Combine harvesters:								
– combine harvesters	371	352	345	343	333	318	95,5	21,7
– forage harvesters	323	308	298	281	276	267	96,7	29,9
– flax harvesting	48	47	48	38	39	27	69,2	8,8
– potato harvesters	31	24	23	21	21	21	100,0	15,6
Balers	358	336	331	269	280	272	97,1	24,4
Solid fertiliser spreaders	216	201	202	215	207	126	60,9	15,7
There are physical tractors per 1000 hectares of arable land	6	6	6	6	6	6	100,0	31,6
Number of harvesters per 1000 hectares of crops								
– combine harvesters	4	3	4	4	4	4	100,0	44,4
– potato harvesters	25	20	18	20	20	19	95,0	39,6
– flaxseed	12	16	15	14	15	15	100,0	45,5

Source / Источник: calculated on the basis of data from the official website of the territorial body of the Federal State Statistics Service in the Vologda Oblast, available at: www.vologdastat.ru / рассчитано на основе данных официального сайта территориального органа Федеральной службы государственной статистики по Вологодской области, доступно по адресу: www.vologdastat.ru.

The presence and severity of this problem is also emphasized by the results obtained as a result of the survey of the heads of agricultural organizations in the region². For example, it was revealed that in 2020 the main funds were worn out by an average of 56% (table 6). The share of tractors older than 10 years is 49%, forage harvesters – 48%, grain harvesters – 38%, tillage machinery – 45-50%.

Table 6 / Таблица 6

**The degree of depreciation of fixed assets of agricultural organizations in the region,
in % of the number of respondents / Степень износа основных фондов сельхозорганизаций
региона, в % от числа ответивших**

Degree of deterioration, %	2015	2016	2017	2018	2019	2020
less than 50	20	0	23	55	26	21
51-60	18	0	31	11	17	26
61-70	18	13	19	11	21	26
71-80	13	9	15	8	22	16
81-90	15	11	4	9	9	8
more than 91	16	0	8	6	5	2
Average value	63	58	56	49	58	56

² The survey was conducted among agricultural organizations of various organizational and legal forms of ownership of the Vologda region in 2021 in order to assess the state of agriculture and determine directions for its improvement.

An acute problem remains the lack of highly qualified personnel, mainly due to low wages and underdevelopment of the social infrastructure of the territory. According to the heads of agricultural organizations of the Vologda region in 2020, the degree of provision of the surveyed agricultural organizations with managers, specialists, workers and seasonal workers was characterized as satisfactory (98,2% of respondents). Compared with the results of the survey conducted in 2020, the proportion of those who noted the need to increase the number of employees in the «managers» category increased slightly.

The mechanism for providing state support remains imperfect: budget funds are allocated to economically strong farms that are able to ensure the return of credit resources, have a collateral base and large sales volumes. Of course, such a concentration of credit resources ensures a relatively high efficiency of budget support, but the situation of medium-sized agricultural organizations and small forms of management (personal subsidiary farms, peasant farms) is aggravated at the same time.

In general, the effectiveness of the actions of the Government of the Russian Federation in solving agricultural problems in 2020, the surveyed heads of agricultural organizations in the region estimated an average of 3,5 points (on a ten-point scale, in 2019 – 4,5 points); the activities of the administration of the region and the district – 3,5 points (in 2019 – 5,7 and 5,0 points, respectively).

It should be noted that, despite the reduction of the resource base, the sufficiently high level of depreciation of the material and technical base, the shortage of highly qualified personnel and the insufficient level of state support for agriculture in the Vologda Oblast for the risky farming zone, production has been intensifying in recent years.

In the livestock industry, milk production in 2020 increased by 4,7% compared to 2019 (18,6% compared to 2000). In terms of the value of this indicator, the Vologda Oblast in 2020 ranked second in the North-Western Federal District (after the Leningrad Region) and 12th in Russia.

This was mainly due to a 5,1% increase in cow productivity. Thus, the average milk yield from one cow in agricultural organizations of the Oblast in 2020 reached an absolute historic record and amounted to 7969 kg (10,1% to the level of 2019, 2,7 times the level of 2000), which is 18% higher than the average value of the indicator in Russia (table 7). The highest cow productivity was achieved in the farms of the Gryazovets District – 9599 kg (5,5% above the 2019 level), Totemsky District – 9065 kg (108,3%) and Sokolsky District – 8958 kg (109,4%).

