EU CAP environmental actions for land management with a focus on the economic sustainability of agri-businesses

Jan Mikula[1], Jan Vavřina[2]

Abstract: Partial agri-environmental measures and ecological management schemes should provide adequate compensation for the implementation of specific practices or ecological commitments regarding land management by business entities under EU Common Agricultural Policy. The agricultural output of such production-related enterprises is commonly achieved with reduced input consumption and lower pressure on the environment. In addition, such production of agricultural primary production enterprises may come from marginal areas that could be left without economic utilisation without financial support, including the associated potential for the provision of ecosystem services, as an additional dimension of social benefits in the framework of landscape management, and the associated potential for the development of biodiversity of the area concerned. This article aims at exploratory study of available secondary data of EU Farm Accountancy Data Network on diversity in agricultural land usage among farms in order to identify relationship between development of their economic performance and structure of land use.

Keywords: land management, EU Common Agricultural Policy, economic performance.
JEL Classification: Q18, Q15

1 Introduction

Significant efforts and resources are being invested into integrated landscape management interventions, a fact closely tied to the challenges of mitigating the impacts of climate change and the related need for regional adaptation in accordance with specific territorial characteristics. Empirical research aimed at quantifying ecosystem services in terms of their benefits to nature and society must necessarily be linked to the evaluation of their effects and their most intensive possible integration with economic activities and the associated use of natural resources (del Río-Mena, 2023). MacDonald et al. (2000) analyse the process of agricultural land abandonment in the mountain regions of Europe (Alps, Pyrenees, Apennines, Carpathians) in the second half of the 20th century. The authors document that between 1960 and 1990, approximately 25% of agricultural land in mountain regions was abandoned. The main factors include: low productivity and high labour costs on sloping land, depopulation of rural areas, ageing of the farming population, poor accessibility and infrastructure. The study describes in detail the environmental consequences of abandonment - initially positive (reduction of erosion, regeneration of vegetation) but in the long term negative (loss of biodiversity of the cultural landscape, increased risk of fires, loss of landscape-forming function). The authors analyse policy responses including compensatory payments in less favourable areas. They show that a combination of economic incentives, support for local products and development of multifunctional agriculture is necessary to effectively prevent land abandonment.

The growing global population and the rising standard of living are driving demand that influences the scale of intensive agricultural production, often associated with the conversion of permanent grasslands or even forests into arable land. These factors negatively affect both carbon retention in organic soil matter and the extent of ecosystem services. Finding a compromise solution to these changes that balances the interests of affected stakeholders and broader societal concerns remains a significant challenge (Johnson et al., 2023). Addressing climate change must objectively involve carbon sequestration from CO_2 emissions through ecosystems. This will play a crucial role in achieving the EU's climate neutrality target by 2050. Activities that can contribute to carbon retention or enhance soil carbon sequestration capacity include afforestation, forest restoration, agroforestry, adoption of agricultural and forestry practices that protect and increase soil carbon, wetland conservation, peatland restoration, and the promotion of long-term and circular bio-based products (European Commission, 2021).

Data from the European Union Farm Accountancy Data Network (EU FADN) indicate that agricultural holdings in areas with natural constraints are associated with less intensive farming practices than farms outside ANC areas. These

[1] Mendel University in Brno, Department of Business Economics, Zemědělská 1, Brno, Czech Republic, xmikula5@node.mendelu.cz.
[2] Mendel University in Brno, Department of Business Economics, Zemědělská 1, Brno, Czech Republic, vavrina@node.mendelu.cz.

farms exhibit lower labour intensity, use fewer inputs (especially mineral fertilizers and pesticides), have lower livestock densities (measured in livestock units per hectare), and make more favourable use of agricultural land compared to farms outside those areas. These general trends are consistent across different types of farming. The least intensive agricultural practices are demonstrably carried out by farms in mountainous areas. From an economic perspective, farms in areas facing the natural constraints typically have smaller economic size and income, lower intermediate consumption, and receive relatively more subsidies per hectare of agricultural land compared to farms outside those areas (European Commission, 2023). This article aims at exploratory study of available secondary data of EU Farm Accountancy Data Network on diversity in agricultural land usage among farms in order to identify relationship between development of their economic performance and structure of land use.

