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Multidimensional analysis and comparison of territories in southern Russia by development level of oil subcomplex

Análisis multidimensional y comparación de los territorios de la región del sur de Rusia en cuanto al nivel de desarrollo del subcomplejo de aceite

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Contents

ABSTRACT:
Formulating new approaches to drafting the strategic development plans for a single-product subcomplex of an agro-industrial complex (AIC) involves the transformation of their structural and functional essence, changes in the institutional environment as well as organizational and economic mechanisms of their functioning and the state regulation. Structural and sectoral fragmentation and territorial asymmetry of the productive and economic level of the subcomplex development strongly influences the stockpiling of problems in maintaining its further growth, which reflected in socio-economic indicators.
Keywords: food facility, food security, oil subcomplex, zonal asymmetry

RESUMEN:
La formulación de nuevos enfoques para la redacción de los planes de desarrollo estratégico para un subcomplejo de un solo producto (aceites) de un complejo agroindustrial (AIC) implica la transformación de su esencia estructural y funcional, cambios en el entorno institucional, así como mecanismos organizativos y económicos de su funcionamiento y la regulación estatal. La fragmentación estructural y sectorial y la asimetría territorial del nivel productivo y económico del desarrollo del subcomplejo influyen fuertemente en la acumulación de problemas para mantener su mayor crecimiento, lo que se refleja en los indicadores socioeconómicos.
Palabras clave: instalaciones de alimentación, seguridad alimentaria, subconjunto petrolero, asimetría zonal

1. Introduction

One of the topical problems of a global significance is food provision and thereby food safety of territories. Therefore, the development and stable functioning of the agrarian

sector is traditionally of great strategic importance for the Russian economy. It is manifested in many aspects while the main of them are the economic diversification and the employment provision of the rural population (Kirwan & Maye, 2013) (Brunori, Malandrin, & Rossi, 2013; Moragues-Faus, Sonnino, & Marsden., 2017).

The Russian agro-industrial complex should be considered as a socio-economic system, which includes enterprises and organizations of different branches and spheres of activity (Kazakova, Kazakov, Korobeinikova, Shikhalieva, & Dubskaya, 2017). Within AIC, there were also steady alterations in volume and qualitative indicators of public demands. There was a status transformation for productive forces. All these factors became the main premises of forming a cluster of interconnected branches of the national economy turning into a new economic system, an integral part of AIC, that is namely a food facility. The food facility is a complex multilevel structural entity consisting of branches and sub-branches. It also includes different types of material productions (Tyczewska, Woźniak, Gracz, Kuczyński, & Twardowski, 2018) (Stephens, Jones, & Parsons, 2018) (Chavas, 2017).

The food facility, for its part, consists of several spheres: production of capital goods, product manufacturing, and delivery to the end consumer. Having its own subject filling, each of these spheres is also defined by specific regimens (economic, technological, sociocultural) (Kurennaya, Levushkina, Miroshnichenko, & Agalarova, 2016).

The morphological composition of the food facility is heterogeneous being formed by the aggregate of food subcomplexes differentiated by the production type (Cafiero, Viviani, & Nord, 2018). According to this feature, in the works of (Bhaduri, Sinha, & Knorringa, 2018) the following categories are identified:

1- for animal breeding: meat-processing, poultry, dairy subcomplexes, etc.;

2- for crop production: grain-product, fruit-and-vegetables, beet-sugar, oil-and-fat (oil, oil-processing) subcomplexes, etc.

2. Methodology

2.1. System analysis and functioning factors of oil subcomplex

System analysis of formation and functioning of food subcomplexes should be based on detailed analysis of objective patterns, principles, and factors of data formation and functioning for productive-economic systems. At this stage of research, the main goals are:

1. research of essential and specific characteristics and peculiarities of oil-and-fat subcomplex;
2. isolation of "oil subcomplex" category from the morphological composition of the oil-and-fat subcomplex;
3. explication (with applying model-graphic representation) of oil-and-fat subcomplex structure based on the unity of three approaches: systemic, sectoral, and structural.

