

Meta-Analysis Of Farmer Welfare Improvement Strategies To Increase Food Security

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Abstract: This research was conducted in May 2024 through a search of the Scopus.com database with the specific topic of farmer welfare, resulting in a maximum of 480 articles as samples from publications between 1956 and 2024. Metadata retrieval was performed using the Scopus.com application, and the data were analyzed descriptively. To accurately depict the research landscape, the data was exported to CSV Excel format and further analyzed using VOS Viewer (VV) version 1.6.20. The findings indicate fluctuations in publications on farmer welfare from 1956 to 2024, with Tang being the most productive researcher. The primary sources for selected publications were the IOP Conference Series: Earth and Environmental Science, Sustainability Switzerland and American Journal Of Agricultural Economics. The most common document types were articles, conference papers, and Book Chapter, while Indonesia, the United States, and India led in farmer welfare development. The University for Development Studies Ghana, Brawijaya University, and UCLA Anderson School of Management were identified as the most influential affiliations in farmer welfare development. The analysis also showed that farmer welfare significantly increased food security, and has a positive impact on food security by enhancing food production and quality.

Keywords: Digitalization, Economic Empowerment, Nutritional Outcomes, Rural Development, Sustainable Development

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Introduction

Food supply needs are something to be met in a country, but unfortunately in Indonesia an estimated 19.4 million people in Indonesia are still starving (Kurnia et al., 2020) is a worrying problem. The problem is supported by the fact that many farmers at the core of the agricultural sector often face difficulties in earning a living for various reasons, including lack of access to

resources, inadequate training, and unfavourable market conditions. Therefore, in order to improve farmers' well-being, it is vital to increase food sustainability and ensure sustainable agricultural development. Farm clearance services, credit programmes, and market access programmes are some of the approaches that have been proposed and implemented to improve farmers' well-being. The agricultural sector in Indonesia has the potential to go to a higher level. However, the obstacle still obstructing the existence of agriculture in Indonesia (Putra, 2021; Marpaung et al., 2023; Putra et al., 2024), due to the lack of comprehensive literary reflection, would thus raise doubts in its implementation. Because in execution of course we need to have adequate facilities. Therefore, this meta-analysis aims to overcome the knowledge gap by synthesizing previous research results on strategies to improve farmers' well-being and its impact on food security, so as to provide a more accurate and reliable estimate of its effectiveness. Thus, the study is expected to provide information to policymakers and practitioners on the most effective strategies for improving farmers' well-being and increasing food sustainability, which can ultimately contribute to achieving the Sustainable Development Goals (SDGs), SDG 2 (Fighting Hunger) and SDG 8 (Decent Jobs and Economic Downturn).

Improving the welfare of farmers is one of the key elements in achieving sustainable food sustainability. Food sustainability reflects a condition in which every individual, at any time, has physical, social, and economic access to sufficient, safe, and nutritious food to meet their nutritional needs and lead an active and healthy life. However, many countries, especially developing countries, often face serious challenges in achieving food sustainability due to the still low welfare of farmers. Farmers, especially small farmers, often operate in unstable economic conditions. Poor nutritional food choices for children are due to poor socio-economic conditions (Simanjuntak et al., 2020) with limited access to technology, shortages of capital, and poor infrastructure they are also vulnerable to climate change and market price fluctuations. This situation has a negative impact on agricultural productivity and, overall, on food security. Various strategies have been implemented to improve farmers' well-being and, ultimately, strengthen food sustainability. These strategies include increased access to agricultural technology, provision of micro-credit, agricultural insurance programmes, of training agricultural management, and strengthening of marketing networks. However, the effectiveness of these strategies often varies depending on the local context and conditions of implementation. Meta-analysis is an effective method to evaluate and combine the results of various existing studies. It is crucial to identify best practices that can be applied more widely to improve farmers' well-being and food sustainability. By identifying and analysing the effectiveness of such strategies, more evidence-based recommendations are expected for policies and programmes aimed at improving farmers' well-being and food security at the global level. In order to sustain food sustainability, improving the welfare of farmers is crucial. Because farmers are the main actors in farming, the farming group serves to provide farm enterprise inputs such as fertilizer and seedlings, provide capital through lending savings, and promote farm yields collectively. (Marita et al., 2021) More prosperous farmers have greater motivation and capacity to increase food production, adopt new technologies, and invest in sustainable agricultural practices. It can improve domestic and national food resilience while reducing rural poverty. To improve the welfare of farmers, various approaches have been proposed and implemented. Because different strategies have different focus, coverage, and effectiveness, it is important to carry out meta-analysis to determine the most effective strategy to improve farmers' well-being and food sustainability.

