


Bibliometric Analysis of the Development of Food Security Studies in the Perspective of Agricultural Economics

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Article Info	ABSTRACT
<p>Article history:</p> <p>Received August, 2025 Revised August, 2025 Accepted August, 2025</p> <hr/> <p>Keywords:</p> <p>Food Security; Agricultural Economics; Bibliometric Analysis; VOSviewer</p>	<p>This study presents a comprehensive bibliometric analysis of global research on food security through the lens of agricultural economics, aiming to uncover the intellectual structure, thematic evolution, and collaborative networks within the field. Using data retrieved from the Scopus database (2000–2025) and analyzed through VOSviewer, the study identifies key trends, influential authors, countries, and emerging research fronts. Keyword co-occurrence mapping reveals that food security remains the central theme, closely linked with agricultural production, climate change, sustainable development, and innovation in agricultural practices. Temporal overlay analysis shows a thematic shift from poverty and nutrition toward climate-smart agriculture and digital transformation, while density visualization highlights research intensity around sustainability and production. Author and country co-authorship networks indicate strong regional clusters, with the United States, India, and the United Kingdom playing leading roles in shaping the discourse. The findings offer practical implications for policymakers and theoretical contributions by expanding the analytical dimensions of agricultural economics in addressing complex food system challenges. Limitations are acknowledged in database scope and keyword-level interpretation, providing directions for further qualitative and regional-specific exploration.</p> <p><i>This is an open access article under the CC BY-SA license.</i></p> <div></div>

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<h2>1. INTRODUCTION</h2> <p>In recent decades, food security has emerged as one of the most critical global challenges [1], [2]. The increasing volatility of food systems, driven by climate change, political instability, economic inequality, and rapid population growth has made the pursuit of sustainable food production and distribution systems a pressing concern for policymakers, academics, and practitioners</p>	<p>alike. According to the Food and Agriculture Organization (FAO), over 735 million people faced hunger in 2022, an alarming indicator that underscores the fragile state of global food systems. This issue is particularly acute in developing countries where agricultural productivity is low, rural infrastructure is underdeveloped, and socio-political instability hampers food access. In such contexts, food security becomes not only a</p>
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humanitarian priority but also an economic imperative [3], [4], [5].

Agricultural economics, as a subdiscipline of economics, plays a pivotal role in addressing food security by offering analytical tools to understand and improve the efficiency, equity, and sustainability of food systems [6], [7]. It covers the complex interplay between agricultural production, resource management, rural development, trade policy, and food consumption behavior. Researchers in this field investigate how market dynamics, public policy, and technological innovation influence food supply chains and livelihoods, especially in agrarian societies [8], [9]. The theoretical frameworks and empirical studies in agricultural economics provide valuable insights for designing policies that ensure stable food access while maintaining economic viability and environmental sustainability [10], [11].

The development of food security studies within the agricultural economics framework has evolved significantly over time. Earlier research emphasized productivity and input efficiency, while contemporary studies have expanded to include resilience, nutrition-sensitive agriculture, climate-smart practices, and socio-economic equity. This evolution reflects a shift from narrow production-centric approaches toward multidimensional frameworks that integrate sustainability, poverty alleviation, gender equity, and global value chains [12]. The interdisciplinary nature of food security now demands collaboration across agricultural sciences, economics, environmental studies, and public health, making bibliometric mapping a useful tool to track thematic shifts, research trends, and scholarly influence over time.

Given the explosion of scientific publications in the last two decades, bibliometric analysis has become an increasingly popular method to synthesize literature in a systematic, quantitative manner. It enables researchers to identify influential authors, institutions, and journals; to visualize the intellectual structure of a field;

and to understand how ideas and topics evolve across time. In the context of food security studies, bibliometric analysis can uncover dominant themes, emerging research fronts, and geographic patterns in scholarly production. This not only aids academics in positioning their research but also supports policymakers and funding agencies in prioritizing research agendas and interventions [13].

Despite the growing interest in bibliometric studies in various domains, comprehensive bibliometric evaluations specifically focusing on food security research through the lens of agricultural economics remain limited. Most prior analyses have focused either on food security in general, or on agriculture without linking it explicitly to economic perspectives [14], [15]. Thus, a focused bibliometric analysis that captures the development and trajectory of food security studies within agricultural economics is essential. This approach allows for a deeper understanding of how economic theories, models, and methodologies have shaped discourse and policy recommendations on food security.

Although the literature on food security is extensive and rapidly expanding, there is a lack of systematic synthesis that specifically maps how this body of research has evolved within the domain of agricultural economics. Consequently, there is limited clarity about the thematic focus, dominant research clusters, geographic spread, and key contributors in this subfield. Without such mapping, researchers and stakeholders may overlook valuable insights, duplicate efforts, or fail to identify pressing knowledge gaps and opportunities for cross-disciplinary collaboration. This study aims to conduct a comprehensive bibliometric analysis of global research on food security from the perspective of agricultural economics.