In relation to the above-mentioned goals, there is a problem of gnoseological and etymological analysis of the category "oil subcomplex" from the perspective of structural and functional as well as systematic-target approaches. We propose to solve it in accordance with the author's methodology. We consider it appropriate to implement analytical activities combining elements of successive and simultaneous approaches. As applied to scientific research, the successive approach will be expressed by the stepwise perception and analysis of the information array, which characterizes the essence and functionality of the single-product subcomplex. This approach is applicable to the analysis of complex economic systems functioning for a long period. The stepwise monitoring and the analysis of parameters characterizing functioning peculiarities of oil-and-fat subcomplex will allow to define specific features of the analyzed subject more precisely, as well as to reveal and examine possible contradictions arising in the process of the subcomplex functioning (Upton, arriving, & Barrett, 2016) (Swaminathan, 2010).

An implementation of the simultaneous approach will provide an opportunity to analyze a

single-product subcomplex as an integral system with pointing out its separate components, spheres, outlines, functions, principles of functioning, and other immanent characteristics.

Applying a combination of the described above approaches as a part of "oil subcomplex" research provides an advantage constituting in the stepwise analysis of the system in terms of its individual parts as well as in obtaining specific information about the system functioning as an integrated whole.

Additionally, the immanent feature of the oil subcomplex functioning is the chronological non-congruence between the separate stages of the production cycle and the dynamic processes occurring in the resource environment. That leads to the time lag appearance between the incurred costs and revenues generated, the uneven workload and the release of labour resources. All that, in turn, often becomes a source of social problems. An instrument to mitigate this contradiction transforms into the following peculiarity of agricultural production regarding the crop production: need to combine a plant growing with non-agricultural activities to refine negative peaks in money flows and a labour force utilization.

The factor of intra-annual and intra-seasonal transformation of market conditions can be caused by different reasons, among which, first of all, a short period from the full maturing of the oil crops till the end of harvesting can be highlighted. The final market purchase prices are formed during this period, which causes their variability and the necessity to implement measures to compensate fluctuations in supply and demand from product suppliers and buyers.

In addition, the characteristic quality of the oil market (oilseed) primary product, which consists in requirement of the operational processing, set a corresponding goal to the participants of the market of oil products.

Next, we consider the technological factor determined by the significant role of seed production as well as an impact of storage, refining, and drying systems. All these processes have a critical impact on the quality of seeds for processing. This particular factor determines the necessary development and improvement of the corresponding infrastructure. Otherwise, the efforts of oilseed producers aimed at obtaining high yields as well as applying advanced and expensive technologies of oil crop cultivation will fail to provide the expected results. Moreover, the underdeveloped technology of product transfer can cause serious losses both in quantitative and qualitative terms (Garretsen & Martin, 2010) (Young, 2010).

A separate issue can be caused by the producers’ intention to maximize profits at the cost of savings on activities of soil fertility conservation. This intention mostly originates from the financial condition of agricultural enterprises. Such strategy often leads to the disarrangement of crop rotations that can yield some results in the short term but results in serious risks due to the demanding soil condition for oil crops in the medium- and long-term.

An important factor determining economic efficiency in the oil subcomplex is the high capital costs of the production process caused by a large number of counterparties, goods, works, and services. The growth of this indicator negatively affects the profitability of oil production aggravating by underdevelopment of the service and logistics base.

It is necessary to take into account the dependence of agricultural production on demographic processes and the rural continuum development that reflects in the fact of certain requirements to the personnel qualification. Moreover, there is a significant problem with the lack or absence of necessary specialists in rural areas due to issues with inadequate salaries and poor social infrastructure.

The crop production dependence on climate is an objective factor and one of the essential ones. Its influence determinates profit fluctuations and generates natural risks.

