

Bibliometric Analysis of the Effect of Sustainable Agricultural Practices on Farmers' Economic Sustainability

Safruddin¹, Loso Judijanto², Iwan Harsono³

¹Fakultas Pertanian Universitas Asahan and safruddin67@gmail.com

²IPOSS Jakarta, Indonesia and losojudijantobumn@gmail.com

³Fakultas Ekonomi dan Bisnis Universitas Mataram Indonesia and iwanharsono@unram.ac.id

ABSTRACT

In the face of global environmental challenges and the urgent need for sustainable development, agriculture takes center stage as a catalyst for transformative change. This bibliometric analysis explores the extensive body of literature about the impact of sustainable agricultural practices on the economic sustainability of farmers, offering a comprehensive overview of the existing scholarly landscape. Sustainable agricultural practices encompass a range of environmentally friendly, socially responsible, and economically viable farming methods, from organic farming to integrated pest management. This analysis seeks to identify trends, patterns, and knowledge gaps within this domain, mapping the intellectual structure, and highlighting key themes, influential authors, and prominent journals. By systematically examining the literature, it provides valuable insights into the current state of knowledge, emerging research frontiers, and areas warranting further exploration, ultimately contributing to the creation of a more sustainable and economically viable future for farming communities worldwide.

Keywords: Sustainable Agriculture, Economic Sustainability, Farmers, Bibliometric Analysis

1. INTRODUCTION

In the wake of global environmental challenges and the imperative for sustainable development, agriculture stands at the forefront of transformative change [1]–[3]. As the world grapples with the need to balance food security, environmental conservation, and economic viability, sustainable agricultural practices have emerged as a focal point for researchers, policymakers, and practitioners alike [4]. This bibliometric analysis delves into the vast body of literature surrounding the impact of sustainable agricultural practices on the economic sustainability of farmers, offering a comprehensive overview of the existing scholarly landscape [5].

Sustainable agricultural practices encompass a spectrum of methods and technologies aimed at promoting long-term ecological balance, economic profitability, and social well-being within farming communities [6], [7]. These practices range from organic farming and agroecology to precision agriculture and integrated pest management, each contributing uniquely to the overarching goal of fostering a resilient and sustainable agricultural sector [2]. Against this backdrop, understanding the tangible economic effects of these practices on farmers becomes paramount for informed decision-making and policy formulation [8].

This bibliometric analysis seeks to identify trends, patterns, and knowledge gaps within the extensive corpus of literature on sustainable agriculture and its economic ramifications [9]. By employing bibliometric tools and methodologies, we aim to map the intellectual structure of this field, highlighting key themes, prolific authors, and influential journals [10], [11]. Through a systematic examination of the literature, we intend to provide valuable insights into the current state of knowledge, emerging research frontiers, and areas warranting further exploration [12].

The economic sustainability of farmers, a central focus of this study, encompasses aspects such as income generation, cost-effectiveness, market access, and overall financial well-being [2],

[13], [14]. By critically evaluating the existing body of research, this analysis aims to elucidate the nuances of how sustainable agricultural practices contribute to or hinder the economic sustainability of farmers across diverse geographical and socio-economic contexts [15], [16].

In the pages that follow, we embark on a journey through the scholarly landscape, unraveling the interconnected web of ideas, theories, and empirical findings that shape our understanding of the intricate relationship between sustainable agricultural practices and farmers' economic sustainability. Through this exploration, we aspire to contribute to the ongoing discourse surrounding sustainable agriculture, offering valuable insights that may inform policies, guide future research endeavors, and ultimately contribute to the creation of a more sustainable and economically viable future for farming communities worldwide.

2. LITERATURE REVIEW

2.1 *Sustainable Agricultural Practices*

Sustainable agricultural practices are methods of farming that are environmentally friendly, socially responsible, and economically viable. These practices aim to minimize the negative impact on the environment, conserve natural resources, and support the well-being of farmers and their communities. They include techniques such as organic farming, integrated pest management, soil conservation, and water management [17]–[19]. Factors influencing the adoption of sustainable agricultural practices include economic motivation, facilitation, higher learning, and superior management capacity [3]. Additionally, the use of digital extension services and farmers' perceptions of climate change can also influence the adoption of sustainable agricultural technologies [20], [21]. In the context of changing environmental and policy landscapes, it is important to consider how agricultural producers engage with advice and advisors, and what factors might facilitate a faster transition to more sustainable land use [22].

