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RESEARCH TRENDS ON AGRICULTURAL SUSTAINABILITY IN EASTERN INDONESIA: A SYSTEMATIC LITERATURE REVIEW

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Abstract. Sustainable agriculture in Eastern Indonesia plays a strategic role in ensuring food security and supporting rural livelihoods. However, its development continues to face various challenges, including land degradation, climate change, and dependence on traditional agricultural practices. This study aims to identify research trends and developments related to sustainable agriculture in Eastern Indonesia through a systematic literature review using a bibliometric approach. The research data were obtained from scientific publications indexed in the Scopus database. The analysis was conducted to identify major research areas, influential publications, and emerging themes in sustainable agricultural studies. The findings reveal three main clusters: (1) the adoption of sustainable agricultural practices and climate change adaptation; (2) the integration of social, economic, and ecological dimensions into sustainable agricultural systems; and (3) technological innovation and agroecological approaches. The results indicate that the involvement of local farmers, the adoption of climate-smart agriculture, and the utilization of technological innovations play important roles in strengthening the resilience of the agricultural sector to the impacts of climate change. Furthermore, more integrated policies and collaboration among stakeholders are required to promote the implementation of sustainable agricultural practices at the local level. This study recommends strengthening future research and developing policies aimed at enhancing agricultural sustainability and food security in Eastern Indonesia, particularly by bridging the gap between research findings and policy implementation.

Keywords: sustainable agriculture, Eastern Indonesia, bibliometric analysis, food security, technological innovation.

I. INTRODUCTION

Sustainable agricultural development is an important pillar in achieving inclusive and sustainable economic development in Eastern Indonesia. The agricultural sector not only plays a crucial role in maintaining food security but also serves as the primary source of livelihood for millions of rural residents. However, the development of this sector continues to face various challenges, including land degradation, dependence on chemical inputs, limited access to technology, and the continued dominance of traditional farming practices. These conditions indicate an urgent need to implement environmentally friendly, economically efficient, and regionally appropriate agricultural practices as part of a broader regional development strategy (Apriyelita & Marviano, 2025).

Agricultural sustainability has interconnected social, economic, and environmental implications. The implementation of sustainable agricultural practices is expected to increase productivity and farmers' incomes without compromising environmental preservation or the availability of natural resources for future generations. This concept is consistent with the Sustainable Development Goals (SDGs), particularly SDG 2, *Zero Hunger*, and SDG 12, *Responsible Consumption and Production*. These goals emphasize the importance of achieving a balance between increasing food production, improving community welfare, and protecting natural resources. Therefore, comprehensive research on the development of sustainable agriculture studies is required to provide a foundation for policies that are more effective and responsive to agricultural challenges in Eastern Indonesia (Sahar et al., 2025; Xu et al., 2024).

The sustainability of the agricultural sector in Eastern Indonesia has become increasingly important because the region faces various challenges, including climate change, land degradation, limited infrastructure, and dependence on conventional farming methods. At the same time, Eastern Indonesia has unique and complex agricultural characteristics, as reflected in the diversity of its commodities, geographical conditions, sociocultural settings, and local farming systems. This diversity requires an agricultural development approach that focuses not only on increasing production but also on social, economic, and ecological dimensions. In this context, examining research trends in agricultural sustainability through a bibliometric approach is relevant for providing an overview of publication developments, research priorities, policies, and innovations related to sustainable agriculture and food security in the region (Sahar et al., 2025; Xu et al., 2024).

The urgency of this study is also driven by the growing need to increase agricultural productivity sustainably amid the impacts of climate change and increasing threats to food security. Sustainable natural resource management in the agricultural sector largely depends on the adoption of technological innovations and policy support that encourages

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environmentally responsible farming practices (Abdullah & Manaf, 2021). The utilization of digital technologies, the application of agroecological practices, the development of climate-smart agriculture, and community-based approaches may provide alternative solutions for improving agricultural productivity and food-system resilience in Eastern Indonesia (Wang et al., 2020). Accordingly, an understanding of current research developments is necessary to assist policymakers and stakeholders in formulating strategies that address the specific needs and challenges of the agricultural sector in the region.

Although research on sustainable agriculture continues to develop, academic understanding of sustainability practices in the agricultural sector of Eastern Indonesia remains limited. The existing literature is dispersed across various topics, including agroecology, organic farming, climate change adaptation, technological innovation, and agricultural resource management. However, relatively few studies have provided a systematic mapping of research developments and trends specifically within the context of Eastern Indonesia (Sutiharni et al., 2024).

A bibliometric approach can be used to identify patterns in scientific development based on publications related to sustainable agriculture. The analysis may include changes in publication output over time, contributions from authors and institutions, patterns of scientific collaboration, influential publications, and dominant and emerging research themes. Through this approach, the present study aims to map research trends in agricultural sustainability in Eastern Indonesia, identify the focus and development of research themes, and determine research gaps that require further investigation. The findings are expected to provide a foundation for future research and offer recommendations for the formulation and implementation of more effective sustainable agricultural policies in Eastern Indonesia.

The Concept of Sustainability in the Agricultural Sector

Sustainability in the agricultural sector involves the integration of economic, social, and environmental dimensions to establish agricultural systems that are productive, resilient, and environmentally responsible. Within this framework, agricultural productivity must balance the need to meet current food demands with the capacity of ecosystems to support future generations. Sustainable agriculture is therefore concerned not only with increasing production but also with conserving natural resources, improving farmers' welfare, and ensuring the long-term sustainability of food systems.