Table 7 / Таблица 7

**Indicators of livestock sector development in agricultural organizations /
Показатели развития отрасли животноводства в сельхозорганизациях**

Indicator	Year									2020 / 2019, %	2020 / 2000, %
	2000	2005	2010	2015	2016	2017	2018	2019	2020		
Total milk yield, thousand tonnes	494,9	470,1	443	469,6	489,3	508,6	532,0	560,6	587,0	104,7	118,6
Milk yield per cow, kg	2975	4219	4890	6411	6668	6914	7160	7580	7969	105,1	267,9
Egg production, mln.	538,3	620,4	587,1	473,0	562,0	494,5	499,7	623,5	617,7	99,1	114,8
Average daily weight gain of cattle, grams.	394	507	551	636	664	661	669	708	727	102,7	184,5
Average egg production per laying hen, pcs.	297	310	313	284	316	293	270	309	314	101,6	105,7

Source / Источник: calculated on the basis of data from the official website of the territorial body of the Federal State Statistics Service in the Vologda Oblast, available at: www.vologdastat.ru / составлено на основе данных официального сайта территориального органа Федеральной службы государственной статистики по Вологодской области, доступно по адресу: www.vologdastat.ru.

Egg production in farms of all categories in the region in 2020 was 617,6 million eggs (99,1% of the 2019 level), including 600,0 million eggs (99,2%) in agricultural organisations. At the end of 2020, the region ranked second among NWFD subjects in terms of egg production. Poultry meat production

has also shown significant growth over the past two years, with gross poultry meat production totalling 19,500 tonnes (121,9% of the 2019 level).

In the sector of crop production the gross harvest of cereals in 2020 was 143,3 thousand tons, which is 25,6% lower than in the previous year, the yield was 17,0 c/ha (higher than in 2000 by 25%; table 8). According to the results of 2020, the region ranked third in the Russian Federation in terms of flax-fibre crops: the sown area was 3,8 thousand ha or more than 11% of the total sown area in the country. The gross flax fiber yield was 1,7 thousand tonnes, with a yield of 6 cwt/ha (50,0% higher than in 2019 and 27,7% higher than in 2000).

Table 8 / Таблица 8

Crop production indicators / Показатели развития отрасли растениеводства

Indicator	Year									2020 / 2019, %	2020 / 2000, %
	2000	2005	2010	2015	2016	2017	2018	2019	2020		
Total gross harvest of agricultural crops, thousand tonnes, incl.											
– grain crops	220,3	192,8	153,5	252,7	222,5	139,2	163,0	192,7	143,3	74,4	65,0
– potatoes	481,5	255,1	173,9	234,7	257,3	106,0	161,1	190,8	136,6	71,6	28,4
– vegetables	127,4	74,4	45,9	60,6	59,9	49,8	47,2	47,3	44,9	94,9	35,2
– flaxseed	3,9	4,5	3,4	4,3	3,4	1,9	2,6	1,4	1,7	121,4	43,6
Crop yield, cent/ha, incl.											
– crops (per harvested area)	13,6	16,4	15,9	22,0	19,8	16,7	15,9	23,5	17,0	72,3	125,0
– potatoes	161,5	115,7	93,8	125,2	139,7	92,3	149,0	179,4	132,2	73,7	81,9
– vegetables	233,1	245,5	229,8	279,7	278,1	270,8	279,9	293,8	280,8	95,6	120,5
– flax fiber	4,7	5,1	4,5	8,8	7,1	5,6	6,5	4,0	6,0	150,0	127,7

Source / Источник: calculated on the basis of data from the official website of the territorial body of the Federal State Statistics Service in the Vologda Oblast, available at: www.vologdastat.ru / составлено на основе данных официального сайта территориального органа Федеральной службы государственной статистики по Вологодской области, доступно по адресу: www.vologdastat.ru.

It should be noted that the region's crop production is characterised by pronounced seasonality and strong dependence on natural and climatic conditions. For example, as for the forage harvesting campaign in 2020, unfavourable natural and climatic conditions had a particular impact on its implementation, as in the previous year: over 30% of the sown areas of grain crops, potatoes and long-fibre flax were waterlogged (over 20 thousand ha), where seedlings were soaked and the remaining crops were in a depressed condition for a long time.

Another positive trend in the region's agriculture is the growth of revenues from sales of agricultural products (compared to the level of 2019 – by 10%) – it amounted to 17,3 billion rubles, including revenues from sales of agricultural products of own production and processed products – 16,4 billion rubles (110,2% against the level of 2019). At the same time, the share of profitable agricultural organisations in the total number of organisations was 90%, the level of profitability (including subsidies) was 12%, excluding subsidies – 2,0%.

