"Governmental approaches to food security management: A bibliometric analysis"

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BUSINESS PERSPECTIVES

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GOVERNMENTAL APPROACHES TO FOOD SECURITY MANAGEMENT: A BIBLIOMETRIC ANALYSIS

Abstract

The government's duty is to guarantee unimpeded access to food. Thus, relevant public policies, individual methods and tools, approaches, and strategic decisions are always the focus of attention of scientists, politicians, and government officials. Recognizing the critical importance of this imperative, this study aims to conduct a bibliometric analysis that sheds light on the scientific landscape of strategic public administration of food security. The paper conducts a bibliometric analysis of scientific publications (using VosViewer – from 1990 to February 2024 using Scopus and WoS scientometric databases); monographs/textbooks (using Google Books and Ngram Viewer – for 1990–2019); and trend analysis (using Google Trends – from 2004 to February 2024).

The analysis showed an exponential increase in the number of publications since 2000, with peaks in 2008 (financial crisis), 2019–2020 (COVID-19), and 2023 (threat to food security due to military conflicts). The clustering of scientific papers by content showed that the most significant (red) cluster unites research that links food security to agricultural development, sustainable development, climate change, and water supply. The spatial clustering of scientific publications revealed that scientific leadership belongs to scientists from the United States and China. The largest research funders are Chinese scientific institutions. It also reflected regional differences in research focus. In particular, Italy, Switzerland, and France emphasize agricultural innovation and quality standards, while China and Australia focus on increasing yields and food storage technologies.

Keywords   government, bibliometric analysis, governance, agricultural policy, food policy, sustainability, strategies, public sector

JEL Classification   Q18, Q56

INTRODUCTION

Ensuring food security is a critical global issue, particularly amid escalating challenges such as climate change, soil degradation, population growth, as well as unequal access to resources, pandemics, and humanitarian crises caused by military conflicts. According to the World Health Organization (WHO) and the Food and Agriculture Organization of the United Nations (FAO), approximately 9% of the world's population suffers from significant hunger, while over 25% live with insufficient income and food insecurity (Richardson, 2023). The consequences of food insecurity are profound, including social unrest, mass migration, and increased poverty. Furthermore, the growing frequency and severity of natural disasters, such as droughts and floods, highlight the urgent need for effective food security management to ensure societal stability and resilience.

Addressing these challenges requires robust governmental intervention and coordinated efforts. Governments are pivotal in formulating and implementing policies to secure food availability and accessibility.

Their strategies encompass various measures, from agricultural subsidies and trade policies to social protection systems and nutrition programs. Effective governance is essential to harmonize these efforts and ensure fair distribution of food resources.

However, managing food security presents significant difficulties, including the scarcity of balanced and objective data necessary for analyzing the efficacy of different policies and programs. This data gap complicates the evaluation, decision-making, and implementation processes. Additionally, the absence of a comprehensive monitoring and evaluation system hampers the ability to track outcomes and adjust strategies based on empirical evidence.

In this context, bibliometric analysis emerges as a valuable tool. By systematically examining existing research on food security, bibliometric analysis can identify and evaluate the most effective approaches. This method not only aids in improving the management of food security at various levels, from local to global, but also highlights areas requiring further investigation. Consequently, bibliometric analysis can guide the prioritization of research and practical efforts, ultimately enhancing the overall effectiveness of food security management.

1. LITERATURE REVIEW

Food security emerges as a critical global concern, drawing the focus of scientific communities, governmental bodies, and international entities. This collective attention is underscored by the abundance of literature addressing the multifaceted issues surrounding food security. For example, Aiyedogbon et al. (2022) and Guliyev (2017) focus on geographical aspects, analyzing the availability of food resources in different regions and the impact of globalization on this access. Dubanych et al. (2023), Orlov et al. (2021), and Atashov (2005) examine the economic and political factors that affect food security, including the role of the state and international organizations in ensuring it. Another vital area of research is the analysis of social aspects, including vulnerable groups and social justice in access to food resources (Weiler et al., 2015; Slade & Carter, 2017; Garcia & Wanner, 2017; Didenko et al., 2020, 2021).

Given the rapid development of digital technologies, it is important to note their significant role in improving food security. Digital innovations are essential in the entire food production and supply chain, from agricultural production to retail sales. Torero (2021) and Litvinova (2022) investigated the impact of digital technologies on various aspects of agriculture and food security. They analyze different types of digital innovations, such as monitoring systems, automated management systems, and digital marketing and product tracking platforms.

Bakharev et al. (2023) explore the role of digital innovations in improving food security. The authors analyze the benefits and challenges of introducing digital technologies in the food industry and highlight potential obstacles and ways to overcome them. They also conclude the importance of integrating digital innovations into modern food supply systems to ensure food safety and quality.