Sustainable agricultural practices can be implemented through various approaches, including crop diversification, agroforestry, ecologically based soil management, and efficient irrigation systems. These approaches are intended to improve resource-use efficiency, maintain soil fertility, and reduce the adverse environmental effects of agricultural activities (Apriyelita & Marviano, 2025). The implementation of agricultural models such as Low External Input Sustainable Agriculture (LEISA) and organic farming may also improve the efficiency of natural resource utilization while reducing dependence on external inputs and synthetic chemicals (Saptana, 2017).

Sustainable agricultural models may also incorporate local knowledge and practices that have developed within communities over generations. Such integration is particularly relevant in Eastern Indonesia because the region has diverse commodities, agroecological conditions, and traditional agricultural practices. Local knowledge can provide a foundation for developing agricultural systems that are compatible with local environmental and sociocultural conditions. Nevertheless, its application needs to be supported by technological innovation to ensure that traditional practices remain productive, efficient, and capable of responding to environmental changes.

The concept of agricultural sustainability also encompasses the capacity to adapt to climate change. One widely applied approach is climate-smart agriculture (CSA). CSA focuses on sustainably increasing productivity, strengthening adaptive capacity to climate change, and reducing greenhouse gas emissions where possible. This approach emphasizes the efficient use of agricultural inputs and the resilience of food production systems in responding to seasonal changes and extreme climate events.

The implementation of CSA requires the integration of agricultural technology, public policy, and local community participation in program planning and implementation. The success of this strategy is strongly influenced by cooperation among stakeholders, including governments, farmers, research institutions, universities, and the private sector (Mandra et al., 2025). The involvement of local communities enables adaptation strategies to be developed according to local needs, knowledge, and agroecological conditions, resulting in solutions that are more responsive and sustainable.

From an economic perspective, agricultural sustainability is concerned not only with food production capacity but also with the equitable distribution of added value throughout agricultural supply chains. The adoption of sustainable practices may create new market opportunities through organic and environmentally friendly product certification. Such certification may increase product competitiveness and expand access to markets with growing demand for responsibly produced agricultural commodities.

Access to more equitable value chains may enable farmers to obtain better prices and incomes. This condition can promote more inclusive economic growth, particularly in rural areas that depend heavily on agriculture. In the long term, sustainable agricultural development may also reduce socioeconomic inequalities and contribute to overall regional development (Sutiharni et al., 2024; Wang et al., 2020).

The Agricultural Sector in Eastern Indonesia: Potential and Challenges

Eastern Indonesia has highly diverse agroecosystems and a wide range of major agricultural commodities, including rice, maize, horticultural crops, plantation crops, and spices. This diversity provides considerable potential for strengthening food security, increasing community incomes, and supporting regional economic growth. Through the implementation of sustainable agricultural practices, this agroecosystem potential can be utilized to meet domestic food requirements while also supporting exports and market diversification.

In addition to commodity diversity, Eastern Indonesia has various local farming systems that are closely connected to the sociocultural conditions of its communities. This diversity can

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be utilized to develop agricultural products based on regional characteristics and local knowledge. Environmentally responsible and market-oriented management can increase product value while strengthening farmers' incomes (Sutiharni et al., 2024).

Despite its considerable potential, the agricultural sector in Eastern Indonesia continues to face several structural challenges. Unequal infrastructure development, inadequate irrigation systems, weak interregional connectivity, and limited market access frequently constrain the distribution of agricultural inputs and outputs. The region's extensive and dispersed geographical conditions also increase transportation costs and weaken farmers' bargaining positions within agricultural marketing chains.

Limited access to technology, finance, market information, and production capital constitutes another major challenge, particularly for small-scale farmers. Some farmers continue to depend on traditional methods of cultivation and land management. Traditional practices may contribute to sustainability when they are compatible with environmental carrying capacity. However, these practices may become inefficient and potentially reduce soil fertility when they are not supported by appropriate resource management (Saptana, 2017). Investment in agricultural technology, infrastructure, financing, extension services, and human resource development is therefore required to support a sustainable agricultural transformation.

Climate change further intensifies the challenges faced by the agricultural sector in Eastern Indonesia. Changes in rainfall patterns, prolonged droughts, rising temperatures, and unpredictable pest and disease outbreaks may cause production instability. Fluctuating yields affect not only food availability but also farmers' incomes and the economic resilience of agricultural households.

Under these conditions, the implementation of climate-resilient adaptation and mitigation strategies is essential. Climate-smart agriculture is a relevant approach because it aims to increase productivity, improve input-use efficiency, and strengthen adaptive capacity to climate change (Apriyelita & Marviano, 2025). The implementation of CSA in Eastern Indonesia requires supportive government policies, technologies suited to local conditions, adequate agricultural extension services, and the active participation of farmers in designing and implementing adaptive solutions.

Another challenge is the limited availability of empirical data and academic documentation regarding sustainable agricultural practices in Eastern Indonesia. This limitation has resulted in insufficient information to support evidence-based policymaking. Existing studies remain dispersed across different disciplines, geographical areas, commodities, and methodological approaches, making it difficult to obtain a comprehensive understanding of sustainable agricultural research developments in the region.