Methods

A multivariate input for the explorative analysis using hierarchical clustering approach is using the EU Farm Accountancy Data Network (FADN) indicators as following: (SE300) Crop protection (€/farm), (SE295) Fertilisers (€/farm), (SE025) Total Utilised Agricultural Area (ha/farm), (SE028) Permanent grassland (ha/farm), (SE027) Permanent crops (ha/farm), (SE026) Arable land (ha/farm), (SE415) Farm Net Value Added (€/farm), (SE420) Farm Net Income (€/farm).

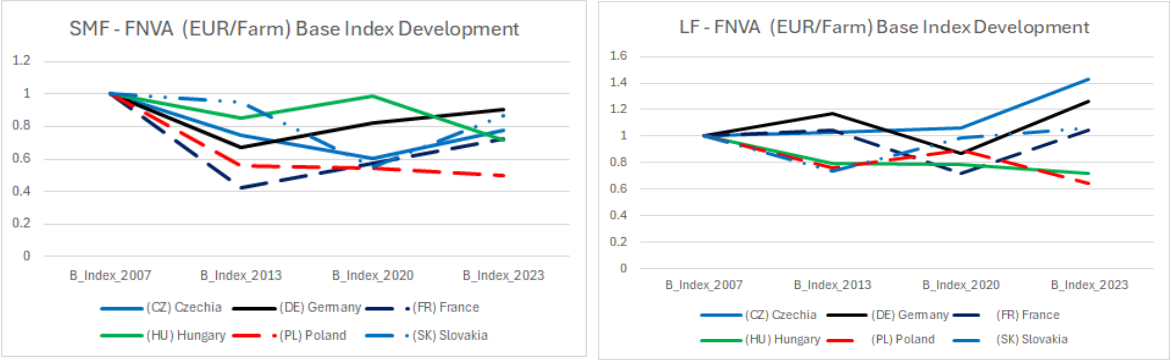
The researched size categories of businesses are according Commission Regulation (EC) No 1242/2008 regarding the amount of their standard output of production as follows: Category 1: 2 000 - 7 999 EUR; Category 2: 8 000 - 24 999 EUR; Category 3: 25 000 - 49 999 EUR; Category 4: 50 000 - 99 999 EUR; Category 5: 100 000 - 499 000 EUR; Category 6: 500 000 EUR and higher. As the sample of small and medium sized farms are regarded entities with their standard output of production lower than 100,000 EUR. Farms with the standard output of production higher then 100,000 EUR are regarded as the large farms.

Software Tibsco Statistica 14 was used for the hierarchical clustering procedures.

2 Research results

Empirical results of this contribution are based on the exploratory analysis of available secondary data arising from a representative long term survey regarding farm accounting data provided by businesses entities.

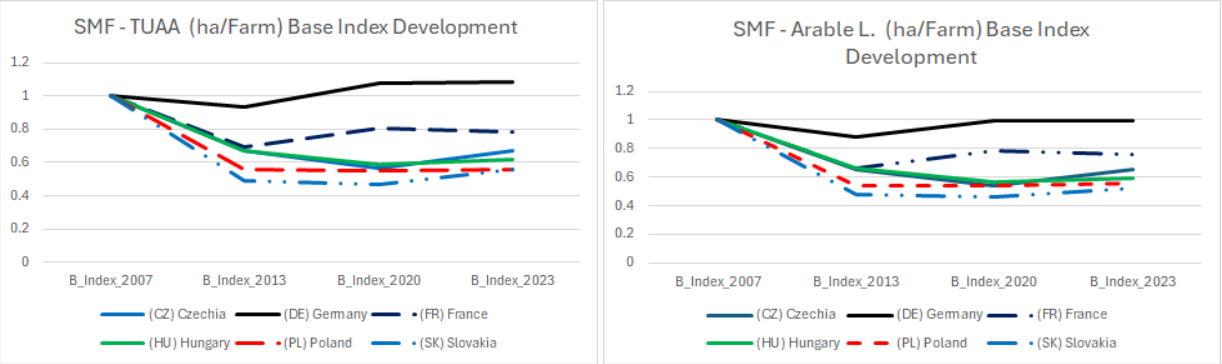
Figure 1 Development of Farm Net Value Added indicator using base index 2007 = 1 of selected EU countries



Source: own work using data of European Commission (©2025)

Fig. 1 illustrates the base index development of Farm Net Value Added (FNVA) for small farms (SF) and large farms (LF) across six European countries - Czechia, Germany, France, Hungary, Poland, and Slovakia - over the years 2007, 2013, 2020, and 2023. Large Farms show greater volatility and higher growth potential in FNVA compared to small farms. Small farms exhibit more stable but lower base index values, indicating slower or more constrained growth in the potential to gain the positive factor income.

