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ASSESSING MODERNIZATION AND STRUCTURAL DYNAMICS IN THE VEGETAL SECTOR OF ROMANIA. A COMPARATIVE STUDY WITH THE EUROPEAN UNION COUNTRIES

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Abstract. *The modernization of Romania's crop sector represents a key component of the country's economic convergence within the European Union, reflecting both its considerable agricultural potential and the persistent structural challenges inherited from the post-communist period. This study aims to examine the structural dynamics, performance trends, and modernization trajectories of Romania's crop production over the past two decades, using a comparative perspective relative to other EU member states. Drawing on official data from Eurostat, the National Institute of Statistics, and the 2020 General Agricultural Census, the research employs descriptive methods, time-series analyses, and cross-country comparisons to assess developments in agricultural land use, farm structure, crop yields, production value, and investment levels. The analysis highlights a dual profile of Romanian agriculture. Romania ranks among Europe's leading countries in terms of cultivated area and total output, especially in the case of maize, wheat, and sunflower. However, productivity and economic efficiency remain limited by excessive land fragmentation, the predominance of small subsistence-oriented farms, low levels of mechanization, and insufficient capital investment. Production variability further underscores the sector's vulnerability to climate stress and technological gaps. Nevertheless, the findings indicate a gradual but discernible process of modernization, supported by the Common Agricultural Policy, ongoing farm consolidation, and the increasingly widespread adoption of modern technologies. Overall, the study shows that Romania's crop sector is undergoing a slow but measurable transition from an extensive, resource-dependent model toward a more competitive and technologically advanced structure. Future progress, however, hinges on sustained investment in mechanization and digitalization, stronger cooperation among farmers, and deeper integration into higher value-added agri-food chains. These directions are essential for accelerating convergence with Western European standards and for fully harnessing Romania's agro-ecological potential.*

Keywords*: modernization, vegetal agriculture, structural transformation, productivity, Romania, European Union*

INTRODUCTION

Agriculture, and particularly the crop sector, holds a strategic position in Romania's economy and represents an important pillar within the broader European agricultural framework. The country benefits from favorable soil and climate conditions, as well as from some of the largest agricultural areas in the European Union, approximately 60% of Romania's territory is agricultural land (GAVRILESCU, 2005). Owing to this potential, Romania has come to play a significant role in the EU agri-food markets, achieving remarkable production levels in cereals and oilseeds. Consequently, the Romanian crop sector contributes substantially to ensuring both national and even European food security, highlighting its importance within the EU as a whole.

However, the modernization and efficiency of Romania's crop sector continue to lag behind those of the more advanced agricultural economies of Western Europe. The agrarian structure remains characterized by excessive fragmentation and traditional practices. Romania records the highest number of agricultural holdings in the EU, approximately 2.88 million farms, nearly nine times the European average, which results in a very small average farm size.

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Moreover, the vast majority of these holdings are oriented toward self-consumption: around 85% of farms consume more than half of their own production (PETRE, 2021). This predominance of subsistence and semi-subsistence farms indicates a low level of market integration and competitiveness within the sector. As a result, Romanian agriculture is often perceived as inefficient (VIZITEU et al., 2024), with productivity and yields per hectare remaining below the levels achieved in Western European countries. Furthermore, production remains highly dependent on natural conditions (such as rainfall patterns) thereby increasing the sector's volatility and vulnerability. These structural and dynamic characteristics, accumulated throughout the post-communist transition, explain the performance gap between Romania and its European partners and underline the need to continue the modernization process.

Over the past decade, Romania's crop sector has embarked on a gradual process of transformation and modernization. Reforms and investments often supported by the Common Agricultural Policy (CAP) funds have led to notable progress: the number of agricultural holdings has decreased, the share of medium and large farms has increased, and economic indicators show improvements in performance (VIZITEU et al., 2024). Nevertheless, the academic literature emphasizes that further efforts are required to enhance modernization and efficiency in order for Romanian agriculture to reach its full competitive potential (VIZITEU et al., 2024). In this regard, priorities include the adoption of advanced agricultural technologies, the promotion of cooperatives, and the consolidation of farms, aimed at overcoming the predominantly extensive character of the sector and boosting productivity.

Therefore, the present study aims to assess the current state of Romania's crop sector through a comparative analysis with other EU member states. Clarifying the current position of Romanian crop production in relation to European standards will allow for the identification of the sector's strengths and weaknesses, while also providing directions for action to fully capitalize on existing advantages and reduce competitiveness gaps.

