Economics and Business International Conference Proceeding
Vol. 1 No. 2, pp. 1120-1132, August, 2024

Analysis of the Effect of Sustainable Agricultural Investment Planning Model on Agricultural Development in Indonesia

Nurul Puspita[1], Muhammad Akbar Maulana[2], Hedy Ilham Widyatama[3]
Department Of Agribusiness, University of Muhammadiyah Semarang
Correspondence Email: nurulpuspita@unimus.ac.id

ARTICLE INFORMATION

Publication information

Research article

HOW TO CITE

Puspita, N., Maulana., M.A., & Widyatama, H.I. (2024). Analysis of the Effect of Sustainable Agricultural Investment Planning Model on Agricultural Development in Indonesia, Economics and Business International Conference Proceeding, 1(2), 1120-1132.

Received: July 20, 2024
Accepted: July 25, 2024
Published: August 1, 2024

ABSTRACT

Planning a sustainable agriculture investment model is essential to address global challenges such as climate change, land degradation, and increasing food demand. The purpose of this research is to design a sustainable agricultural investment model using bibliographic analysis method. Bibliographic analysis was used to identify research trends, collaboration networks, and key themes related to sustainable agricultural investment from various scientific publications published between 2015 and 2024. Data were collected from major scientific databases and analyzed using bibliometric software. The results show that the number of publications on this topic has increased significantly over the past decade, with increasing emphasis on the integration of advanced technologies, government policies and environmentally friendly agricultural practices. These findings provide a basis for designing an investment model that not only optimizes crop yields but also considers social and ecological aspects. This proposed model will help policy makers, investors, and farmers make better decisions towards sustainable and competitive agriculture. Investment models that potentially provide opportunities for sustainable agriculture in Indonesia include food estate, agritourism, climate intelligence, organic, agroforestry, and agroecology. These investment models are expected to solve problems related to sustainable agriculture in Indonesia.

Keywords: Investment Planning Model, Sustainable Agricultural, Bibliographic analysis

INTRODUCTION

Indonesia is known as an agricultural country, this makes agriculture an important sector for food sustainability. But agriculture in Indonesia is also not free from the problems that exist, one of the problems of agriculture in Indonesia is the lack of interest in developing potential investment models in the agricultural sector. The concept of sustainable agriculture has become a fundamental pillar in global efforts to realize food security in Indonesia, rural development and environmental conservation (Budiman et al., 2022; Harahap et al., 2023; Iskandar & Sarastika, 2023; Legowo et al., 2021). Sustainable agriculture means meeting the needs of the present without compromising the ability of the next generation to meet their own needs (Iskandar & Sarastika, 2023; Jaman et al., 2021, 2022). The sustainable Agriculture investment planning model can help ensure food security, improve farmers' welfare, and promote sustainable rural development by considering various aspects of sustainability, including economic, social, and environmental factors (Perwitasari et al., 2018). Basically, investment is the placement of a number of funds with the aim of obtaining profits later (Halim 2005: 4). And actions to increase assets and direct a number of funds or other resources to achieve economic benefits in the future. Investment in agriculture can encourage technological innovation and sustainable ecosystems to increase productivity in the agribusiness sector. This can improve the welfare of the community and business actors in particular. Here are some significant search results, namely Agrosilvopastura, Agroecology, Climate Smart Agriculture, Agritourism and Organic farming. One example of an investment model that has been widely implemented is Organic farming, organic farming has grown rapidly and is used in more than 120 countries around the world. 30.4 million hectares of agricultural land are currently managed organically (Mahapatra et al., 2009). To reduce the negative impact of agriculture on the environment, increase resilience to environmental change, and improve the quality of life of the current population without compromising the quality of life of future generations, organic farming is an attractive alternative (Melo et al., 2021). To support sustainable agriculture efforts, the ecosystem approach to health is a promising framework. To generate shared knowledge and develop practical solutions, participation, transdisciplinarity and knowledge-to-action principles are essential. This article aims to describe several models of investment planning in sustainable agriculture that have potential for agricultural development in Indonesia.

LITERATURE REVIEW

Kiki Yulianto Faculty of Agricultural Technology, Sumbawa University of Technology Agroecology: A Future Sustainable Agriculture Model. 2016, The phenomenon of global warming has had an impact on changing the world's climate order which we are currently feeling the impact globally. Global climate change has had a real impact on all aspects of people's lives in Indonesia and in the world at large. In the past year, many farmers have experienced crop failure due to erratic climate and weather conditions. Farming schedules and patterns have changed.