The aim of this meta-analysis is to review and synthesize existing literature on strategies for

improving farmers' welfare. This analysis will find the most widely used strategies, how effective they are, and find the factors that contribute to the success or failure of such strategies. It is estimated that the findings of this analysis will provide useful recommendations for policymakers, development practitioners, and organizations responsible for improving the welfare of farmers

Methods

In this paper, bibliometric analysis and literature exploration are adopted to explore "farmer welfare". A total of 480 documents indexed in Scopus were collected and analyzed using the online database tool Scopus.com. Many studies using this database alone were found in the literature (Malanski et al., 2021; Neelam & Sood, 2020; Sun & Yuan, 2020; Karmaoui, 2022). This method allows for exploration of the most relevant and current studies in the field of sedimentation utilization for sustainable agriculture, exploring influential authors and countries. One key term used and formulated when processed with the Scopus tool: "farmer welfare".



Figure 1. Research search structure

This research was conducted in May 2024, resulting in 480 articles in the initial search published in document results from 1956 to 2024 (Figure 1). The extracted data was exported in CSV Excel format including information such as citations, abstracts, keywords, authors and countries, affiliations, publication year, funding details, publication type, and citations. This exported data was processed using specialized software VOS Viewer, to calculate occurrences, associations, and trends of important terms.

VOS Viewer was used to analyze and visualize data related to the main research terms taken from the Scopus database, reclassifying high-quality publications. This is considered the largest scientific database of scientific literature (Schotten et al., 2017). VOS Viewer software was developed by Van Eck & Waltman, (2010) using the Java programming language. This bibliometric tool uses clustering algorithms based on the occurrence of key term methods (Leydesdorf et al., 2012). In this paper, two categories of analysis were performed: network analysis using key research terms and manual classification of keywords and their meanings.

Bibliometric Analysis

In this step, the main analysis types available in the software were conducted, co-occurrence, co-authorship, and citation. For each type, three existing visualization categories were processed: network visualization, density, and trends.

Bibliometric analysis method in this research

This method was used with five steps introduced by Fahimnia et al. (2015). These five steps include the definition of the word "Farmer Welfare" Define Search Keywords, Initial Search Results, Refine Search Results, Organize Initial Data Statistics, and Data Analysis.

Classification of keywords and their meanings

This classification aims to highlight in more detail and identify more aspects not provided by the VOS Viewer. This software allows key term classification in unnamed groups only connected statistics, while the proposed classification is based on organizing these words using their meanings. For example, all key terms that make up "data" will be collected and classified based on their occurrence and relationship. This allows for the inclusion of key terms: big data, data mining, satellite data, data collection, data handling, data acquisition, data merging, database, metadata, open data, data visualization, and data integration in one category.

Results and Discussion

This paper explores efforts by a large number of researchers to provide a synthesis in improving farmer welfare for the future in supporting food security productivity. The results indicate an increasing trend in the number of indexed documents published between 1956 and 2024 using 480 documents taken from the online Scopus tool (Figure 2a). In recent decades, farmer welfare has become a major concern in efforts to strengthen food security and rural development. Supportive policies such as subsidies and agrarian reform are increasingly being applied, while the adoption of advanced technologies such as drones and automatic irrigation systems has helped improve efficiency and crop yields. Farmers now use e-commerce platforms to sell their products directly to consumers, significantly increasing their income. Additionally, modern training programs and digital literacy provide farmers with the necessary tools to optimize production and marketing. Thus, the development of farmer welfare has become an important approach in achieving sustainable food security and inclusive rural development.

These trends are revolutionizing the agricultural sector by introducing more supportive policies, such as

subsidies and agrarian reforms, and adopting advanced technologies such as drones and automatic irrigation systems. Farmers use e-commerce platforms to sell their products directly to consumers, significantly increasing their income. Modern training programs and digital literacy help farmers optimize production and marketing. All of this not only enhances farmer welfare but also strengthens food security and rural development. The first study (Figure 2a) exploring the period in 1956 titled "Discussion: Canada's Price Support Policy and Its Performance" (Farnsworth, 1956). Agricultural and biological sciences, medicine, earth and planetary sciences are the top three domains (Figure 2b). National Natural Science Foundation of China, National Office for Philosophy and Social Sciences, and United States Agency for International Development are the top three funding sponsors (Figure 2c). However, the IOP Conference Series Earth and Environmental Science, Sustainability Switzerland, and American Journal of Agricultural Economics are the main sources for selected publications (Figure 2d). regarding the type of document article, conference paper, book chapter (Figure 2e), while Indonesia, United States, And India Are the Leading Countries in Farmer Welfare Development (Figure 2f). University For Development Studies Ghana, Brawijaya University, And UCLA Anderson School of Management Are Three of the Most Influential Affiliates in research farmer welfare investigated (Figure 2g)