MATERIAL AND METHODS

The study was conducted based on a descriptive and comparative analysis of official statistical data regarding the crop sector in Romania and the other member states of the European Union.

The data sources included Eurostat, the National Institute of Statistics (NIS), and the General Agricultural Census (2020 round), complemented by information from the relevant scientific literature. The study employed a multi-annual analysis, providing an overview of the structural evolution and performance of the crop sector.

The main indicators used in the analysis were: utilized agricultural area, farm structure, average farm size, areas cultivated with major crops, average yields per hectare, and the volume of investments in agricultural fixed assets. The analysis involved statistical processing of the data through temporal and spatial comparison methods, complemented by graphical representations and summary tables.

This approach made it possible to identify modernization trends, disparities relative to the EU average, and the key structural and technological factors influencing the competitiveness of Romania's crop agriculture.

RESULTS AND DISCUSSIONS

At the EU level, Romania stands out as having the sixth largest utilized agricultural area, benefiting from vast expanses of fertile arable land (DRĂGULEASA et al., 2023). More

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specifically, in 2020, Romania's utilized agricultural area amounted to 12.76 million hectares, representing approximately 7% of the EU's total agricultural area. Of this, arable land accounted for 8.57 million hectares (Figure 1).

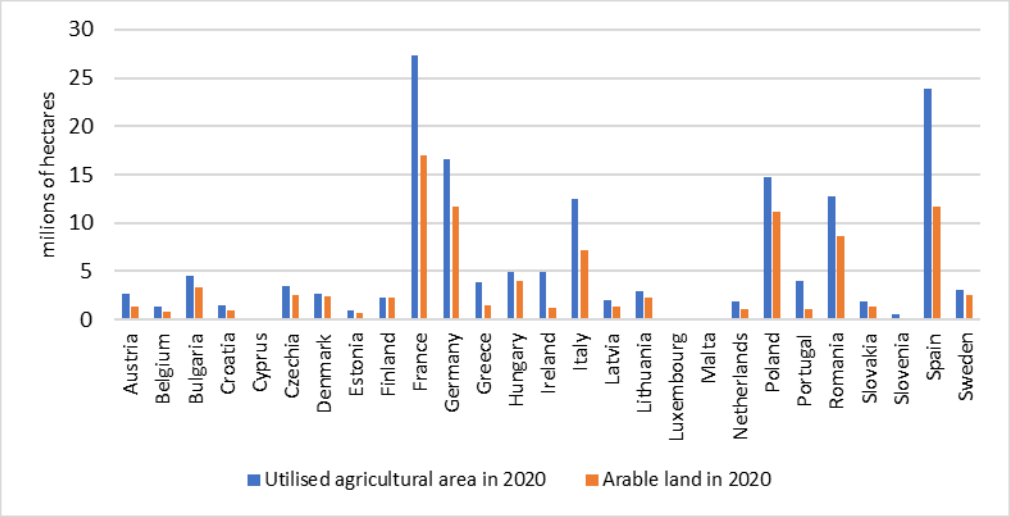

Figure 1. Utilised agricultural area and arable land in EU member states in 2020.
Source: Eurostat data processing

The vast cultivated areas and the high volumes of grains and industrial crops produced on Romanian soils contribute significantly to export revenues and strengthen the country's position as a key player in the European food supply chain. This agricultural potential also has important socio-economic implications. The agricultural sector remains a cornerstone of the rural economy, employing over one-fifth of the national workforce, predominantly in rural areas (URSU et al., 2023). Large-scale use of farmland supports rural employment and can stimulate rural development by creating new opportunities in the agri-food industry and other agriculture-related activities. At the same time, the extensive arable land serves as a strategic reserve for ensuring food security (POPESCU, 2022). Some studies estimate that Romania's agri-food potential could feed a population nearly twice its current size, while still allowing for substantial export capacity (OTIMAN, 2014).

According to the chart below (Figure 2), Romania ranks at the top in terms of the number of farms, holding 2.88 million farms in 2020. The data illustrate a strong polarization between Western and Eastern Europe: the East has a larger number of small farms, while the West has fewer but significantly larger and more mechanized ones. This situation directly influences European agricultural policies, which must balance the needs of small-scale farmers in the East with those of large-scale producers in the west.