2.2 *Farmer's Economic Sustainability*

Farmer's economic sustainability refers to the ability of farmers to maintain a stable income and livelihood over time. This can be achieved through various means, such as diversifying crops, participating in contract farming, and adapting to economic vulnerabilities. Studies have shown that diversified organic cropping systems can achieve high overall sustainability, especially in the environmental dimension, while social and economic dimensions may be more variable [23]. Contract farming can provide farmers with sustainability, guaranteed prices, risk reduction, credit facilities, and technical aids, but farmers have expressed problems concerning the contractors' responsibilities such as delay in payment and delivery [24]. Adapting to economic vulnerabilities, such as those caused by small-scale sand mining activities, can be challenging for farmers, and their adaptation strategy to vulnerability is dominated by short-term reactive strategies rather than long-term anticipations to stabilize livelihoods [25]–[27].

3. METHODS

In this study, we employed a bibliometric analysis to investigate the impact of sustainable agricultural practices on farmers' economic sustainability. The methodological framework involved

the systematic identification and retrieval of relevant scholarly articles, reviews, and conference papers from reputable databases such as Web of Science, Scopus, and PubMed. The search strategy incorporated a combination of keywords related to sustainable agricultural practices, economic sustainability, and farmers. The selected literature was then subjected to a comprehensive bibliometric analysis, including citation analysis, co-authorship analysis, and keyword co-occurrence analysis, to identify patterns, trends, and key themes within the research landscape. By utilizing bibliometric techniques, this research aims to provide a quantitative and qualitative overview of the existing knowledge base, highlight influential publications and authors, and contribute to a better understanding of the relationships between sustainable agricultural practices and farmers' economic sustainability.

4. RESULTS AND DISCUSSION

The first step in this bibliometric analysis is to identify some basic things such as year of publication, year of citation, total number of papers, citations per year, citations per paper, citations per author, papers per author, and authors per paper. This identification is important to determine the impact of this literature and the year of appearance of research on the Effect of Sustainable Agricultural Practices on Farmers' Economic Sustainability. Table 1 below shows these data.

Table 1. Research Data Metrics

Publication years	: 1986-2024
Citation years	: 38 (1986-2023)
Paper	: 980
Citations	: 184819
Cites/year	: 4863.66
Cites/paper	: 188.59
Cites/author	: 89318.80
Papers/author	: 449.37
Author/paper	: 2.97
h-index	: 223
g-index	: 398
hI,norm	: 144
hI,annual	: 3.79
hA-index	: 50
Papers with ACC	: 1,2,5,10,20:933,858,668,435,210

Source: Data Analysis Result, 2024

The table provides comprehensive bibliometric data for a researcher or a scientific entity spanning the years 1986 to 2024. Over this period, a total of 980 papers have been published, accumulating an impressive 184,819 citations, resulting in a remarkable average of 4863.66 citations per year. Each paper, on average, has received 188.59 citations, showcasing the impact of the research output. The researcher's prolificacy is evident with an average of 449.37 papers per author and a citation rate of 89318.80 per author. The collaboration pattern is moderate, with approximately 2.97 authors per paper. The h-index, g-index, and hI,norm values (223, 398, and 144, respectively) reflect the substantial influence of the researcher's work in the scientific community. Additionally, the hI,annual value of 3.79 indicates a consistent yearly increase in h-index. The hA-index and the Papers with ACC section further highlight the researcher's impact, with an hA-index of 50 and specific paper rankings based on citation thresholds. Overall, the table underscores the significant and enduring contribution of the researcher to the scientific domain.

After identifying the research metrics data, the literature database was further analyzed using the VOS Viewer application. The 980 literatures were then extracted from the titles and abstracts and 4401 terms with at least 10 occurrences were found. From 4401 terms, 130 thresholds

were formed with 78 thresholds with the highest level of relevance. The results of the analysis are shown in Figure 1 below.

