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DEVELOPMENT OF BULGARIAN AGRICULTURE PRODUCTION STRUCTURES

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Abstract

Bulgarian agriculture is traditional and very important for developing rural areas. Over the years, the agricultural sector has been transformed by processes and policies that affect its changes. The Common agricultural policy significantly facilitates the transformation of Bulgarian agriculture regarding farm development and redistribution of activities. In this regard, the article aims to track the development of the main agrarian structures in Bulgaria from 2010 to 2020. The materials provide the most recent statistical data for the analytical period, during which we examined the evolution of Bulgaria's main agricultural systems. We used regional-level indicators such as farm numbers, utilized agricultural areas, farms by economic size classes, standard output by economic size classes, and farm specialization. The study takes into account production volume discrepancies between regions and the Country. The South-Eastern region has the most significant economic contribution, producing more than EUR 250,000 Standard Output while having the fewest farms. Conversely, the South-West and South-Central areas have the lowest economic share, making less than EUR 2,000 Standard Output while having the most farms. This zoning presents a complete picture of farm economic conditions, which impacts agricultural growth in Bulgarian rural areas. Finally, regarding GDP distribution in key economic centers and mechanical movement, Sofia (the Capital), Plovdiv, Varna, Burgas, and Kardzhali show the most significant contrasts.

Key words**:** *rural development, agriculture, production structures, changes*

INTRODUCTION

In Bulgaria, the pandemic has impacted the regional economic development map. In some regions, the economy is expected to decrease in nominal terms in 2020. It was found that the capital city of Bulgaria, Sofia – the first driving force, has a Gross domestic product (GDP) nearly stable at slightly over BGN 51 billion, or 43% of the national economy (Figure 1) [29]. The second force is Plovdiv, whose economy forms more than half of the gross product of the South-Central Region. The third force, Varna, maintained a robust industry on the outskirts of the maritime capital despite experiencing a decline in the service sector. Stara Zagora is the next force that temporarily overtook Burgas, the area that suffered the hardest pandemic hit. Veliko Tarnovo and Ruse, which move comparatively at the same rate of development, are the next forces. The gap between Northern and Southern Bulgaria is determined mainly by the lesser size of the economic hubs in Northern Bulgaria, except Varna, and the weaker connectivity between them. A treemap chart, which provides a hierarchical view of the Regional Gross Domestic Product data, demonstrates the spread of economic centers (Figure 1).

According to Institute for Market Economics [30], sixteen significant economic centers stand out, covering 132 municipalities set map the borders of Bulgaria’s economic centers. The centers include about ¾ of the country's population, accounting for over 80% of Bulgaria's economic activity. Every economic center has a core and a peripheral (Map 1).

The municipalities with the best local economies are the economic cores, and the municipalities closest to that core's economy are the peripheries. The study [30] found that some of the sixteen centers have multiple cores due to existing links between the different cores and a shared perimeter or zone of influence.