One of the critical aspects of research in this area is the analysis of the role of governments in ensuring food security and the effectiveness of their strategies. Plastun et al. (2021) and Pakhnenko and Kuan (2023) focused on the study of various aspects of public governance of food security, including political, economic, legal, and social aspects. Santeramo and Lamonaca (2021) analyzed the role of public programs and policies in ensuring access to food, determined their impact on food security, and identified gaps in the effectiveness of such programs. Abdallah et al. (2021) focused on the effectiveness of regulatory mechanisms, such as price policies, subsidies, and tariffs on food imports, in ensuring price stability and reducing food crises.

Another important research topic is the study of governments' responses to food crises, such as droughts, floods, epidemics, and conflicts, and the identification of effective strategies and management measures to prevent and overcome the consequences of such crises. In particular, the COVID-19 pandemic has brought new challenges to global food security, as elucidated by AlNemer

(2023). The study underscores the urgent need to address the pandemic's implications on food systems and the vulnerabilities it exposes, emphasizing the importance of resilience and adaptation in food security management. Zhuravka et al. (2023) study food security in the context of military conflict.

In addition, Smyth et al. (2016), Frankenberger and Constas (2014), Guo et al. (2011), Singh and Pandey (2023) analyze the role of international organizations in supporting food security and working with governments to implement management strategies. The World Food and Agriculture Organization (FAO), the World Bank, and the Institute for Food Policy and Research (IFPRI) are vital in providing expertise, policy development, and funding for food security projects.

Mentel et al. (2020) and Jägermeyr et al. (2017) explore the role of civil society and non-profit organizations in ensuring food security. These organizations are active at the local and global levels, collaborating with governments and other stakeholders to implement projects to develop and support agricultural and food systems.

Bibliometric analysis in the field of food security plays an essential role in scientific research, providing a systematic view of the development of this field. One of the main aspects of bibliometric analysis is identifying advanced thematic research areas. This analysis helps identify key topics and issues addressed in scientific publications and determine their development over time. For example, the scientific community is actively researching topics related to increasing yields, fighting foodborne diseases, or the impact of climate change on crop productivity.

In particular, the literature on food security management encompasses a diverse array of studies that provide insights into various aspects of global food security. R. Ohlan and A. Ohlan (2023) conducted a bibliometric analysis to assess scholarly research in food security, revealing the breadth of interest and research activity in this domain.

A bibliometric analysis of blockchain technology in the agri-food sector, offering potential avenues for enhancing food security through technological innovation, is conducted by Sugandh et al. (2023). Their study underscores the role of emerging technologies in transforming food systems and improving efficiency and transparency in food supply chains.

Despite the large number of studies on food security management, there is a noticeable gap in the scientific discourse, particularly the lack of a comprehensive meta-analysis that would outline strategic food security management. This gap is significant given the critical role of government interventions in shaping and protecting food security paradigms in national contexts. Furthermore, strategic food security governance emerges as a multifaceted and dynamic field, constantly evolving and closely intertwined with socioeconomic, political, and environmental dynamics.

Therefore, this study aims to explore strategic food security governance by comprehensively analyzing governmental approaches to identify key ideas, methodologies, and emerging trends in addressing challenges and implementing best practices in this critical area.

2. METHODS

The study is based on a sample of scientific publications obtained from the Scopus and Web of Science bibliometric databases.

The meta-analysis of research on public administration of food security began in 1990, as this period is marked by significant global political and economic changes that have influenced the development of approaches to food security. Also, starting from this period publications have been appearing on approaches to public administration of food security in scientometric databases.

Table 1 presents a description of each method, the specifics of their use for the current study, and the periods available for each tool.

The following search queries were used to conduct an in-depth meta-analysis as part of the research:

- "Food security AND Management";

- "Food security AND Management AND Government approaches";

Table 1. Main methodological tools and their use in the current study

Instrument	Specific use in the current study	Period
In-built Scopus instruments by Elsevier and In-built WoS instruments by Clarivate Analytics	Quantitative evaluation and comprehensive analysis of the evolution of research in the field of food security management and its governmental approaches based on publications obtained from Scopus and WoS databases	from 1990 to February 2024
VosViewer software	Contextual, evolutionary, and spatial clustering and creation of bibliometric maps, visualizing relationships, trends, and chronological patterns	from 1990 to February 2024
Google Trends and Ngram Viewer	Internet queries and trends related to food security management	from 1990 to February 2024 (Google Trends)
Ngram Viewer	Studying the frequency of use of food security management terms in printed texts from Google Books	from 1990 to February 2019 (Ngram Viewer)
General scientific research methods: analysis, synthesis, logical generalization, and comparative analysis	Investigation of theoretical aspects of strategic food security management. Comprehensive understanding of the complexities of food security management	from 1990 to February 2024

- "Food security AND Management AND Strategic interventions "

- "Food supply Chain AND Security";

- "Nutritional security";

- "Food sovereignty";

- "Emergency food aid";

- "Climate change AND Food Security".