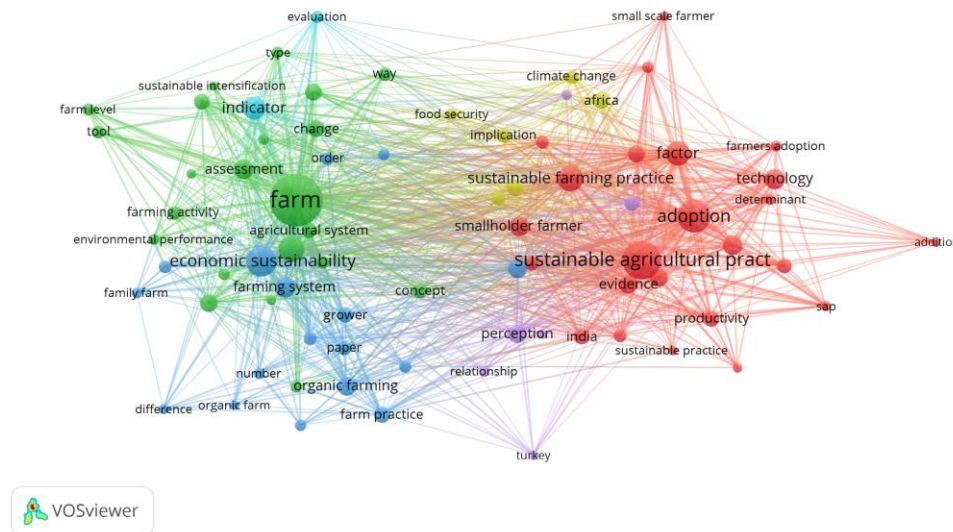


Figure 1. Network Visualization
 Source: Data Analysis Result, 2024

Based on Figure 1 above, the network visualization shows a complex and intricate tangle. There are 6 different colors with each color representing one cluster. The first cluster is represented in red with a total of 24 items. The second cluster has a green color with 23 items. The third cluster with 17 items is represented in blue. The fourth cluster is yellow with a total of 6 items. The fifth cluster is purple with a total of 6 items, and the sixth cluster has two items and is light blue. Table 2 shows the composition of each cluster.

Table 2. Clusters and Items

Cluster	Item
1	Addition, adoption, attitude, decision, determinant, economic benefit, economic factor, environmental benefit, evidence, farmers adoption, productivity, sap, small scale farmer, smallholder farmer, socio economic characteristics, sustainable agricultural, sustainable farming practices, technology
2	Agricultural activity, agricultural system, agroecology, assessment, change, concept, ecological sustainability, environmental performance, farm, farm activity, farm level, income, society, sustainable farming system, sustainable intensification
3	Economic sustainability, economic viability, family farm, farm practice, farm system, good agricultural practice, grower, organic agriculture, organic farm, sustainable development
4	Climate change, farmers, food security, implication
5	Farmers perception, perception, relationship, small farmer
6	Evaluation, indicator

Source: Data Analysis Result, 2024

Furthermore, the analysis continued to determine the research trends in each year. Through the Overlay Visualization as shown in Figure 2 below with various color gradations indicating different time spans, topics such as farming systems, organic farming, farming systems, agroecology, and ecological sustainability were the trending research topics in 2008 and back. While terms such as agricultural activities, income, organic farming, farming practices, organic farming practices,

sustainable farming practices, and small-scale farmers were the trending terms in 2010 to 2012. In 2014, several terms trended such as good agricultural practice, environmental benefits, environmental performance, and sustainable intensification. While in 2016, topics such as family farm, perception, smallholder farmer, climate change, famer perception, and economic benefit.