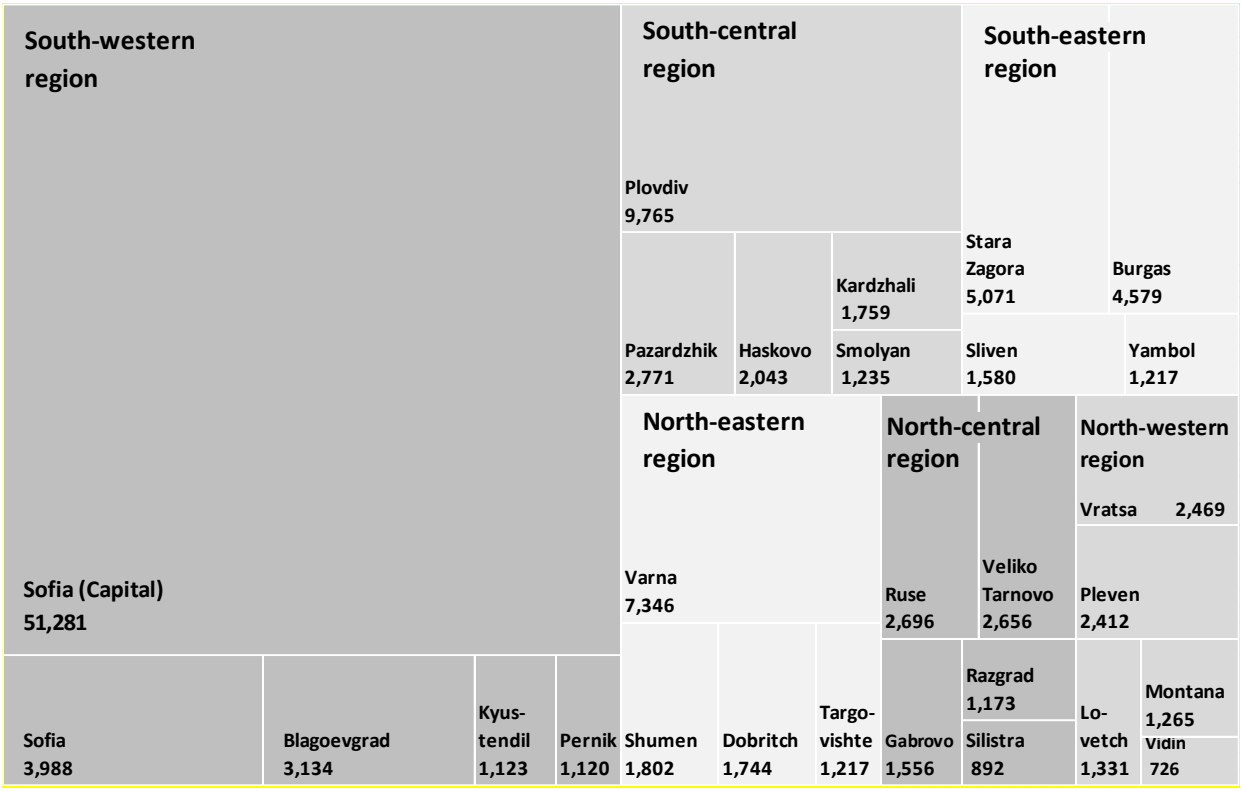
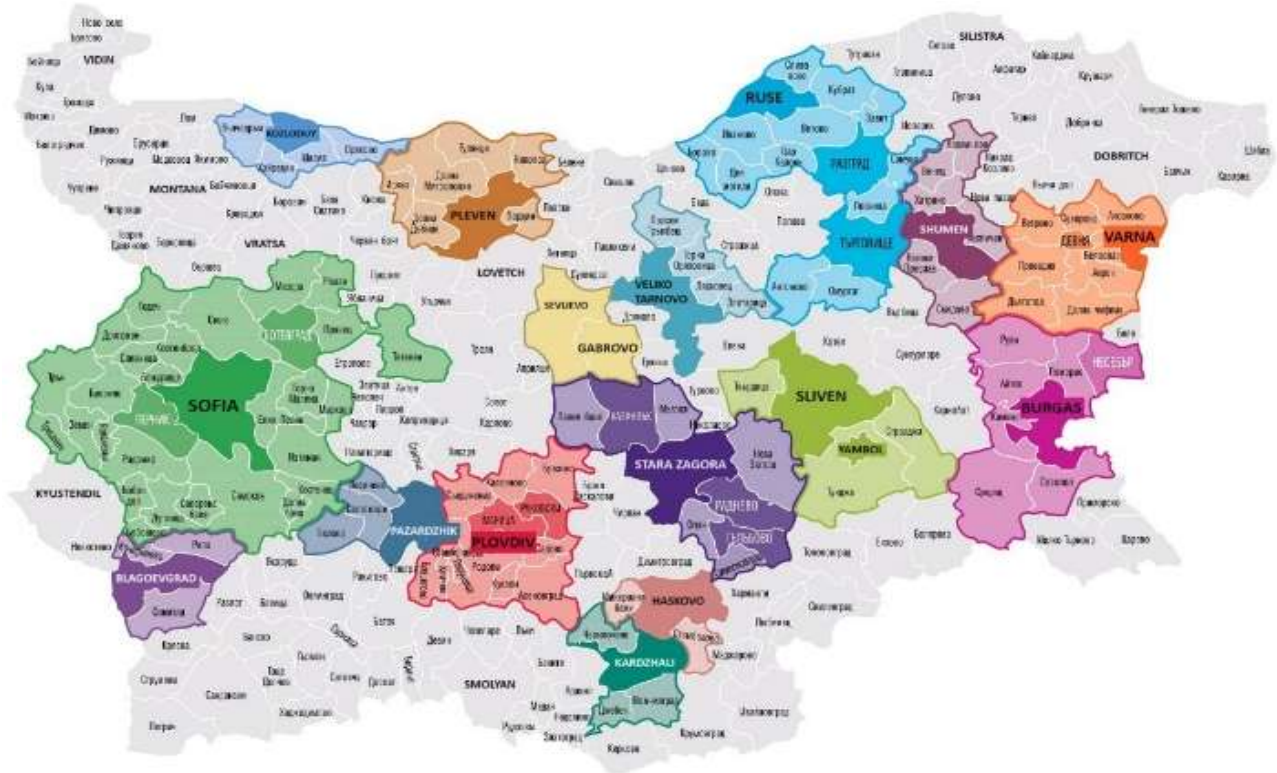


Fig.1. Regional Gross domestic product in Bulgaria – 2020 (mln. BGN)
Source: Institute for Market Economics (2022) [29].