These search queries were formulated using the AND logical operator to ensure the relevance and accuracy of the publications retrieved.

3. RESULTS AND DISCUSSION

Meta-analysis begins with analyzing the dynamics and quantity of publications retrieved using various search terms related to food security management. This comprehensive overview enables informed decision-making regarding resource allocation, research focus, and policy formulation, ultimately contributing to more targeted and impactful strategies for addressing challenges in food security management.

Figure 1 shows statistics on the number of scientific publications and their total citations from 1990 to February 2024. This information was obtained by searching the in-built tools of the Scopus and WoS databases using selected search queries.

Analyzing the data in Figure 1, the following conclusions can be formulated:

- the topics with the highest number of publications and citations, such as "food security management" and "nutritional security," are central to food security research. This can be explained by their general relevance and importance for global health and development;

- publications identified by the search query "food security management AND government approaches" are characterized by a significant number of citations, which indicates a great interest in the role of government strategies in ensuring food security. This may be due to increased attention to the political aspects of food security management;

- research on strategic interventions in the field of food security, although less published and cited, is of considerable importance for the development of effective risk and crisis management strategies;

- a large number of publications filtered by the search terms "food supply chain security" and "sustainable agriculture" demonstrate a great interest in the aspects of sustainability and efficiency of food systems. This reflects a general movement in the scientific community toward more sustainable and ecologically balanced food systems.
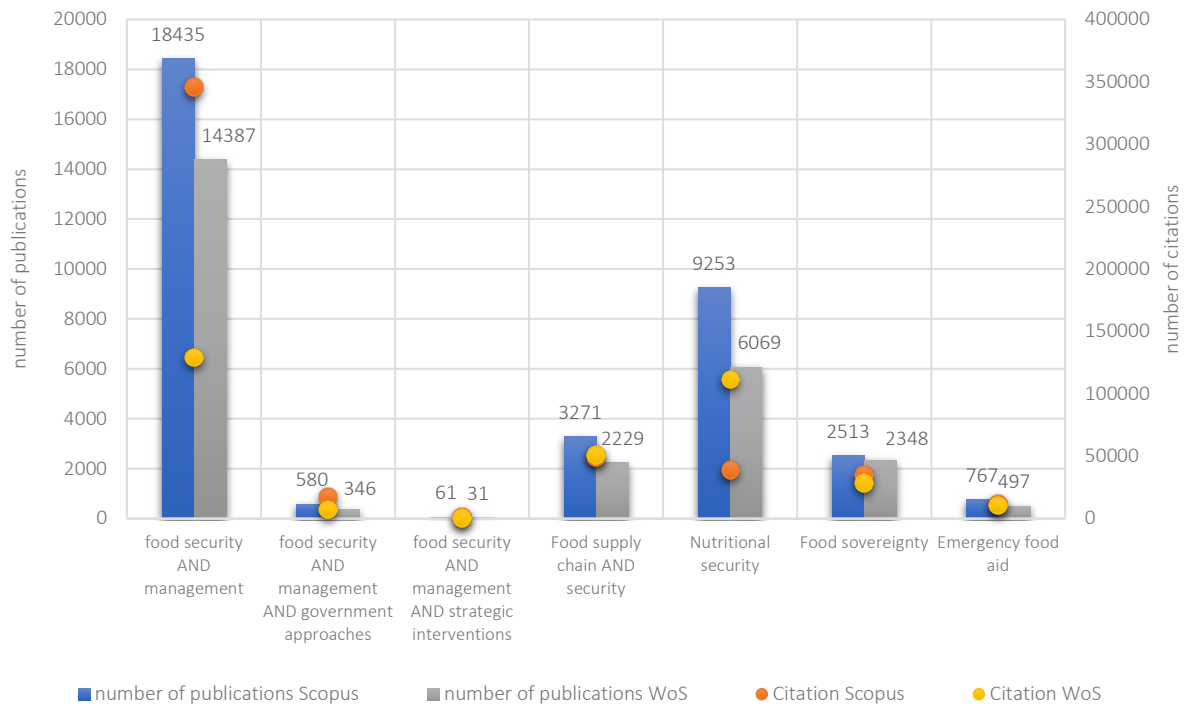
Further research in food security focuses on two search queries: "food security management" and

Figure 1. Statistical analysis of scientific publications on government approaches in food security management

"food security management AND government". This is justified by the fact that the search query "food security management" was the most popular among scientific publications and had the most significant number of citations in both the Scopus and WoS databases. In addition, it covers a wide range of aspects of food security management, including governmental approaches, strategic interventions, food supply systems, food policy, sustainable agriculture, and other key aspects. This focus will increase the concentration of research in this area and deepen the understanding of the importance of strategic food security management in the modern world. And the search query "food security management AND government" will be used as an additional one to more accurately identify publications on government approaches to food security management and provision.

