# THE SUSTAINABILITY APPROACH FOR THE AGRICULTURAL SECTOR AT EU LEVEL

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***Abstract:*** *This paper examines the evolution and current state of agricultural sustainability in the European Union, recognizing the sector's significant impact on the environment, economy and society. Using a bibliographic and bibliometric analysis of literature from 2010 to 2024, the authors use databases such as Web of Science, Science Direct, Google Scholar and Sciendo and VOSviewer software to help identify key themes and concepts, revealing a growing interest in topics such as energy efficiency, greenhouse gas emissions, digitization, sustainable farming practices and sustainable intensification. The findings indicate that agricultural sustainability is a complex, multidimensional concept, involving environmental, economic and social dimensions that are often difficult to reconcile. The study finds significant progress in some EU countries, but also persistent discrepancies, particularly between Western European and Central and Eastern European nations, underlining the need for more coherent and context-specific policies. The paper concludes that successful progress towards sustainability depends on integrating all dimensions of sustainability into agricultural strategies, highlighting the roles of digitization and sustainable intensification, and that collaboration between policy makers, farmers and the private sector is essential to achieve sustainability in European agriculture as well.*

***Key words****: sustainable agriculture, economic sustainability, sustainable practices, sustainability indicators*

## INTRODUCTION

The agricultural sector plays an essential role in the economic and social development of a country, influencing not only food security but also economic stability and environmental sustainability. Thus, in a global context marked by climate change, population growth, and pressure on natural resources, the concept of sustainability in agriculture has become increasingly relevant.

The paradigm of "sustainability" applies to agriculture as well as other economic sectors and human activities. Similar to the broader concept of "sustainable development," discussions about "sustainable agriculture" include various definitions and interpretations, and the multiple attempts to define "sustainable agriculture" reflect different perspectives. In the social sphere, the main premise, emphasizing the ethical aspect, is "meeting the needs of the present generation without compromising the prosperity of future generations," according to the Brundtland Report [4,6,11]. The social and natural aspects of "agricultural sustainability," as well as its long-term importance, are highlighted by Francis and Youngberg (2013), who consider that "it is a philosophy based on human goals and an understanding of the long-term impact of our activities on the environment." (Francis, 1990), while Runowski (2007) emphasizes the ethical aspects of agriculture within the sustainability paradigm and the need to balance environmental, economic, and ethical objectives.

The concept of sustainability emerged immediately after the publication of the Brundtland Report, starting with the 1988 European Union Declaration on the Environment and the 2001 Gothenburg Strategy, the promotion of sustainable development and the deepening of its definition became the cornerstone of the European community's long-term policy perspective [1,3].

A high-level political agreement among the heads of the European Union member states supported the adoption of the principle of sustainable development in 1988 in the Declaration on the Environment as "an overarching objective of all Community policies." In pursuit of this objective, the Declaration called for new solutions to existing environmental problems "in the interests of sustainable growth and a better quality of life." In the 1992 Maastricht Treaty on European Union, the term was given importance in defining the Community's objective of achieving "sustainable development" in the context of economic and environmental policies [2,7,9,10].

The European Union's 2020 strategy currently provides the general strategic guidelines for all European Union policies, including agricultural policy, and further refines the three pillars of sustainability. It calls for measures to make growth sustainable, smart, and inclusive, in addition to setting the growth target in terms of "building a resource-efficient, sustainable, and competitive economy." This is expected to lead the European Union "to prosper in a low-carbon and resource-limited world, while preventing environmental degradation, biodiversity loss and the unsustainable use of resources" [5,8].

Sustainability was enshrined in Article 11 of the Treaty on European Union: "Environmental protection requirements must be integrated into the definition and implementation of the Union's policies and activities, in particular with a view to promoting sustainable development" (European Union 2008, Article 11). It is clear that sustainability is a normative concept, representing a high-level desire or aspiration. Although there is general consensus that it is a beneficial concept, there are profound differences in its intellectual approach. These differences may explain the real difficulties in applying sustainability concepts, and they may also constitute an obstacle to the implementation of derivatives of sustainability, such as sustainable intensification.

Despite significant progress in sustainability research, there are still important gaps that require further attention. For example, comparisons between different geographical regions are limited, and the diversity of measurement methods makes it difficult to compare results across studies. In addition, most studies focus on specific countries or regions, and there is insufficient comparative research at the global level. There is also a need for more detailed exploration of the impact of different government and fiscal policies on sustainability in the agricultural sector, and future studies should analyze the long-term effects of these policies and develop more harmonized methodologies for assessing sustainability[14,16].