2. METHODS

This study employs a bibliometric analysis approach to systematically examine the development of food security research from the perspective of agricultural

economics. Bibliometric analysis is a quantitative method that uses publication metadata to uncover trends, influential authors, research networks, and thematic structures within a body of literature [13]. It is particularly useful for mapping the intellectual landscape of a research field, revealing how scholarly attention has evolved over time and identifying gaps or underexplored areas. This study focuses on articles, reviews, and conference papers published between 2000 and 2025, retrieved from the Scopus database, which is recognized for its wide coverage and robust citation indexing in the fields of social science and agriculture.

The search strategy was constructed using a combination of keywords relevant to food security and agricultural economics. The search query included terms such as: "food security" OR "food insecurity" AND "agricultural economics" OR "agriculture and economics" OR "economic perspective on agriculture". These keywords were applied to the article title, abstract, and keywords fields to ensure comprehensive coverage. The initial search returned a total of 27,945 documents. After applying inclusion criteria (peer-reviewed journal articles, English language, and subject relevance) and removing duplicates or irrelevant results, 977 documents were selected for analysis. The metadata, including author names, institutional affiliations, publication years, keywords, abstracts, source titles, and citations, were exported in BibTeX format for processing. The analysis using VOSviewer was conducted across three major dimensions: (1) Keyword co-occurrence analysis to identify dominant themes and topic clusters within the literature; (2) Co-authorship network analysis to explore collaborative relationships among researchers and countries; and (3) Citation analysis to determine the most influential articles and intellectual foundations of the field.

3. RESULTS AND DISCUSSION

Keyword Co-Occurrence Network

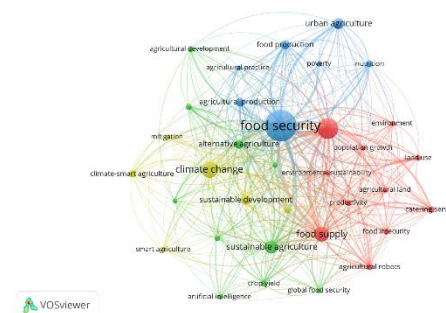


Figure 1. Network Visualization

Source: Data Analysis

The most prominent feature of the map is the large central node labeled "food security", indicating that this term is the dominant focus of the literature. Its central position and the high density of connections imply that food security serves as the conceptual and thematic core around which other related topics orbit. The strong linkages radiating outward from this node suggest that food security is deeply interconnected with various subtopics, including agricultural production, climate change, food supply, and sustainability. This confirms that food security is a highly interdisciplinary research domain, drawing from environmental science, economics, agricultural technology, and policy studies. The blue cluster (top side of the map) primarily represents research themes related to agricultural production, urban agriculture, poverty, and nutrition. These keywords reflect a body of literature that focuses on the role of agricultural output in ensuring household and national food security, particularly in urbanizing contexts. The presence of terms like urban agriculture and nutrition suggests that researchers are increasingly concerned with how to produce adequate and nutritious food within cities, especially in the face of growing urban poverty. This cluster aligns closely with socio-economic research in agricultural economics that explores access, equity, and food availability in rapidly changing urban environments.

On the right-hand side, the red cluster includes terms such as population growth, land use, environment, agricultural land, and

food insecurity. This grouping highlights research that examines external pressures on food systems, particularly from environmental degradation, land conversion, and demographic expansion. The prominence of population growth and land use as connected nodes reflects a growing concern in the literature about how limited agricultural land and environmental constraints are undermining long-term food security. These studies often intersect with agricultural economics by evaluating land-use efficiency, policy incentives for land conservation, and the economics of environmental sustainability. The green cluster in the lower left contains keywords such as climate change, sustainable development, climate-smart agriculture, mitigation, smart agriculture, and crop yield. This cluster represents the integration of climate change adaptation and sustainability frameworks into food security studies. The inclusion of climate-smart agriculture and artificial intelligence indicates that recent research trends emphasize technological innovations and adaptive strategies for ensuring food security under climate uncertainty. From an agricultural economics perspective, this reflects a shift toward cost-benefit analyses of innovation adoption, productivity optimization under climate stress, and sustainability transitions in agricultural systems.