Thus, the next stage of the meta-analysis for the selected search queries is to analyze the dynamics of publications to identify trends in developing research on strategic food security management. Figures 2 and 3 show the dynamics of scientific publications on the search query "food security management" in the Scopus and WoS databases.

Figures 2 and 3 show that the number of scientific publications on the topic "food security management" in both databases is growing yearly. This indicates the active interest of the scientific community in this topic. After 2000, there has been an exponential increase in scientific publications, which indicates a growing interest in food security and its management in the academic community. Some years, such as 2019 and 2020, show particularly high growth rates of scientific publications, which may be due to the increased interest in food security in the context of global challenges such as the COVID-19 pandemic. The peak of publications in 2023 may be due to the still unresolved problems caused by the COVID-19 pandemic, Russia's full-scale invasion of Ukraine, the Israeli-Palestinian conflict, and other armed and political conflicts that have arisen in the world and led to the actualization of the food security problem. In addition, other possible factors include climate change, natural disasters, socio-economic crises, and geopolitical tensions that have affected the availability, stability, and quality of food and have prompted researchers to study strategic food security management actively. In general, the dynamics of scientific publications by the search term "food security management AND government"
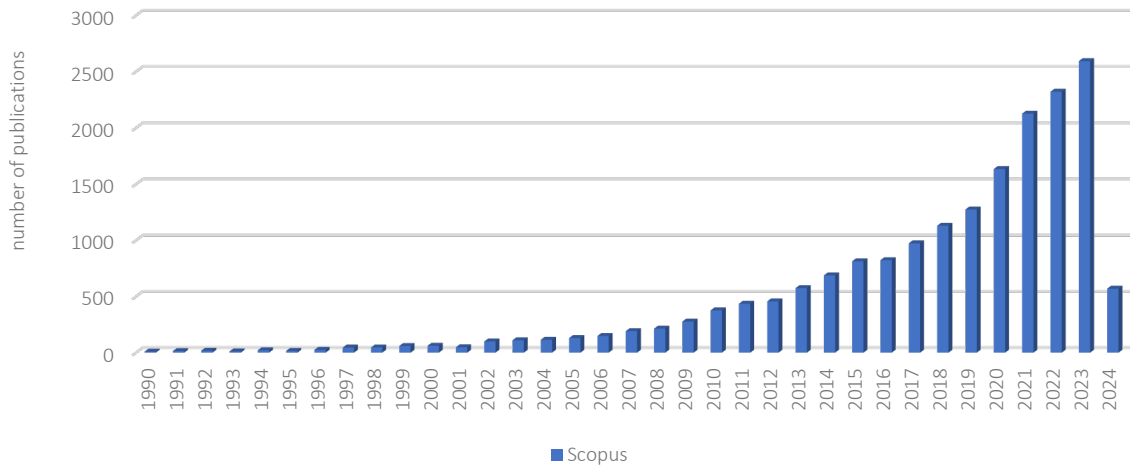
Figure 2. Dynamics of published articles in the Scopus database, from 1990 to February 2024, number of articles
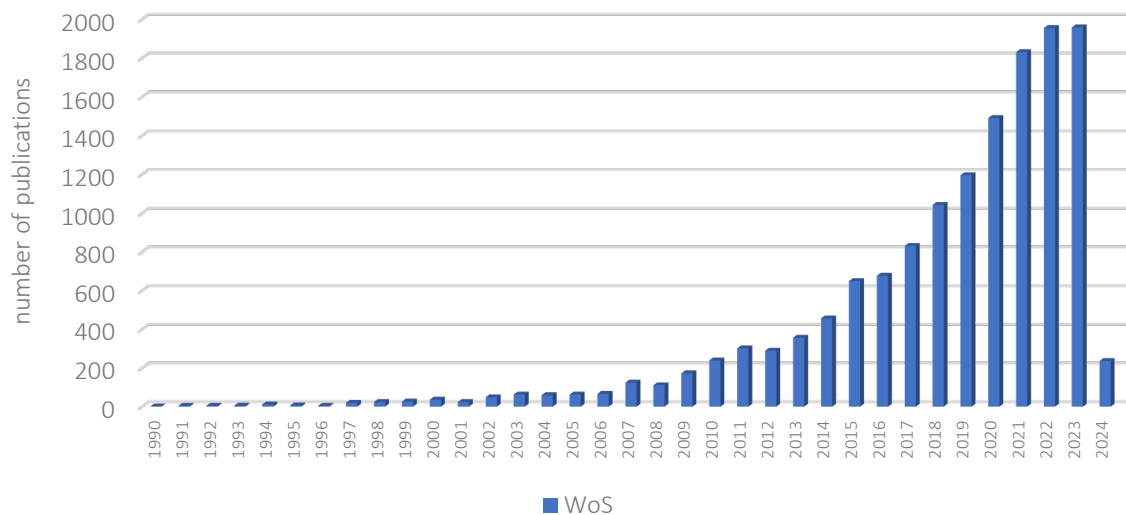
Figure 3. Dynamics of published articles in the WoS database, from 1990 to February 2024, number of articles

in the Scopus and WoS databases have identical dynamics.