Map 1. Main economic centers in Bulgaria – 2021
Source: Institute for Market Economics (2023) [30].

Nine economic centers stand out in the direction of agricultural development [30]. The "Pleven" economic center has the highest share of added value in the agriculture sector (12.3%). Agriculture plays a dominant role in smaller municipalities like Iskar and Nikopol.

The second position is the economic center "Sliven-Yambol" (11.5%), where agriculture plays a significant role in Yambol's peripheral municipalities, accounting for half of the added value.

It is followed by "Ruse-Targovishte-Razgrad" with 10.2% added value and "Shumen" with 7.9%. In fifth position is the economic center "VelikoTarnovo" (6.6%), where agriculture plays a more significant role in the core. The following is "Haskovo" (4.8%), where agriculture again dominates the periphery. The lowest share is found in the economic centers "Pazardzhik" (3.8%) and "Zagore" (3.3%). The leading agricultural sector in the economic center "Kozloduy" is found in the periphery municipalities, contributing significantly and generating over half of the added value.

Regarding Bulgarian agricultural development, the trend is to an annual farm decline. The farms decreased by 64%, which is approximately 230 thousand farms, for the studied period 2010-2020 (Figure 2). At the same time, the utilized agricultural area increased with 9%, which means that many farmers are cultivating much more area than before. This dual structure is a common for Bulgaria and since 1989 is not changing, even the policy get changed and trying to create a middle size farms.

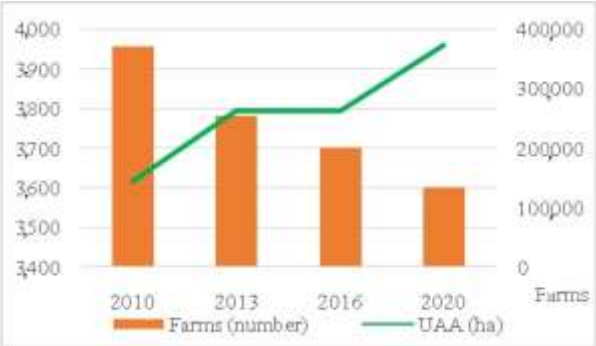


Fig. 2. Utilized agricultural area and farms number in Bulgaria – 2010-2020
Source: Own calculation by data of [34].

Average utilized agricultural areas data confirm this. At national level, we observed that 11% of farmers run over 90% of average utilized agricultural area of 50 ha, while 17% of farmers run over 8% of average utilized agricultural area of 10 to 50 ha, considering that the average size of utilized agricultural areas is 36 ha (Figure 3). It was found that at the national level farms with less than 5 ha represent 64.5% of all holdings in Bulgaria, and 63.7% of all holdings in the European Union [7].

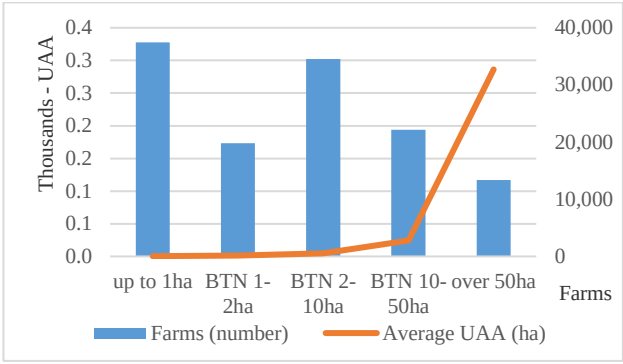


Fig. 3. Farm distribution by size of utilized agricultural area in Bulgaria – 2020
Source: Own calculation by data of [31].

It was found that the agricultural production structure has changed generally from policy, economics, social, environmental, and technology point of view in other countries [4, 14, 36]. Following this, we examine Bulgarian development of agrarian systems in terms of policy, economics, social, and ecological factors.

Regarding the policy development, in Bulgaria, many studies are dedicated to the problems related to reducing farms and increasing the share of big production structures. This problem was due to changes in farm intensification, which furthered Bulgarian agriculture problems since 2007 [48].

In some respects, the Common agricultural policy (CAP) helps farm development, rejuvenation of the agricultural sector, improvement infrastructure in rural areas [25], supporting farmers' income [23], implementation innovation [17], and others through the application of the Rural Development Programme. In other respects, the CAP creates a permanent trend of farm reduction [7]. Some authors note significant problems and factors limiting the Bulgarian development of sectors such as fruits, vegetables, and livestock [27], [38].