Network analysis uses the term primary research

The appearance of all key terms taken from selected documents is the first calculation method used in this The minimum number of keyword research. occurrences is 5 to display only the most relevant key terms. Of the 2621 keywords (generated by the software), 123 met the search and total link strength thresholds appearing alongside other key terms. Using this counting method, six main groups were found (Figure 3a). The first group of 37 items is represented by red circles which include terms such as food security, farming system, and sustainable development (Figure 3a). Group two consisting of 29 items represented in green includes the terms Agriculture policy, climate change, and insurance (Figure 3a). Group three is a group of 22 items in blue that include the terms farmers' attitude, market condition, and urbanization (Figure 3a). Groups of four groups consisting of 13 items are represented in vellow which include the terms adoption, supply chain, and commercialization (Figure 3a). Groups of five groups consisting of 12 items are represented in purple which include the terms smallholder, income, and price dynamics (Figure 3a).



Figure 2. Research structure in the field of farmer welfare using 480 documents published for the period 1956–2024. (a) Evolution of publications during the research period; (b) publications classified within the domain; (c) funding sponsor; (d) selected publication sources; (e) document by type; (f) document by leading countries; and (g) influential affiliations in the field under investigation.



Figure 3. Network analysis based on current key search terms: "Farmer Welfare" using publications for the period 1956–2024 and the VOS Viewer tool; (a) an event and connecting the Network; (b) density visualization; and (c) trends in key terms.

Table	1 Five Most Influential (Countries, Number (Of Documents, Ci	tations And Total Link Stre	ngth
	Country	Document	Citation	Total Link	
				Strength	
	United States	82	1744	57	
	United Kingdom	24	597	27	
	China	65	589	22	
	Netherlands	13	550	9	
	<u>Indonesia</u>	107	477	17	



Figure 4. Map of the most influential countries by number of documents published and citations



Figure 5. Example Network Visualization Of The Most Trending Key Terms Used In Current Searches In The Period 1973– 2024. Food Security (Figure 5a), Farmers Knowledge (Figure 5b), Farmers Attitude (Figure 5c), Agriculture (Figure 5d), Smallholder (Figure 5e), Economics (Figure 5f).

The second visualization method of the VOS Viewer relates to Overlay Visualization. The findings describe factors to improve farmers' well-being so that it can provide an increase in food reserves for food security (Figure 3b), as well as the third visualizing method of VOS Viewer connected to Density Visualisation. The future trend of the methods used in this field suggests that the public is beginning to realize that the welfare of farmers plays a crucial role in ensuring sustainable food security. (Figure 3c).

Countries are mapped based on the number of documents published and citations In this subsection, co-authorship is the analysis type and 'country' is the unit of analysis, full count is the calculation method, and 25 is the minimum number of countries per document. However, the minimum number of countries per selected document is 5 documents. Of 78 countries, 24 met the threshold.

For each of the 5 countries, the total strength of cooperative relations with other countries is estimated. The number of countries with the largest total link strength is estimated to be 24 countries. Using VOS Viewer software, the output shows that the Indonesia is the most productive country in terms of publication quality, followed by United States in the fields studied (Figure 5, Table 1)

The importance of the trending topic of farmer welfare is highlighted in several studies within the context of rural development, indicating that current issues related to farmers' social, economic, and environmental conditions are increasingly receiving attention in efforts to enhance their well-being. In this context, current research and policies emphasize the importance of improving farmers' living conditions, ensuring the sustainability of agricultural practices, and addressing challenges such as climate change and economic uncertainty. These efforts aim not only to directly improve farmers' income and welfare but also to ensure the sustainability of agricultural ecosystems and rural livelihoods as a whole.

Based on a meta-analysis review, the first group of 37 items, represented by red circles in Figure 5a, collectively emphasizes the foundational aspects crucial for ensuring food security through enhanced production, distribution, and market integration of food products. Adoption of new agricultural technologies improves productivity and efficiency in food production, while a well-managed supply chain ensures reliable distribution and timely delivery to consumers. Commercialization expands market reach, driving economic benefits and food accessibility. These processes interconnect to enhance food security by strengthening production, distribution, and economic sustainability within global food systems.

The second group of 29 items in green in Figure 5b focuses on agriculture policy, climate change, and insurance. Effective policies are essential for sustainable agricultural practices amidst climate challenges, regulating production impacts and environmental conservation. Adaptation strategies mitigate climate effects on productivity, ensuring resilience in farming communities. Insurance mechanisms protect against crop failures, fostering stability and investment. These components underscore a comprehensive approach needed for sustainable agricultural development and resilience in uncertain environmental conditions.

