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SUSTAINABILITY AND RESPONSIBILITY: A BIBLIOMETRIC ESG ASSESSMENT IN EUROPEAN AGRICULTURE

SUSTENABILITATE ȘI RESPONSABILITATE: O EVALUARE BIBLIOMETRICĂ ESG ÎN AGRICULTURA EUROPEANĂ

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Abstract: *Această lucrare examinează integrarea dimensiunilor de mediu, sociale și de guvernanță (ESG) în literatura de specialitate privind sustenabilitatea în agricultura din Uniunea Europeană. Scopul studiului este de a identifica modul în care aceste dimensiuni sunt reflectate și interconectate în cercetarea academică actuală, precum și de a evidenția eventualele dezechilibre tematice sau lacune. Folosind o abordare bibliometrică, studiul analizează modelele de co-apariție a cuvintelor-cheie extrase din publicații relevante din Web of Science, procesate cu ajutorul instrumentului de vizualizare VOSviewer, pentru a identifica temele dominante și relațiile din discursul academic. Rezultatele dezvăluie un peisaj de cercetare extrem de interconectat în care dimensiunile de mediu și de guvernanță sunt puternic reprezentate și strâns legate, în timp ce aspectele sociale rămân relativ slab dezvoltate și mai periferice. Constatările sunt interpretate în lumina principalelor cadre de politici ale UE, inclusiv Politica Agricolă Comună (PAC) și Pactul Verde European, ambele promovând o abordare mai integrată și holistică a sustenabilității în agricultură. În ciuda acestei direcții politice, literatura de specialitate nu reflectă încă pe deplin o perspectivă ESG echilibrată. Lucrarea concluzionează că sunt necesare cercetări suplimentare pentru a integra mai bine dimensiunile sociale în evaluarea sustenabilității și pentru a alinia mai strâns activitatea academică cu prioritățile politice în evoluție ale UE. Aceste perspective contribuie la o înțelegere mai cuprinzătoare a implementării ESG în sistemele agricole.*
Cuvinte-cheie: *sustenabilitate, ESG, agricultura europeană, analiză bibliometrică, Pactul Verde European, Politica Agricolă Comună (PAC)*
JEL CLASSIFICATION: Q01, Q18, Q56, O13

INTRODUCTION

Nowadays, in the so-called age of discovery, sustainability has become a central and pivotal principle meant to guide the transformation of the agricultural systems within the European Union. Increasing environmental pressures, coupled with evolving expectations coming from society and regulatory demands, have led to the growing adoption of Environmental, Social, and Governance (ESG) frameworks as tools for assessing and guiding agricultural performance. From this point forward, we will use the acronym ESG when referring to the Environmental, Social, and Governance considerations, and each letter will correspond to one of the three. In this context, the appearance of a shift suggests that agriculture should no longer be concerned only with productivity but should also focus on the implications for the environment, social aspects, and governance structures. At the European level, public policies have played an important role in this transition. The Common Agricultural Policy (CAP), introduced in 1962, was originally focused on supporting farmers' incomes and stabilizing agricultural markets. Over time, it has been gradually adapted to include sustainability objectives and rural development measures. More recently, the European Green Deal has strengthened this direction by promoting a broader transformation of the agricultural sector. Initiatives such as the Farm to Fork Strategy and biodiversity targets aim to support more sustainable

practices. Together, these policies promote a more integrated approach to sustainability, which is closely linked to ESG principles.

Despite this policy booster, the academic literature on sustainability in agriculture remains fragmented across different thematic areas. Environmental issues, governance mechanisms, and social considerations are often studied separately, raising questions about the extent to which ESG dimensions are addressed jointly. If we want to understand how the main themes are interconnected, we need to assess whether current research reflects the integrated policy vision promoted at the EU level.

This study examines how research on sustainable agriculture in the European Union aligns with environmental, social, and governance (ESG) principles. It explores the main topics researchers focus on, how these topics are connected, and where gaps or imbalances may exist, using bibliometric analysis. This study adds to existing research in a few key ways. First, it maps out ESG-related studies in European agriculture and shows how different aspects of sustainability are linked. Second, it finds that environmental and governance topics are studied more often, while social issues receive less attention. Third, it provides evidence that academic research does not fully match the priorities set by EU policies, highlighting the need for a more balanced and integrated ESG approach.

The rest of the paper is structured in the following way. The next section addresses the research methodology, including the data collection process and the bibliometric approach employed. The results section presents and explains the main findings of the keyword co-occurrence analysis and discusses the identified thematic clusters. Finally, the conclusion section summarizes the main findings and outlines implications for future research on ESG integration in European agricultural sustainability.