Regarding the economic development, agriculture's contribution to total value added has steadily dropped since joining Bulgaria to the European Union [6]. A key factor for the

successful Bulgarian agriculture development is the sustainable increase in productivity and efficiency [32]. Another factor for economic development is land consolidation and territorial planning [3]. The local territorial strategies have shown a positive impact on the economic environment of the rural municipalities, which have introduced the local integrated strategies under the Common local-led development programme [1]. Other factors influencing the development are linked to infrastructure, markets and the quality of the working force [26].

Financing of the agricultural value chain is necessary to focus on integration in the chain of finance providers, structural government support to strengthen the supply chain, enhancement of risk protection information systems, and strengthening collaboration and cooperation [31]. Also, developing high-added-value products is related to high financial investment and participation in a longer value chain [22].

Regarding the social development, many factors have an impact on production structures in agriculture in Bulgaria, such as population ageing [19], negative demographic trends [33], lack of sufficient labour resources [9], and low economic activities [1]. Despite negative demographic tendency in Bulgaria, it was found that urban unemployment falls in all regions in Bulgaria, while two of rural areas have high unemployment level in rural areas and lower in the urban areas [20]. It was found that generational renewal is possible in more successful farms [11, 12].

Land fragmentation [14], [15], [48] and changing the primary livelihood of the population [47] impacted on population migrate to large economic centers in search of more profitable work [2], [13]. This leads to desertification of rural areas and consolidation of small farms [18].

Nowadays it matters competitiveness for sustainable development of economic entities in rural areas [41]. Urban farming is gaining popularity [42]. Proximity to the larger urban centers impacts organic farming, direct sales, and agricultural diversification [21].

Anticipated developments in rural areas by the end of 2027 have been predicted, and optimistic scenarios have been put up, which should lead to positive improvements in socioeconomic and demographic aspects [39]. However, barring a significant worsening in demographic indices, the author anticipates that the negative trend of depopulation in rural areas will persist, albeit slower than before.

Ensuring access to digital technologies in rural areas depends on social, economic, and political systems providing fundamental conditions and opportunities for digital transformation [8]. Regarding the ecological development, some environmental risks are linked to a negative influence on natural resources such as soil, water and air [43]. In some contexts, the CAP strategic plan introduced a new system of eco-schemes aimed at ensuring farmers' income by implementing environmentally friendly production systems such as agroecology, agroforestry, and organic farming [10].

Cluster analysis is a grouping method that assigns an object to a specific group. This method is one of the most popular procedures for analyzing data. It was first used as a term in 1939 [46]. The word "cluster" means a group of closely lying objects whose primary goal is to reveal the hidden groupings of the studied objects [24].

Clustering analysis methods are classified into two types: non-hierarchical and hierarchical. The first category of approaches involves partitioning the data space into a structure known as a Voronoi Diagram including a series of areas containing subsets of related data. The second is based on the concept of creating a binary tree of data, which is then merged into related groupings. This tree, also known as a dendrogram, is a handy overview of data that has been joined to form groups depending on their known distance [5].

A hierarchical approach generates a breakdown of the provided data items. According to how the hierarchical breakdown is generated, it may be classed as agglomerative. The divisive hierarchical clustering method, also known as the top-down technique, begins with all of the items in the same cluster. In each iteration, a cluster is divided into smaller clusters until each item is

put in its own cluster or a termination condition is met [45].

In agriculture, it was researched through cluster analysis the performance of agriculture and food industry sectors [37], the internal structure of farms based on a multicriteria evaluation, main functions of agriculture [28], and others.

Some authors applied cluster analysis to factors such as land use, physical farm dimensions, socio-economic and management characteristics, and environmental indicators at level NUTS 2 [16]. Also, in some studies, cluster analysis was applied, which brought information about targeted regions at the NUTS 2 level and identified good practices for applying in Romania and Poland [40].

In Bulgaria, cluster analysis was created at the NUTS 3 level, studying revealing the place and the role of Bulgarian agriculture in rural development which defined the following clusters: "economically poor - ecologically stable", "economically developed", and "transitional - towards good economic development and ecologically unstable" [35], 44]. Also, cluster analysis was made by classifying the regions based on socio-economic criteria and indicators of employment in the country by main agricultural categories. Another study used cluster analysis to determine the attitudes of Bulgarian farmers toward the implementation of innovations [11].

The study aims to follow the change in the development of the main agrarian structures in Bulgaria in the period of 10 years.

MATERIALS AND METHODS

The article is based on the latest statistic data, which is available according to studied issues. The study includes the following parts, presented in the Figure 4.