In the current economic climate, the impact of the COVID-19 pandemic on the functioning of industry organisations cannot be overlooked. Thus, the pandemic has most acutely exposed the serious problems of food independence, the social and economic importance of which is highlighted by Presidential Decree № 20 of 21 January 2020 «On Approval of the Doctrine of Food Security of the Russian Federation»³.

³ Decree of the President of the Russian Federation of January 21, 2020 № 20 «On Approval of the Food Security Doctrine of the Russian Federation», available at: <https://www.garant.ru/products/ipo/prime/doc/73338425/>.

1. Due to a sharp drop in consumer incomes (down 18% during April-June 2020)⁴ and rising unemployment, food consumption culture has changed: demand for individually packaged and locally produced products with a low price threshold has increased. The meat sector could suffer in this situation, as demand for expensive meats has declined significantly; in contrast, the poultry sector looks the most promising, as poultry is the cheapest type of meat. Also at risk are segments of the dairy industry producing expensive cheeses and other premium products.

2. There are food shortages created artificially by the consumers themselves over the course of a few days due to the general rush and increased demand for storable foods (cereals, canned foods, potatoes, carrots, etc.).

3. The halt of active export-import operations due to border closures has resulted in complicated supply chains and higher prices for food products (reduced affordability). Primarily imported vegetables, fruit and dairy products, especially in light of the closure of the border with Belarus, which provides up to 15% of the dairy market.

4. Channels and modes of marketing have been transformed (reduced physical availability of food).

Many food markets and small food outlets are closed during the quarantine period, which has had a negative impact on the marketing of small and medium-sized farms, as well as the inability to buy food in remote parts of the territory. The sale of products through the internet space has come to the fore.

Despite the robotisation and automation of production, the labour shortage faced by Russian agricultural producers due to the pandemic is another pressing issue that needs attention.

First and foremost, these are seasonal workers and those whose labour, if contaminated, cannot be replaced by any other unoccupied worker without professional knowledge and education in the field (milkmaid, tractor driver, agronomist, zootechnician, etc.). As a result, agricultural producers may encounter difficulties in ensuring a complete cycle of production, which is likely to lead to a reduction in the quality of products and the overall productivity of enterprises in the sector.

In general, among the factors constraining agricultural production in 2020, managers most often mentioned insufficient budget support of agricultural producers (82%), the current economic and political situation in Russia as a whole (59%), the worsening disparity of prices for agricultural products (59%) and the critical state of the material and technical base. Difficulties for farmers in production activities were also caused by the lack of highly qualified personnel (46%), the high level of taxation (36% of respondents) and the inability or unwillingness of farmers to work (36%).

The role of agriculture, as noted above, is crucial in the development of the entire agro-industrial complex. This is due to the integration of technical-technological, socio-economic and natural-biological processes and systems. The distinctive features of this industry are the seasonal nature of production; the use of land as a subject and means of labor; strong dependence on natural conditions; lower, compared with other sectors of the economy, marketability of products; slow turnover of the used means of labor; irregularity of the production process, etc. These features have a strong influence on the form, pace and overall process of agricultural production allocation, and also explain the predominant influence of natural factors over socio-economic ones.

Let us first consider the natural factors shaping the territorial differentiation of agricultural production in the Vologda region.

The territory of the region is located in the north of European Russia in the middle and southern taiga sub-zones and belongs to the zone of risky agriculture, characterized by a significant swampiness (12% of the total area). It is caused by slow flow processes due to the flat topography, high precipitation, the presence of water-resistant loams and clays deposited at a shallow depth and an abundance of groundwater.

The climate of the Vologda region is characterised as moderately continental with a short spring, a relatively warm, humid summer, a wet autumn and a long, cold, snowy winter with a steady snow cover. The frost-free period lasts from 95 days in the south-east to 125 days in the south-central part of the region.

⁴ Economists have estimated Russia's economic losses from the coronavirus available at: <https://rg.ru/2020/04/12/ekonomisty-veba-ocenili-poteri-ekonomiki-rossii-ot-koronavirusa.html>.

The region is located in a zone of excessive moisture: annual atmospheric precipitation is 500-650 mm, while evaporation from the water surface and areas occupied by forests is 500-550 mm, from the land – 400-450 mm, from swamps – 350-400 mm. A stable snow cover covers the ground for 165-170 days, reaching a height of 40 to 60 cm in the field and up to 75 cm in the forest by the end of winter.