Continuing the dynamic analysis of scientific publications using these terms, a study was conducted on Google Trends (Figures 4 and 5). This analysis identified trends and popularity of the searched terms in the general public, as well as possible connections between academic and practical interests. The analysis can complement and expand the knowledge of how strategic food security governance is perceived and discussed and the impact of governmental measures on this process in the broader public domain.

Figures 4 and 5 show a rather similar trend of increasing interest in food security manage-

ment and the role of the government in this regard since 2004. However, an interesting point is the peak of searches for the term "food security AND management" at the end of 2005 and the highest value for the query "food security management AND government" in 2008. In 2005, the peak of interest may be related to significant global events, such as food supply disruptions due to natural disasters or conflicts, which drew the attention of the public and scholars to food security issues.

In 2008, the peak of interest can be attributed to the global financial crisis, which increased attention to the role of governments in ensuring food security and responding to food crises.
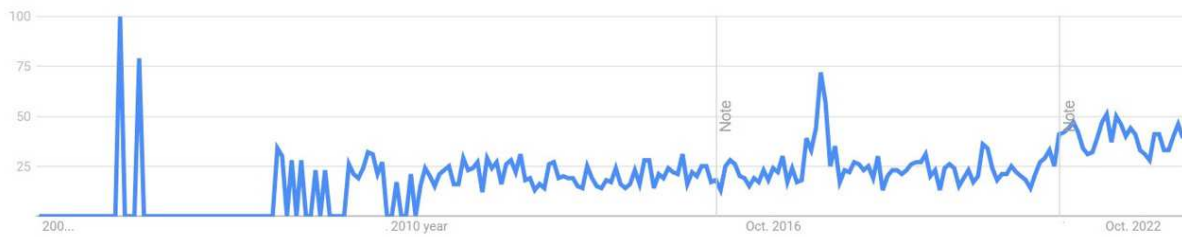
Figure 4. Google Trends results of Internet users' queries about "food security AND management" worldwide for 2004 – February 2024
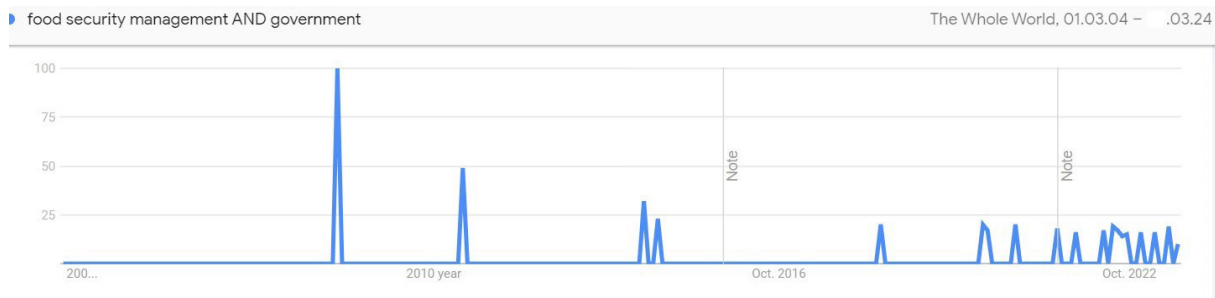
Figure 5. Google Trends results of Internet users' queries about "food security AND management AND government" worldwide for 2004 – February 2024

The term "food security AND management" (Figure 6) in the Books Ngram Viewer (a tool that analyzes the frequency of use of words or phrases in texts stored in the Google Books database) reflects a similar trend to that shown in Figures 2 and 3.

However, it should be noted that the data in the Books Ngram Viewer are available only until 2019, so one cannot entirely rely on this information representativeness, especially since 2019, there has been an intensification of interest in food security issues, due to several global and regional events or trends. Notably, the term "food security

AND governance AND government" is not in the Google Books database.

After the dynamic analysis, it is essential to move on to the sectoral analysis to gain a deeper understanding of the context and specifics of the problem (Figure 7).