In the article is included analytical period 2010-2020, as we analyzed the development of the main agrarian structures in Bulgaria. We assigned the following tasks to meet the study's aim: 1) Introduction of regional development of the country; 2) Theoretical concepts for reasons for changing agrarian structures (politics, economy, social and ecological development) were presented; 3) The actual change in the production structures in Bulgaria was traced at the territorial level according to the farm size and specialization;

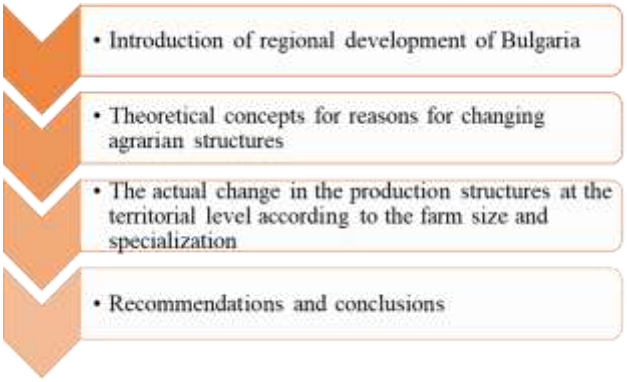


Fig. 4. Methodological framework
Source: Own elaboration.

4) A cluster analysis of some variables at the NUTS 3 level was applied; 5) Conclusions and reasons for the change in agrarian structures were made.

In the study we used following indicators by regional level in Bulgaria:

-Farms number;
-Utilized agricultural area;
-Farms by economic size classes;
-Standard Output by economic size classes;
-Farm specialization.

RESULTS AND DISCUSSIONS

We have assigned ourselves many tasks in order to achieve the research objectives.

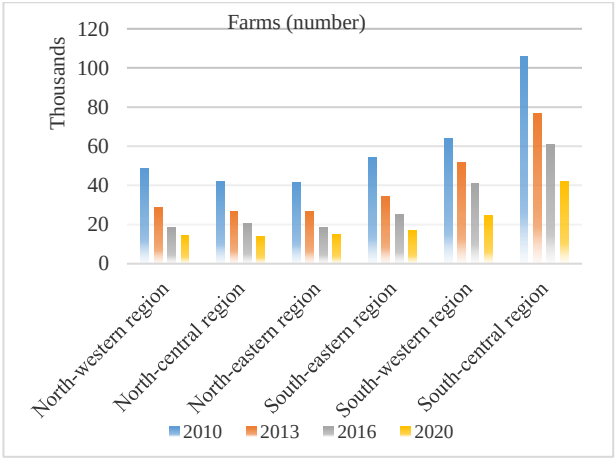


Fig. 5. Farms number by regions in Bulgaria
Source: Own calculation by data of [34].

The first is to track the actual change in production structures at the regional level in

Bulgaria. Over 10 years, the number of farms dropped at national and regional levels (Figure 5).

For the same period, we observe an increase in the used agricultural area at the regional level (Figure 6).

Second, we analysed the actual change in production structures by the growth of Bulgarian farms. The distribution of farms by economic class gives us an idea of their real economic size, expressed by Standard Output (Figure 7 and Figure 8).

According to the laws for implementing the measures under the Rural Development Program, the Standard Output reflects the monetary value of the produced agricultural products at the producer's price.

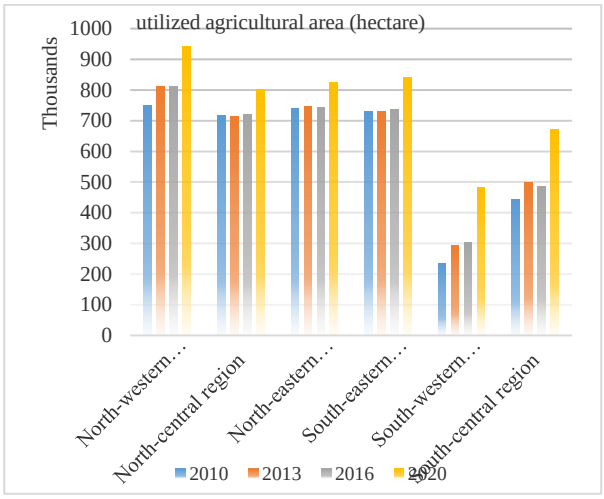


Fig. 6. Utilized agricultural area by regions in Bulgaria
Source: Own calculation by data of [34].