Furthermore, from Amar Ma'ruf University of Asahan (agrosilvopasturai as planned farming systems towards sustainable agriculture). 2017, Financial analysis shows that the three agroforestry systems are economically feasible in the research location. A more suitable and sustainable agroforestry system (where income can meet livelihood needs, land is not degraded and suitable for agricultural techniques) to be introduced in the buffer zone of Langkat Regency. It is a type of agrosilbo pastula which is a combination of trees. Forest plants, food crops and forage grasses. The terrain is usually steep to very steep with a flat base and loose soil structure. Dadi Dadi Galuh University Ciamis, Indonesia. Development of organic farming system: how the process and strategy for sustainable food security in Indonesia 2021. This research uses a case research study through the application of qualitative methods, Researchers also want to study phenomena that talk about agricultural development. Based on Organic Farming System, Sustainable. The results explained that the concept of organic farming is based on plant and animal productivity. In addition, this process relies on the conservation of natural resources in the long term. Organic farming itself is a model that is designed, developed and managed. In this way, the aim is to limit the use of inorganic fertilizers, provide nutrients for plants, improve soil conditions and most importantly maintain ecological balance. Overall. Santi Elvira, Ramadhani Eka Putra, and Heri Rahman. Agrotourism 2022, Multidimensional Scalling (MDS) analysis method and modified Rapfish analysis tool were used to conduct sustainability status analysis. Rap-Agrotourism analysis will provide information about the status of sustainability in terms of various dimensions, which will be used to create a tourism management and development strategy (Toni, 2021).

The Rap-Agrotourism analysis procedure includes analyzing and determining the attributes of the dimensions of tourism data (Toni, 2021). According to the results of the analysis, "Upang" Strawberry Farm Agritourism multidimensionally has less sustainability status (49.79%) based on the ecological dimension of 48.38 percent (less sustainable); economic dimension 53.61 percent (moderately sustainable); socio-cultural dimension 51.21 percent (moderately sustainable); and the dimension of facilities and infrastructure 46.42 percent (less sustainable). Improvements in the ecological, institutional, and facilities and infrastructure dimensions indicate a lack of sustainability. A Hadid1), S Jumiyati2), B Toknok3), P Dua2), Haeruddin4) Adoption and Development Strategies of Sustainable Agriculture Based on Climate Smart Agriculture. 2023, SWOT Analysis (Strengths, Weaknesses, Opportunities, and Threats) is an analytical method used to determine the development strategies of sustainable agriculture based on Climate Smart Agriculture. Internal factor analysis can identify strengths and weaknesses, while external factor analysis can identify opportunities and threats. The Climate Smart Agriculture Implementation Program aims to improve farmers' knowledge and skills and includes the following activities:

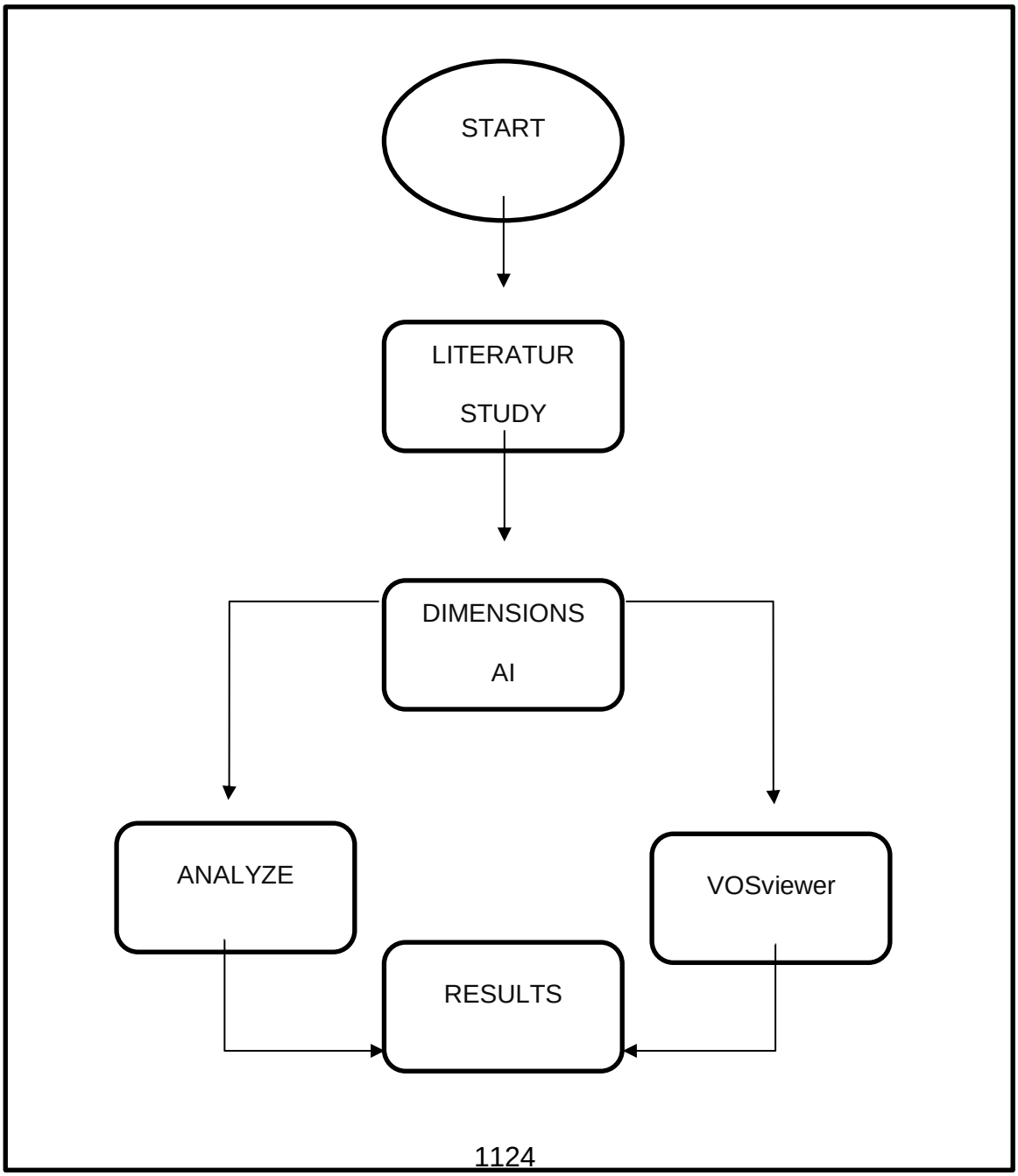
1. Water management, the ability to regulate the availability of water both in quantity and quality according to the needs of plants.