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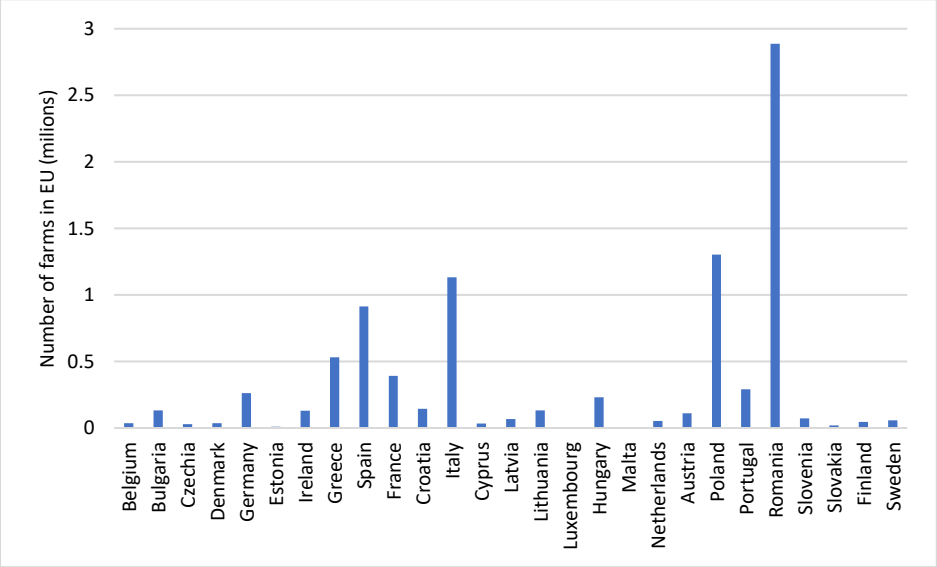

Figure 2. The structure of farms in the EU: number of farms by member state in 2020.
Source: Eurostat data processing

The situation regarding the number of agricultural holdings in Romania, however, appears to be improving over time. According to data from the 2020 General Agricultural Census, over a ten-year period, the number of holdings decreased by 25% (approximately 972,000). The same census shows that in 2019, the number of holdings without legal personality was 2.86 million, while the number of commercial holdings with legal personality (those that most effectively sustain production) was around 25,000.

Although Romania has the largest number of farms, the average farm size is among the smallest in the European Union. According to Eurostat data, the average Romanian farm covers 4.4 hectares, well below the European average of 17–18 hectares. This indicates a pronounced fragmentation of agricultural land, dominated by small, subsistence-oriented family farms, with only a limited number of commercial holdings. The situation becomes even more concerning when considering the average size of agricultural holdings without legal personality, which, according to the 2020 General Agricultural Census, was only 2.7 hectares in 2019.

Romania accounts for slightly more than one-third of the total number of agricultural holdings in the European Union (31.8%) followed by Poland with 14.4% and Italy with 12.5% (Figure 3). The chart in figure 4 highlights the pronounced polarization within the structure of Romanian agricultural holdings. Over 54% of farms have sizes between 0.1 and 1 hectare, and 36% fall between 1 and 5 hectares, indicating a predominance of small and very small farms, primarily focused on subsistence production. Large agricultural holdings, exceeding 50 hectares, represented only about 1% of the total number of farms. However, a positive aspect is that these larger holdings utilized 54% of the total agricultural area. In contrast, farms smaller

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than one hectare used 4.6% of the agricultural land, while those between 1 and 5 hectares accounted for 18.2%.

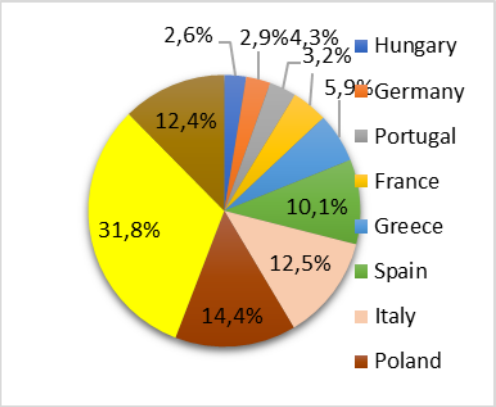

Figure 3. Percentage distribution of the farms in the EU member states.
Source: Eurostat data processing