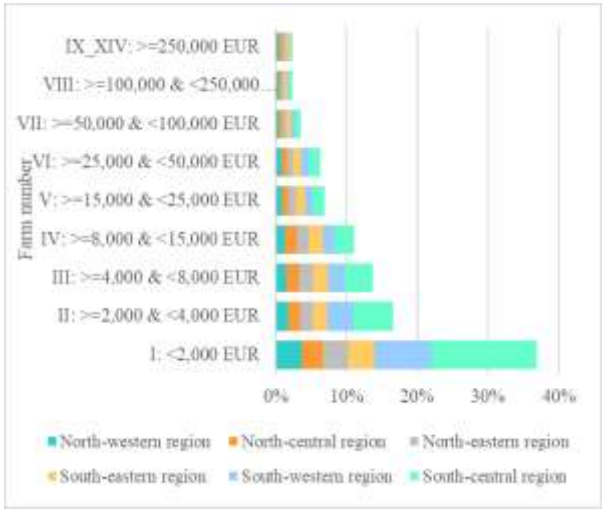


Fig. 7. Farms by economic size classes by regions in Bulgaria
Source: Own calculation by data of [34].

This value is calculated in EUR. It should be noted that the Standard Output excludes direct payments, value-added tax, and other taxes. It is calculated based on average prices for agricultural/livestock production.

The research considers regional and national disparities in production volumes. The northern regions, including the South-Eastern region, have the most significant economic share, producing more than EUR 250,000 Standard Output while having the lowest farm number. On the other hand, the South-West and South-Central regions have the lowest economic proportion, producing less than EUR 2,000 Standard Output while having the biggest farm number. This zoning provides a comprehensive picture of the farm economic situation, which also influences the agricultural development of Bulgarian regions.

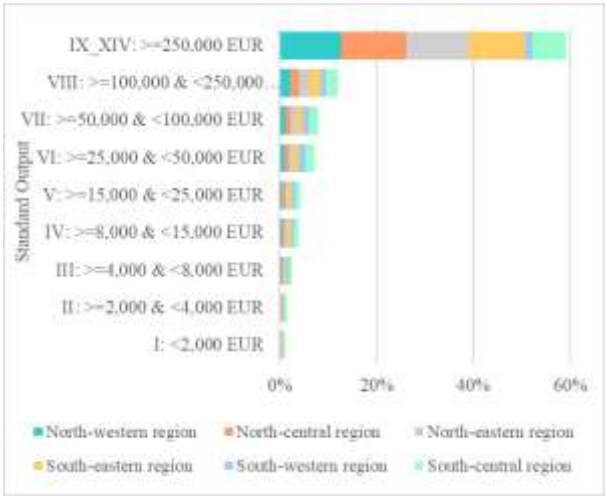


Fig. 8. Standard Output by economic size classes by regions in Bulgaria
Source: Own calculation by data of [34].

Third, we track the actual change in production structures in Bulgaria based on farm specialization. Examining the specialization of farms gives us an in-depth picture of the agricultural orientation of the regions.

The overall Standard Output in Bulgaria is 4,091,460, with specialized farms accounting for 92% and mixed farms accounting for 8%. Cereals, oilseeds, and protein crops dominated (53.5%) among specialized farms, followed by farms breeding pigs, poultry and rabbits (9.4%), and milk cattle (8.7%). On the other hand, mixed farms are dominated by arable crops and grazing livestock (3.4%). In other

research it was found small share of women farmers, as dominant share has men engaged in Bulgarian agriculture [26].

According to data from the last national census of farms in Bulgaria in 2020, farms are mainly classified into crop-growing, animal-breeding, and mixed farms based on specialization. On the other hand, crop farms consist of two cluster groups, the first of which includes technical and field crops, forming 64.4% of standard output at the national level, and the second includes orchard farms, forming 3% of standard output at the national level. Regarding livestock farms, they also form two cluster groups. The first group includes farms with cattle (11,2% standard output), and the second - small cattle and small farm animals (13% standard output). The last classification group includes farms with mixed cultivation of crops growing and grazing livestock, which form 8% of standard output at the national level.

It was found that farm specialization over ten years changed standard output. The group of crop farms increased their standard output by 40.3%, and the group of livestock and mixed farms decreased their standard output by 32% and 35%, respectively. The change in agricultural production structures in Bulgaria is provoked by many factors in rural areas, such as:

-reducing farms and increasing the share of big production structures;
-farm development, rejuvenation of the agricultural sector, improvement infrastructure;
-supporting farmers' income;
-CAP creates a permanent trend of farm reduction;
-land consolidation and territorial planning;
-high-added-value products is related to high financial investment;
-negative demographic trends;
-urban unemployment falls;
-generational renewal is possible in more successful farms;
-land fragmentation;
-changing the primary livelihood of the population;
-population migrate to large economic centers;
-desertification of rural areas and consolidation of small farms;
-competitiveness for sustainable development of economic entities;
-urban farming is gaining popularity.