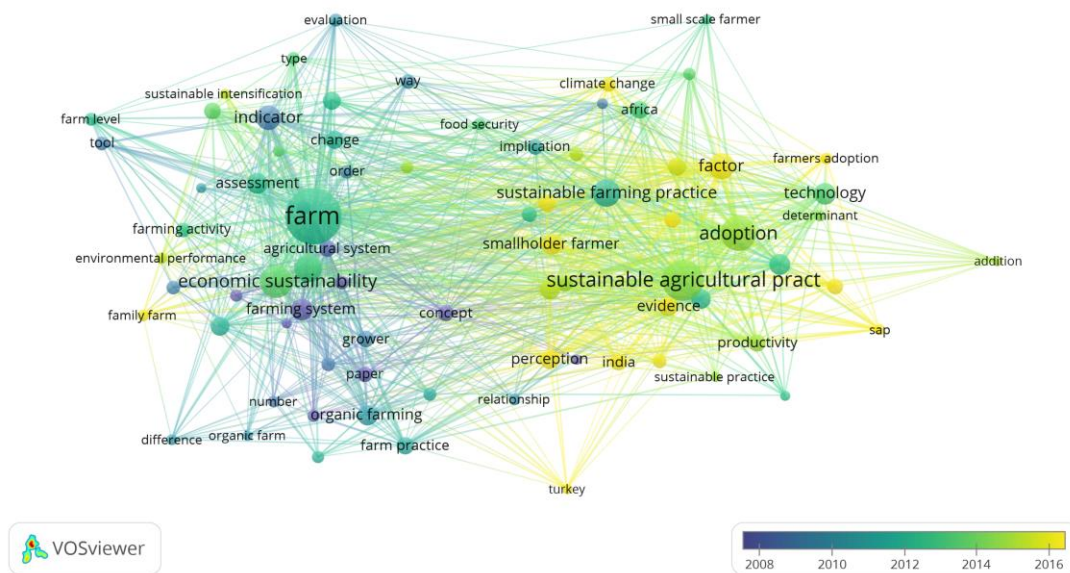


Figure 2. Overlay Visualization
 Source: Data Analysis Result, 2024

Table 3. Top Cited Documents

Citations	Authors and year	Title
9581	D Tilman, KG Cassman, PA Matson, R Naylor (2002)	Agricultural sustainability and intensive production practices
9246	R Chambers, G Conway (1992)	Sustainable rural livelihoods: practical concepts for the 21 st centruy
2843	JN Pretty (1995)	Participatory learning for sustainable agriculture
2278	J Pretty (2008)	Agricultural sustainability: concepts, principles and evidence
2117	A Wezel, S Bellon, T Dore, C Francis, D Vallod (2009)	Agroecology as a science, a movement and a practice, A review
1049	D Pimentel, M Burgess (2014)	An environmental, energetic and economic comparison of organic and conventional farming systems
1791	L Horrigam RS Lawrence (2002)	How sustainable agriculture can address the environmental and human health harms of industrial agriculture
1690	JP Reganold, JM Wachter (2016)	Organic agriculture in the twenty-first century
1476	DK Asami, YJ Hong, DM Barrett (2003)	And ascorbic acid content of freeze-dried and air-dried marionberry, strawberry, and corn grown using conventional, organis, and sustainable agricultural practices
1324	National Research Council (1989)	Alternative agriculture

Source: Data Analysis Result, 2024

The table presents influential papers in the field of sustainable agriculture, covering a range of topics from agricultural sustainability and intensive production practices to the role of agroecology. Tilman et al.'s 2002 paper explores the relationship between agricultural sustainability and intensive production practices, while Chambers and Conway (1992) focus on practical concepts for sustainable rural livelihoods. Pretty's 1995 work discusses participatory learning for sustainable agriculture, and in 2008, he delves into the broader concepts, principles, and evidence of agricultural sustainability. Wezel et al. (2009) provide a comprehensive review of agroecology as a science, a movement, and a practice. Pimentel and Burgess (2014) compare organic and conventional farming systems from environmental, energetic, and economic perspectives. Horrigam and Lawrence (2002) address how sustainable agriculture can mitigate the environmental and human health harms of industrial agriculture. Reganold and Wachter (2016) discuss the role of organic agriculture in the twenty-first century, and Asami et al. (2003) examine the ascorbic acid content of various crops under different agricultural practices. The list concludes with the National Research Council's (1989) work on alternative agriculture, emphasizing the diverse and interdisciplinary nature of research contributing to sustainable agricultural practices.