2.2. Potential areas for development of oil subcomplex

The process of sustainable development of any productive-economic system including oil subcomplex is a complicated, multistage sequence of logically interconnected steps implemented in fulfilment of the strategic management over a period of time. It is important not only to define the strategy but also to elaborate effective tools for the sustainable development of the planning entity. The methodological component of the development vision for the oil subcomplex is based on the triality of manufacturing, life-supporting and social (leisure quality supply) directions.

It should be noted that separate directions of the oil subcomplex development, in its turn, are structured into detached components. Thus, within the manufacturing direction there are blocks of the actual production activities (technical and technological aspects and yield-increasing measures); efforts of, essentially, a research character (breeding, development of new varieties and hybrids); the formation of organizational and economic relations creating a favourable environment to facilitate a higher realization probability of the existing development capacities of productive-economic systems.

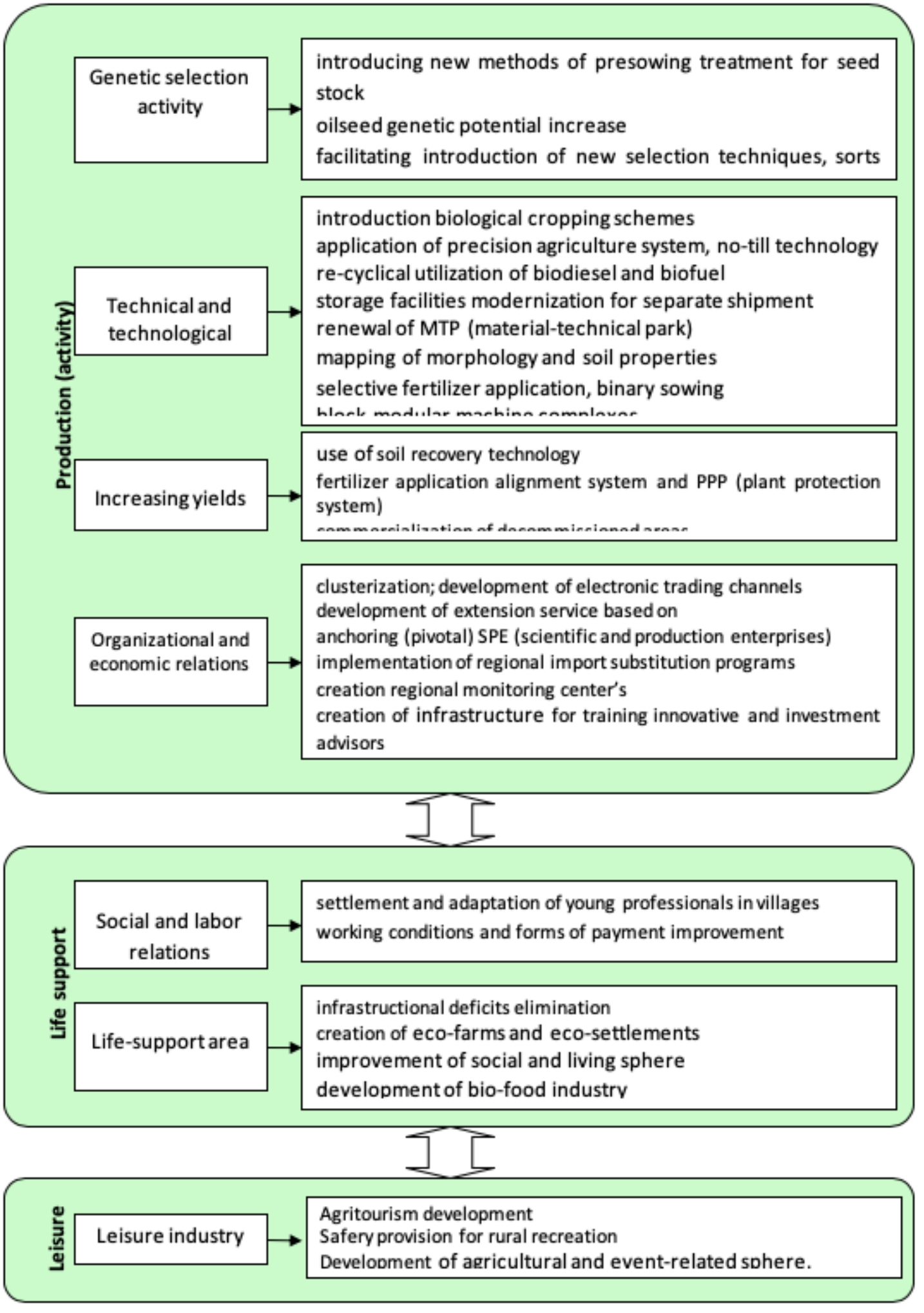
The second, life-support direction, is formed by improving the quality of social and labour relations. Their main role is to enhance the life and work capacity of personnel involved in the oil subcomplex functioning. The second component of this direction (life support) involves the processes that are not directly related to oil crop production:

1. infrastructural deficits generating a negative social background (lack or absence of kindergartens, medical and rehabilitation facilities, lack of recreational opportunities in lodging houses, sanatoriums, etc. for the population of the subcomplex region, a.s.o.);
2. improvement of the housing sector and the social sphere (increase numbers of facilities providing social care and support services for the population: service-related installations, trading enterprises, banks, etc.);
3. green policy implementation is a creation of eco-settlements and eco-farms characterized by environment-friendly production and favourable ecological situation;
4. bio-food industry development is manufacturing new kinds of production through innovative processing areas and application of primary processed products.

The third direction is leisure comprising quality improvement of recreational and free-time activities of the population living in the oil subcomplex region.

Thus, it is obvious that the sustainable development of the oil subcomplex involves a range of activities. Their implementation should be systematic and targeted resulting in positive progress of production, social and ecological character. And their simultaneous acquisition will mark the development sustainability of the oil subcomplex.

Figure 1
Conceptual development
areas of oil subcomplex



Source: compiled by authors

2.3. Methodology for multidimensional zonal evaluation of oil subcomplex condition

The area of the Stavropol territory is roughly divided into 4 agro-climatic zones based on the primary features of the natural-climatic environment. The absence of infrastructural and industrial characteristics reduces the analytical and predictive value of such grouping. In order to make justified project decisions on the management of agro-industrial complex as a whole, as well as strategic food subcomplexes, in particular, a comprehensive evaluation and zoning of the territory are required.

The cumulative effect of this approach is based on the following logically constructed stages:

- building information and analytical base, data formalization in matrix form;

- assessment of the resource-infrastructural level of territorial units (method of multidimensional comparative analysis);

- detection of regional differentiation and indication of zoning types;

- parameterization of groupings and assessment of their potential.

Analyzing the agrarian territorial-production complex of the Stavropol territory with regard to oil-and-fat subcomplex, it is necessary to note that under conditions of contemporary economic developments the agribusiness orientation does not have a strict unidirectional production purpose (meeting demands of the local population with one of the most basic products), but adapts to socio-economic demands of the market with maximum flexibility (diversification, extended lineup of oil crops).

The growth of assortment diversity provides an opportunity of technological experiment on soils with different characteristics without the significant reduction of yields and the quality of the commercial production.

An analytical potential of the "Pattern" technique allows to identify the level of development condition for the oil subcomplex with a high degree of confidence. This method is characterized by selecting and accepting the best values of the considered indicators for reference:

$$Cij = Xij / Ximax \qquad (1)$$

where Xij are actual measures of development indicators for the oil subcomplex of the Stavropol territory;

$Ximax$ is the best value of indicators among all areas of the Stavropol territory;

$I = 1,2, \dots, n$ is a number of indicators;

$J = 1,2, \dots, n$ is a number of districts.