Bibliometric analysis is therefore needed to identify publication trends, relationships among publications, dominant research themes, and research gaps requiring further investigation. Such analysis can provide a more systematic overview of research developments and serve as a basis for formulating research agendas and policy recommendations. Bibliometric methods can consequently support evidence-based policies aimed at accelerating the sustainable transformation of the agricultural sector in Eastern Indonesia (Sahar et al., 2025; Xu et al., 2024).

Bibliometric Analysis

The term bibliometric analysis was first introduced by Pritchard (1969). Bibliometric analysis is a quantitative method used to measure, map, monitor, and evaluate the development of scientific publications based on bibliographic data. Such data may include publication output, citations, authors, affiliations, journals, countries, references, and keywords contained in scientific documents (Gokhale et al., 2020).

Bibliometric analysis is used to understand patterns of scientific communication and the development of knowledge within a particular research field. Through this method, researchers can evaluate the contributions of publications, authors, institutions, and countries to the advancement of a scientific discipline. It can also provide an overview of the influence of a publication within the academic community based on the number and patterns of citations it receives.

Bibliometric analysis generally consists of performance analysis and science mapping. Performance analysis is used to evaluate scientific productivity and impact based on indicators such as publication output, citation counts, the most productive authors, the most productive institutions, and the journals that publish or receive the highest number of citations. Science mapping, meanwhile, is used to describe the intellectual, conceptual, and social structures of a research field.

Science mapping can be conducted using several techniques, including co-authorship analysis, co-citation analysis, bibliographic coupling, and keyword co-occurrence analysis. Co-authorship analysis identifies collaboration patterns among authors, institutions, or countries. Co-citation analysis identifies documents or authors that are frequently cited together and thus describes the intellectual foundations of a field. Bibliographic coupling indicates relationships between publications based on the references they share. Keyword co-occurrence analysis is used to identify relationships among concepts, dominant themes, and emerging research topics (Talan, 2021).

A major advantage of bibliometric analysis is its ability to evaluate publication performance and structure relatively objectively using quantitative data. This method enables researchers to identify global and local research trends, map the development of a field, and identify underexplored research gaps. This information can be used to formulate future research agendas and support policymakers in developing data-driven decisions (Karakus & Ersozlu, 2019; Hincapie et al., 2021).

In this study, bibliometric analysis is employed to map the development of research on agricultural sustainability in Eastern Indonesia. The analysis covers publication trends, author and institutional contributions, publication sources, collaboration patterns, influential documents, and the occurrence and relationships of keywords. The results are expected to reveal the structure of knowledge, dominant themes, emerging research issues, and research gaps within the literature on sustainable agriculture in Eastern Indonesia.

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II. RESEARCH METHODS

This study employed a bibliometric approach to analyze the development and research trends related to sustainable agriculture in the context of Eastern Indonesia. Bibliometric analysis enables researchers to quantitatively explore scientific literature in order to identify publication patterns, thematic developments, collaboration networks, and potential research gaps. The data collection process involved a systematic search and selection of publications indexed in Scopus, which is a reputable scientific database widely used in bibliometric studies.

This approach was used to identify publication volume and growth, citation patterns, author collaboration, institutional contributions, and influential research themes in the field of sustainable agriculture (Wang et al., 2020; Abdullah et al., 2021). Bibliometric analysis was also conducted to complement the qualitative synthesis, thereby providing a more comprehensive evaluation of the existing literature. Through this analysis, the development of scientific knowledge within a discipline can be mapped based on the relationships among publications, authors, institutions, and research concepts (Sundarakani & Ghouse, 2024).

The bibliographic data retrieved from Scopus were subsequently exported and analyzed using VOSviewer software. The software was used to map and visualize bibliometric networks based on publication, citation, authorship, and keyword data. VOSviewer can generate visualizations of co-authorship networks, relationships among keywords, and the organization of research themes into several clusters (van Eck & Waltman, 2010).

These visualizations not only assist in identifying influential authors and publications but also reveal collaboration patterns and the conceptual and thematic structures of the research field. Therefore, the bibliometric approach provides insights into the intellectual and social dimensions of sustainable agriculture research in Eastern Indonesia.

The PRISMA flow diagram was used to illustrate the process of identifying, screening, assessing the eligibility of, and selecting the publications included in the analysis. The use of this diagram was intended to ensure that the literature selection process was systematic, transparent, and traceable.

Inclusion and Exclusion Criteria

Inclusion criteria were established to ensure that the publications analyzed were consistent with the objectives and scope of the study. The literature included in the analysis consisted of scientific articles that explicitly addressed sustainable agriculture in Eastern Indonesia. The selected publications could include empirical research, policy analyses, or case studies that contributed to the understanding of sustainable agricultural practices and development in the region.

Publications were included when they met the following criteria:

1. The publication addressed sustainable agriculture, agricultural sustainability, food security, agroecology, organic farming, climate change adaptation, or agricultural technological innovation.
2. The study was related to the context of Eastern Indonesia.
3. The publication was an original research article, policy analysis, or case study presenting empirical findings.
4. The publication appeared in a peer-reviewed journal.
5. The publication was written in English or Indonesian.
6. The publication contained adequate bibliographic information and was available in full text for analysis.