2. Soil management, the ability to manage agricultural land through the use of organic fertilizers. This has a positive impact on increasing agricultural production both qualitatively and quantitatively.
3. Crop management, the ability to increase the added value of land by optimizing crop diversification to increase agricultural production and farmers' income.
4. The ability to develop climate-smart products to produce secondary products through agribusiness management, product processing, and marketing activities.

Arjena Nayunda Risdianto, Felix Marshal Jotham, Nurdin. Analysis of the Implementation of the "Food Estate" Policy in Efforts to Protect Agricultural Land Sustainability and Food Security in Central Kalimantan Province. 2024, The qualitative method involves collecting data from various sources relevant to the research topic. These sources can include books, journal articles, papers, and even online sources. The data collected from these sources is then thoroughly and critically analyzed to find answers to the research questions. In Central Kalimantan, the Food Estate program has an impact on agricultural land as it aims to increase food production, especially rice, through the development of large-scale agricultural areas. As a result of this program, agricultural supporting infrastructure such as irrigation systems, roads, and agricultural production facilities have been built. However, the program also has an impact on pre-existing agricultural land. Some farmlands in the area have been developed prior to this program. Some pre-existing farmland In addition, there are many issues facing the program. These include infrastructure deficiencies, socio-cultural and technical constraints in agricultural mechanization, and land ownership issues.

RESEARCH METHOD

This research method uses a bibliometric approach to determine the effect of sustainable agricultural investment model planning on agricultural development in Indonesia. In this research, the data used comes from sources of scientific information, for example from journals, articles, and scientific literature. Data collection using dimension ai with the keyword "investment model planning", then the collected data is described and analyzed using bibliometric methods and conducting literature analysis to find patterns, trends, and relationships between related concepts. It is expected that this methodology will provide a comprehensive understanding of the influence of sustainable agriculture investment model planning on the development of agriculture in Indonesia. In addition, this methodology will make a significant contribution to the development of knowledge and practice in this field.