To support sustainability in agriculture, it is essential to develop integrated public policies that address the economic, social, and environmental dimensions of sustainability simultaneously. These policies should be flexible and adaptive, capable of responding quickly to market changes and the impact of climate change by regularly evaluating existing policies and adjusting them based on objective and transparent criteria to maximize their efficiency and impact on farms [17,18]. A harmonized framework for sustainability assessment needs to be developed to allow comparison of results between different studies and geographical regions. This framework should include a set of standardized and easily applicable indicators that are accepted internationally. Local characteristics and the diversity of economic and social contexts should also be taken into account in the development of these indicators.

## MATERIALS AND METHODS

The paper presents a bibliographic and bibliometric analysis of the literature on sustainable agriculture in the European Union. The methodology used involves a qualitative analysis to highlight the frequency of relevant keywords and explore cooperation networks between authors, institutions, and countries in this field. The data used for this analysis were collected using the Web of Science, Science Direct, Google Scholar, and Sciendo databases, known for their extensive coverage of high-quality scientific articles.

The analysis was carried out using keywords such as "sustainable agriculture," "agricultural policies," "European Union," and "agricultural sustainability" for the period 2010-2024, including all types of articles published in English to ensure comprehensive coverage of the relevant literature. As a result of applying the selection criteria, a total of 111 papers and articles were identified.

The bibliographic analysis of relevant studies in the literature included studies, research, and analyses from the period 2010-2024. In this study, VOSviewer software was used to analyze the frequency of keywords and generate a co-occurrence matrix, which allowed the identification of main themes and relationships between authors and institutions in the field of sustainable agriculture. After collecting the data, it was imported into VOSviewer software to analyze keyword frequency and generate a co-occurrence matrix, which allowed the identification of the main themes and concepts associated with sustainable agriculture in the European Union, as well as the relationships between authors and institutions involved in this field of research (Figure 1).

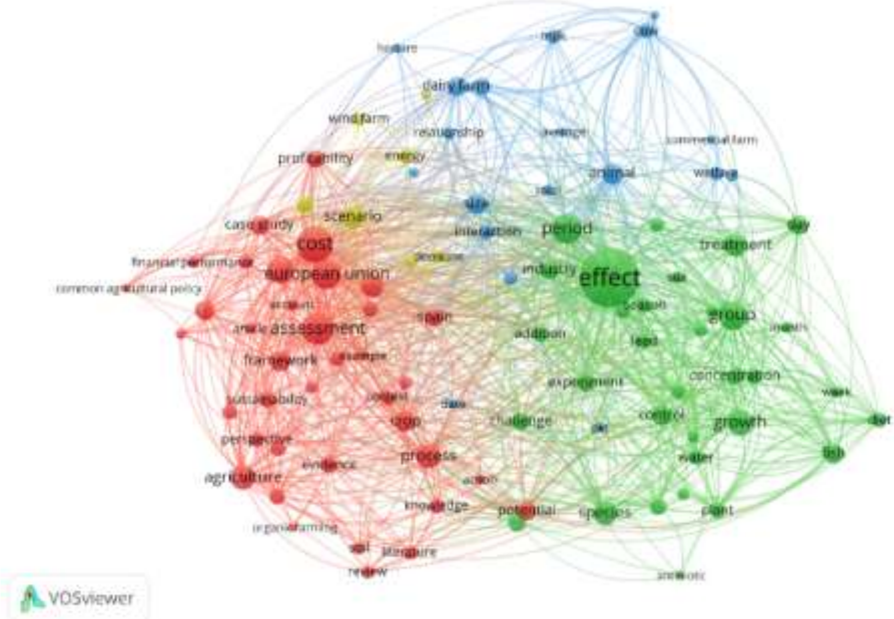


**Figure 1. Co-occurrence matrix identifying the main themes and concepts associated with sustainable agriculture in the European Union**

*Source: created by the author using VOSviewer software*

The results of the analysis showed a steady increase in interest in sustainable agriculture in the European Union, with a growing number of publications in recent years. The most frequently identified keywords were "sustainable agriculture," "sustainability indicators," "energy efficiency," "greenhouse gas emissions," "digitization in agriculture," "sustainable agricultural practices," "common agricultural policy (CAP)," and "sustainable intensification." These keywords highlight the main research directions and show the concern for the economic, environmental, and social aspects of sustainability in agriculture. Figure 2 presents the analysis performed and the distribution of research studies in the field of agricultural sustainability.