As indicative figures, we selected the following:

X_1 – Cultivated areas of oil crops in all categories of farms (hectares);

X_2 – Gross yield of oil crops (tonnes);

X_3 – Average number of employees engaged in agricultural production (number of people);

X_4 – Sold oil crops (tonnes);

X_5 – Deposited mineral fertilizers (in the equivalent of 100% of nutrients) for crops in agricultural organizations (tonnes);

X_6 – Availability of agricultural machinery in agricultural organizations at year's end (units);

X_7 – Cost of capital stock (million rubles);

X_8 – Share of oil crops in cultivated areas (%);

X_9 – Sunflower yielding capacity (centners per hectare);

X_{10} – Rapeseed yielding capacity (centners per hectare);

X_{11} – Flax yielding capacity (centners per hectare);

X_{12} – Soybean yielding capacity (centners per hectare).

The list of indicators is open and supplemented that allows to group territories in certain directions: material support, agricultural and technological characteristics, natural-climatic conditions and other (table 1).

Table 1
Integral assessment calculation of oil crop production level in Stavropol territory, for period 2008-2017*

Regions	∑ Xij/Xi	Multivariate mean value	District rank

Apanasenkovsky district	4,12	**0,342989**	20
Arzgirsky district	2,63	**0,21909**	24
Levokumsky district	3,03	**0,252215**	22
Neftekumsky district	1,85	**0,154371**	26
Turkmensky district	3,59	**0,298774**	21
Aleksandrovsky district	5,79	**0,482098**	10
Blagodarnensky district	4,23	**0,352746**	19
Budennovsky district	4,82	**0,40285**	16
Ipatovsky district	7,63	**0,636233**	**6**
Kursky district	4,38	**0,365242**	18
Novoselitsky district	5,39	**0,44881**	12
Petrovsky district	6,78	**0,564732**	**7**
Sovetsky district	6,48	**0,539939**	**8**
Stepnovsky district	2,39	**0,199281**	25
Andropovsky district	2,94	**0,244863**	23
Grachevsky district	5,10	**0,42494**	15
Izobilnensky district	6,43	**0,535973**	9
Kochubeevsjy district	8,57	**0,714422**	**3**
Krasnogvardeisky district	9,55	**0,795971**	**1**
Novoaleksandrovsky district	9,25	**0,771163**	**2**
Trunovsky district	8,19	**0,682693**	**4**
Shpakovsky district	5,14	**0,428328**	14
Georgievsky district	7,87	**0,656211**	**5**
Mineralovodsky district	5,75	**0,478801**	11
Kirovsky district	5,47	**0,455484**	12
Predgorny district	4,42	**0,368337**	17

Ximax	12,00	1	x

* The calculation is carried out according to the actual data from Stavstat for the period of 2008-2017 years (Stavropol region in figures, 2017, 2017).

3. Results

Based on the assessment results of the oil crop production level in the Stavropol territory by using the "Pattern" technique it is possible to group the districts in the following categories:

- districts with the highest level of oil crop production;
- districts with a high level of oil crop production;
- districts with a medium level of oil crop production;
- districts with a low level of oil crop production (table 2).

The first group is represented by leading districts characterized by their border location, the proximity to major transportation hubs (the Krasnodar territory and the Rostov territory), and the high development level of infrastructure component (fixed capital stock, warehouses and elevators, oil level determining lines, and processing plants). Within the territory of the mentioned districts, the challenge of the self-sustainment capability of oil crops and processing products is fully solved, whereas a significant surplus of production is exported and sold in neighbouring districts.

The second group includes seven geographically dispersed districts located in different natural-climatic conditions of economy management, nevertheless displaying almost an equally high level of oil crop production. This aspect allows to establish identification characteristics of that grouping:

- highest production levels (gross yield, crop productivity);
- a significant share of oil crops in the overall structure of cultivated areas (20% of the group’s average);
-cultivation of all the analyzed species of oil crops, including niche ones (flax).