RESULTS AND DISCUSION

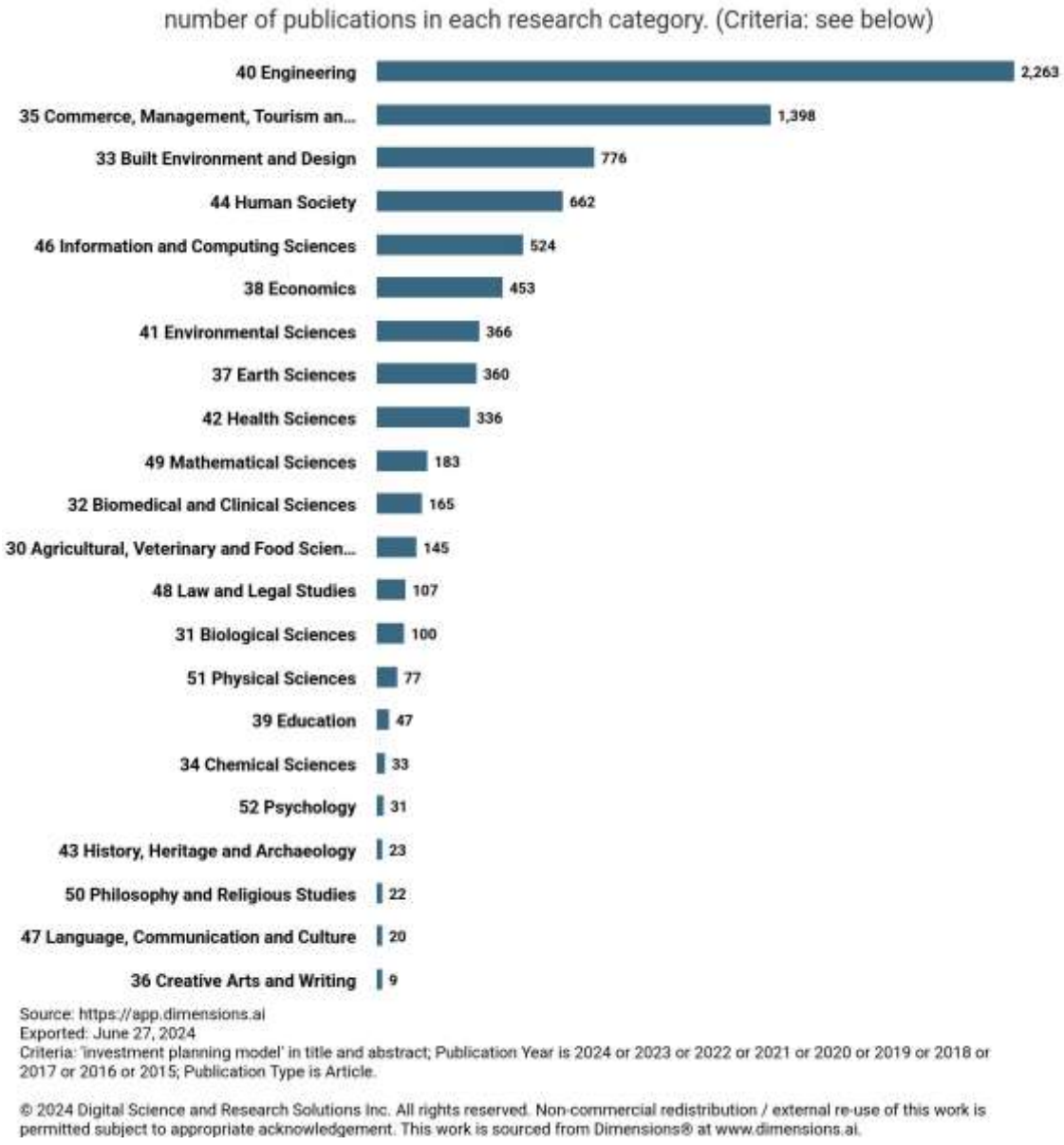


Figure 1
Source: Dimensions ai, 2024

Figure 1 explains the number of publication research categories from the keyword "investment planning model" and produces a total of 5,809 publication articles from 2015 - 2024. With the most publication articles, Engineering as many as 2,263. Next followed by the publication of Commerce, Management, Tourism and services articles with a total of 1,398 publications. Publication of Built Environment and Design articles amounted to 776 publications. Publication of Human society articles with a total of 662. Next is the publication of Economics articles totaling 453 publications. Furthermore, followed by publication of agricultural, Veterinary and food scienses articles with a total of 145 publications. This data provides an overview of how much research on investment model planning for sustainable agricultural development in the academic literature. Engineering is one of the important things as it supports productivity, efficiency, development of

sustainable agricultural technology innovations that no longer occur excessive labor as the main actors of agriculture. Commerce certainly has a role as an ease of consumers and producers accessing a wider market with competitive prices and cutting the marketing chain. The built environment is one example that is in line with sustainable agriculture because the built environment can streamline the market chain, improve quality and sustainability, preserve the environment and develop agricultural communities.