Figure 2 Development of Total Utilised Agricultural Area in comparison with indicator Arable Land using base index 2007 = 1 of selected EU countries for small and medium sized farms in selected EU countries



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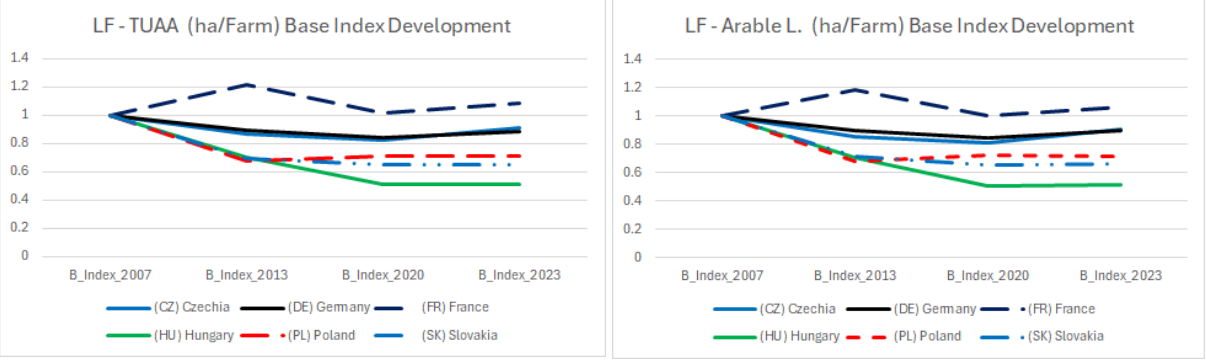
The Total Utilised Agricultural Area (TUAA) in comparison with the Arable Land index for the case of the small farms follows a similar but slightly less pronounced trend compared to TUAA (see Fig. 2). The gap between TUAA and Arable Land indices in some countries (e.g., Czechia, Slovakia) suggests a diversification of land use beyond arable farming, possibly into permanent grasslands or other agricultural uses. Countries with stable indices (Germany, France) may reflect mature agricultural structures with limited land expansion or consolidation. The divergence in trends between TUAA and Arable Land in countries like Poland may indicate policy-driven land use changes or structural shifts in farm management.

Figure 3 Development of Total Utilised Agricultural Area in comparison with indicator Arable Land using base index 2007 = 1 of selected EU countries for the largest farms in selected EU countries**.**