The third group, depicted by 22 items in blue in Figure 5c, highlights farmers' attitudes, market conditions, and urbanization crucial for rural development. Understanding farmer attitudes promotes sustainable agricultural practices, fostering economic growth and community resilience. Market dynamics shape rural economies, influencing livelihoods and income opportunities. Urbanization alters land use, diversifying agriculture and market access. Together, these factors emphasize the role of agricultural practices, market dynamics, and urban development in shaping rural development, enhancing livelihoods, and promoting sustainable economic growth.

The fourth group, represented by 13 yellow items in Figure 5d, emphasizes aspects like technology adoption, supply chain, and commercialization closely related to food security. Adopting new agricultural technologies enhances food production efficiency, bolstering food security through increased availability. A robust supply chain ensures reliable food distribution, while commercialization expands market opportunities, enhancing accessibility and economic sustainability in agriculture. Overall, this group highlights how technological innovation, supply chain management, and commercial strategies support food security by strengthening production, distribution, and economic sustainability in global food systems.

The fifth group, depicted by 12 purple items in Figure 5e, focuses on smallholder farmers, income, and price dynamics closely tied to food security and food safety. Smallholder farmers play a crucial role in food security as primary food producers for local and national populations. Increasing their income enhances access to sufficient and quality food, a cornerstone of food security. Stable price dynamics ensure economically accessible food availability. Therefore, understanding and addressing challenges faced by smallholder farmers related to income and price dynamics are key to supporting food security and achieving sustainable food safety.

The sixth group, represented by 10 pink items in Figure 5f, integrates human, economic, and non-human



Figure 6 Citation analysis Most cited documents

aspects. Human factors such as agricultural policies and farmer welfare are pivotal in creating conditions that support food security. Economic factors including market prices and access influence farmer income and their ability to manage economic uncertainties affecting food availability. Non-human factors like climate change and agricultural technology also contribute to food system vulnerability or sustainability. Understanding the complex relationships among human, economic, and non-human factors is crucial for designing policies that support farmer welfare and enhance holistic food security.

Based on a meta-analysis review, the groups of items in Figure 5a collectively emphasize foundational aspects essential for food security and rural development. The first group (red circles) underscores the importance of enhancing food production, distribution efficiency, and market integration through technology adoption and supply chain management. These processes are crucial for improving food availability and economic sustainability globally. The second group (green circles) highlights the significance of effective agricultural policies, climate change adaptation, and insurance mechanisms in ensuring resilient farming practices and stability amidst environmental challenges. The third group (blue circles) focuses on farmers' attitudes, market dynamics, and urbanization impacts, crucial for shaping sustainable rural development and enhancing community resilience. The fourth (yellow circles), fifth (purple circles), and sixth (pink circles) groups emphasize aspects like adoption, smallholder technology farmer empowerment, income dynamics, and socio-economic factors, all integral to enhancing food security and achieving sustainable agricultural development. These findings underscore the interconnected strategies needed to address global food security challenges comprehensively.

Document citation map based on the number of citations to a document

In this subsection, co-authorship is the analysis type and 'country' is the unit of analysis, full count is the calculation method, and 25 is the minimum number of countries per document. However, the minimum number of countries per selected document is 3 documents of the 1528 authors, 20 met the threshold. The number of authors with the largest total link strength is estimated to be 20 authors. Using VOS Viewer software, the output shows that Kautz is the most productive author in terms of publication quality, followed by Athman in the fields studied (Figure 6).

Conclusion

The initial study exploring the period in 1956, is titled "Discussion: Canada's Price Support Policy and Its Performance" (Farnsworth, 1956). The findings indicate fluctuations in publications on farmer welfare from 1956 to 2024, with Tang being the most productive researcher. The primary sources for selected publications were the IOP Conference Series: Earth and Environmental Science, Sustainability Switzerland and American Journal of Agricultural Economics. The most common document types were articles, conference papers, and Book Chapter, while Indonesia, the United States, and India led in farmer welfare development. The University for Development Studies Ghana, Brawijava University, and UCLA Anderson School of Management were identified as the most influential affiliations in farmer welfare development.

The first group of 37 items is represented by red circles which include terms such as food security, farming system, and sustainable development (Figure 5a). Group two consisting of 29 items represented in green includes the terms Agriculture policy, climate change, and insurance (Figure 5b). Group three is a group of 22 items in blue that include the terms farmers' attitude, market condition, and urbanization (Figure 5c). Groups of four groups consisting of 13 items are represented in yellow which include the terms adoption, supply chain, and commercialization (Figure 5d). Groups of five groups consisting of 12 items are

30

represented in purple which include the terms smallholder, income, and price dynamics (Figure 5e). Groups of six groups consisting of 10 items are represented in pink which include the terms human, economics, non human (Figure 5f).

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