

Meta Analysis of The Role of Agricultural Insurance in Enhancing Farmers' Financial Independence

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Abstrak

Kami melakukan penelitian ini pada bulan September 2024 dengan mencari basis data Scopus.com secara khusus untuk asuransi petani, yang menghasilkan maksimum 69 artikel sebagai sampel dari publikasi antara tahun 1984 dan 2024. Kami melakukan pengambilan metadata menggunakan aplikasi Scopus.com dan menganalisis data secara deskriptif. Kami mengeksplor data ke format CSV Excel dan menganalisisnya lebih lanjut menggunakan VOSViewer (VV) versi 1.6.20 untuk menggambarkan lanskap penelitian dengan akurat. Temuan menunjukkan fluktuasi dalam publikasi tentang asuransi petani dari tahun 1984 hingga 2024, dengan Aboonajm menjadi peneliti yang paling produktif. Sumber utama untuk publikasi yang dipilih adalah Sustainability Switzerland, QRC Advisor, dan Agricultural Finance Review. Jenis dokumen yang paling umum adalah Artikel, makalah konferensi, dan tinjauan, sementara China, Amerika Serikat, dan Indonesia dalam pengembangan asuransi petani. Kami mengidentifikasi Kementerian Kesehatan dan Kesejahteraan, Universitas Zhejiang, dan Universitas Nasional Taiwan sebagai tiga afiliasi paling berpengaruh dalam penelitian asuransi petani yang diteliti. Analisis tersebut juga menunjukkan Secara umum, asuransi petani telah menjadi topik penting karena perannya dalam mengatasi risiko yang dihadapi oleh petani, seperti perubahan iklim dan ketidakstabilan pasar. Asuransi ini memberikan perlindungan finansial, membantu petani pulih dari kerugian dan menjaga stabilitas pendapatan. Inovasi seperti asuransi berbasis indeks, yang memanfaatkan teknologi dan data, telah meningkatkan aksesibilitas, terutama bagi petani skala kecil. Selain melindungi dari risiko jangka pendek, asuransi juga mendorong investasi jangka panjang dalam praktik pertanian berkelanjutan, menjadikannya alat yang sangat penting untuk ketahanan pertanian.

Kata kunci: Inovasi asuransi, Keberlanjutan dalam Pertanian, Ketahanan pangan, Perubahan iklim, Risiko pertanian

Abstract

We conducted this research in September 2024 by searching the Scopus.com database specifically for farmer insurances, which yielded a maximum of 69 articles as samples from publications between 1984-2024. We performed metadata retrieval using the Scopus.com application and descriptively analyzed the data. We exported the data to CSV Excel format and further analyzed it using VOSViewer (VV) version 1.6.20 to depict the research landscape accurately. The findings indicate fluctuations in publications on farmer insurance from 1984 to 2024, with Aboonajm being the most productive researcher. The primary sources for selected publications were the Sustainability Switzerland, QRC Advisor, Agricultural Finance Riview, The most common document types were Article, conference paper, and riview, while China, The United States, and Indonesia in farmer insurance development. We identified Ministry Of Health And Welfare, Zhejiang University, National Taiwan University are the three most influential affiliates in farmer insurance research investigated The analysis also showed In general, farmer insurance has become an important topic due to its role in addressing the risks faced by farmers, such as climate change and market instability. This insurance provides financial protection, helping farmers recover from losses and maintain income stability. Innovations like index-based insurance, which use technology and data, have improved accessibility, especially for small-scale farmers. In addition to protecting against short-term risks, insurance also encourages long-term investments in sustainable farming practices, making it a crucial tool for agricultural resilience.

Keyword: Agricultural risk, Climate change, Food security, Insurance innovation, Sustainability in agriculture

INTRODUCTION

Agriculture is a crucial economic sector, especially in developing countries, as it significantly contributes to food supply and the livelihoods of millions of people (Putra, 2021). However, farmers frequently face various challenges that can threaten the sustainability of their operations and their financial well-being. One major challenge is the risk associated with extreme weather, climate change, and market price fluctuations. Increasingly unpredictable climate conditions, such as prolonged droughts or severe floods, can drastically damage crops, while commodity price instability can lead to highly uncertain farmer incomes (Mariyono, 2023).

In addressing these risks, agricultural insurance becomes a vital tool. Insurance provides financial protection that helps farmers cope with losses due to crop failure, price declines, or natural disasters. With insurance, farmers can reduce the financial burden that may arise from such losses and thus maintain the stability of their income. Additionally, insurance can encourage farmers to adopt more innovative and sustainable farming practices, as they have a safeguard that protects their investments (Setiadi *et al.*, 2021).