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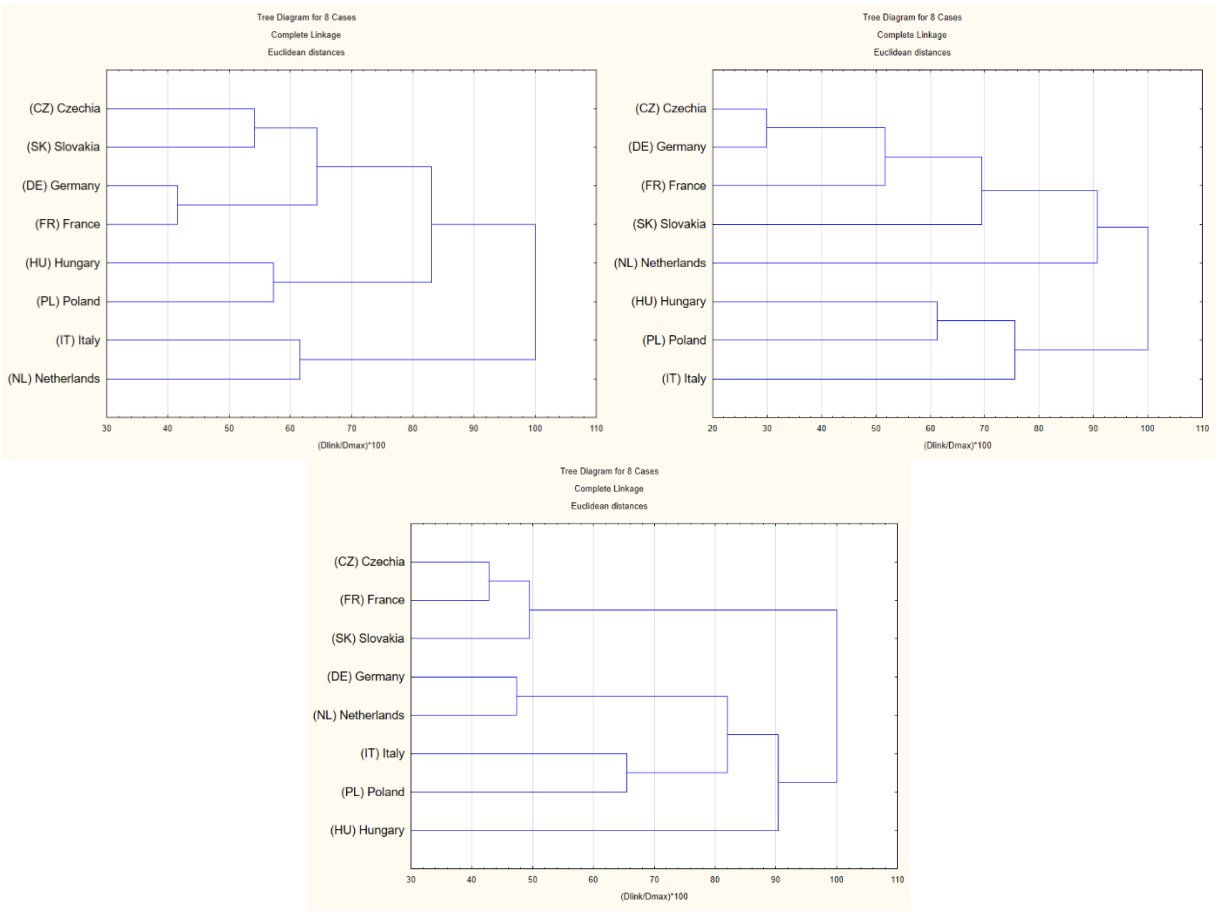
The identified trends on Fig. 3 regarding Total Utilised Agricultural Area (TUAA) in both indicators are highly correlated, indicating that changes in total utilised agricultural area are largely driven by changes in arable land. This finding is similar to the previous findings regarding small and medium sized farms.

Figure 3 Results of hierarchical clustering regarding the multivariate criterions for the observed small and medium farms