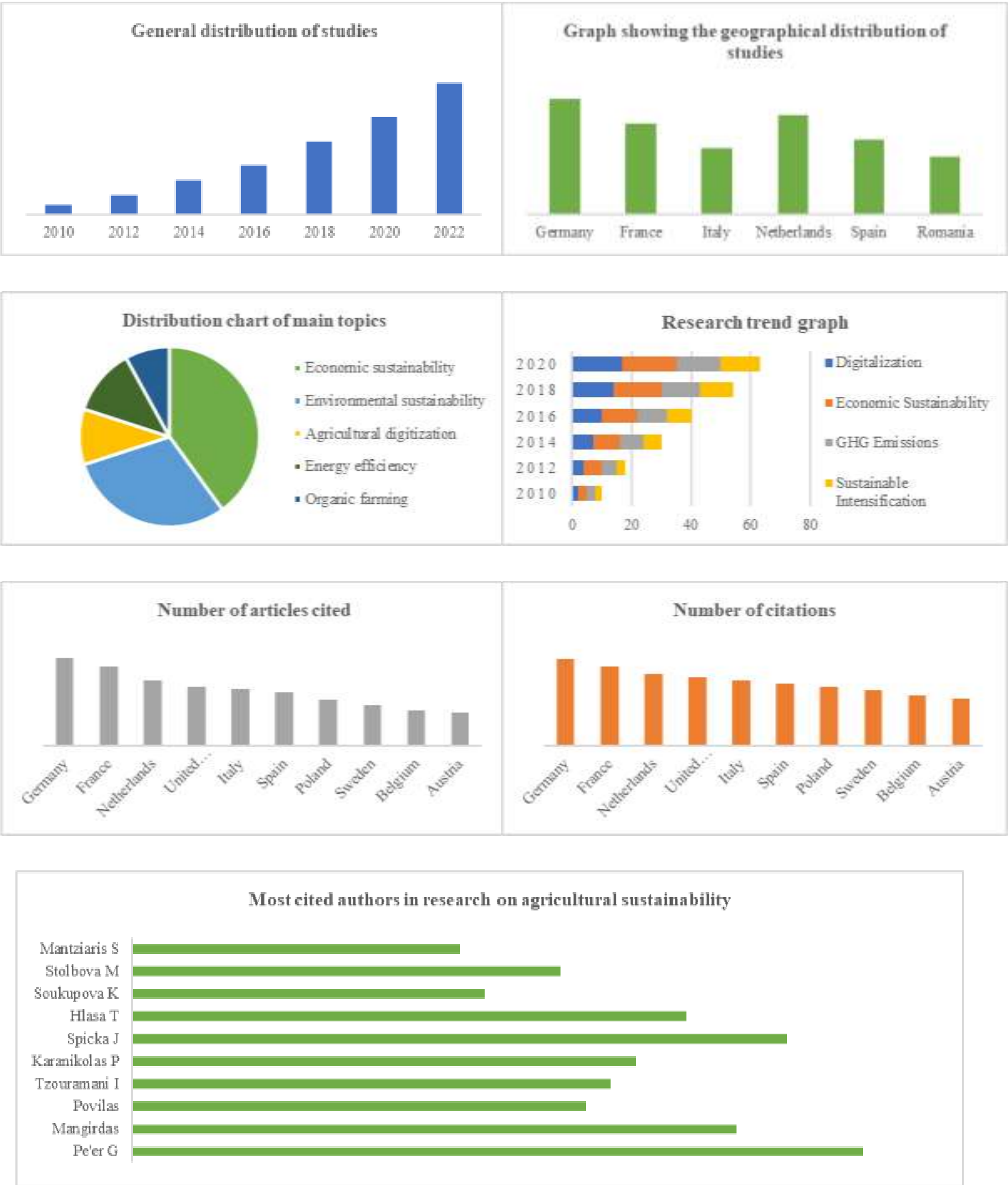


**Figure 2. Analysis and distribution of research studies in the field of agricultural sustainability**

The analysis and distribution of research studies in the field of agricultural sustainability focused on the temporal distribution of studies, which shows an increase in the number of studies published in the field of agricultural sustainability between 2010 and 2022. We thus observe a slow increase until 2016, followed by a significant acceleration, with a peak in 2022, suggesting a growing interest in research in this field, against a backdrop of increasing awareness of sustainability issues.

The geographical distribution of studies shows that research is mainly concentrated in European countries, with Germany (14 studies), the Netherlands (12 studies), and France (11 studies) in the top positions, reflecting these countries' active policies in the field of sustainable agriculture and their support for academic research.

The graph on the distribution of main research topics shows five major themes: economic sustainability (40%), environmental sustainability (30%), agricultural digitization (10%), energy efficiency (12%) and organic farming (8%), with economic and environmental sustainability dominating, suggesting that most research is focused on finding solutions to make agriculture more profitable and environmentally friendly, and the research trend chart illustrates the evolution of interest in different research topics over time, with digitalization and economic sustainability showing significant growth in recent years, and greenhouse gas emissions and sustainable intensification being topics of continuous interest from 2012 to the present.

Research on agricultural sustainability is unevenly distributed across Europe. Most studies come from Western Europe (the Netherlands, Germany, France, Italy), Northern Europe (Denmark, Finland, Sweden), and Southern Europe (Spain, Portugal). However, there is a lower representation of research from Central and Eastern Europe, such as Poland, Hungary, and Slovakia, which may indicate a need for greater involvement and investment in research in these regions.