However, despite the significant benefits of insurance for farmers, there are still many challenges in its implementation. Limitations in access, understanding, and the cost of insurance often pose obstacles, particularly for smallholder farmers and those in remote areas (Mariyono, 2023). Therefore, it is essential to explore how insurance can be optimized to support farmers' financial independence and enhance the overall resilience of the agricultural sector.

This study aims to analyze the importance of insurance for farmers in achieving financial independence and evaluate how various insurance schemes can be implemented more effectively to address existing challenges. By understanding the role and impact of insurance, it is hoped that solutions can be found to improve accessibility, effectiveness, and acceptance of insurance among farmers, thereby supporting their sustainability and financial independence in the future.

METHOD

We investigate "Farmer insurance" by applying bibliometric analysis and literature. We conducted a comprehensive analysis of 69 papers indexed by Scopus using the online database tool on Scopus.com. The literature documents extensive research using this database. The references cited are from the following authors. This approach enables the examination of the most pertinent and current research in the area of using

sedimentation for sustainable agriculture, investigating the most significant authors and countries involved. The utilization of Scopus tools generates the significant term " Farmer insurance."

The first search yielded a total of 69 items published in documents over the period 1984–2024 (Figure 1). The produced data in Excel CSV format contains various information, including quotations, abstracts, keywords, authors and their affiliations, countries, year of publication, funding details, publishing kinds, and citations. VOS Viewer, a specialized software, analyzes the exported data to identify the frequency, relationships, and patterns of significant phrases.

Vosviewer is a software tool that analyzes and visualizes data related to significant research keywords from a high-quality Scopus database. People often regard it as the most extensive scientific database of scholarly publications. The reference is from created the VosViewer software in 2010 using the Java programming language. This bibliometric tool employs a clustering technique that is based on a key phrase occurrence methodology. This report performs two types of analysis: network analysis using prominent research terms, and manual categorization of keywords and their corresponding definitions.

Bibliometric Analysis

In this stage, the program provides the following forms of analysis: performance, shared events, co-writing, and quotes. The program sorts existing visualizations into three categories for each type: network visualization, density, and trend. This research utilizes the bibliometric analysis approach, following the five phases established. These five processes define the term "Farmer insurance " and use it as the search keyword. The process consists of four steps: search results, search result completeness, initial data statistics generation, and data analysis.

Classify essential words and their definitions.

This categorization aims to highlight additional details and pinpoint features not provided by the spectator. The program categorizes important phrases into unspecified clusters using related data, but the suggested classification system arranges these words according to their semantic significance. We will collect and categorize all "data" keywords through frequency and connection analysis. It includes key concepts such as big data, data mining, satellite data, collecting, data handling, data acquisition, data merging, databases, metadata, open data, database visualization, and data integration under a single category.

RESULTS AND DISCUSSION

This article examines the efforts of many researchers to synthesize the use of recent advances in farmer insurance, exploring development opportunities for the future in support of sustainable agricultural practices and climate resilience. The study emphasizes the role of innovative technologies, data analytics, and tailored insurance products in mitigating risks faced by farmers due to unpredictable weather patterns, market fluctuations, and other external factors. The results show an increasing trend in indexed documents published between 1984 and 2024, using 69 documents retrieved from the online tool Scopus (Figure 2a).

Farmer insurance has become increasingly important in recent decades due to the growing challenges and risks in the agricultural sector. Some of the main factors driving attention to farmer insurance are climate change, which makes weather harder to predict, as well as natural disasters like floods, droughts, and hurricanes that can destroy crops in a short amount of time. In addition, market price fluctuations are also a major problem for farmers, as unstable commodity prices can lead to income uncertainty. Farmer insurance is designed to protect farmers from economic losses due to crop failure or unexpected drops in income. In the past, these insurance schemes may have been limited, but with advancements in technology and data analytics, insurance can now be more personalized according to farmers' needs. For example, satellite technology and weather sensors can be used to monitor land conditions in real-time, allowing insurance premiums to be calculated more accurately based on the specific risks farmers face in certain areas. Moreover, the emergence of index-based insurance has become an important innovation. Instead of paying claims based on actual losses, this type of insurance is based on certain indicators, such as rainfall or temperature, that affect agricultural yields. If those indicators reach a certain threshold, farmers automatically receive compensation, making the claims process faster and more efficient. With increasing risks in the future, especially related to climate change, the need for stronger and more flexible insurance schemes will continue to grow. Effective insurance can provide financial stability for farmers, ensure food security, and support the sustainability of the agricultural sector.