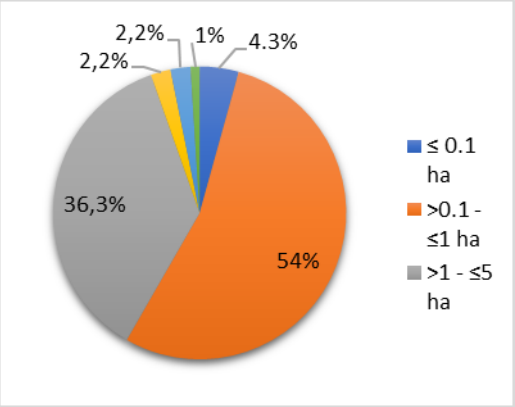

Figure 4. Percentage distribution of farms in Romania by size.
Source: Procesing of data from General Agricultural Census, 2020

Among the main causes of these structural problems in Romanian agricultural holdings are the historical legacy of the post-collectivization period, when land was reallocated into small plots, and the aging of the rural population, which limits both investment and modernization. Other contributing factors include the lack of farmer associations and agricultural cooperatives, the low level of mechanization, and the difficulties in accessing European funds. These structural issues within agricultural holdings generate significant economic and social impacts. Romanian agriculture accounts for a large share of total employment (around 20% of the active population, compared to the EU average of 4–5%). However, the low profitability of small farms results in a relatively modest contribution of agriculture to GDP (approximately 4%) (NIS, 2024). Ultimately, this structure affects most farmers' incomes and reduces their ability to adapt to the demands of the European market.

The charts below illustrate Romania's position among the EU Member States in terms of the average area cultivated with the main agricultural crops (wheat, maize, barley, and sunflower) during the period 2020–2024.

Romania occupies an intermediate position in the ranking of wheat cultivation areas, following countries such as France, Germany, and Poland (Figure 5). With an average of about 2.5 million hectares under wheat, Romania nevertheless ranks among the top five wheat producers in the European Union. In the case of maize, Romania ranks first, ahead of countries such as France, Poland, and Hungary (Figure 6). With an average cultivated area exceeding 2.3 million hectares, Romania confirms its status as the largest maize producer in the EU. This dominant position is explained by the long tradition of maize cultivation, its adaptability to local climatic conditions, and the high demand for it on both domestic and external markets.

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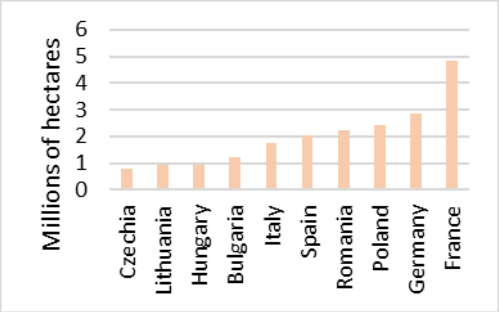

Figure 5. Top ten EU member states ranked by the average wheat cultivation area during the period 2020-2024.
Source: Eurostat data processing

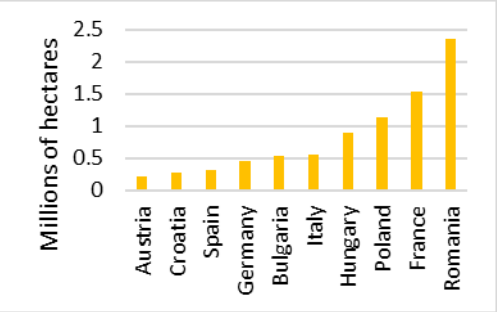

Figure 6. Top ten EU member states ranked by the average maize cultivation area during the period 2020-2024.
Source: Eurostat data processing

In the case of barley, Romania has a smaller share compared to other major producing countries such as Spain, France, and Germany (Figure 7). With an average cultivated area of less than 0.7 million hectares, the country ranks around the middle of the EU standings. Nevertheless, barley remains an important crop, especially in the southern and eastern regions, being used both as animal feed and in the brewing industry. Romania also holds a leading position in sunflower cultivation, with an average area of approximately 1.1 million hectares, followed by Bulgaria and France (Figure 8). This crop plays a major role in Romanian agriculture due to its adaptability to local soil and climate conditions, its high yields, and the strong demand on the European market for vegetable oils.