The commercial orientation of this group implies not only the self-sufficiency but also a significant share of stocks with the prospect of selling at higher prices in the off-season and creating a seed base to meet the domestic needs of the district.

The third group is represented by districts with different production and infrastructure indicators. A large number of objects (13) implies a vast coverage area of the region. To justify the inclusion of this or that district, the period of research was enlarged from one year (low degree of indication) to ten years (years 2008-2017) with the purpose to reduce an influence of a natural-climatic factor. The districts with the maximum integral assessment indicators are in a transboundary state with the second group allowing enlisting them for analysis as a grouping with a strong base. These districts are oriented towards self-sufficiency and supporting ones with a critically low level of oil crop production.

Specific aspects of the third group:

- the entire aggregated cultivated area of oil crops is several times higher than that of previous groups;
- low production levels (productivity, gross yield);
- various assortment composition of oil crops, low level of flax production (natural-climatic factor);
- reduction in the number of people employed in agricultural production.

Identification of the outsider-districts with extremely low production level and natural-climatic potential clearly speaks for inconsistency of the production process within the region. These districts do not hold any empirical interest or analytical value for the purposes of our research.

Table 2
Grouping of Stavropol territory districts
according to oil subcomplex development level

Interval values for typological groups of districts		District type	Districts of Stavropol territory, included in group	Linguistic characteristics of typological group
I	1-0,75	Highest level	Krasnogvardeisky district Novoaleksandrovsky district	This group is represented by the leading districts of the region that lack the imbalance of production and infrastructure indicators. Significant volumes of marketable products are sold for export.
II	0,74-0,50	High level	Ipatovsky district Petrovsky district Sovetsky district Izobilnensky district Kochubeevsjy district Trunovsky district Georgievsky district	Districts included in this group are sufficiently developed in terms of production indicators, but have some problems within the infrastructure component. The group forms an array that produces high quality oil crop. Substantial volumes are sold outside the territory and for export.
III	0,49-0,25	Medium level	Apanasenkovsky district Levokumsky district Turkmensky district Aleksandrovsky district Blagodarnensky district Budennovsky district Kursky district Novoselitsky district Grachevsky district Shpakovsky district Mineralovodsky district Kirovsky district Predgorny district	This large group is represented by districts located in the subhumid areas with a sufficiently high degree of risk characteristics for agro-industrial production affecting the operating capabilities. The districts fully solve the problem of food supply regarding oil crops both inside and outside the group.
IV	0,24-0	Low level	Arzgirsky district, Neftekumsky district, Stepnovsky district, Andropovsky district	The group is represented by districts with insufficient production volume to meet the demands of the population. The cultivation of oil crops is implemented mainly due to compliance with a farming rotation.

Source: compiled by authors

This grouping allows defining specific directions of regulation and support for the oil subcomplex within the framework of the federal and regional agroeconomic policy taking into account production and infrastructural capacity of territories.

4. Conclusions

The results of the multidimensional analytical research based on the "Pattern" technique are in the following conclusions:

• the preferred tools to identify problematic areas for stimulation and support of the oil subcomplex is a grouping not only according to the diversity of natural-climatic characteristics of the territory but also considering production and infrastructural capacity;

• grouping by applying the "Pattern" technique identifies the weak and strong areas of the Stavropol territory based on the level of oil subcomplex development both for the purposes of food self-sufficiency and commercial orientation of the districts.

In general, the regional agro-industrial complex of the Stavropol territory regarding the oil crop production is represented by a significant material base, inter-district relations form a stable platform for the development of integration processes.

A significant weakness of the industry is the reduction in the number of people employed in agricultural production. It was caused by an insufficient level of material incentives and the specific activity's dropping out of the labour interests of young qualified personnel. It is also a matter of serious concern that there is a low renewal rate of production funds and technical equipment of enterprises.

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