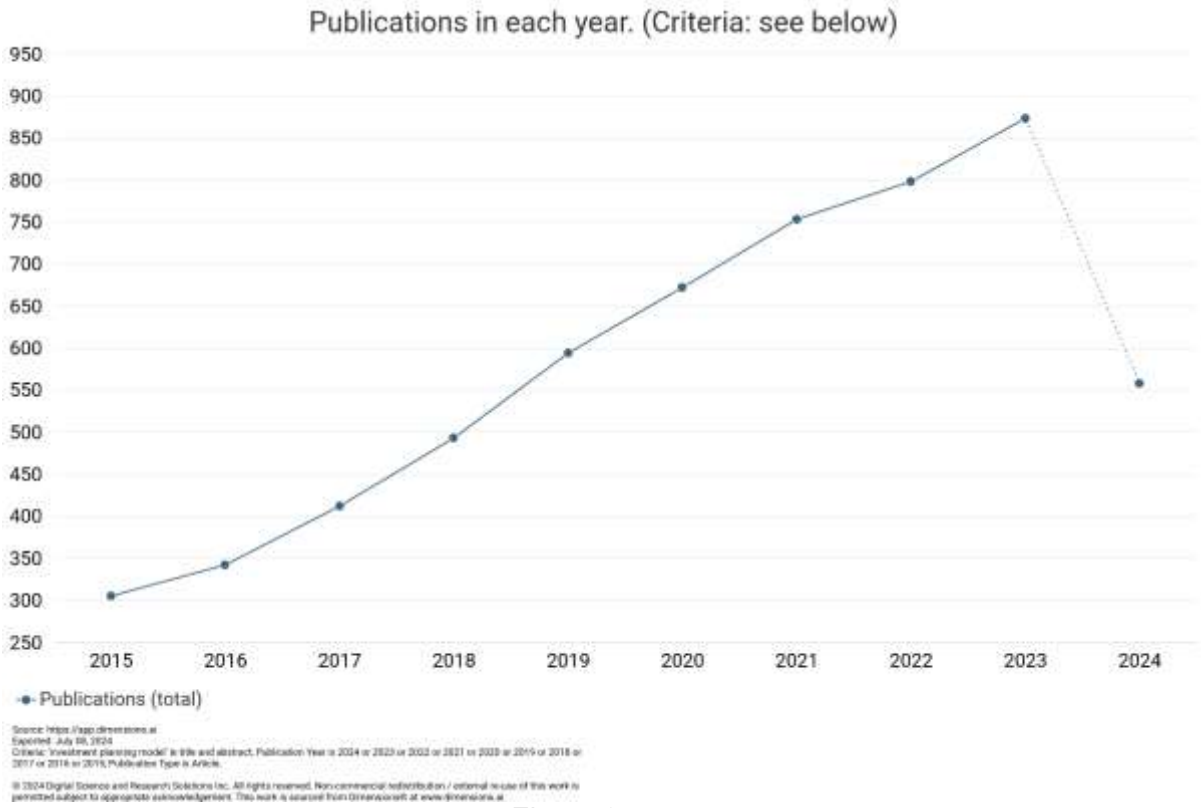


Figure 2.
Source: Dimension ai, 2024

The graph above illustrates the number of publications from 2015-2024 which shows that publications have increased significantly until 2023. But in 2024 it experienced a drastic decline, this provides an opportunity for further research on investment model planning so that interest in research in the sustainable agricultural planning model sector can increase like the previous year.