The studies analysed in this chapter focus on different aspects of sustainable agriculture, including structural change, economic, energy and environmental efficiency, digitisation, sustainable intensification and the impact of the Common Agricultural Policy (CAP), while some papers focus on assessing agricultural sustainability using specific indicators (economic, social, environmental), while others explore the impact of external factors, such as the 2008 global financial crisis on the European agricultural sector. The studies also use various statistical and econometric methods, such as Data Envelopment Analysis (DEA), regression analysis, Chow and Quandt tests, latent profile analysis, and the Ward method.

## RESEARCH RESULTS

The idea of agricultural sustainability is not new; it was first addressed in Thomas Malthus's 1798 work, An Essay on the Principle of Population. Malthus highlighted the risk of exponential population growth that could exceed food production capacity, leading to famine and conflict. Although this scenario did not materialize until the beginning of the 21st century due to technological advances, constraints on economic growth and their impact on agricultural productivity have become a growing concern.

The concept of "sustainable agriculture" became prominent following the publication of the Brundtland Report in 1987, which introduced and popularized the idea of "sustainable development." Thus, sustainability in agriculture is a hotly debated topic and is internationally recognized as essential for the transition to sustainable global development, although there is general consensus on its importance, and definitions of agricultural sustainability and how to implement it in public policy vary considerably. This variation is partly due to the fact that agricultural sustainability is a concept derived from various types of "alternative" agriculture, such as organic, regenerative, and ecological agriculture. Essentially, there are three dimensions and different levels that are used to assess sustainability in agriculture, as shown in Figure 3.


**Figure 3. Basic dimensions and levels used to assess sustainability in agriculture**
*Source: developed by the author based on Zhen and Routray (2003); Hayati et al. (2010)*

The multidimensional approach developed by the FAO (1991), which summarises these principles as "the management and conservation of natural resources and the orientation of technological and institutional change so as to ensure that human needs are met on a continuing basis by present and future generations". Such development (in agriculture, forestry, and fisheries, etc.) protects the genetic resources of soil, water, and wildlife, while being environmentally sustainable, economically viable, and socially acceptable. This subchapter explores various studies in the literature on the concept of sustainable agriculture in the European Union, with a focus on structural changes, economic, energy, and environmental efficiency, as well as the impact of agricultural policies, international events, and digitization on the performance and sustainability of agriculture in EU member states.

Brad et al. (2018) analyze the path towards agricultural sustainability by assessing the factors influencing EU debt, analyzing data collected between 2008 and 2015. The study aims to assess how various subsidies and costs associated with agriculture influence farmers' short- and long-term debt. The results of the research show that decoupled subsidies and specific costs have a significant impact on agricultural debt, and that increases in labor and agriculture-specific input costs lead to an increase in total debt. The indicators analyzed for agricultural sustainability by assessing the factors influencing EU debt are presented in Table 1.

**Table 1.**

**Indicators analyzed on the sustainability of agriculture by assessing factors influencing EU debt**

| Nr. crt. | Indicators | Definition of indicators |
|---|---|---|
| 1 | Total debt | Measures the total value of debts recorded at the end of the year by the farms analyzed. |
| 2 | Long-term debt | Represents the value of debts with a repayment period of more than one year. |
| 3 | Short-term debt | Represents debts for a period of less than one year or outstanding cash payments. |
| 4 | Decoupled subsidies | Subsidies granted on the basis of agricultural area or number of animals, without being linked to production. |
| | Specific costs | Costs related to inputs for crops and animals, measured per unit of agricultural area or per animal. |
| | Cash flow in total capital | The ratio between cash flow and total capital of the farm. |

*Source: prepared by the author based on Brad et al., 2018*

The study reveals that decoupled subsidies have a significant effect on reducing agricultural debt, suggesting that they provide additional resources to farmers to finance agricultural activities without incurring additional debt. On the other hand, specific costs and those related to external labor lead to an increase in debt, indicating that farms need additional financial resources to cover these expenses. The paper therefore recommends the implementation of tailored financing programs that take into account the specific characteristics of each farm and support the transition to sustainable agriculture.

Martinho (2019) investigates whether the various reforms of the Common Agricultural Policy, the global financial crisis of 2008, and other European and international events have led to structural changes in the agricultural sector of the European Union. The author uses data from the Farm Accountancy Data Network (FADN) for the period 1989-2016, applying tests such as Chow and Quandt to identify structural breaks in agriculture. The results of the study show that these structural changes differ among the twelve original EU Member States and depend on the variables analyzed, and that the financial crisis and the data collection methods adopted by the EU had a greater impact on European farms than the CAP reforms, with the exception of the 1992 reform and trade liberalization. In the study, the authors analyzed several relevant indicators to assess structural changes in the EU agricultural sector, as presented in Table 2.