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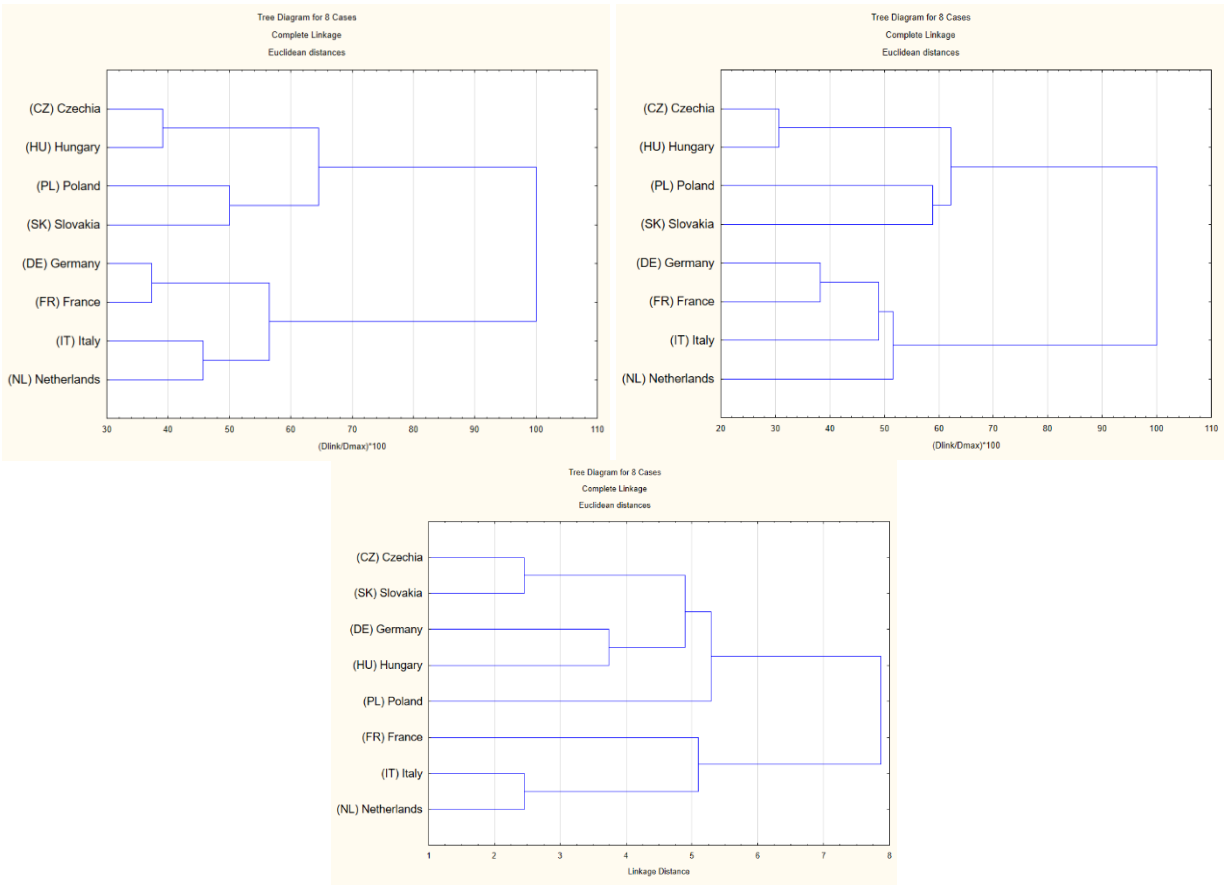
Dendograms presented in Fig. 3 represent a dynamic view on the selected multivariate criterions, involving % of Environmental subsidies from total operating subsidies,, % of LFA subsidies from total subsidies, Crop protection Expenditures (€/farm), expenditure for Fertilisers (€/farm), Total Utilised Agricultural Area (ha/farm), Permanent grassland (ha/farm), Permanent crops (ha/farm), Arable land (ha/farm), Farm Net Value Added, Farm Net Income (€/farm). Czechia (CZ) and Slovakia (SK) form the closest pair, reflecting also their historical, economic and structural characteristics. Germany (DE) and France (FR) cluster suggesting a core EU representatives in the sample. Hungary (HU) and Poland (PL) form a distinct cluster representing Central-Eastern European countries. Italy (IT) and Netherlands (NL) are more distant, indicating divergent development paths, possibly due to differences in agricultural structure characteristics. Development towards the observed time period of years 2021 -2023 (bottom down dendrogram) refers that small and medium-sized farms gets closer regarding the multivariate characteristics in Czechia (CZ) and France (FR). It could reflect a CAP policy-driven convergence accompanied with a similar trends in inovations. Slovakia (SK) also joins this cluster, reinforcing the Central European core country. Germany (DE) and Netherlands (NL) form a separate cluster, possibly reflecting highly industrialized agricultural systems. Italy (IT), Poland (PL), and Hungary (HU) form a broader cluster, suggesting shared challlenges in their development.

Figure 4 Results of hierarchical clustering regarding the multivariate criterions for the observed large farms



Source: own work using data of European Commission (©2025)

Dendograms presented in Fig. 4 also represent a dynamic view on the selected multivariate criterions as provided regarding the previsou Fig. 3, but for the case of the largest farms. Eastern European countries Czechi, Hungary and Poland are tightly grouped, suggesting regional convergence. Western countries form separate clusters, indicating divergence in their development for the initial observed period of years 2007 – 2013 (upper left dendrogram). Through the next development representing years 2014 – 2020 (upper right dendrogram), it is indentified a possible internal cohesion over time. Germany shifts closer to France and Italy, indicating alignment in their Common Agricultural Policy harmonization. The last observed period of years 2021 – 2023 represent a less regionally determined situation. It could represent a divergence at EU-level, reshaping traditional grouping.