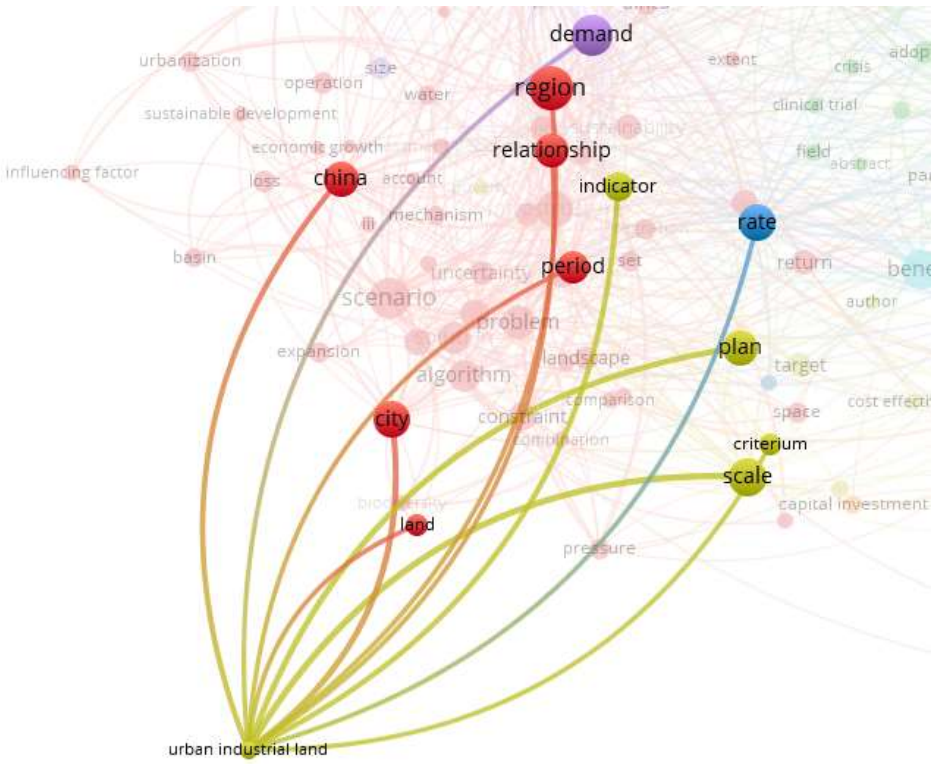


Figure 3. Network Visualization
Source: Dimension ai, 2024

A term network mapping analysis automatically generated by VOS Viewer was conducted to determine how the current research is classified based on theme similarity and proximity. The yellow cluster with the keyword "urban industrial land" covers several important sectors that can influence sustainable agricultural investment models such as the Food Estate program which is a government program that aims to increase food production, especially rice, through the development of large-scale agricultural areas. The yellow cluster also includes several industrial sectors and government networks. Urban industrial land is the main aspect of the yellow cluster, which means that when urban industrial land does not work properly, it will affect several aspects such as relationships, demand, and planning itself. There are several important relationships between sustainable agriculture and urban industrial land, especially in the context of sustainable urban development and land use planning.

Here are some points that explain the relationship between the two concepts. Efficient land use: In the context of sustainable agriculture, land use needs to be efficient to ensure not only farmland productivity but also biodiversity and health-supportive ecosystems. On the other hand, urban industrial areas need to be carefully planned to avoid urban sprawl that can reduce the amount of land available for agriculture on the outskirts of cities. Reducing Carbon Emissions: Sustainable agriculture often includes practices that reduce carbon emissions, such as: Use of renewable energy, efficient waste management, and tree planting. Urban industries should also contribute to reducing carbon emissions through green technology, energy efficiency and improved waste management. Local food availability: Sustainable agriculture near cities ensures the supply of fresh, high-quality local food for urban residents and reduces the need for long-distance transportation. Industrial parks that support efficient logistics infrastructure help to better distribute local food.

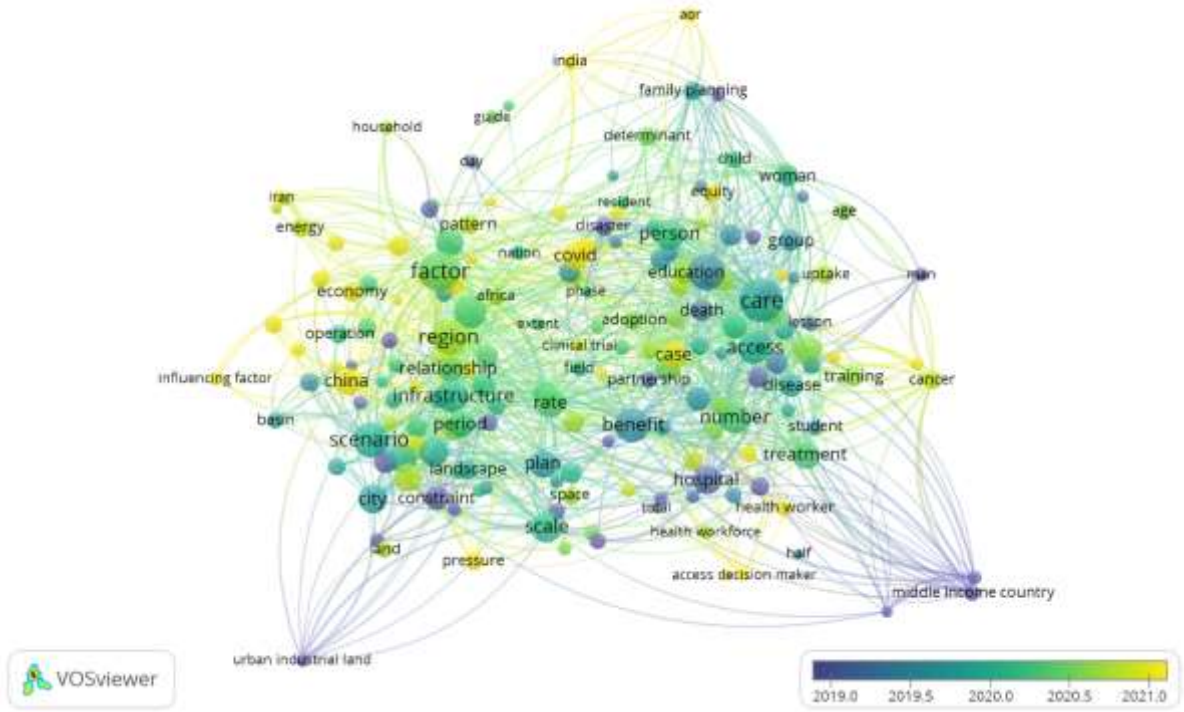


Figure 4. Network Visualization
Source: Dimension ai, 2024

The network map with the keyword "investment model planning" features a time element, displayed with a color gradient from yellow (2021) to blue (2019). The mapping can show how the research focus in sustainable agriculture investment model planning has changed within three (3) years.