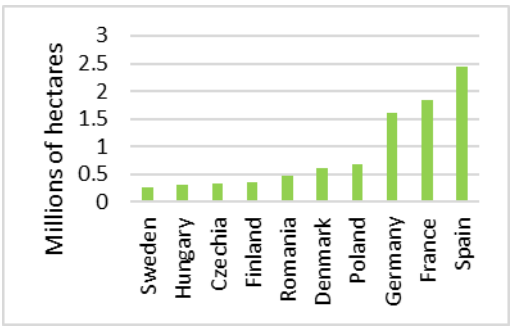

Figure 7. Top ten EU member states ranked by the average barley cultivation area during the period 2020-2024.
Source: Eurostat data processing

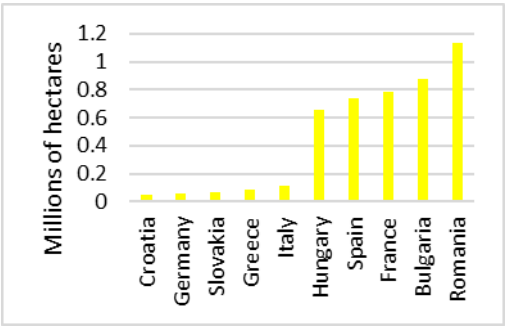

Figure 8. Top ten EU member states ranked by the average sunflower cultivation area during the period 2020-2024.
Source: Eurostat data processing

Although Romania can take pride in certain figures regarding cultivated area, the picture is less optimistic when it comes to actual production. The country reflects a clear imbalance between its natural potential and its technological, economic, and structural limitations. Romania benefits from fertile soils, a favorable climate, and a long agricultural tradition that could support high yields; however, greater investment is needed in mechanization, land consolidation, the adoption of high-performance inputs and modern

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technologies, as well as in effective policies and adequate logistical infrastructure to sustainably increase average yields per hectare.

Compared to other EU Member States, Romania presents high agricultural potential due to its favorable natural conditions. From the perspective of the natural environment, Romania possesses high-quality soils and a pedoclimatic diversity well suited for field crops. For instance, in the plains, chernozem soils predominate, known for their high agricultural potential (OROIAN, 2023; POPESCU et al., 2023; NMA & EPEOC, 2013). However, climate change is placing growing pressure on sensitive crops. For example, projections estimate a shortening of the growing season by 13–19 days for wheat and 15–25 days for maize in the coming decades, which reduces production potential (CUCULEANU, 1999).

The mechanization of agriculture in Romania remains in a modernization phase. Although progress has been made, the average level of equipment remains significantly below the Western European average (MARIN et al., 2023; MIRON & LUP, 2015). This significantly affects yield levels per hectare. For example, an analysis from 2019–2022 shows that the number of tractors and agricultural machines is positively correlated with average cereal yields ($R^2 = 0.943$), indicating that investments in mechanization and technology directly contribute to performance (DRAGOMIR et al., 2023).

In addition, land fragmentation remains a major structural problem. Very small farms and dispersed plots reduce the efficiency of agricultural operations and hinder the use of modern technologies (ALEXANDRI, 2014). Access to certified inputs, fertilizers, and pesticides is also uneven, while the large-scale adoption of "smart farming" technologies remains lower compared to Western Europe.

On the other hand, the influence of the Common Agricultural Policy has brought direct subsidies and investment support, contributing to improved performance. However, production costs (fuel, labor, inputs) remain high in Romania, eroding profit margins and reducing the attractiveness of technological investments. Furthermore, market access, logistical infrastructure, and market prices for agricultural products strongly influence farmers' decisions and the level of investment they undertake.

The technological and structural factors mentioned above largely explain why, despite Romania's considerable agricultural potential, average yields per hectare do not consistently reach top levels. The data presented in the table below (Table 1) illustrate this, showing wheat yields ranging from 4–5 tons/ha in favorable years (e.g., 2017 with 4.9 t/ha) to only 3 t/ha in 2020, highlighting the sector's vulnerability to climatic and technological factors.

Table 1

Average yield per hectare in Romania for the main crops between 2014 and 2020.
Source: Processing of data from National Institute of Statistics

Year	Wheat (t/ha)	Maize (t/ha)	Barley (t/ha)	Oat (t/ha)	Rye (t/ha)	Sunflower (t/ha)	Rape (t/ha)	Soybeans (t/ha)	Sugar beet (t/ha)
2014	3.6	4.8	3.6	2.1	2.4	2.2	2.6	2.5	44.7
2015	3.8	3.5	4.0	2.0	2.5	1.8	2.5	2.0	39.1
2016	3.9	4.2	4.3	2.2	2.5	2.0	2.8	2.1	40.6
2017	4.9	6.0	4.7	2.5	2.9	2.9	2.8	2.4	41.6
2018	4.8	7.6	5.1	2.4	2.8	3.0	2.5	2.7	38.0
2019	4.7	6.5	4.7	2.2	2.8	2.8	2.3	2.6	40.4