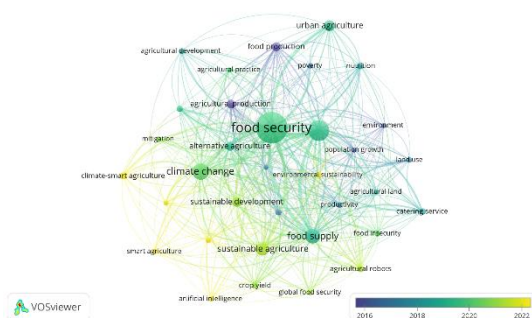


Figure 2. Overlay Visualization

Source: Data Analysis

The central and most consistently researched theme remains “food security”, depicted in a greenish tone, indicating sustained scholarly attention around the 2019–2021 period. Closely linked terms such as food production, agricultural production,

climate change, and sustainable development also share similar hues, suggesting that they have been stable focal points throughout the late 2010s into the early 2020s. These core nodes reflect enduring concerns within agricultural economics, particularly the intersection of food access, environmental challenges, and development policies. The strong co-linkages among these terms also highlight an integrated and maturing discourse. More recent research directions are evident in the yellow-colored terms, such as smart agriculture, climate-smart agriculture, artificial intelligence, sustainable agriculture, and crop yield. These keywords signal an increasing interest in technological and innovation-driven solutions to enhance food security. Their emergence in the 2021–2022 timeframe points to a shift toward precision agriculture, automation, and digital transformation in agricultural practices. This aligns with global movements toward climate adaptation, efficiency, and sustainability in response to escalating food system vulnerabilities and environmental stress.

On the other hand, keywords with darker tones (blue to purple) such as poverty, nutrition, urban agriculture, and environment represent areas that were more prominent in the pre-2018 period. These terms suggest that earlier research was heavily concerned with socio-economic access to food, nutritional outcomes, and urban food strategies. While these topics remain important, their relatively lower recency implies either saturation in scholarship or a shift in focus toward more technical, systemic, and innovation-oriented approaches in recent years. This evolution reflects how food security studies within agricultural economics have expanded from social and environmental diagnosis to solution-oriented technological paradigms.

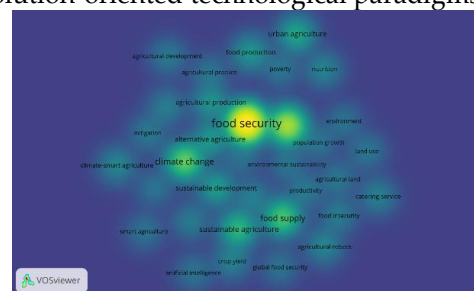


Figure 3. Density Visualization

Source: Data Analysis

The density map reveals "food security" as the most central and intensely studied keyword, indicated by the bright yellow hotspot at the center of the visualization. This shows that it serves as the nucleus of scholarly discourse in this domain. Surrounding it, keywords such as agricultural production, climate change, alternative agriculture, and sustainable development appear in lighter green shades, signaling high but slightly less concentrated research attention. These closely linked terms suggest that discussions of food security are tightly coupled with environmental factors, production systems, and the broader sustainability agenda, common focal points in agricultural economics research. In contrast, peripheral keywords such as smart agriculture, artificial intelligence, catering service, and agricultural robots appear in darker blue areas, signifying lower research density or emerging topics. While these terms are gaining traction, they have not yet reached the core of the scholarly conversation. This spatial and color gradient suggests that although foundational concerns like productivity, land use, and climate change dominate the field, there is growing exploration into innovation-driven and technological approaches.

Co-Authorship Analysis



Figure 4. Author Visualization

Source: Data Analysis

Figure 4 above illustrates the collaborative landscape among key authors in the field of food security research within the scope of agricultural economics. The map reveals two distinct clusters of scholars with limited interconnectivity, indicating that collaborative research is often concentrated

within specific author groups. On the left, Campbell and Barrett form a red cluster, showing a strong co-authorship tie, while on the right, a green cluster includes David J., Badgley, and Crush, who are closely linked, suggesting frequent collaboration. The single light green edge connecting Barrett and David J. implies a weak or occasional connection between these two research groups. The presence of segmented author clusters highlights a degree of fragmentation in the literature, suggesting opportunities for more integrated, cross-group collaboration to strengthen knowledge exchange and diversify perspectives within the field.