BASIC CONTENT

Brief analysis of bibliographic sources in the field of the researched problem

The literature that focuses on the sustainability, or ESG, aspect of the agricultural sector has grown significantly over the past decade. When examining this discipline, we see a strong representation of interdisciplinary research spanning environmental sciences, agricultural economics, and policy studies. This distribution highlights the inherently cross-cutting nature of sustainability, which requires integrating ecological, economic, and institutional perspectives (Foley et al., 2011). A significant part of existing publications pays special attention to issues such as climate change, resource management, and biodiversity. This fact highlights that the environmental dimension is the most extensively studied in terms of sustainability in agriculture. In contrast, social dimensions, such as working conditions, gender, and rural inequalities, are less prominently represented, suggesting a relative imbalance in the literature. Studies related to governance occupy an intermediate position, often addressing policy tools, legislative frameworks, and institutional mechanisms (Candel, 2014). A large portion of existing research focuses on topics such as climate change, resource management, and biodiversity, indicating that the environmental dimension of agricultural sustainability has received the most attention. By contrast, social issues, such as labor conditions, gender equality, and rural disparities, are less frequently studied, indicating an imbalance in the literature. Studies on governance fall somewhere in between, often examining policies, regulatory frameworks, and institutional arrangements (Candel, 2014). The focus on policy-related topics is closely connected to the influence of the European Union's agenda, particularly the Common Agricultural Policy and, more recently, the European Green Deal. These frameworks have stimulated academic debate on the effectiveness of policy tools in promoting sustainable agricultural practices (European Commission, 2019; Matthews, 2020). However, despite this policy relevance, the literature often remains fragmented, giving us the principal conclusion that integration remains limited across all three dimensions combined, here represented by environmental, social, and governance.

Altogether, the main idea that is worth taking along the way from this section is that the bibliography sources give strong hints towards the idea that even though sustainability is a well-cemented topic in the agrarian field of research, the existence or the short-term adoption of a fully

integrated ESG perspective is still in an emerging phase. This underscores the need for a more holistic approach that serves as a unifying bridge across disciplinary and thematic boundaries.

Methodology

The principal research method used in this study is the bibliometric approach. It was chosen since it means to examine the structure of sustainability-related research in agriculture, with a particular focus on the integration of Environmental, Social, and Governance (ESG) dimensions. The popularity of this type of analysis stems from its widespread use in identifying patterns, trends, and relationships within large bodies of academic literature by analyzing publication metadata such as keywords, citations, and co-occurrence frequencies.

The dataset used was constructed with the help of Web of Science, one of the major academic databases. The process was of standard nature, and was conducted using the following query string: TS = ("agriculture" AND "sustainability" AND "European Union" AND "environment" AND "social" AND "governance"). The initial query summed a number of 647,146. We refined the results with a multitude of filters. First, we only accepted open-access efforts, reducing the number to 346,853. Second, the document type was limited to articles, resulting in 80,498 publications. Finally, a time filter was applied to include only recent contributions published between 2020 and 2024, which reduced the dataset to 377 documents. These criteria were selected to ensure both accessibility and topical relevance, while maintaining a manageable dataset for analysis. The selected documents were downloaded as a .txt file, then imported into the Vosviewer software. A keyword co-occurrence analysis was performed to identify relationships between key concepts in the literature. The analysis was based on author keywords, with a minimum occurrence threshold of 5. This means that only keywords that appeared at least 5 times across the dataset were included in the network, ensuring the analysis focused on the most relevant and recurring terms. To make the entire process more palpable and facile to understand, we incorporated a scheme where all the steps taken are being highlighted, as we can see below:

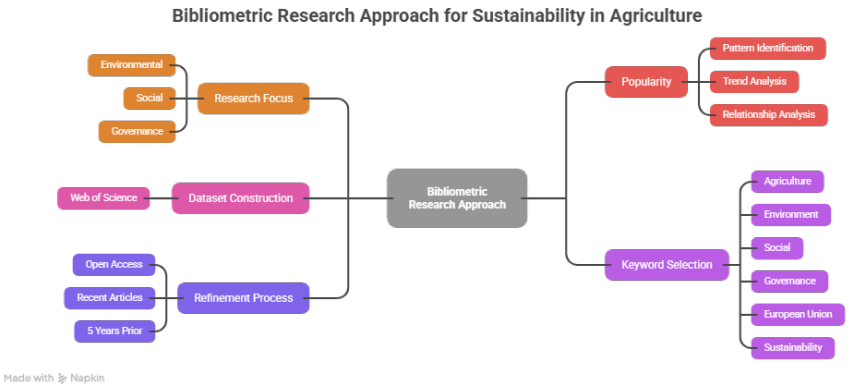


Figura 1. Bibliometric Analysis Process

Sursa: Author's processing via Napkin https://www.napkin

To explore the conceptual aspect of the selected literature, it was decided to construct a keyword co-occurrence analysis. This method brings to light how frequently specific keywords appear together in the same publications, thereby revealing underlying thematic relationships. The tool selected to provide the results in our endeavor is Vosviewer. The choice to pick this software is not at all random, and it is thanks to its popularity among academic peers and its quality in network map generation. These maps are depicted in clusters or nodes where each keyword and link shown indicates instances and strengths of co-occurrence. Explaining the meanings behind the resulting visualization is a rather intuitive feature: the size of each node reflects the frequency of a keyword, while the distance and thickness of links indicate the strength of association between terms. Keywords that frequently co-occur are grouped into clusters using a clustering algorithm, with each cluster

representing a distinct thematic area within the literature. When interpreting each cluster, it is important to note that interpretation can be guided by its most prominent keywords and its relative position within the network.

A crucial point to take into account is that while a bibliometric analysis provides a systematic overview of the current literature, it can be subject to certain limitations. The results reflect the quality of the selected database, with implications for the search criteria and keyword assessment. These factors can significantly influence the scope of the dataset. Moreover, the type of map selected to our advantage, the co-occurrence analysis, indeed captures relationships between concepts but does not assess the depth or quality of individual studies. Regardless of this limitation aspect, this type of study still brings value since it offers a robust and transparent means of identifying dominant themes and gaps within the field of choice, in our case, agriculture.

The results

After performing the key-occurrence map, we can see that it reveals a highly connected landscape in which the main hub is represented by "sustainability". This one functions as a central concept, bringing together multiple thematic disciplines that have correspondence to the environmental, social, and governance (ESG) dimensions. The prominence and central positioning of sustainability indicate that it serves as the primary analytical lens through which diverse agricultural and policy-related issues are examined (Pretty, 2008).

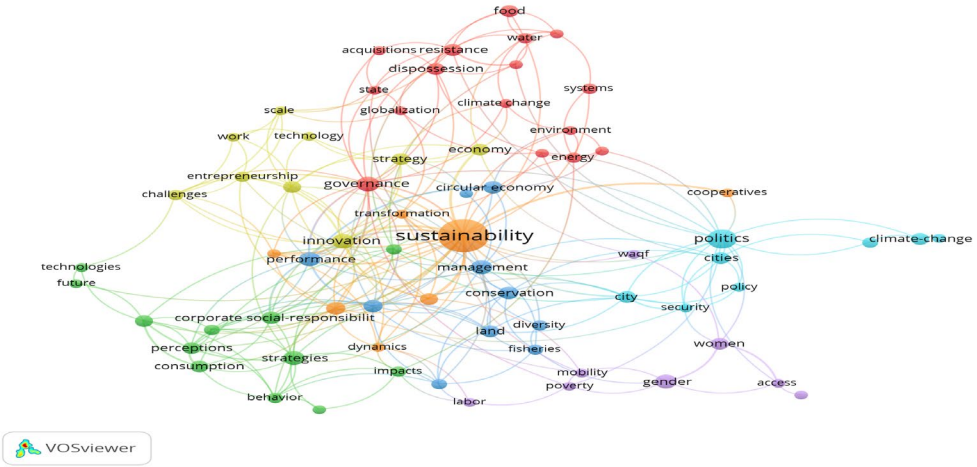


Figura 2. Keyword Co Occurrence Map
Sursa: Author's processing via Vosviewer

In terms of clusters, the environmental one is the most prominent, having words such as "climate change", "energy", "water", and "food systems". This density is strong evidence of the literature's general focus on ecological aspects, which are considered the primary drivers of agricultural transformation, as outlined by Foley et al. 2011. This cluster also brings to light that the main issues the EU agenda prioritizes are of an environmental nature. Closely related to this, we have the governance dimension, encompassed in a blue cluster. The proximity between the two themes can be interpreted as meaning that environmentally beneficial outcomes are strongly made a reality thanks to regulatory frameworks. This aspect is especially evident in the Common Agricultural Policy, which increasingly links financial support to environmental performance through conditionality and eco-schemes (Matthews, 2020).