These criteria were established to improve the relevance of the selected literature and the accuracy of data interpretation (Page et al., 2021).

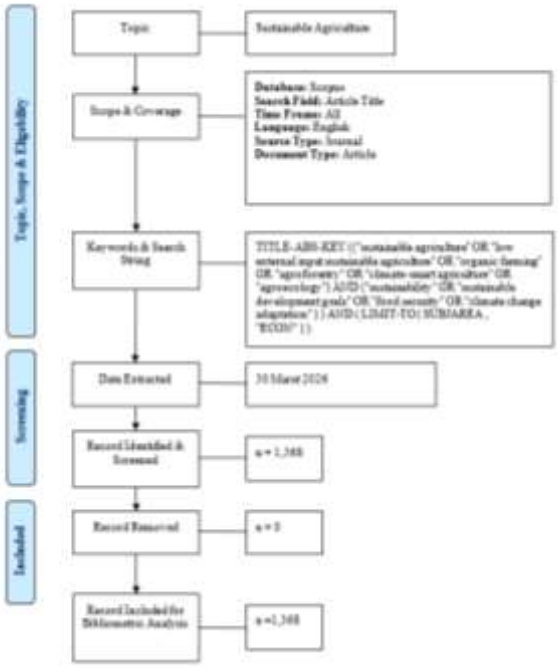


Figure 1. PRISMA Flow Diagram

In contrast, exclusion criteria were applied to eliminate publications that were inconsistent with the research focus. The following types of publications were excluded:

1. Articles that presented only theoretical discussions without empirical findings.
2. Review articles that did not provide primary data or were not directly related to the research context.
3. Publications outside the agricultural sector, such as urban studies unrelated to agricultural activities.
4. Conference papers, editorials, notes, book chapters, and other nonarticle publications.
5. Articles unrelated to Eastern Indonesia.
6. Publications that could not be accessed or reviewed in full.
7. Duplicate publications identified during the search process.

These exclusion criteria were applied to maintain the consistency and relevance of the documents analyzed (Yaohong et al., 2025). The literature selection process followed systematic review principles to maintain the objectivity, transparency, traceability, and reproducibility of the research process. The procedure was aligned with internationally recognized guidelines for systematic literature reviews and bibliometric analysis.

Data Analysis and Visualization

To complement the qualitative synthesis, bibliometric analysis was conducted using VOSviewer software. Bibliographic data from publications that passed the screening process were exported from the Scopus database in a format compatible with the software. The data were subsequently examined to identify duplicates, terminological inconsistencies, and variations in keyword spelling.

A data-cleaning process was conducted by standardizing terms with similar or closely related meanings. For example, the terms *sustainable agriculture* and *agricultural sustainability* could be harmonized to prevent them from being interpreted as entirely separate concepts. Keyword normalization was necessary to improve mapping accuracy and reduce network fragmentation.

The analysis focused on keyword co-occurrence. This technique was used to identify relationships among keywords, dominant research themes, and groups of emerging topics within the literature. The more frequently two keywords appeared together in the same publications, the stronger the relationship between them.

The results were visualized in the form of bibliometric networks. In VOSviewer visualizations, the size of a circle indicates the frequency with which a keyword occurs, while the connecting lines represent relationships or co-occurrences among keywords. A shorter distance between keywords indicates a stronger thematic relationship. Different colors indicate the classification of keywords into conceptually related research clusters.

Based on the keyword mapping results, three main clusters were identified, as presented in the following table.

Cluster	Main Keywords
Cluster 1	adoption, climate change, resilience, food security, practice, farmers, study, soil, crops, factors, effects, data
Cluster 2	sustainability, development, system, agriculture, organic farming, case, case study, paper, article, India
Cluster 3	agriculture, technology, chapter, book, sustainable development, innovation, environment, agroecology

Cluster 1 represents themes related to the adoption of agricultural practices, climate change, resilience, food security, soil and crop conditions, and factors influencing farmers' decisions. This cluster indicates that climate change adaptation and food-system resilience are important themes within the sustainable agriculture literature.

Cluster 2 focuses on sustainability, development, agricultural systems, and organic farming. The presence of terms such as case study, article, and India indicates that part of the literature employed case-study approaches and compared or referred to research conducted in other countries with relevant agricultural characteristics.

Cluster 3 includes themes related to technology, innovation, sustainable development, the environment, and agroecology. This cluster reflects increasing academic attention to the use of technology and innovation to support a more sustainable and environmentally responsible agricultural transformation.

These three clusters were used as the basis for interpreting the thematic structure of the literature, identifying dominant research priorities, and determining topics that require further investigation.

III. RESULTS AND DISCUSSION

Thematic Cluster Analysis

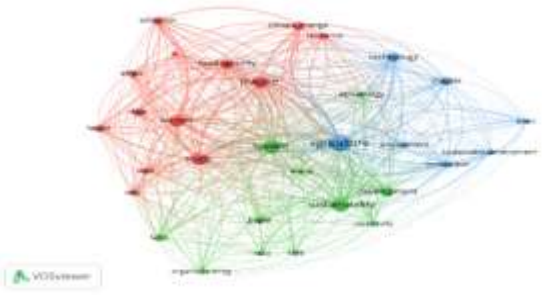
Keyword co-occurrence analysis using VOSviewer was conducted to map the structure of research on agricultural sustainability in Eastern Indonesia. The network visualization showed that central keywords, such as *agriculture*, *sustainability*, *development*, and *system*, dominated the literature. This finding indicates that previous studies have largely focused on sustainable development and the development of agricultural systems.