Figure 7 highlights significant research contributions from agriculture and biological sciences (21%) and ecology (21%) in food security management. At the same time, a smaller number of publications in the fields of computer science, bio-
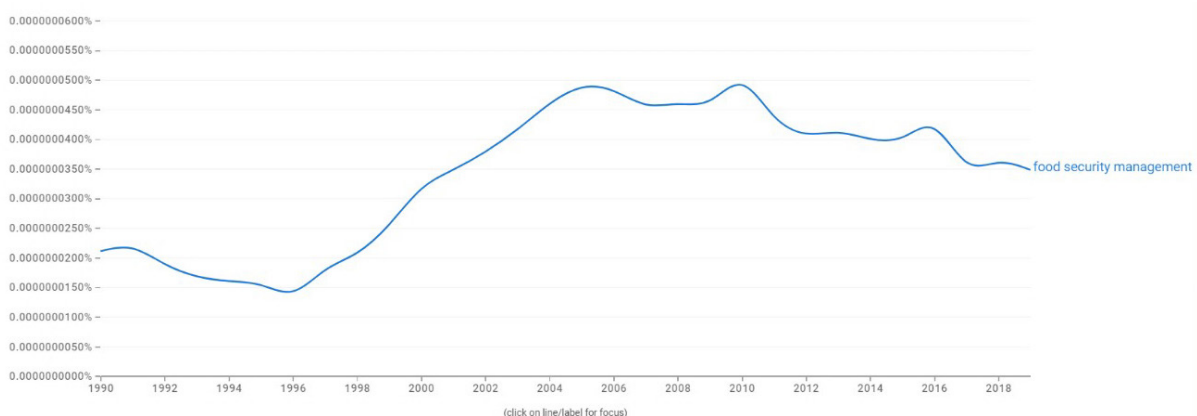
Figure 6. Summary of the frequency of use of the term "food security management" in the Books Ngram Viewer, globally, 1990–2019
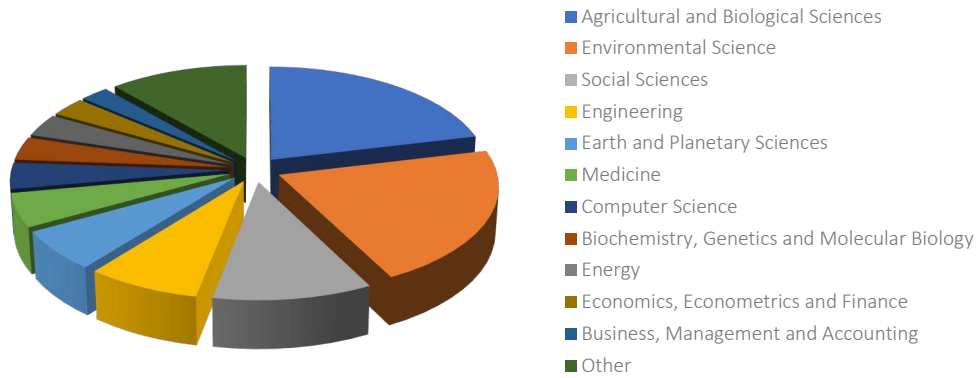
Figure 7. Structural analysis of research on food security management by subject areas

chemistry, genetics, molecular biology, etc. may indicate the need for further research in these areas to expand the understanding of the problem of food security management and provision.

The next stage of the bibliometric analysis is to consider the geographical distribution of scientific publications on food security (in the context of the search query "food security management").

This approach allows for a deeper understanding of the food security problem's geographical aspect and helps identify prospects for further research in this area. Figures 8 and 9 show the distribution of the number of publications within countries.