**Table 2.**

**Relevant indicators for assessing structural changes in the agricultural sector of the European Union**

| Nr. crt | Indicators | Definition of indicators |
|---|---|---|
| 1 | Labor force (hours worked) | The indicator measures the total number of hours worked on representative farms in different EU Member States, which is an important factor in understanding developments in the use of agricultural labor and changes in the structure of employment in the agricultural sector. |
| 2 | Utilized agricultural area (hectares) | This indicator reflects the total size of land used for agriculture, so agricultural area is essential for understanding trends in the expansion or reduction of agricultural land and for assessing the impact of agricultural policies on land management. |
| 3 | Total number of livestock units | This indicator measures the total number of livestock units owned by farms, providing an insight into the size and specialization of livestock production in different Member States. |
| 4 | Total income (euros) | This indicator tracks the total income generated by farms, both from crops and livestock, and is essential for assessing the economic performance of agricultural holdings and identifying the impact of economic and agricultural policies on farmers' incomes. |
| 5 | Total subsidies (excluding investments) | Subsidies received by farms, excluding those for investment, are an important indicator of the financial support provided by the European Union to farmers, allowing the impact of subsidies on the economic and structural performance of agricultural holdings to be assessed. |
| 6 | Total assets (euros) | The indicator reflects the total value of assets owned by farms, including land, equipment, and other resources, providing information on the investment capacity and financial stability of agricultural holdings in the context of structural changes. |

*Source: developed by the author based on Martinho, 2019*

Martinho's study also highlights that, although there have been several reforms of the CAP, their impact on the structure of European farms has been limited compared to other international events, and the global financial crisis has had a significant effect on agriculture in the EU, causing structural disruptions in the following years, particularly in the period 2009-2011, with varying effects across EU countries, highlighting the diversity of the European agricultural sector.

Domagała (2021) analyzes the economic and environmental aspects of agriculture in EU countries, examining the economic, energy, and environmental efficiency of agriculture in EU Member States in 2019 using the Data Envelopment Analysis (DEA) method. The aim of the research was to determine the efficiency of agriculture in EU countries from a multidimensional perspective, including economic, energy, and environmental aspects. The results of the study show that only seven EU countries (the Netherlands, Denmark, Greece, Cyprus, the United Kingdom, Italy, and Ireland) have economically and energy-efficient agriculture. These countries are considered leaders in eco-efficiency, combining economic and energy efficiency with low greenhouse gas emissions. The paper also identifies several countries with inefficient agriculture, including Poland, Latvia, Estonia, and Slovakia, which were classified as "lagging" due to their low economic and environmental efficiency. Another important finding of Domagała's study is the identification of a positive correlation between energy efficiency and greenhouse gas emission efficiency, suggesting that countries with more energy-efficient agriculture tend to have lower greenhouse gas emissions. The conclusions of the paper highlight the need to adopt more efficient agricultural technologies and practices in order to reduce the inputs required and, implicitly, to improve the eco-efficiency of the agricultural sector in the EU. the author suggests that agricultural policies should be better aligned with sustainability objectives in order to improve the economic and environmental performance of agriculture in EU Member States.

Magrini (2022) assesses the sustainability of agriculture in European Union countries using a multivariate group-based modeling approach to identify groups of countries with common trends in sustainable objectives. The study covers 26 EU countries, analyzing 12 indicators related to the economic, social, and environmental dimensions of agricultural sustainability over a 15-year period (2004-2018). The results identify three distinct groups of countries that perform differently in achieving sustainable goals, thus providing valuable information for the formulation of more effective agricultural policies within the EU's Common Agricultural Policy.

Figure 4 presents the indicators analyzed by Magrini on the sustainability of agriculture in European Union countries.