The cluster related to field practices, represented by keywords such as *farm*, *organic farming*, and *farmer*, indicates considerable attention to the implementation of agricultural practices and the role of farmers as key actors. Meanwhile, keywords associated with innovation and technology, including *technology*, *innovation*, and *sustainable development*, were closely connected to the concept of sustainability. The environmental cluster, represented by *climate change*, *resilience*, and *food security*, highlights the importance of ecological issues, climate change adaptation, and food security in sustainable agriculture research.

The occurrence of the keyword *India* indicates that studies conducted in India were used as references or were connected to the literature analyzed. Therefore, this keyword does not directly represent the local context of Eastern Indonesia but may reflect comparative perspectives, conceptual references, or similarities in agricultural challenges between the two regions.

Overall, the network visualization demonstrates the integration of agricultural practices, sustainable development, technological innovation, and environmental issues. The identified clusters are interconnected and provide a comprehensive representation of the thematic structure of sustainable agriculture research.

Figure 2. Network Visualization of Relevant Keywords



The cluster visualization revealed three main thematic clusters that demonstrate how the agricultural sector is positioned within the literature on sustainability research trends in Eastern Indonesia.

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Table 1. Clusters and Main Keywords

Cluster	Main Keywords
Cluster 1	adoption, climate change, resilience, food security, practice, farmers, study, soil, crops, factors, effects, data
Cluster 2	sustainability, development, system, agriculture, organic farming, case, case study, paper, article, India
Cluster 3	agriculture, technology, chapter, book, sustainable development, innovation, environment, agroecology

Cluster 1 illustrates the relationship between the adoption of sustainable agricultural practices, responses to climate change, and the food-security challenges faced by farmers. Research in this cluster focuses on how agricultural innovations are adopted by farmers and how various factors, data, and effects influence the resilience of agricultural systems as a whole.

The keywords in this cluster indicate the extensive use of empirical data and field-survey approaches to map the complex relationships among agricultural practices, production outcomes, soil conditions, and resilience to climatic pressures. The research metadata also demonstrate increasing attention to evidence-based adaptation strategies and the role of farmers in maintaining the long-term sustainability of food production amid global climate change (Sahar et al., 2025; Contreras et al., 2025).

Cluster 2 represents a research approach that positions agriculture as an integrated system in which sustainability, social development, and sustainable agricultural practices interact. Studies in this cluster frequently apply case-study designs and conceptual discussions to compare different sustainability models, including organic farming and sustainable agricultural systems associated with global development objectives (Terán-Samaniego et al., 2025; Contreras et al., 2025).

Cluster 3 emphasizes the role of technology, innovation, and ecological approaches in sustainable agriculture. Keywords such as *technology*, *innovation*, *environment*, and *agroecology* indicate the development of research evaluating new technologies, including digitalization, the Internet of Things (IoT), artificial intelligence, and agricultural information systems. These technologies are examined in relation to productivity improvement, resource-use efficiency, and the strengthening of agricultural ecological systems. This cluster demonstrates the connection between technological innovation and the achievement of long-term sustainability goals (Terán-Samaniego et al., 2025; Xu et al., 2024).

Density Visualization Analysis

Density visualization analysis using VOSviewer revealed the concentration of the most dominant keywords in the literature on agricultural sustainability in Eastern Indonesia. Areas with brighter colors indicate keywords with a high frequency of occurrence and strong relationships, whereas darker areas indicate keywords with lower frequencies or more limited relationships.

The visualization showed that keywords such as *agriculture*, *system*, *sustainability*, *development*, *farmer*, and *practice* had the highest density levels. This finding indicates that the analyzed literature positions sustainable agricultural development as a complex system. The research focuses on field-level agricultural practices, the role of farmers, and resource management in achieving sustainability objectives. This result is consistent with global bibliometric findings concerning the development of sustainable agriculture research (Contreras et al., 2025; Xu et al., 2024).

Keywords such as *food security*, *land*, and *crop* also demonstrated high density. This indicates that empirical studies emphasize the relationships among agricultural practices, productivity, land use, and food-system resilience. The findings suggest that research in this area tends to be practical and implementation-oriented, including the evaluation of field practices, agricultural innovation, and adaptation to environmental changes such as climate change and land degradation (Chimi et al., 2025).

In contrast, terms such as *chapter* and *book* had medium to low density levels. This finding indicates that most of the analyzed literature consisted of scientific articles applying empirical quantitative or qualitative methods rather than publications in the form of books or book chapters.

The density pattern confirms that agricultural sustainability research trends tend to prioritize field practices, agricultural-system dynamics, productivity, resource-use efficiency, and responses to environmental challenges. Therefore, the density visualization indicates that the analyzed studies primarily produced practical empirical findings. These findings can provide a foundation for sustainable agricultural development strategies and help identify dominant research priorities related to the adaptation of agricultural systems to local conditions and environmental changes (Contreras et al., 2025; Xu et al., 2024).