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2020	3.0	4.0	2.9	1.9	2.5	1.9	2.2	1.9	33.7
2021	4.8	5.8	4.8	2.4	2.9	2.5	3.1	2.5	39.9
2022	4.0	3.3	4.4	2.2	2.7	1.9	2.6	1.8	31.7
2023	4.2	4.0	4.3	2.0	2.8	1.9	2.8	2.1	32.4
2024	4.1	2.8	4.4	2.1	2.5	1.2	2.3	2.1	38.2

Gross fixed capital investments are a key indicator of agricultural modernization, as capital (machinery, buildings, equipment) determines both the pace of technology adoption and productivity growth (HAYAMI & RUTTAN, 1985). In 2023, Romania recorded €1.8 billion and ranked 23rd out of 27 EU member states (Figure 9). The contrast with Western countries is striking: France reached €14.6 billion, Germany €12.6 billion, Italy €10.7 billion, and the Netherlands €5.6 billion; even Austria (€2.7 billion) surpassed Romania. In other words, France's level was more than eight times that of Romania, and Germany's over seven times higher. These disparities reflect distinct agricultural structures (larger farms, more intensive capitalization) and the overall EU trend of increasing on-farm investment in machinery (HERMAN, 2025). Moreover, investment responses are influenced by CAP design and decoupling, which can either accelerate or slow down modernization (VIAGGI et al., 2011).

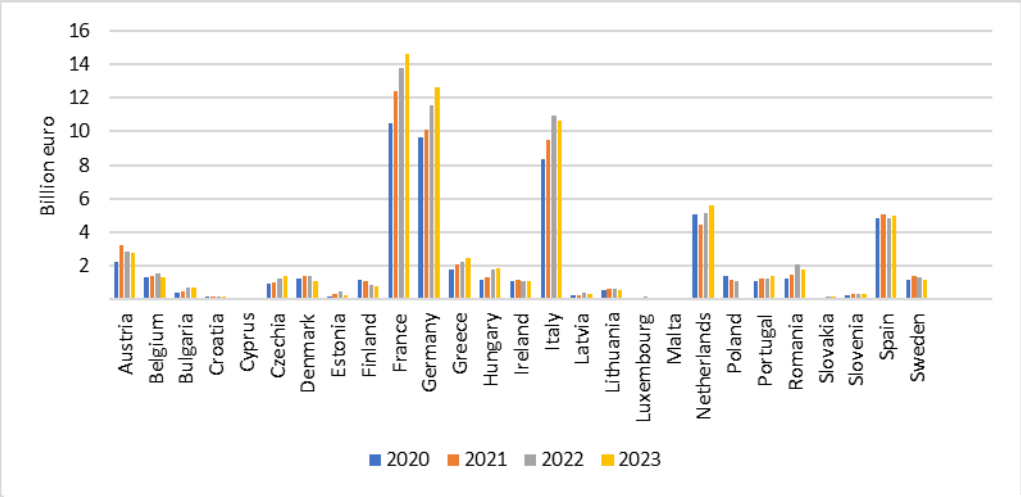

Figure 9. The level of investments made by the European Union member states in agriculture between 2020 and 2023. Source: Eurostat data processing

The literature also highlights cases of sectoral "overcapitalization" within the EU, emphasizing that not only the volume but also the quality and efficiency of investments matter (PETRICK & KLOSS, 2012). Consequently, Romania needs to direct its investments toward complementary productive capital (technology plus knowledge) in order to quickly bridge the gap with Western Europe.

CONCLUSIONS

Romania holds significant agricultural potential within the European Union, ranking among the main producers of cereals and oilseeds thanks to its extensive farmland and favorable soil and climatic conditions. However, the performance of the crop sector remains constrained by land fragmentation, the predominance of small farms, low levels of mechanization, and insufficient investment in technology and infrastructure.

The analysis shows that although Romania remains competitive in terms of production volume, yields per hectare and value added continue to fall below the European average. Progress achieved through the Common Agricultural Policy funds and through farm consolidation indicates a gradual process of modernization, yet convergence with Western European countries remains slow.

To fully capitalize on its natural and economic advantages, investments need to be directed toward mechanization, digitalization, and farmer cooperation. In this way, Romanian crop farming can evolve from an extensive model to a competitive and sustainable one—driven by innovation and efficiency.

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