The first study (Figure 2a) exploring the period was in 1984, entitled “Mental health and primary care in Greece” (Ierodiakonou, 1984) The top three domains are agricultural and biological sciences, Economics, Econometrics and Finance, and medicine (Figure 2b). National natural science foundation of China, National Office for Philosophy

and Social Sciences, National Science Council were the top three funding sponsors (Figure 2c). Sustainability Switzerland, QRC Advisor, Agricultural Finance Riview (Figure 2d). Regarding the document types, Article, conference paper, and riview (Figure 2e), China, The United States, and Indonesia are the leading countries in farmer insurance development (Figure 2f). Ministry Of Health And Welfare, Zhejiang University, National Taiwan University are the three most influential affiliates in farmer insurance research investigated (Figure 2g).

Network Analysis Uses The Term Primary Research

The first calculation method used in this research is the appearance of all key terms taken from selected documents. The minimum number of keyword occurrences is 3 to display only the most relevant key terms. Of the 640 keywords (generated by the software), 28 met the search and total link strength thresholds appearing alongside other key terms. By using this counting method, four main groups were found (Fig. 3a). By using this counting method, four main groups were found (Fig. 3a). The first group of 9 items is represented by red circles, which include terms such as human, risk assessment, and controlled study (Figure 3a). Group two consists of 6 items represented in green, including the terms food security, crop insurance, and insurance companies (Figure 3a). Group three is a group of 5 items in blue that includes the terms agriculture, climate change, and risk management (Fig. 3a). Groups of four groups consisting of 4 items are represented in yellow, which include the terms standard, medical record, and documentation (Figure 3a).