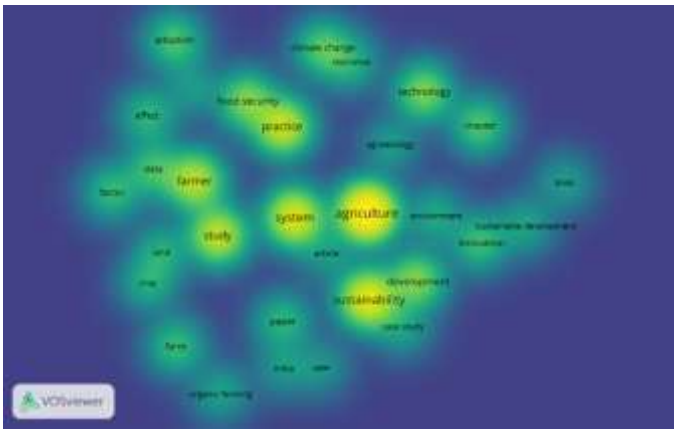

Figure 3. Density Visualization of Relevant Keywords

Interpreting Research Trends in Agricultural Sustainability in Eastern Indonesia

The main findings of this review demonstrate the integration of sustainable agricultural practices, technological innovation, and policy perspectives within the discourse on agricultural sustainability. This integration is apparent in both policy contexts and field-level implementation.

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Based on the bibliometric mapping results, three major themes require further investigation: (1) the adoption of sustainable agricultural practices focusing on food security and climate change adaptation; (2) sustainable development and agricultural systems that integrate economic, social, and ecological dimensions; and (3) innovation and technology influencing agricultural sustainability through digital technology and agroecological approaches.

Adoption of Sustainable Agricultural Practices and Food Security

The first cluster concerns the adoption of sustainable agricultural practices and food security. This theme encompasses the implementation of environmentally responsible farming models, the role of farmers, and the adaptation of production systems to climate change.

Studies within this cluster, including those conducted by Saptana (2017) and Sahar et al. (2025), emphasize the importance of organic farming and sustainable agricultural practices in achieving long-term food security, particularly in regions vulnerable to climate change. The implementation of organic farming and agroecology can increase productivity without degrading natural resources. These approaches are consistent with the Sustainable Development Goals (SDGs), particularly SDG 2, *Zero Hunger*, and SDG 12, *Responsible Consumption and Production*.

Through empirical data-based approaches, studies in this cluster demonstrate that climate data, changing soil conditions, and the effects of climate change influence agricultural productivity and food security. These factors need to be considered in the formulation of sustainable agricultural strategies (Saptana, 2017).

Contreras et al. (2025) also demonstrate that climate change adaptation has become increasingly urgent, particularly in regions experiencing food insecurity. Food security in Eastern Indonesia is influenced by the availability of natural resources, access to productive resources, technological support, and collaboration among relevant actors.

Adaptation strategies may include soil conservation, crop diversification, the use of climate-resilient varieties, and the development of efficient irrigation systems. Evidence-based approaches are required to produce policies that are more responsive to local problems and support long-term food security (Sahar et al., 2025).

Studies in this cluster also position local farmers as key actors in the adoption of sustainable practices. The success of sustainable agriculture depends not only on the availability of new technologies but also on farmers' involvement in selecting, adapting, and applying those technologies.

Barriers faced by farmers, including limited access to information, capital, technology, extension services, and policy support, need to be identified and addressed. Effective policies should consider economic, social, environmental, and technological dimensions while actively involving farmers in the formulation and implementation of sustainable agricultural policies (Saptana, 2017).

Table 2. Key Studies in the Sustainable Agricultural Practice Adoption and Food Security Cluster

No.	Author(s)	Title	Journal/Publisher	Policy/Practice Focus
1	Saptana (2017)	*Sustainable Agriculture Practices in Indonesia*	*Sustainability Science*	Sustainable agricultural economics and the implementation of organic farming models
2	Sahar et al. (2025)	*Adaptation Strategies to Climate Change in Agriculture*	*Discover Sustainability*	Food security and climate change adaptation in the agricultural sector
3	Contreras et al. (2025)	*Trends in Sustainable Agriculture Practices*	*Discover Sustainability*	Sustainable development policies and the role of farmers in agricultural systems

Sustainability, Development, and Agricultural Systems

Research in the second cluster indicates that agricultural sustainability depends substantially on the transformation of agricultural systems that integrate economic, social, and environmental dimensions. Abdullah and Manaf (2021) identified several challenges in sustainable agricultural development, including limited access to technology, insufficient funding, and limited government capacity to support sustainable policies.

Their study emphasizes the need for an integrative approach combining socioeconomic considerations with principles of ecological sustainability. Such an approach is required to establish more resilient and sustainable agricultural systems. Furthermore, several sustainability programs have been unable to adequately address local problems because of limited community participation during the planning and implementation stages.

Villamor et al. (2015) provide a perspective on land-use change, gender, and livelihoods in plantation areas of Sumatra. Their study shows that changes in land-use patterns, particularly in regions dependent on oil-palm plantations, can influence gender-based divisions of roles in agricultural management.

Women farmers frequently face limited access to land, technology, financing, and decision-making processes. These conditions may restrict their ability to adopt and develop sustainable agricultural practices. The findings emphasize the importance of inclusive agricultural policies that consider gender dimensions in their planning and implementation (Villamor et al., 2015).

Terán-Samaniego et al. (2025) discuss the importance of agroecology as an approach to sustainable agricultural development. Agroecology integrates ecological sustainability principles with social innovation and does not focus solely on short-term productivity.