Based on a statistical analysis of the number of publications on food security within countries, it was found that the United States has the most sig-
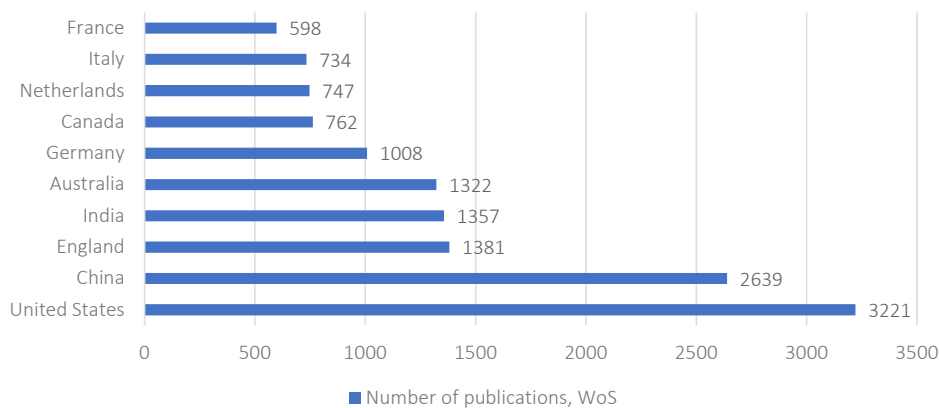
Figure 8. Number of scientific publications on food security management
in the WoS database by country
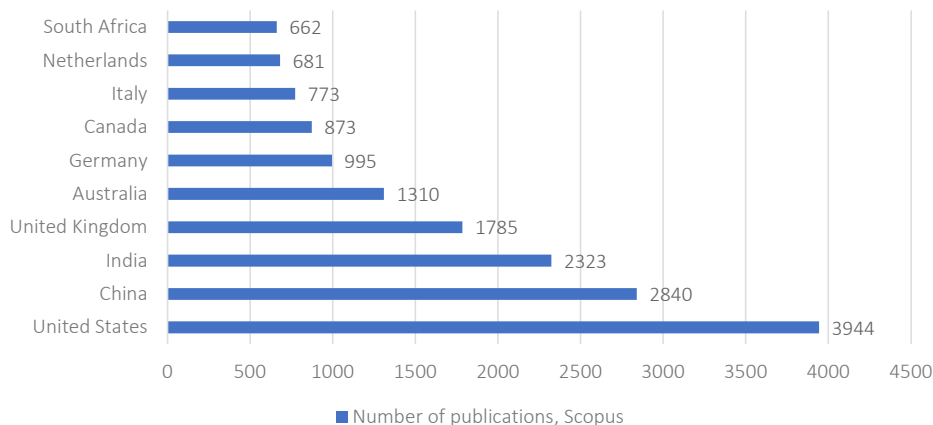
Figure 9. Number of scientific publications on food security management
in the Scopus database by country

nificant number of scientific publications in both data sources (WoS – 3,221 publications, Scopus – 3,944), which indicates its leadership position in the study of strategic food security management. China, India, and Australia are also highly ranked in both data sources, which may be due to their large populations and significant agricultural sectors. Increased research activity in developing countries, such as India, China, and South Africa, may indicate a growing focus on food security in these regions. A significant number of publications in several European countries, such as England, Germany, and Italy, is due to the high scientific potential and interest in food security issues.

Also, considering the geographical distribution of scientific publications on food security governance between countries, it is important to study which organizations or foundations fund research in this area. Such analysis contributes to developing a more objective and balanced management

strategy, which is key to national security and the well-being of citizens.

Figures 10 and 11 demonstrate that government agencies and foundations in different countries are investing significant resources in funding research on food security governance. In particular, the allocation of funds by Chinese institutions, such as the Chinese Academy of Sciences, the Chinese Agricultural University, and the Chinese Ministry of Education and Ministry of Agriculture, indicates the high priority of this issue for the Chinese government. At the same time, foundations and organizations from the United States, the European Union, and India also play an important role in funding food security research, demonstrating the global nature of this problem and the need for joint efforts to address it.

The analysis of affiliations of scientific publications also indicates the leading positions of China