The green cluster can be interpreted as a CSR focus area, with words such as "corporate social responsibility", "consumption", "behavior", and "consumers". Since it brings into discussion themes such as consumers and behaviour, we finally witness the appearance of the social part. This aligns with existing literature noting that sustainability transitions in agri-food systems are not only policy-

driven but also shaped by market actors and consumer behavior, even if to a lesser extent in academic research (Candel, 2014). Innovation is evident in the yellow cluster, where it becomes clear that an ESG-focused transition in the agriculture industry requires innovative measures. This is a crucial factor that drives sustainable transitions, particularly in the context of digital agriculture and efficiency improvements. This reflects the EU's broader priorities in promoting modernization and sustainability through technological change. In contrast, the social cluster offers quite general keywords, for example, “gender”, “poverty”, or “participation” appear smaller and have a much more peripheral role than their counterparts presented earlier. Its relative isolation suggests that social equity considerations are not yet fully embedded within the core sustainability discourse. This is noteworthy given the increasing emphasis on inclusiveness and rural development in EU strategies.

This map, as a whole, can be interpreted in light of the European Green Deal, as this strategy aims to promote a more integrated approach to sustainability across environmental, economic, and social areas (European Commission, 2019). For this reason, it intends to encompass all the main priorities that this specific set of policies aims to achieve.

Although the strong links among the environment, governance, and innovation clusters suggest partial alignment with this vision, the weaker integration of social themes reveals a persistent gap between policy ambitions and academic research.

Table 1 Cluster interpretation of keyword co-occurrence analysis

Cluster	Main Theme	Key Keywords	Interpretation
Red Cluster	Environmental systems (E)	climate change, energy, water, food, environment, systems, dispossession, agricultural change	Focuses on ecological pressures and resource systems, highlighting environmental sustainability challenges in agriculture
Blue Cluster	Policy & governance (G)	politics, policy, cities, governance, security, circular economy, conservation, management	Emphasizes institutional frameworks and public policy shaping sustainability outcomes
Green Cluster	Corporate & behavioral (S/G)	corporate social responsibility, consumption, behavior, strategies, consumers, communication, design	Captures firm-level actions and societal behavior influencing sustainability transitions
Yellow Cluster	Innovation & strategy (E/G)	innovation, performance, technology, strategy, scale, work, entrepreneurship, challenges	Highlights the role of innovation and strategic management in implementing sustainability
Purple Cluster	Social equity (S)	gender, women, access, participation, poverty, mobility	Represents social justice and inclusiveness, relatively peripheral in the network
Cyan Cluster	Resources & livelihoods (E/S)	land, fisheries, diversity, labor, rights, impacts, city	Connects environmental resource use with social and economic livelihoods

Sursa: Author’s own Processing via Word, and Vosviewer

To gain a deeper understanding of exactly what the map aims to present to us, it was wise to include a table that not only provides the main keywords for each cluster but also adds thematic

explanations and the main theme from the ESG spectrum each knot covers. Nevertheless, all the aspects presented in this table have been addressed previously, so the table above serves more as a synthesis to keep the ideas organized. A small general conclusion that may come out of this table is the obvious presence of an imbalance in the research interest of the three dimensions. Environmental and governance aspects are well established and closely interconnected, while social considerations are comparatively underrepresented. This lack of proportion highlights the need for more holistic ESG frameworks that better integrate social indicators, thereby improving the alignment between academic research and evolving EU policy priorities.

CONCLUSIONS/RECOMMENDATIONS

All things considered, the results indicate that ESG integration in the agricultural sustainability literature remains incomplete. The dominance of environmental and governance dimensions, combined with the weaker presence of social aspects, highlights the need for more balanced approaches. Future research should place greater emphasis on social factors and examine more closely how environmental, social, and governance aspects interact in a consistent, structured way. Doing so would make sustainability assessments more solid and reliable, while also making them more useful for supporting EU policy goals.

With all the factors transposed in this paper, it was demonstrated that the contribution meant for this paper has been achieved. So, without further ado, it is visible that despite the increasing policy emphasis on integrated sustainability, the academic literature on EU agriculture remains unevenly developed across ESG dimensions. Using a swift combination of a straightforward policy guide and the main bibliometric mapping, the study provided empirical evidence of a strong alignment between environmental and governance themes, alongside the relative marginalization of social aspects. This observation brought to light an existing gap in current research and highlighted the need for more holistic analytical frameworks that better reflect the multidimensional nature of sustainability. In this regard, the paper succeeds in including the bibliometric study as a practical tool for assessing ESG integration and for identifying priorities for future research in line with evolving EU policy objectives. As a recommendation for future research efforts in this field, it is to have a greater focus on the social dimension, since, as we have assessed, it is in fact the most underrepresented of the three, especially since the industry of agriculture, historically, has relied heavily on the human factor, even with the modern efforts of industrialization of processes.

In conclusion, this study demonstrates that bibliometric analysis provides a useful tool for mapping the conceptual structure of sustainability research and identifying key gaps. For EU agriculture, the findings underscore the importance of moving toward a more comprehensive ESG framework that reflects the integrated vision outlined in current policy strategies.

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