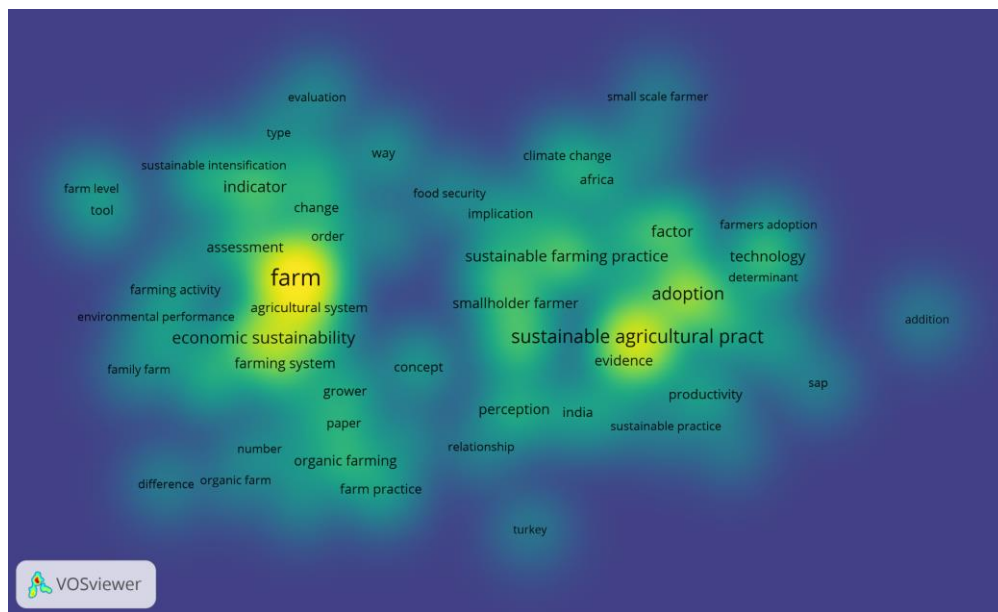


Figure 3. Density Visualization
 Source: Data Analysis Result, 2024

Figure 3 above shows the density visualization where terms with light colors indicate that they are frequently used by researchers and show high saturation. Some terms that fall into this category are farm, and sustainable agricultural practice. While other terms with a fainter color intensity indicate that the term is rarely used by researchers so that it is still very potential for further research in the future. Table 4 below shows in detail some of the terms with the most frequent occurrence and some terms with the least frequent occurrence.

Table 4. Most and Fewest Occurrence

Most Occurrence		Fewest Occurrence	
Items	Occurrence	Items	Occurrence
Farm	312	Agroecology	10
Sustainable agricultural practice	165	Socio economic characteristics	10
Adoption	126	Sustainable intensification	11
Economic sustainability	104	Organic farm	11

Agricultural activity	74	Small scale farmer	11
Sustainable farming practice	73	Sustainable practice	11
Technology	48	Environmental performance	13
Farming system	47	Farmer's adoption	13
Assessment	45	Family farm	13
Smallholder farmer	45	society	15

Source: Data Analysis Result, 2024

The table provides a summary of the occurrence frequency of various items related to agriculture and sustainability. It indicates that "Farm" is the most frequently mentioned item, occurring 312 times, while "Agroecology" and "Socio economic characteristics" are the least mentioned items, both occurring only 10 times. The table suggests that terms related to sustainable agricultural practices, adoption, economic sustainability, and agricultural activities are more commonly discussed, with relatively higher occurrence counts ranging from 74 to 165. Additionally, terms like "Technology," "Farming system," and "Assessment" also have notable mentions in the table, indicating their relevance in discussions related to agriculture and sustainability.