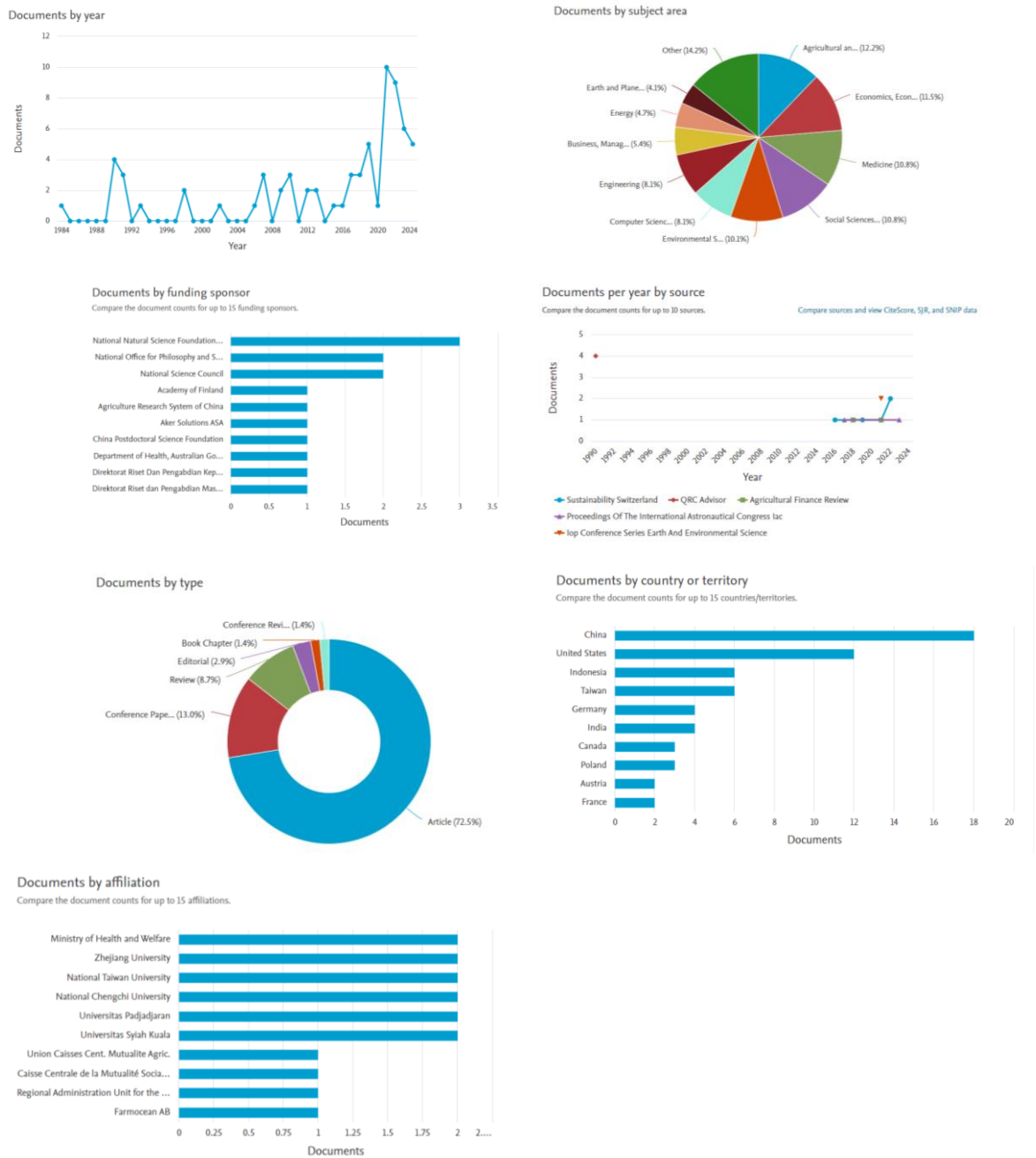


Figure 1. Research structure in the field of Farmer Insurance using 69 documents published for the period 1984–2024. (a) Evolution of publications during the research period; (b) publications classified within the domain; (c) funding sponsor; (d) selected publication sources; (e) document by type; (f) Document by leading countries (g) influential affiliations in the field under investigation.

The second visualisation method of the vosviewer related to the Overlay Visualization of the findings describes the direction of exploitation of the farmer insurance. The direction of exploitation of farmer insurance is increasingly focused on enhancing resilience and sustainability in agricultural practices. Agricultural insurance serves as a critical safety net, enabling farmers to manage risks associated with climate change, natural disasters, and market fluctuations, thereby stabilizing their income and promoting investment in sustainable farming methods (Philip & G., 2024) (Clipici & Frant, 2013). Government support plays a vital role in this context, as it stimulates the insurance market and enhances the competitiveness of agricultural products (Glotova *et al.*, 2024). Moreover, the integration of technology and cooperative models among farmers can optimize resource utilization and improve access to insurance, particularly for smallholder farmers facing significant uncertainties (Lopulisa *et al.*, 2018). As agricultural insurance evolves, it is essential to address challenges such as high premiums and limited coverage to ensure its effectiveness in safeguarding farmers' livelihoods and contributing to food security (Mahul, 1998; Glotova *et al.*, 2024).

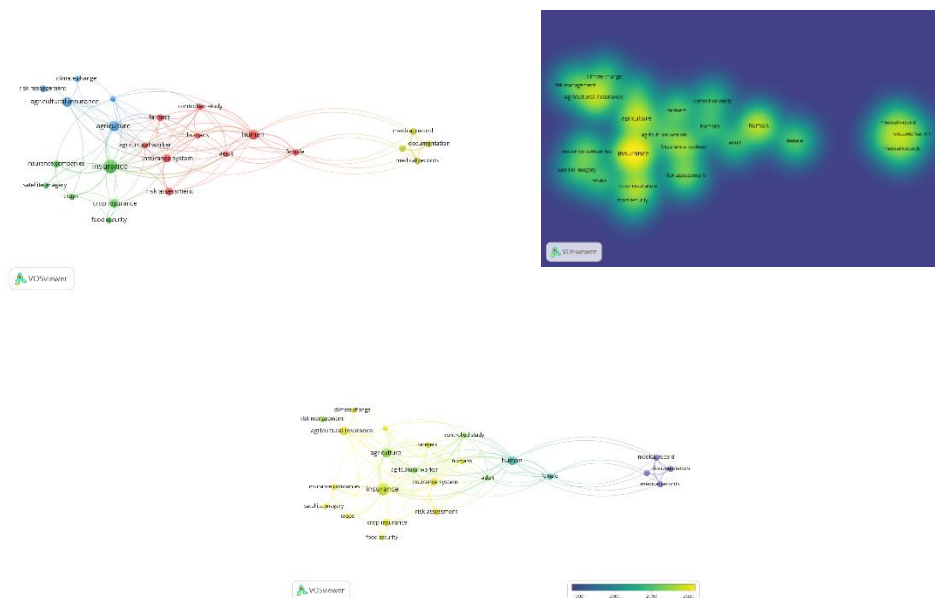


Figure 2. Network analysis based on current key search terms: "farmer insurance" using publications for the period 1984–2024 and the vosviewer tool; (a) an event and connecting the Network; (b) density visualisation; and (c) trends in key terms