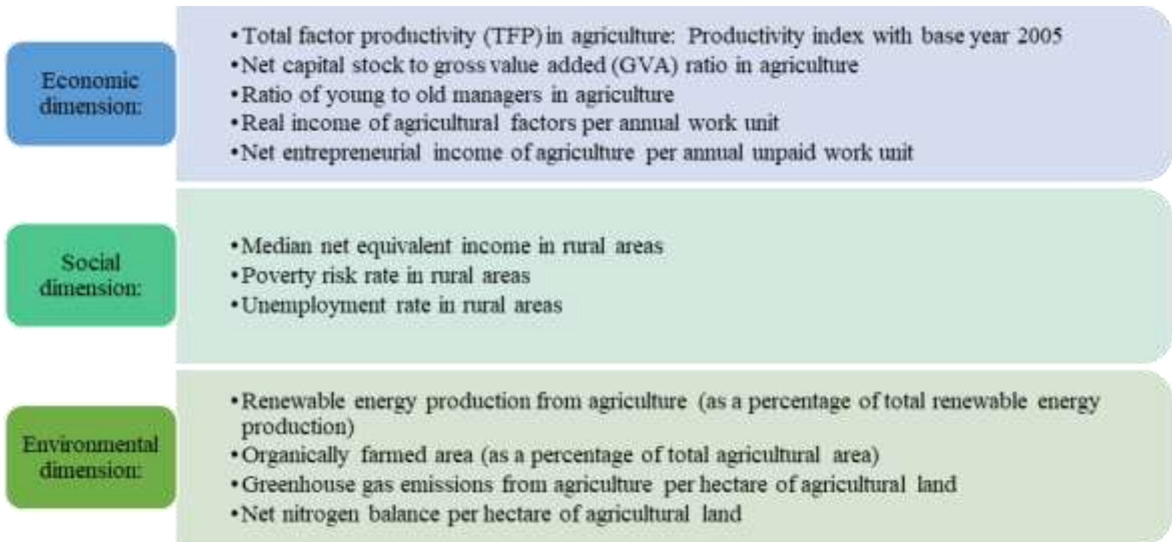


**Figure 4. Indicators analyzed regarding the sustainability of agriculture in European Union countries**

*Source: developed by the author based on Magrini, 2022*

The study results highlighted three groups of countries with distinct trajectories in achieving sustainable goals:

- Group 1 (Austria, Finland, France, Hungary, Italy, Luxembourg, Portugal, Slovenia, Spain), characterized by trajectories that largely meet sustainability goals, with the exception of the youth/elderly ratio among agricultural managers and greenhouse gas emissions, which are on an upward trend. In practice, these countries have generally achieved social sustainability but have only partially succeeded in economic and environmental sustainability;
- Group 2 (Bulgaria, Cyprus, Germany, Greece, Ireland, Latvia, the Netherlands, Poland, Sweden, the United Kingdom) showed variable progress in achieving sustainability goals, with significant improvements in renewable energy production and ecological culture, but with difficulties in maintaining nitrogen balance and managing greenhouse gas emissions;
- Group 3 (Belgium, Czech Republic, Denmark, Estonia, Lithuania, Romania, Slovakia) faced the greatest challenges in achieving sustainability goals, particularly in terms of economic and social sustainability, but made notable progress in renewable energy production and green culture.

The study's conclusions highlight the importance of differentiated agricultural policies that take into account the specific trajectories of each group of countries and promote tailored measures to improve the sustainability of agriculture within the European Union.

MacPherson et al. (2022) analyze future agricultural systems and the role of digitalization in achieving sustainability goals. Through the use of advanced technologies such as the Internet of Things (IoT), artificial intelligence (AI), and robotics, digitalization has significant potential to improve efficiency, productivity, and food safety. However, there are uncertainties regarding the impact of this digitization on other sustainable development principles, such as biodiversity conservation, soil protection, and human health. The paper reviews German and European policies to highlight the institutional, social, and legal preconditions necessary for digitalization to support agricultural sustainability.

The paper identifies and analyzes a number of technologies and indicators that can contribute to achieving sustainability goals in agriculture (Figure 5).

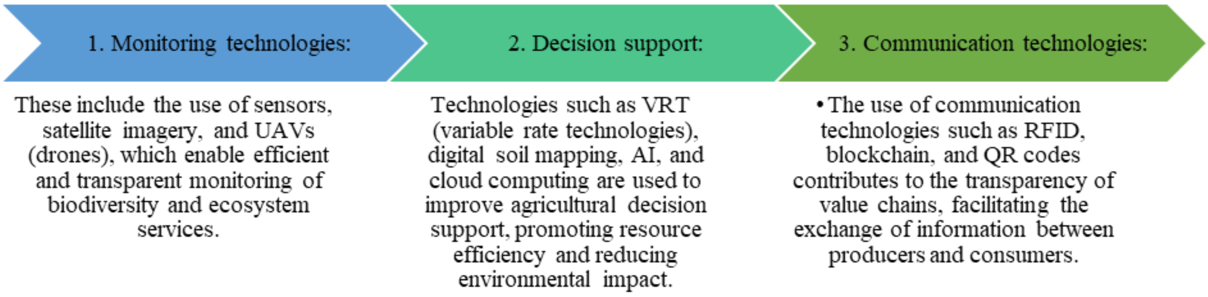


**Figure 5. Technologies and indicators that can contribute to achieving sustainability goals in agriculture**

*Source: developed by the author based on MacPherson et al., 2022*

Although digital agriculture is recognized in some policy strategies (such as the Farm to Fork strategy), it is generally treated as a secondary issue, with a greater focus on resource efficiency than on other aspects of sustainability. Technologies that improve decision support and monitoring are essential for achieving most agricultural sustainability goals, including soil protection, biodiversity conservation, and climate change mitigation. The study proposes four future scenarios for digital agriculture, ranging from scenarios with centralized government control to decentralized models focused on local environmental protection. Each scenario has different implications for how digitization will influence agricultural sustainability, and the development of a coherent and adaptive legal framework for digital agriculture is essential to ensure that digital technologies are used in ways that support sustainability and do not amplify existing problems, such as inequalities in access to technologies or the overconcentration of power in the hands of large technology companies.