1. 2019 (blue): In this year, there is a focus on income and industrial enterprises involved in the sector, as indicated by the keywords "middle income country" and "urban industrial land". This suggests that research in the early period may focus more on understanding and analyzing the basics of urban economics and industrial issues.
2. Around 2020 (Green): Keywords such as "care", "infrastructure", "problem" and "factor" become more prominent, signaling a transition towards sustainability issues and the development of sustainable investment planning models. With the changes taking place, research is likely to shift towards developing the investment planning potential of the development period 5.0.
3. 2021 (yellow): Keywords such as "covid", "economy" and "trend" are prominent at the end of the period, indicating that research has moved towards understanding the impact of the COVID-19 pandemic on the agricultural sector and the economy, and the importance of resilience in the face of the crisis. This may include studies on how agriculture and the economy adjusted and survived during the pandemic.

Table 1. Top Literature Cited

Citations	Authors and year	Title
1,819	Mohammad Shahidehpour	Optimal Expansion Planning of Energy Hub With Multiple Energy Infrastructures
1,181	Javier Contreras	Joint Expansion Planning of Distributed Generation and Distribution Networks
668	Goran R Strbac	Strategic Valuation of Smart Grid Technology Options in Distribution Networks
556	Xinwei Shen	Expansion Planning of Active Distribution Networks With Centralized and Distributed Energy Storage Systems
338	Matti L Lehtonen	Optimal Harmonic Mitigation in Distribution Systems with Inverter Based Distributed Generation
573	Joao Paulo Da Silva Catalao	A multi-stage joint planning and operation model for energy hubs considering integrated demand response programs
304	Qaiuwei Wu	Optimal Stochastic Deployment of Heterogeneous Energy Storage in a Residential Multienergy Microgrid With Demand-Side Management
346	Bo Zeng	A Chance Constrained Information-Gap Decision Model for Multi-Period Microgrid Planning
426	Miadreza Shafei-khah	Hybrid stochastic/robust optimization model for resilient architecture of distribution networks against extreme weather conditions
798	Chongqing Q Kang	Mixed-integer linear programming-based optimal configuration planning for energy hub: Starting from scratch

Table 2 displays the top most cited literature in the context of the influence of sustainable agriculture investment planning models. The most frequently cited work is Mohammad Shahidehpour's (2015) article titled "Optimal Expansion Planning of Energy Hub With Multiple Energy Infrastructures" with a total of 1,819 citations, which discusses the optimal expansion planning model for an energy hub with multiple energy systems. Followed by Javier Contreras (2015) with 1,181 citations in the article "Joint Expansion Planning of Distributed Generation and Distribution Networks" which introduces the multistage distribution system expansion planning problem, which takes into account both dispersed generating and distribution network investments. Goran R Strbac (2017) with the article "Strategic Valuation of Smart Grid Technology Options in Distribution Networks" has 668 citations, discussing an innovative stochastic planning model that takes into account investments in both traditional and smart grid assets, including coordinated voltage control, demand-side response, and soft open points. Furthermore, Xinwei Shen (2016) in "Expansion Planning of Active Distribution Networks With Centralized and Distributed Energy Storage Systems" has 556 citations, discussing an advanced active distribution network (ADN) planning model that incorporates energy storage system (ESS) use. Matti L Lehtonen (2021) with the article "Optimal Harmonic Mitigation in Distribution Systems with Inverter Based Distributed Generation" has 338 citations, reviewing in order to satisfy the IEEE 519 standard, the planning problem's objectives are to reduce total harmonic distortion (THD), power loss, filter investment

cost, and voltage profile improvement while taking various limitations into account. Another article that is also often cited is the work of Chongqing Q Kang, (2018) an article entitled "Mixed-integer linear programming-based optimal configuration planning for energy hubs: Starting from scratch" with 798 citations, discusses a novel optimal planning method for a community level MES that jointly determines the optimal generation, conversion and delivery of electricity, heat, cooling, and other services. This data illustrates the wide range of topics and approaches relevant in the context of the influence of sustainable agricultural investment planning models on agricultural development in Indonesia and the importance of this literature in supporting the understanding and development of strategic concepts in the field.