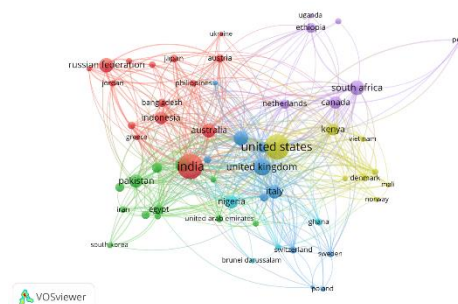


Figure 5. Country Visualization

Source: Data Analysis

Figure 5 visualizes country-level co-authorship networks in food security research within agricultural economics, revealing a complex and globally interconnected scholarly landscape. The United States occupies the central position with the largest node size and the highest number of co-authorship links, indicating its pivotal role as a global hub for research collaboration. Other major contributors include India, the United Kingdom, and South Africa, each forming dense clusters of cooperation with both regional and international partners. The red cluster represents strong collaboration among Asian countries such as India, Indonesia, Bangladesh, and Russia, while the blue and yellow clusters highlight transatlantic partnerships involving European nations like Italy, the Netherlands, and the UK, often linking to African collaborators such as Kenya, Nigeria, and Ghana. Notably, countries like South Africa, Ethiopia, and Peru form a separate purple cluster, suggesting regionally concentrated research

activity, possibly reflecting localized food security concerns.

Citation Analysis

Table 1. Top Cited Literature

Citation	Author	Title
1386	[16]	Climate-smart agriculture for food security
1112	[17]	Precision agriculture and food security
941	[18]	Soil and the intensification of agriculture for global food security
733	[19]	Agriculture, pesticides, food security and food safety
590	[5]	The role of agriculture in ensuring food security in developing countries: Considerations in the context of the problem of sustainable food production
571	[20]	Urban agriculture, poverty, and food security: Empirical evidence from a sample of developing countries
531	[21]	Nano-enabled pesticides for sustainable agriculture and global food security
504	[22]	Water for agriculture: Maintaining food security under growing scarcity
492	[23]	Soil salinity under climate change: Challenges for sustainable agriculture and food security
459	[24]	Evergreen Agriculture: A robust approach to sustainable food security in Africa

Source: Scopus Database

Practical Implications

The findings of this bibliometric study offer several important practical implications for policymakers, development agencies, agricultural stakeholders, and food system practitioners. First, the centrality of themes such as food security, climate change, and agricultural production emphasizes the need for integrated policy frameworks that link environmental sustainability with food availability and agricultural resilience. Governments can use these insights to prioritize resource allocation toward climate-smart agriculture, rural development, and food system innovation. Moreover, the recent emergence of topics like artificial intelligence and smart agriculture highlights the growing relevance of digital technologies and data-driven decision-making in improving productivity, monitoring supply chains, and reducing food waste. Institutions working on food policy can leverage this trend to design digital literacy programs and promote tech adoption among farmers, especially in developing countries.

Theoretical Contributions

This study contributes to the theoretical advancement of food security research in agricultural economics by mapping the evolution, intellectual structure,

and thematic diversity of the field. Through co-occurrence, overlay, and density visualization, the study confirms that food security has evolved from a production-centric paradigm toward a multidimensional and interdisciplinary construct. It also provides empirical evidence of how research clusters have shifted from foundational themes like poverty and nutrition to more contemporary concerns such as sustainability, technology, and climate resilience. Theoretically, this analysis enriches agricultural economics by integrating systems thinking and innovation diffusion frameworks, demonstrating that food security is not solely a function of output levels, but also shaped by institutional, environmental, and technological contexts. The mapping further supports the relevance of cross-disciplinary approaches, merging economic theory with sustainability science and digital transformation literature.

Limitations

While this bibliometric analysis offers valuable insights, several limitations must be acknowledged. First, the study relied exclusively on the Scopus database, which, despite its breadth, may not capture relevant literature indexed in other platforms such as Web of Science or regional databases. Second,

the analysis was limited to documents published in English, potentially excluding important contributions from non-English-speaking regions where food insecurity is most severe. Third, although VOSviewer effectively visualizes co-occurrence and temporal trends, it does not analyze full-text content, limiting the ability to capture nuanced arguments, methodologies, or theoretical debates within individual papers. Finally, the interpretation of keyword clusters is influenced by researcher judgment, and while efforts were made to ensure accuracy, subjectivity cannot be entirely eliminated. Future research could combine bibliometrics with qualitative content analysis to deepen insights into specific subfields or regional dynamics within food security discourse.

4. CONCLUSION

Based on the comprehensive bibliometric analysis of food security research from the perspective of agricultural economics, this study concludes that the field

has evolved into a highly interdisciplinary and globally collaborative domain. The central focus on “food security” is consistently reinforced by interconnected themes such as agricultural production, climate change, sustainability, and emerging technologies like smart agriculture and artificial intelligence. Temporal and density visualizations reveal a shift from foundational socio-economic concerns (like poverty and nutrition) toward solution-oriented and innovation-driven approaches in recent years. Key authors and countries show clustered yet influential contributions, with the United States, India, and the United Kingdom emerging as pivotal hubs of collaboration. However, the fragmented co-authorship structure suggests room for deeper integration across research communities. This study not only maps the intellectual structure of the domain but also identifies future research directions that combine economic theory, sustainability science, and digital transformation to address complex food system challenges.

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