Staniszewski et al. (2023) examine the sustainable intensification of agriculture in European Union regions, focusing on the impact of structural features on this process. Using regional RICA data for the period 2004–2018 and applying latent profile analysis and the Ward method, the authors identify four clusters of regions with distinct structural features. The intensity of the sustainable process was also measured using the environmentally adjusted Malmquist-Luenberger productivity index. The indicators analyzed to assess the sustainable intensification process in different EU regions are presented in Table 4.

**Table 4.**

**Indicators to assess the process of sustainable intensification in different regions of the EU**

| Nr. crt | Indicators | Definition of indicators |
|---|---|---|
| 1 | Utilized agricultural area (UAA) | Measures the total area used for agricultural activities, which is a fundamental indicator for assessing sustainable intensification. |
| 2 | Total factor productivity (TFP) | A key indicator that measures the efficiency with which all inputs are used in agricultural production, adjusted for environmental factors. |
| 3 | Livestock density per unit of agricultural area | This indicator reflects the impact of livestock production on the environment. |
| 4 | Cost of fertilizers and pesticides | These indicators measure the intensity of chemical input use, which can affect agricultural sustainability. |
| 5 | Crop diversity (Simpson index) | Measures cultural diversity on agricultural land, an essential indicator for assessing the impact on biodiversity. |
| 6 | Labor and capital productivity | Assessment of the efficiency of labor and capital use in agricultural production. |

*Source: developed by the author based on Staniszewski et al., 2023*

The study identified four main clusters of EU regions with distinct structural features:

1. Cluster 1: regions with small farms and mixed production, predominantly in eastern Poland, Romania, Croatia, Greece, southern Italy, and Bulgaria;
2. Cluster 2: regions with large farms, predominantly oriented towards livestock production, located in the United Kingdom, France, the Benelux countries (Belgium, the Netherlands, and Luxembourg), Scandinavia, and some regions of Italy and Spain;
3. Cluster 3: post-communist industrial farms, located in eastern Germany, the Czech Republic, and Slovakia;
4. Cluster 4: regions with small, unspecialized, and polarized farms, predominantly in the Baltic States, western Poland, Austria, Hungary, and central and southern Spain.

The results of the analysis showed that the process of sustainable intensification was uneven between 2005 and 2018, significantly influenced by the global financial crisis of 2008-2013. During this period, technological progress slowed, mainly due to low investment and limited access to credit, but after 2013 the situation stabilized and progress was more uniform, with some regions benefiting from CAP reforms that supported green payments and a more equitable distribution of resources. An important finding of the study is that farmers in regions with large and specialized farms (cluster 2) experienced the smallest decline in sustainable intensification, suggesting that farm concentration and specialization are key factors for achieving progress in sustainability.

## CONCLUSIONS

Sustainable agriculture is a concept that varies over time and place, which means that any assessment of sustainability must be contextualized according to the specifics of an agricultural system. A significant challenge in assessing these systems is identifying and applying appropriate spatial and temporal indicators to determine whether an agricultural practice is sustainable or not. This difficulty arises because sustainability involves at least three interdependent dimensions: ecological, economic, and social, which can be difficult to reconcile, given that each has a different time scale and perspective in each context.

Reviewed research has shown that farmers need to adopt sustainable economic practices that maximize profitability and resource efficiency while reducing environmental impacts. In addition, it is essential to manage the risks associated with agriculture, such as market fluctuations, climate risks, and vulnerability to external factors. In this sense, financial sustainability not only supports the economic development of the agricultural sector, but also contributes to global food security and the well-being of rural communities.

The literature reveals a methodological diversity in sustainability research, including multivariate statistical analyses (such as principal component analysis (PCA), cluster analysis, and multivariate logistic and linear regressions), modeling and simulation techniques (such as stochastic simulations and fuzzy logic), and the use of participatory approaches (such as the Delphi method). These methods allow for a detailed assessment of the complex relationships between different financial factors and provide a deeper understanding of the variability and interdependencies between financial data. Participatory approaches, involving direct consultation with farmers and financial analysts, are essential for capturing local perspectives and developing solutions tailored to the specific context of each farm. The reviewed studies therefore highlight the need for flexible and innovative methodologies that take into account the economic, social, and ecological specificities of each geographical region.