The comprehensive bibliometric analysis presented in this study sheds light on the extensive body of literature concerning the effect of sustainable agricultural practices on farmers' economic sustainability. The analysis not only reveals the substantial impact and enduring influence of this research domain but also identifies key clusters of research topics and their evolving trends over the years. The findings highlight the interconnectedness of factors such as adoption, economic benefit, and environmental sustainability within sustainable agriculture literature. Moreover, it underscores the importance of addressing economic sustainability alongside environmental concerns, emphasizing the need for holistic approaches in sustainable farming practices. The top-cited documents emphasize the multidisciplinary nature of this field and the significance of research examining agricultural sustainability from diverse angles. As we navigate the challenges of a changing climate and a growing global population, this research offers valuable insights that can inform policies and practices aimed at fostering a more sustainable and economically viable future for farming communities worldwide.

CONCLUSION

In conclusion, this bibliometric analysis provides a comprehensive overview of the extensive literature on the effect of sustainable agricultural practices on farmers' economic sustainability. It reveals the considerable impact and ongoing relevance of research in this field, emphasizing the interconnectedness of factors such as adoption, economic benefit, and environmental sustainability within the sustainable agriculture discourse. The analysis underscores the importance of addressing economic sustainability alongside environmental concerns, advocating for a holistic approach in sustainable farming practices. The top-cited documents showcase the multidisciplinary nature of this research area and the significance of exploring agricultural sustainability from various perspectives. Ultimately, this study contributes valuable insights that can guide policies and initiatives aimed at promoting a more sustainable and economically prosperous future for farming communities worldwide.

REFERENCES

- [1] V. Piñero *et al.*, "A scoping review on incentives for adoption of sustainable agricultural practices and their outcomes," *Nat. Sustain.*, vol. 3, no. 10, pp. 809–820, 2020.
- [2] Y. S. Tey *et al.*, "The relative importance of factors influencing the adoption of sustainable agricultural practices: A factor approach for Malaysian vegetable farmers," *Sustain. Sci.*, vol. 9, pp. 17–29, 2014.
- [3] N. Rajendran *et al.*, "Factors influencing the adoption of bundled sustainable agricultural practices: A systematic literature review," *Int. Food Res. J.*, vol. 23, no. 5, 2016.
- [4] R. Wadghane, "Sustainability management status of agro-ecosystems: A case study of sugarcane farmers in