Several studies have underscored the significance of this emerging topic, highlighting the critical role that farmer insurance plays in mitigating risks associated with modern agricultural challenges. Research emphasizes how effective insurance schemes can provide a safety net for farmers, safeguarding their livelihoods against unpredictable environmental factors and market volatility. These studies also explore how advancements in technology, such as satellite monitoring and data-driven models, are revolutionizing the insurance industry, making it more responsive and accessible for farmers. Additionally, they point to the growing need for insurance solutions that can adapt to the increasing threats posed by climate change.

On the other hand, there are challenges and limitations associated with the implementation of farmer insurance. Many smallholder farmers, especially in developing countries, often face barriers to accessing insurance due to high premiums, lack of awareness, and limited financial literacy. Additionally, the complexity of insurance products can make them difficult to understand and trust, leading to low adoption rates. Furthermore, insurance companies may struggle with accurately assessing risks in regions with limited data, which can result in either overpriced premiums or inadequate coverage. These obstacles highlight the need for more inclusive, affordable, and transparent insurance solutions that cater to the unique needs of different farming communities.

To design solutions that can reduce the impact of these challenges, stakeholders must focus on a few key areas. First, improving awareness and education about insurance products is essential to help farmers understand the benefits and processes involved. This can be done through government programs, partnerships with NGOs, and community outreach efforts. Second, making insurance more affordable and accessible is critical. This can be achieved by offering subsidies or low-cost insurance options, particularly for smallholder farmers, and leveraging technology to reduce administrative costs. Mobile platforms, for example, can be used for premium payments and claims processing, simplifying the process for farmers in remote areas. Third, utilizing data-driven approaches to improve risk assessment is vital. Integrating satellite data, weather forecasting, and machine learning models can provide more accurate and localized risk evaluations, ensuring fair premiums and better coverage. Index-based insurance, which relies on weather patterns or crop yields, can also streamline the claims process and make it more transparent. Lastly, public-private partnerships are crucial to scale these solutions. Collaboration between governments, insurers, and technology providers can lead to more

sustainable and inclusive insurance models, helping to strengthen agricultural resilience against both current and future risks. We visualised four examples during the period 1984–2024 to illustrate the relationship between the most trending topics: Insurance system (Figure 4a), Insurance (Figure 4b), Agriculture (Figure 4c), standard (Figure 4d).

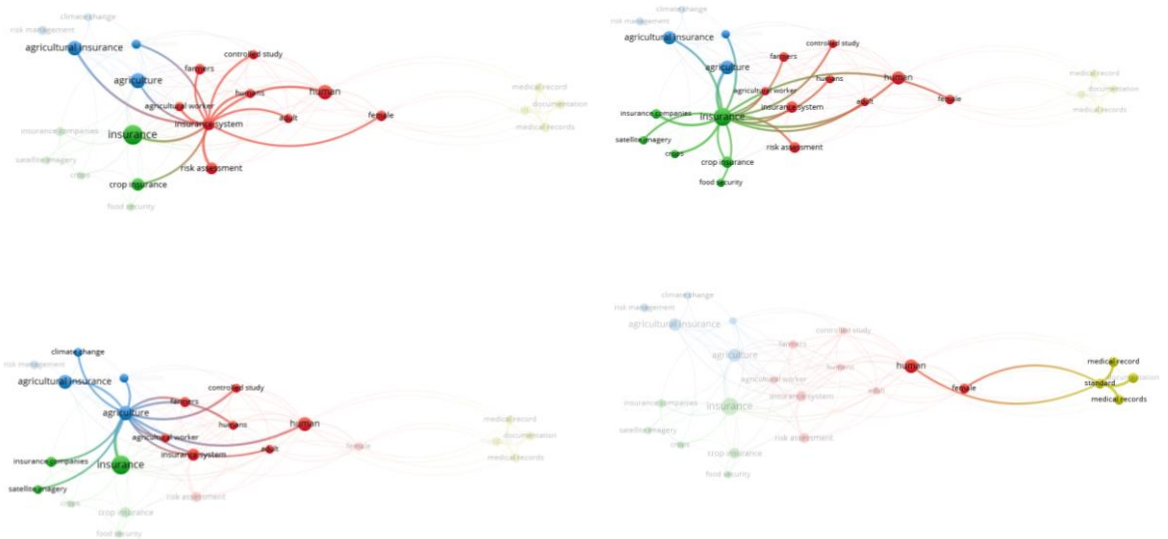


Figure 4. Example network visualisation of the most trending key terms used in current searches in the period 1973–2024. Insurance system (Figure 4a), Insurance (Figure 4b), Agriculture (Figure 4c), standard (Figure 4d).