Considering the distribution of GDP in the major economic centers and the mechanical movement, the most significant contrast is in Sofia(Capital), Plovdiv, Varna, Burgas and Kardzhali.

Also, the study included the distribution of farms by size of the utilized agricultural area at the NUTS 3 level in Bulgaria, including 28 districts. The analysis shows that the initial set of cluster groups was four but the cluster numbers were changed due to no or little change in cluster centres. Hereby, the stopping criterion was reached at the third iteration, and the minimum distance between initial centers is 101,801.546 (Table 1).

Itera-tion	Change in Cluster Centers			
	1	2	3	4
1	16,273.533	14,286.885	2,293.859	25,137.045
2	0.000	0.000	4685.372	5530.820
3	0.000	0.000	0.000	0.000

Table 1. Iteration History by regions in Bulgaria (2020)
Source: Own calculation by SPSS Statistics

The final cluster centers (Table 2) and number of cases (Table 3) were shown. A dendrogram visually represents the data from 2020 (Figure 9).

The first cluster center defines Bulgaria's most significant territory, including Veliko Tarnovo, Plovdiv, and Haskovo districts, predominantly from the South-Central region. The second cluster center pick the next larger group including Pleven, Dobrich, Burgas, Stara Zagora and Yambol districts, predominantly from the South-Eastern region. The third cluster center defines the next group, which in the study is the most numerous, including following districts: Vidin, Vratsa, Lovech, Montana, Razgrad, Ruse, Silistra, Varna, Targovishte, Shumen, Sliven, Blagoevgrad, Sofia (district), predominantly from the North-Western, North-Central and North-Eastern regions. The fourth cluster center chose the last group with a smaller utilised agricultural area, which includes Gabrovo, Kyustendil, Pernik, Sofia (Capital), Kardzhali, Pazardzhik, and Smolyan districts, predominantly from the South-Western region.

Table 2. Final Cluster Centers by regions in Bulgaria (2020)

	farms.UAA	size.UAA
1	5,744.33	235,895.83
2	4,221.00	354,163.00
3	4,049.62	156,432.15
4	4,532.14	58,118.86

Source: Own calculation by SPSS Statistics.

Table 3. Number of Cases in each Cluster (2020)

Cluster	1	3
	2	5
	3	13
	4	7
Valid		28
Missing		0

Source: Own calculation by SPSS Statistics.

The cluster analysis and the Institute for Market Economics analysis have observed the withdrawal of the agricultural sector and the concentration of the service sector in the South-Western region of Bulgaria. One of the key factors influencing this shift is Sofia (Capital), which serves as a significant economic center. However, this concentration negatively affects the development of agriculture in the region, highlighting the need for a more balanced economic strategy.

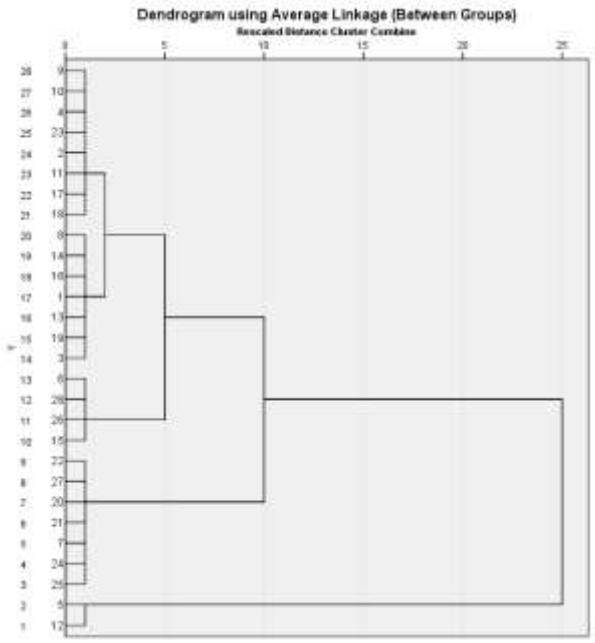


Fig. 9. Dendrogram by regions in Bulgaria (2020)
Source: Own calculation by SPSS Statistics Final

We returned to compare the same cluster with the 2010 data. In the 4 clusters formed, the stopping criterion was reached at the sixth iteration, and the minimum distance between initial centers is 85,479.918 (the change with 2020 is 16%). The final cluster centers (Table 4) and number of cases (Table 5) were shown. A dendrogram visually represents the data from 2010 (Figure 10).