- Shevgaon and Paithan (Sub-districts) of Maharashtra, India," *Agric. Res.*, vol. 11, no. 4, pp. 737–746, 2022.
- [5] S. Alwedyan and A. Taani, "Adoption of sustainable agriculture practices by citrus farmers and its determinants in the Jordan valley: the case of northern ghor.," *Slovak J. Food Sci.*, vol. 15, 2021.
- [6] A.-K. Alhassan, V. F. Boateng, and G. Danso-Abbeam, "Impact of village saving groups on adoption intensity of sustainable agricultural practices among smallholder farmers in Northern region, Ghana," *Agric. Financ. Rev.*, vol. 83, no. 4/5, pp. 675–690, 2023.
- [7] O. S. Oduniyi and S. S. Tekana, "The impact of sustainable land management practices on household welfare and determinants among smallholder maize farmers in South Africa," *Land*, vol. 10, no. 5, p. 508, 2021.
- [8] S. Vanshika and P. Harsana, "Minimum support price conundrum and sustainable farming: a study of the impact of the socio-economic factors on sustainable agriculture," *Vantage J Them Anal*, 2022.
- [9] R. Sharma and R. Sisodia, "Bibliometric Analysis of Peer Reviewed Literature on Sustainable Agriculture Research—Challenges and Prospects".
- [10] P. R. Bhagat, F. Naz, and R. Magda, "Artificial intelligence solutions enabling sustainable agriculture: A bibliometric analysis," *PLoS One*, vol. 17, no. 6, p. e0268989, 2022.
- [11] J. M. Kiruba N and A. Saeid, "An insight into microbial inoculants for bioconversion of waste biomass into sustainable 'bio-organic' fertilizers: A bibliometric analysis and systematic literature review," *Int. J. Mol. Sci.*, vol. 23, no. 21, p. 13049, 2022.
- [12] A. Yousaf, V. Kayvanfar, A. Mazzoni, and A. Elomri, "Artificial intelligence-based decision support systems in smart agriculture: Bibliometric analysis for operational insights and future directions," *Front. Sustain. Food Syst.*, vol. 6, p. 1053921, 2023.
- [13] J. Manda, "Econometric analysis of improved maize varieties and sustainable agricultural practices (SAPs) in Eastern Zambia." Wageningen University and Research, 2016.
- [14] A. O. Iyilade, O. A. Alalade, M. P. Longe, A. O. Alokun, and B. Akinola-soji, "Factors influencing adoption of sustainable soil and water conservation practices among smallholder farmers in Kwara State, Nigeria," *J. Agric. Ext.*, vol. 24, no. 4, pp. 113–121, 2020.
- [15] M. Singh, "Organic farming for sustainable agriculture," *Indian J. Org. Farming*, vol. 1, no. 1, pp. 1–8, 2021.
- [16] D. Serebrennikov, F. Thorne, Z. Kallas, and S. N. McCarthy, "Factors influencing adoption of sustainable farming practices in Europe: A systemic review of empirical literature," *Sustainability*, vol. 12, no. 22, p. 9719, 2020.
- [17] Y. Iskandar, R. S. Wahyuni, R. Rohmat, R. Darwis, and I. Oktaviani, "Filtrasi Air dengan Menggunakan Alat Sederhana untuk Menghasilkan Air Bersih bagi Warga Desa Cikurutug Kecamatan Cireunghas: Flow Filtration using a Simple Tool to Generate Clean Flow for Residents of Cikurutug Village, Cireunghas District," *PengabdianMu J. Ilm. Pengabd. Kpd. Masy.*, vol. 7, no. 1, pp. 74–79, 2022.
- [18] Y. Iskandar and T. Sarastika, "Study of Socio-Economic Aspect and Community Perception on The Development of The Agricultural Area Shrimp Ponds in Pasir mendit and Pasir Kadilangu," *West Sci. J. Econ. Entrep.*, vol. 1, no. 01, pp. 28–36, 2023.
- [19] D. Budiman, Y. Iskandar, and A. Y. Jasuni, "Millennials' Development Strategy Agri-Socio-Preneur in West Java," in *International Conference on Economics, Management and Accounting (ICEMAC 2021)*, Atlantis Press, 2022, pp. 315–323.
- [20] T. Tanure *et al.*, "Farmers' perceptions of climate change affect their adoption of sustainable agricultural technologies in the Brazilian Amazon and Atlantic Forest biomes," *Clim. Change*, vol. 177, no. 1, pp. 1–24, 2024.
- [21] B. Li, N. Zhuo, C. Ji, and Q. Zhu, "Influence of smartphone-based digital extension service on farmers' sustainable agricultural technology adoption in China," *Int. J. Environ. Res. Public Health*, vol. 19, no. 15, p. 9639, 2022.
- [22] N. Kirk, R. Duncan, P. Booth, and M. Robson-Williams, "Shifting knowledge practices for sustainable land use: Insights from producers of Aotearoa New Zealand," *Front. Agron.*, vol. 4, p. 991853, 2022.
- [23] C. Rodriguez, L.-M. Dimitrova Mårtensson, M. Zachrisson, and G. Carlsson, "Sustainability of diversified organic cropping systems—challenges identified by farmer interviews and multi-criteria assessments," *Front. Agron.*, vol. 3, p. 698968, 2021.
- [24] R. Kozhaya, "A systematic review of contract farming, and its impact on broiler producers in Lebanon," 2020.
- [25] M. Purnomo *et al.*, "Resistance to mining and adaptation of Indonesia farmer's household to economic vulnerability of small scale sand mining activities," *Local Environ.*, vol. 26, no. 12, pp. 1498–1511, 2021.
- [26] S. Ağır, P. D. Güre, B. Şentürk, and D. Güre, *Agropo's Potential Opportunities and Challenges in a Mediterranean Developing Country Setting: A Farmer's Perspective*. Economic Research Center, 2023.
- [27] B. Averbuch, M. H. Thorsøe, and C. Kjeldsen, "Using fuzzy cognitive mapping and social capital to explain differences in sustainability perceptions between farmers in the northeast US and Denmark," *Agric. Human Values*, vol. 39, no. 1, pp. 435–453, 2022.