Farmer insurance is essential in addressing the numerous risks and uncertainties that modern farmers face, particularly in an era of rapid environmental and economic changes. With climate change causing more frequent and severe weather events such as droughts, floods, and storms, farmers are increasingly vulnerable to crop failure and loss of income. Insurance provides a safety net that helps protect them from these unforeseen disasters, ensuring they can recover financially and continue their operations. In many regions, especially those prone to unpredictable weather patterns, the ability to mitigate such risks is vital for maintaining agricultural productivity and food security.

Additionally, farmer insurance plays a crucial role in stabilizing farmers' incomes in the face of volatile market conditions. Global commodity prices often fluctuate due to a range of factors, including supply chain disruptions, trade policies, and market demands. These price shifts can leave farmers exposed to significant financial losses. By providing compensation in times of market downturns, insurance schemes help smooth out income volatility and reduce the economic stress that comes with unstable pricing. This stability is

especially important for smallholder farmers, who often operate on tight margins and cannot afford to absorb substantial losses.

Moreover, farmer insurance promotes long-term sustainability in the agricultural sector. It encourages farmers to invest in more innovative and sustainable practices, as the risk of financial failure is reduced. With access to insurance, farmers are more likely to adopt new technologies, diversify crops, and implement environmentally friendly practices that enhance resilience against future risks. In this way, insurance not only acts as a short-term buffer but also supports the ongoing growth and sustainability of farming communities, contributing to a more resilient and secure agricultural system overall.

In conclusion, farmer insurance is a vital tool in addressing the growing challenges faced by the agricultural sector, particularly in light of climate change and market volatility. By providing financial protection against unpredictable weather events and fluctuating commodity prices, insurance helps farmers maintain their livelihoods and ensure the stability of their operations. It also empowers farmers to make long-term investments in sustainable practices, driving innovation and resilience in the sector. As risks continue to evolve, expanding access to affordable and effective insurance solutions will be essential for safeguarding the future of agriculture and ensuring global food security.

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

In this subsection, co-authorship is the analysis type, 'country' is the unit of analysis, the full count is the calculation method, and ignore document with a large number of authors per document. However, the minimum number of countries per selected document is one documents of the 211 authors, 211 of which met the threshold. The number of authors with the largest total link strength is estimated to be 211 authors. Using VOSViewer software, the output shows that [Aboonajmi](#) is the most productive author in terms of publication quality, followed by Adjemian in the fields studied (Figure 5)

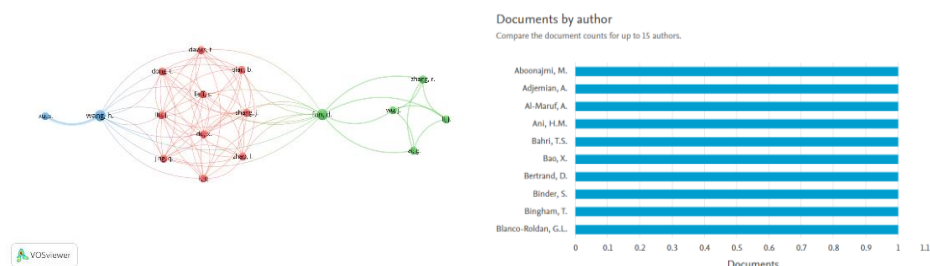


Figure 5 Citation analysis Most cited documents

CONCLUSION

In general, farmer insurance has become an important topic due to its role in addressing the risks faced by farmers, such as climate change and market instability. This insurance provides financial protection, helping farmers recover from losses and maintain income stability. Innovations like index-based insurance, which use technology and data, have improved accessibility, especially for small-scale farmers. In addition to protecting against short-term risks, insurance also encourages long-term investments in sustainable farming practices, making it a crucial tool for agricultural resilience.

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Data availability Data included in the manuscript.

Declaration of Conflicting Interests There are no competing interests in the manuscript.

Human and Animal Rights We declare that this research complies with all regulations and confirmations.

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