As far as the soil cover of the Vologda region for agricultural production is concerned, it is rather diverse: podzolic soils prevail in the northern part, sod-podzolic soils in the southern part, swampy soils are found in some places. Podzol soils are dominant in the soil cover of the oblast and have very low natural fertility (high acidity, low content of humus, phosphorus, potassium). It should be noted that bog-podzol soils in agronomic terms are the most infertile, requiring liming, fertilisation and regulation of the water-air regime. They are widespread in the western part of the region. In general, the fertility of most soils in the oblast is low. Average humus content in the soil is 2,5%. More than half of the cultivated (arable) soils are highly acidic, many are prone to erosion and are overwatered. In view of this, agricultural producers annually apply large amounts of organic, mineral, and nitrogen fertilisers and reclaim the soil, otherwise crop yields fall many times over or it becomes impossible to grow them.

Analysis of the productivity of arable land in the region has shown that spring grain crops are highly productive in Kirillovsky District (over 70 appraisal points), while in other districts the soils are moderately productive (41-70 appraisal points). The productivity of arable lands for spring grain crops in 2020 on the average in the region is equal to 57 points on a 100-point scale of appraisal.

Thus, natural and climatic conditions limit the range of crops that can be cultivated in the region in an acceptable and cost-effective manner.

In order to study the regional differentiation of agricultural production in the Vologda region and identify points of growth in municipal districts, the typological groupings based on a set of economic indicators for 2020, characterizing the availability of resources and the results of production activity of the districts, have been carried out. The cluster analysis by the method of «average» in the software package «STATISTICA 10» on 33 qualitative and quantitative indicators was carried out to identify the typological groups.

As a result, four groups of districts were identified (table 9).

Table 9 / Таблица 9

Characteristics of groups of municipal districts by level of agricultural production in the Vologda region in 2020 / Характеристика групп муниципальных районов по уровню сельскохозяйственного производства в Вологодской области в 2020 году

Indicator	Group 1	Group 2	Group 3	Group 4
Cropland area, ha	57199,0	27408,0	12958,0	6321,0
Area under crops, ha	54801,0	25920,0	14785,0	3816,0
Area of cereals, ha	22386,0	8574,0	4746,0	1141,0
Area of forage lands, ha	34106,0	16696,0	9654,0	2356,0
Number of resident rural population, thousand people	32,2	21,4	7,1	4,9
Average monthly income of one worker, rub.	43602,0	35832,0	34744,0	30748,0
Number of cattle, heads	37356,0	10825,0	4485,0	1082,0
Number of cows, heads	17116,0	5191,0	1320,0	575,0
Presence of cattle per 100 ha of farmland, heads	80,0	35,0	33,7	18,6
Presence of cows on 100 hectares of farmland, heads	24,0	13,7	15,7	10,0
Presence of cattle on 100 ha of arable land, heads	65,0	34,7	35,2	23,5
Cows on 100 ha of arable land, heads	28,5	16,3	16,8	12,7
Gross milk yield, tons	146020,0	44586,0	17425,0	3707,0
Average milk yield from a cow, kg	9672,0	8611,0	9008,0	6448,0
Average daily gain of cattle, grams	684,0	579,7	752,0	413,6
Milk production per 100 ha of farmland, kg	1824,0	844,3	930,9	413,4
Cattle and poultry meat production per 100 ha of farmland, kg	106,5	228,7	38,9	16,1
Gross harvest of grain, tons	46972,0	16038,0	8097,0	1540,0
Cereals and legumes yield (from sown area), c/ha	24,1	19,3	20,8	13,5

Indicator	Group 1	Group 2	Group 3	Group 4
Efficiency of capital formation, rubles (gross output in comparable prices, g per 100 rubles of fixed assets)	2,9	2,4	1,4	1,2
Equity capital (availability of fixed assets per one hectare of agricultural land)	165,5	71,5	79,1	16,7
Equipped capital (availability of fixed assets per one employee)	3819,0	2893,0	3258,0	1745,0
Labour productivity (at comparable prices), rub.	25514,5	27971,3	16344,8	9241,3
Labour costs for the production of 1 centner of milk, man/hour	1,3	1,5	1,8	3,2
Labour cost of production of 1 ct of grain, man/hr.	0,3	0,4	0,6	0,7
The cost of production of 1 ton of milk, rub.	16885,5	17082,7	21874,0	19413,0
The cost of production of 1 ton of grain, rub.	7180,5	7896,3	16138,0	13636,0
Material intensity of production, rub.	44,1	42,0	46,9	55,7
Power capacities, thous. horsepower	194,3	73,3	30,7	7,1
Energy availability, horsepower (availability of energy facilities per 100 ha of farmland)	330,0	237,0	260,0	101,0
Energy efficiency, horsepower (availability of energy facilities per 1 employee engaged in agriculture)	78,0	86,0	108,0	68,0
Profitability of all operations (with subsidies), %	24,5	8,9	14,5	6,7
Current liquidity ratio	4,94	2,9	3,24	1,24

Source / Источник: calculated by the authors / рассчитано авторами.