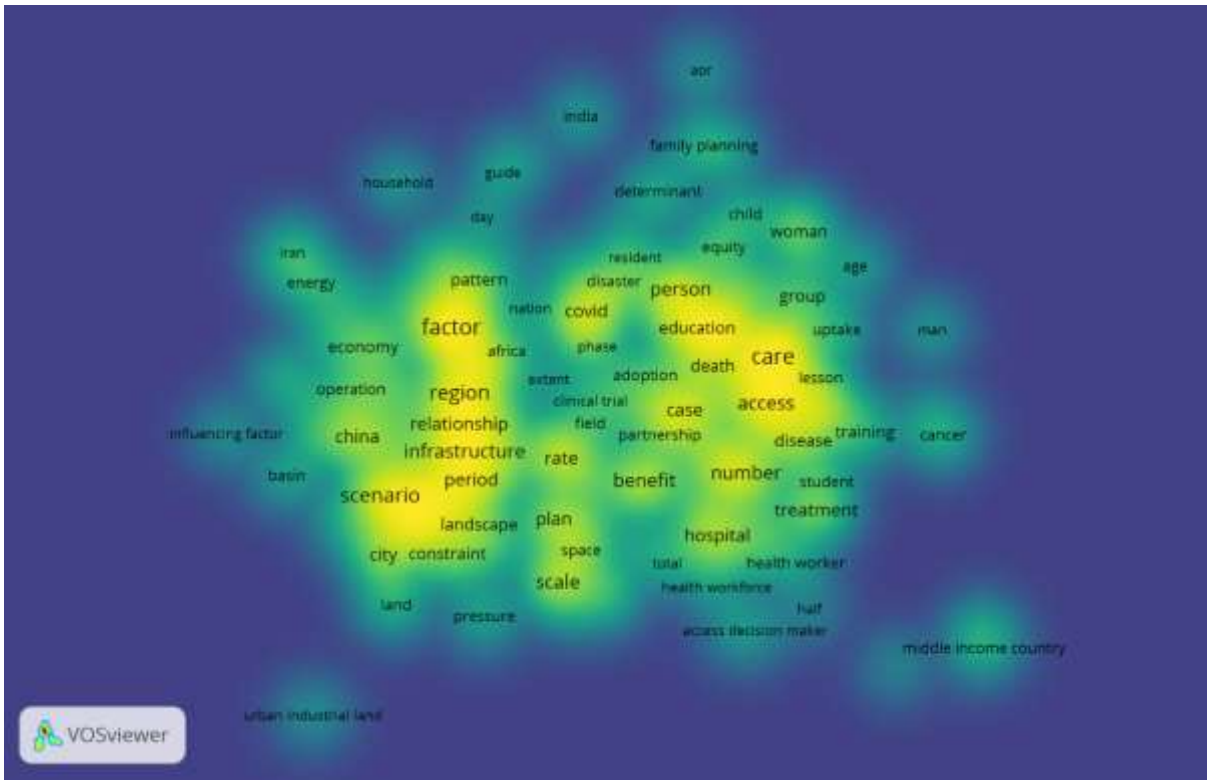


Figure 5. Density Visualization
Source: Dimension ai, 2024

In the set of information being analyzed above, less frequently occurring or less connected topics may be shown in a fainter light zone on this VOSviewer keyword network map. In the context of sustainable agriculture investment show planning, under-researched topics may indicate under-researched areas that could be potential research opportunities in the future. These topics are:

1. Urban industrial land: Being in a faint position, this illustrates that there is room for further research on sustainability in planning investment models. As well as enabling the potential for sustainable agriculture.
2. Education: this theme is one of the important factors to support the sustainability of sustainable agriculture that will help farmers and communities increase productivity and implement sustainable agriculture programs as well as build awareness of the importance of sustainable agriculture as a long-term future.
3. Economy: with a supportive economy being one of the influences on the development of investment model planning, its role is needed for sustainable agriculture in Indonesia.

4. Partnership: While partnerships have been widely discussed, their application in investment model planning and contribution to sustainable agriculture goals requires further research.

CONCLUSION

From the results and discussion presented, it can be concluded that this research provides a comprehensive overview of the relationship between sustainable agriculture investment model planning in Indonesia, with a focus on business strategies for sustainable agricultural development. Bibliometric analysis reveals that the interest and impact of research on this topic is considerable, with a significant number of works addressing the strategy of sustainable agriculture planning model, its relationship with the development of agriculture in Indonesia, as well as related issues such as food estate, agritourism, climate intelligence, organic, agroforestry, and agroecology. This investment model is expected to solve problems related to sustainable agriculture in Indonesia in the context of sustainable agriculture. The term network map and density mapping indicate potential research opportunities in certain under-researched topics, such as urban industrial land, education, economy and partnership.

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