This approach involves various stakeholders, including farmers, academics, governments, and the private sector. Agroecology is particularly relevant to Eastern Indonesia because the region's agroecosystem diversity and local knowledge can be integrated with green technologies. By developing environmentally responsible technologies and strengthening local knowledge, agroecology can provide an important strategy for reducing climate-change impacts and improving food security (Terán-Samaniego et al., 2025).

Table 3. Key Studies in the Sustainability, Development, and Agricultural Systems Cluster

No.	Author(s)	Title	Journal/Publisher	Policy/Practice Focus
1	Abdullah, M. H., & Manaf, M. A. (2021)	*Trends and Challenges in Sustainable Agricultural Development: A Bibliometric Analysis*	*Environmental Sustainability*	Analysis of developments and challenges in implementing sustainable agriculture
2	Villamor, G. B., Akiefnawati, R., et al. (2015)	*Land-use Change and Gendered Livelihood Shifts in Central Sumatra, Indonesia*	*International Forestry Review*	Effects of land-use change on gender roles and livelihoods in agricultural systems
3	Terán-Samaniego, K., Robles Parra, J. M., et al. (2025)	*Agroecology and Sustainable Agriculture: Conceptual Challenges and Opportunities—A Systematic Literature Review*	*Sustainability*	Agroecological concepts and challenges in developing sustainable agricultural systems

Innovation, Technology, and the Environment

The third cluster identifies the roles of innovation, technology, and the environment in advancing agricultural sustainability. Technology and innovation have become important elements in improving resource-use efficiency, strengthening decision-making processes, and reducing the impacts of climate change on agricultural activities.

Terán-Samaniego et al. (2025) emphasize the importance of agroecological approaches that not only introduce new technologies but also consider local values and traditional knowledge in natural-resource management. This approach integrates sustainable agricultural practices, green technologies, and digital innovations to reduce negative environmental impacts without compromising agricultural productivity.

Xu et al. (2024) demonstrate that digital technologies, including the Internet of Things (IoT), big data, artificial intelligence, and agricultural information systems, can be used to monitor and manage agricultural activities more efficiently. These technologies enable farmers to obtain more accurate and timely data, thereby improving decisions related to water use, fertilizers, pesticides, soil conditions, and production timing.

Digital technologies also contribute to food-security monitoring and the development of climate-change adaptation strategies. Their implementation can help increase productivity while reducing resource use and the risk of environmental degradation (Xu et al., 2024).

In this context, government policies supporting innovation and the use of green technologies are essential. Sundarakani and Ghouse (2024) emphasize that long-term sustainability requires technologies capable of reducing the agricultural sector's dependence on external inputs, including chemical fertilizers and synthetic pesticides.

Collaboration among governments, researchers, technology developers, educational institutions, and farmers is an important factor in developing and implementing environmentally responsible technologies. Such collaboration can accelerate the transformation of sustainable agriculture in Eastern Indonesia and other regions (Sundarakani & Ghouse, 2024).

Table 4. Key Studies in the Innovation, Technology, and Environment Cluster

No.	Author(s)	Title	Journal/Publisher	Policy/Practice Focus
1	Terán-Samaniego et al. (2025)	*Agroecology and Sustainable Agriculture: A Conceptual Review*	*Sustainability*	Agroecological approaches in sustainable agricultural policy
2	Xu et al. (2024)	*Digital Technologies in Sustainable Agriculture*	*Heliyon*	Sustainable agricultural technologies and the implementation of digital innovation
3	Sundarakani & Ghouse (2024)	*Blockchain Technologies for Food Security*	*Foods*	Technology-based innovative policies supporting food security

IV. CONCLUSIONS

This systematic literature review analyzed research trends related to agricultural sustainability in Eastern Indonesia through bibliometric mapping of relevant scientific publications. The analysis identified three main thematic clusters. The first cluster concerns the adoption of sustainable agricultural practices aimed at strengthening food security and climate change adaptation. The second cluster encompasses sustainability, development, and agricultural systems that integrate economic, social, and ecological dimensions. The third cluster focuses on innovation and technology that support

agricultural sustainability through digital technologies and agroecological approaches. The findings demonstrate that digital technologies and agroecology play strategic roles in improving resource-use efficiency, agricultural productivity, and the resilience of agricultural systems to climate change. The application of technologies such as agricultural information systems, the Internet of Things (IoT), and data-driven management can support more accurate decision-making. At the same time, agroecological approaches enable the integration of modern innovation, local knowledge, and environmental conservation principles. Despite the growing attention to field-level practices and technical innovation, the bibliometric mapping indicates that research on sustainable agriculture in Eastern Indonesia remains limited in its comprehensive integration of structural, institutional, and policy dimensions. A gap remains between empirical research findings and their incorporation into inclusive agricultural policies and governance. Furthermore, the participation of local farmers and community groups in policy planning and implementation needs to be strengthened. Future research should therefore focus on developing evidence-based policies that connect research findings, farmers' needs, local agroecological conditions, and institutional governance. Collaboration among governments, universities, research institutions, the private sector, and local communities is required to accelerate the implementation of sustainable agricultural practices. Future studies should also pay greater attention to policy effectiveness, farmers' access to technology and financing, social inclusiveness, and the long-term effects of innovation on the environment and farmers' welfare. Overall, this study contributes to mapping the thematic development, knowledge structure, and research gaps related to agricultural sustainability in Eastern Indonesia. The findings can provide a foundation for more focused research agendas and policy formulation aimed at strengthening food security, improving farmers' welfare, and developing agricultural systems that are resilient to climate change.