## REFERENCES

**[1]. BATHAEI A., ŠTREIMIKIENĖ D.,** 2023, A Systematic Review of Agricultural Sustainability Indicators, Agriculture, 13(2):241, https://doi.org/10.3390/agriculture13020241

**[2]. BOBITAN N., DUMITRESCU D., BURCA V.,** 2023, Agriculture's Efficiency in the Context of Sustainable Agriculture—A Benchmarking Analysis of Financial Performance with Data Envelopment Analysis and Malmquist Index, Sustainability, 15(16):12169, https://doi.org/10.3390/su151612169

**[3]. BOIX-FAYOS C., DE VENTE J.,** 2023, Challenges and Potential Pathways Towards Sustainable Agriculture within the European Green Deal, Agricultural Systems, 207:103634, https://doi.org/10.1016/j.agsy.2023.103634

**[4]. BRAD L., POPESCU G., ZAHARIA A., DIACONEASA M. C., MIHAI D.,** 2018, Exploring the Road to Agricultural Sustainability by Assessing the EU Debt Influencing Factors, Sustainability, 10(7):2465, https://doi.org/10.3390/su10072465

**[5]. COCA O., CREANGĂ D., VIZITEU Ș., BRUMĂ I. S., ȘTEFAN G.,** 2023, Analysis of the Determinants of Agriculture Performance at the European Union Level, Agriculture, 13(3):616, https://doi.org/10.3390/agriculture13030616

**[6]. COULIBALY T. P., DU J., DIAKITÉ D.,** 2021, Sustainable Agricultural Practices Adoption, Agriculture (Poľnohospodárstvo), 67(4):166–176, https://doi.org/10.2478/agri-2021-0015
**[7]. DOMAGAŁA J.,** 2021, Economic and Environmental Aspects of Agriculture in the EU Countries, Energies, 14(22):7826, https://doi.org/10.3390/en14227826
**[8]. KELLY E., LATRUFFE L., DESJEUX Y., RYAN M., UTHES S., DIAZABAKANA A., DILLON E., FINN J.,** 2018, Sustainability Indicators for Improved Assessment of the Effects of Agricultural Policy across the EU: Is FADN the Answer?, Ecological Indicators, 89(2):903–911, https://doi.org/10.1016/ j.ecolind.2017.12.053
[**9]. KRÓLCZYK J. B., LATAWIEC A.,** 2015, Sustainability Indicators for Agriculture in the European Union, in: Sustainability Indicators in Practice, DeGruyter Open, pp. 182–204, https://doi.org/10.1515/9783110450507-015
**[10]. LATRUFFE L., DIAZABAKANA A., BOCKSTALLER C., DESJEUX Y., FINN J., KELLY E., RYAN M., UTHES S.,** 2016, Measurement of Sustainability in Agriculture: A Review of Indicators, Studies in Agricultural Economics, 118(3):123–130, https://doi.org/10.7896/j.1624
**[11]. LAURETT R., PAÇO A., MAINARDES E. W.,** 2021, Sustainable Development in Agriculture and its Antecedents, Barriers and Consequences – An Exploratory Study, Sustainable Production and Consumption, 27:298–311, https://doi.org/10.1016/ j.spc.2020.10.032
**[12]. MACPHERSON J., VOGLHUBER-SLAVINSKY A., OLBRISCH M., SCHÖBEL P., DÖNITZ E., MOURATIADOU I., HELMING K.,** 2022, Future Agricultural Systems and the Role of Digitalization for Achieving Sustainability Goals. A Review, Agronomy for Sustainable Development, 42:70, https://doi.org/10.1007/s13593-022-00792-6
**[13]. MAGRINI A.,** 2022, Assessment of Agricultural Sustainability in European Union Countries: A Group-Based Multivariate Trajectory Approach, AStA Advances in Statistical Analysis, 106:673–703, https://doi.org/10.1007/s10182-022-00437-9
**[14]. MARTINHO V.J.P.D.,** 2019, Testing for Structural Changes in the European Union's Agricultural Sector, Agriculture, 9(5):92, https://doi.org/10.3390/agriculture9050092
**[15]. MERGONI A., RITA DIPIERRO A., COLAMARTINO C.,** 2024, European Agricultural Sector: The Tortuous Path Across Efficiency, Sustainability and Environmental Risk, Socio-Economic Planning Sciences, 92:101848, https://doi.org/10.1016/j.seps.2024.101848
**[16]. STANISZEWSKI J., GUTH M., SMĘDZIK-AMBROŻY K.,** 2023, Structural Conditions of the Sustainable Intensification of Agriculture in the Regions of the European Union, Journal of Cleaner Production, 389:136109, https://doi.org/10.1016/j.jclepro. 2023.136109
**[17]. XAVIER A., COSTA FREITAS M.D.B., FRAGOSO R., ROSÁRIO M.D.S.,** 2022, Analysing the Recent Dynamics of Agricultural Sustainability in Portugal Using a Compromise Programming Approach, Sustainability, 14(19):12512, https://doi.org/10.3390/su141912512
**[18]. ZHU N., STREIMIKIS J., YU Z., BALEZENTIS T.,** 2023, Energy-Sustainable Agriculture in the European Union Member States: Overall Productivity Growth and Structural Efficiency, Socio-Economic Planning Sciences, 87(Part A):101520, https://doi.org/10.1016/j.seps.2023.101520