3 Conclusions

FADN represents the only harmonised system for collecting microeconomic data from commercial agricultural holdings across the EU (EJ FADN ©2025). In the previous studies e.g. Špička and Smutka (2014) it was analysed the technical efficiency of agricultural enterprises and also were identified factors that influenced it. The results showed significant variability in efficiency between countries - enterprises in the "old" member states (especially the Netherlands or Belgium) achieved higher efficiency than in the new member states, including the Czech Republic. The study identified as key factors of efficiency: enterprise size (larger enterprises are more efficient), production specialization, capital intensity and the farmer's level of education. Scown et al. (2020) carry out an extensive spatial analysis combining FADN data with geographical information on land use across the EU. The study quantifies that only 15% of agricultural land in the EU is managed in a way that significantly supports environmental objectives. Yet CAP subsidies are distributed largely by area, without regard to environmental performance. Pe'er ea al. (2019) criticize the current structure of the CAP and proposes reforms to increase environmental efficiency. The authors identify three main structural problems: (1) Area-based direct payments encourage concentration and intensification at the expense of landscape diversity, (2) ecological focus areas have minimal environmental benefits because they allow for too wide a choice of measures, including low-value ones, agri-environmental schemes cover only a limited part of agricultural land and often compensate for practices that have limited impact. Their article presents an alternative model based on real environmental performance, where subsidies would be

linked to measurable environmental objectives (biodiversity, soil quality, water retention, carbon sequestration). The authors argue that the current land use structure in the EU - dominated by large, homogeneous blocks of arable land - is unsustainable and requires a transformation towards a mosaic landscape with a more diverse land use structure. Lakner et al. (2022) assess whether the new instruments will lead to a diversification of land use patterns. The study shows considerable heterogeneity between Member States in the design of eco-schemes - some Member States propose ambitious measures (e.g. conversion of arable land to permanent grassland, extensive orchards), while others limit themselves to minimalist measures. An economic analysis based on modelling of FADN data shows that eco-schemes can lead to a 5-15% decrease in income for intensive farms, but this decrease is fully compensated by subsidies. For extensive farms, eco-schemes can even increase income, as the requirements are close to their current practice. The article identifies potential trade-offs between productivity and environmental objectives and discusses how different land use patterns affect the economic viability of farms.

Zagata et al. (2020) provide a historical and sociological analysis of the development of Czech agriculture after 1989, with an emphasis on the adoption of the concept of sustainability. The authors use a combination of quantitative data (statistics on the structure of enterprises, land use, subsidies) and qualitative methods (interviews with 50 farmers). The study shows that the transformation of Czech agriculture had three phases: (1) 1990-2000: privatization and restitution, decrease in farming intensity due to the economic crisis, (2) 2000-2010: growth of large enterprises, increase in intensity, beginning of organic farming, (3) 2010-present: diversification, increase in small enterprises, growing interest in sustainable practices. An important finding is that Czech agriculture remains highly concentrated (average farm size 152 ha, the highest in the EU) with a dominance of large corporate farms. Agro-environmental measures were adopted mainly by small and medium-sized enterprises, while large enterprises are oriented towards intensive production. The study also documents a generational change - younger farmers are more open to sustainable practices and diversification.

This paper presents an exploratory analysis of farm accounting data from selected EU countries, focusing on small and large farms. Large farms show higher volatility and growth potential in Farm Net Value Added compared to small farms, which demonstrate more stable but slower growth. Identified Land Use Trends regarding small and medium farms, the gap between Total Utilised Agricultural Area (TUAA) and Arable Land suggests diversification into non-arable uses (e.g., grasslands). Stable trends in countries like Germany and France reflect mature agricultural systems, while divergence in Eastern European countries may indicate structural changes. For the sample of large farms the Total Utilised Agricultural Area and Arable Land indicators are highly correlated, indicating that changes in land use are primarily driven by arable land adjustments. Exploration arising from the hierarchical clustering approach for the sample of small and medium farm reveals regional similarities for the Czechia and Slovakia forming a close pair, Germany and France representing core EU countries, while Hungary and Poland cluster together as Central-Eastern European countries. Over time period of years 2021–2023 Czechia, France, and Slovakia converge, possibly due to CAP policies implementation and innovation trends. For the sample of the observed representatives of the largest farms, Eastern European countries (Czechia, Hungary, Poland) cluster together, while Western countries diverge. Over time, Germany aligns more with France and Italy, showing possible CAP harmonization. By 2021–2023, regional patterns become less distinct, suggesting a shift in EU-level agricultural dynamics.

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