REFERENCES

[1] Abdullah, M. H., & Manaf, M. A. (2021). Trends and challenges in sustainable agricultural development: A bibliometric analysis. *Environmental Sustainability, 14*(2), 221–230. https://doi.org/10.1007/s10333-021-00810-3

[2] Apriyelita, & Marviano. (2025). Sustainable agricultural practices for climate resilience: A comparative analysis in Indonesia. *Sustainability Science, 16*(4), 231–245. https://doi.org/10.1007/s10333-025-0876-1

[3] Chimi, S., et al. (2025). Empirical assessment of sustainable farming practices. *Agricultural Systems Research, 38*(2), 145–160. https://doi.org/10.1016/j.agsy.2025.02.005

[4] Contreras, R., et al. (2025). Trends in sustainable agriculture practices. *Discover Sustainability, 6*(1), 50–68. https://doi.org/10.1007/s43621-025-00050-8

[5] Gokhale, S., Bansal, A., & Mistry, H. (2020). Bibliometric analysis in scientific research: A review of methods and trends. *Research Evaluation, 29*(1), 75–92. https://doi.org/10.1093/reseval/rvz041

[6] Hincapie, J. R., Lopez, M., & Gonzalez, R. (2021). A bibliometric approach to the analysis of trends in climate change and agriculture research. *Environmental Sciences, 18*(4), 220–237. https://doi.org/10.1007/s11356-020-10563-w

[7] Karakus, M., & Ersozlu, A. (2019). Evaluating the global research trends in sustainable development through bibliometric analysis. *Sustainability, 11*(8), 2279. https://doi.org/10.3390/su11082279

[8] Mandra, M. A. S., Mithen, M., & Sahabuddin, E. S. (2025). Penerapan pertanian cerdas iklim: Peluang, tantangan, dan strategi peningkatan kapasitas adaptasi petani pada Daerah Irigasi Saddang di Sulawesi Selatan. In *Prosiding Seminar Nasional* (3rd ed.). Universitas Negeri Makassar.

[9] Page, M. J., et al. (2021). PRISMA 2020 explanation and elaboration: Updated guidance and reporting standards for systematic reviews. *BMJ, 372*, n160. https://doi.org/10.1136/bmj.n160

[10] Sahar, R., Munawaroh, M., & Iqbal, J. (2025). Climate change adaptation in agriculture food supply chains: A bibliometric and content analysis. *Discover Sustainability, 6*, 1396. https://doi.org/10.1007/s43621-025-02105-9

[11] Saptana. (2017). Sustainable agriculture practices in Indonesia. *Sustainability Science*. https://doi.org/10.1007/s10333-017-0523-4

[12] Sundarakani, B., & Ghouse, M. (2024). Blockchain technologies for food security. *Foods, 13*(5), 1120–1135. https://doi.org/10.3390/foods13051120

[13] Sutiharni, F., Sari, D., & Prasetyo, P. (2024). A systematic review on sustainable agricultural practices in Indonesia: An analysis of research trends and policy implications. *Agricultural Policy Review, 29*(2), 109–125. https://doi.org/10.1007/s43621-025-01901-7

[14] Talan, M. (2021). Bibliometric analysis of agricultural sustainability research: Global trends and local opportunities. *Journal of Sustainable Agriculture, 34*(3), 180–195. https://doi.org/10.1007/s10333-021-0532-7

[15] Terán-Samaniego, K., Robles Parra, J. M., et al. (2025). Agroecology and sustainable agriculture: Conceptual challenges and opportunities—A systematic literature review. *Sustainability, 17*(2), 456–474. https://doi.org/10.3390/su17020456

[16] van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics, 84*(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3

[17] Villamor, G. B., Akiefnawati, R., et al. (2015). Land-use change and gendered livelihood shifts in Central Sumatra, Indonesia. *International Forestry Review, 17*(1), 50–65. https://doi.org/10.1505/146554815814832667

[18] Wang, X., Zhai, G., & Li, S. (2020). A bibliometric analysis of global research on sustainable agriculture. *Sustainability, 12*(16), 5332. https://doi.org/10.3390/su12165332

Volume 10, Number 02, Page 1007-1016
e-ISSN: 2598-120X; p-ISSN: 2598-117X

[19] Xu, J., Li, Y., Zhang, M., & Zhang, S. (2024). Digital technologies in sustainable agriculture. *Heliyon, 10*(14), e34612. https://doi.org/10.1016/j.heliyon.2024.e34612

[20] Xu, L., et al. (2024). Digital technologies in sustainable agriculture. *Heliyon, 10*(3), e09234. https://doi.org/10.1016/j.heliyon.2024.e09234

[21] Yaohong, W., Radin Firdaus, R. B., Xu, J., Dharejo, N., & Gui, J. (2025). China's rural revitalization policy: A PRISMA 2020 systematic review of poverty alleviation, food security, and sustainable development initiatives. *Sustainability, 17*(2), 569. https://doi.org/10.3390/su17020569