The first typological group is represented by the «leaders» districts – Vologodsky, Gryazovetsky and Cherepovetsky. They differ significantly from the rest by the level of agricultural production; they have the highest aggregate value by almost all indicators and are characterized by the availability of the largest resources for production (e.g., sown area and arable land (54,8 thousand ha and 57,2 thousand ha respectively), the number of cattle and cows, the number of rural population, energy equipment, energy availability, equipment, etc.), high production indicators in the branches of animal husbandry and crop production, as well as a strong financial and economic position (figure 3).



Fig. 3. / Рис. 3. The first typological group of municipal districts according to the level of agricultural production in the Vologda region and its individual characteristics / Первая типологическая группа муниципальных районов по уровню сельскохозяйственного производства в Вологодской области и ее индивидуальным особенностям

Source: / Источник: developed by the authors / разработано авторами.



Fig. 5. / Рис. 5. The third typological group of municipal districts according to the level of agricultural production in the Vologda region and its individual characteristics / Третья типологическая группа муниципальных районов по уровню сельскохозяйственного производства в Вологодской области и ее индивидуальным особенностям
 Source: / Источник: developed by the authors / разработано авторами.

The fourth typological group includes eleven municipal districts of the region: Babayevsky District, Babushkinsky District, Belozersky District, Vazhegodsky District, Vytegorsky District, Kaduisky District, Nyuksensky District, Syamzhensky District, Kharovsky District and Chagodoshchensky District (figure 6). In the districts of this group agriculture has a rather «low» level of development. The volume of agricultural production (including livestock and crop production) is much lower than that of the first and second groups. In some districts, agricultural production is currently in decline.



Fig. 6. / Рис. 6. The fourth typological group of municipal districts by the level of agricultural production in the Vologda region and its individual characteristics / Четвертая типологическая группа муниципальных районов по уровню сельскохозяйственного производства в Вологодской области и ее индивидуальным характеристикам
 Source: / Источник: developed by the authors / разработано авторами.

Thus, the study has shown a deep territorial differentiation of the Vologda region's municipal districts by the level of agricultural production (figure 7). The districts of the first and second typological groups are located mainly in the south and south-west of the region's territory (except for Veliky Ustyug District, located in the second group) and are adjacent to major developed cities – Vologda, Cherepovets, Sheksna, Veliky Ustyug. The districts of the third typological group are located in the central and eastern part of the Oblast, the fourth in the west, the north and two districts (Babushkinsky and Nyksensky) in the east.



Fig. 7. / Рис. 7. Territorial differentiation of agricultural production in the Vologda region in 2020 /
Территориальная дифференциация сельскохозяйственного производства
в Вологодской области в 2020 году

Source: / Источник: developed by the authors / разработано авторами.

On the whole, the study deepens the system mapping of agricultural production development in rural areas. This provides an opportunity to develop a reasonable set of measures to smooth the regional territorial differentiation of agricultural production, in conjunction with the measures of state management of agricultural production.

Conclusions

The study has shown a significant territorial differentiation of municipal districts in the Vologda region by the level of agricultural production. The districts of the first and second typological groups are located mainly in the south and south-west of the region's territory (with the exception of Veliky Ustyug District, located in the second group) and are adjacent to major developed cities – Vologda, Cherepovets, Sheksna, Veliky Ustyug. The districts of the third typological group are located in the central and eastern part of the region, the fourth in the west, the north and two districts (Babushkinsky and Nyksensky) in the east.

It should be noted that in the territory of the Vologda Oblast in the current situation among the implemented target programmes in the agricultural sector there is no one directly aimed at reducing the territorial differentiation of agricultural production. Indirectly this fact confirms the low priority of this problem for the regional authorities. At the same time, in spite of the separate facts of application

of the state agrarian policy tools aimed at smoothing the territorial differentiation in agricultural production in the Vologda Oblast, in general it is in a latent state, only partially present within the federal socio-economic policy, without specific objectives, monitoring system and effective forms, methods and mechanism of regulation of the existing differentiation of agriculture. Also in the conditions of poorly differentiated budget support to agricultural organizations in the Vologda Oblast, carried out in the form of subsidies, there is no economic interest of commodity producers in the diversification of agricultural products produced.

The study deepens the systemic mapping of the development of agricultural production in rural areas, which gives us in future studies an opportunity to reasonably develop a set of directions, measures, tools of state management of agricultural production to smooth the territorial differentiation, as well as to improve the system of logistics for the transition of agriculture to the intensive way of development as a whole.

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