Table 4. Final Cluster Centers by regions in Bulgaria (2010)

	farms.UAA	size.UAA
1	13,151.64	47,873.86
2	15,733.20	203,573.35
3	11,255.00	313,292.65
4	11,123.00	144,590.03

Source: Own calculation by SPSS Statistics.

Table 5. Number of Cases in each Cluster (2010)

Cluster	1	11
	2	5
	3	2
	4	10
Valid		28
Missing		0

Source: Own calculation by SPSS Statistics.

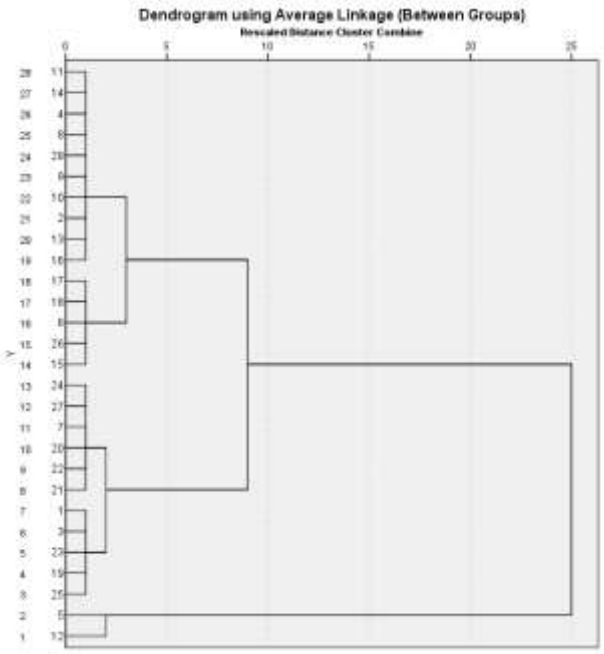


Fig. 10. Dendrogram by regions in Bulgaria (2010)
Source: Own calculation by SPSS Statistics Final.

The first cluster center include following districts: Vidin, Lovech, Gabrovo, Blagoevgrad, Kyustendil, Pernik, Sofia (Capital), Sofia (district), Kardzhali, Pazardzhik, Smolyan, predominantly from the South-Western region. The second cluster

defines the next group, including following districts: Veliko Tarnovo, Stara Zagora, Yambol and Plovdiv, predominantly from the South-Eastern region. The third cluster center picks the next group including: Pleven and Dobrich district. The fourth cluster center includes districts: Vratsa, Montana, Razgrad, Ruse, Silistra, Varna, Targovishte, Shumen, Sliven and Haskovo, predominantly from the North-Central and North-Eastern regions.

CONCLUSIONS

Bulgarian agriculture is a traditional sector that is vital to rural development. The agricultural industry has evolved over time due to the processes and policies that influence its developments. The Common Agricultural Policy greatly supports Bulgarian agricultural reform in terms of farm development and activity redistribution.

In this context, we examined the growth of Bulgaria's major agrarian structures from 2010 to 2020. At the regional level in Bulgaria, we examined farm numbers, utilized agricultural land, farms and standard output by economic size class, and farm specialization. We found that the number of farms fell at both the national and regional levels, but the share of used agricultural land increased at the regional level.

Furthermore, we discovered regional and national inequalities in production volumes. This indicates that the northern region and the South-Eastern region, has the largest economic share but the smallest farm number. The South-West and South-Central regions, on the other hand, have the smallest economic proportion but the greatest number of farms. The zoning offers a thorough picture of the farm's financial status, which influences agricultural development in Bulgarian rural areas.

In terms of actual change in farm specialization, research has indicated that specialized farms have the biggest proportion, while mixed farms have the smallest. We focus on the most important farms cultivating cereals, oilseeds, and protein crops, followed by those raising pigs, poultry, rabbits, and milk cattle.

When comparing 2010 and 2020 data, the cluster groups do not change. Even the two larger cluster groups are preserved. There is only movement between areas within the clusters, but it is not large.

Finally, we recommend favorable changes in agricultural production structures in Bulgaria:

-Prioritize small and medium-sized farms in production structures;

-Improve infrastructure and farm development through changes to the CAP;

-Support farmers' income through real activity;

-Land consolidation and territorial planning - to prevent agricultural land fragmentation;

-High-added-value products - ensuring enough financial resources;

-Change for positive demographic trends - to ensure adequate actions to prevent negative consequences;

-Farm education - staff specialization;

-Rural unemployment falls - providing enough jobs and decent salaries;

-Generational renewal - in most farms;

-Preservation/return of the population in rural areas - ensure main livelihood;

-Migration to rural areas - revitalization of rural areas;

-Development of competitiveness - for sustainable development of economic entities.

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