Figure 10. Organizations funding scientific research on food security management in Scopus
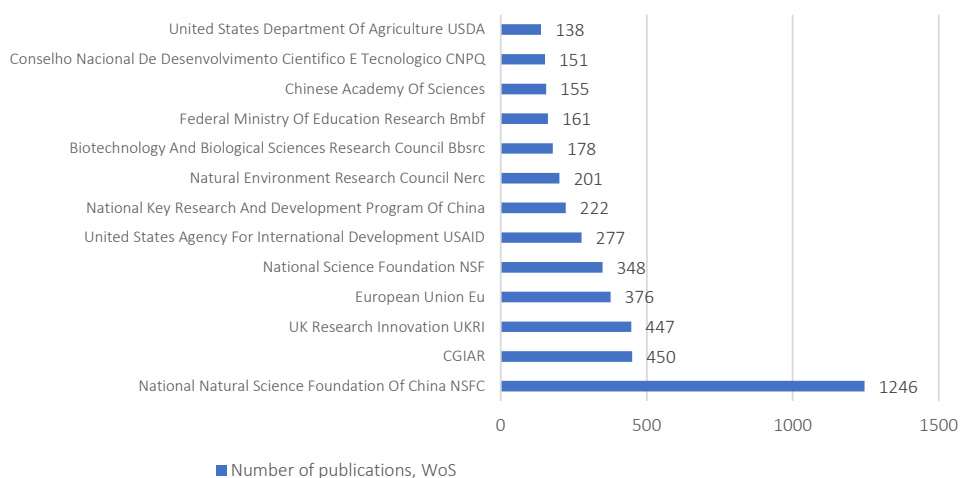
Figure 11. Organizations funding scientific research on food security management in WoS
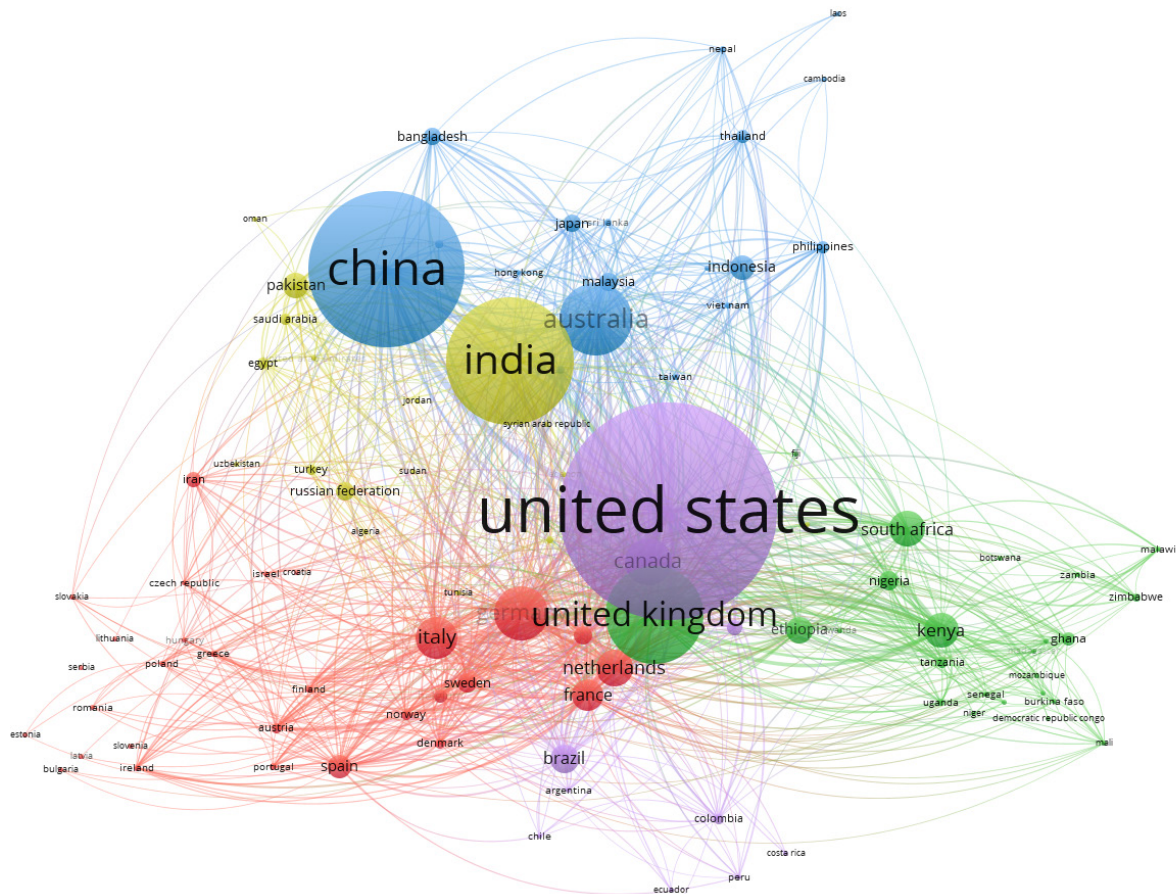
Figure 12. Spatial clustering of research on food security governance

(primarily the Chinese Academy of Sciences) and the United States in implementing research on strategic food security management.

In addition, a significant number of publications affiliated with universities and research institutions from the Netherlands, India, and Indonesia indicate the active development of international scientific cooperation in the field of food security. Government organizations, such as the Ministry of Education of the People's Republic of China and the Indian Council of Agriculture, are actively involved in forming the scientific base on food security. This indicates the significant attention of government agencies to this problem. For this reason, exploring the linkages between countries becomes an integral part of the next stage of the meta-analysis. Figure 12 shows the bibliometric map of scientific publications by territorial affiliation.

Based on the results of the spatial clustering (based on the bibliometric map), five clusters were identified, shown in Figure 12 in blue, purple, red, yellow, and green. In particular, cluster 1 (red) includes countries such as Italy, Switzerland, France, Spain, the Netherlands, Austria, Finland, Germany, Sweden, etc. These countries are known for their high-quality standards and innovative approach to agriculture and food. Research conducted in these countries often focuses on the introduction of the latest technologies in agriculture, the creation of effective management systems, and ensuring food quality.

The second cluster (blue) covers countries such as China, Australia, Indonesia, Japan, the Philippines, Bangladesh, Malaysia, etc. These countries have large populations and high levels of food imports. This geographical distribution may be due to the need for large quantities of food for local consumption and export. Research in these countries usually aims to develop agriculture, increase yields, and develop food storage and processing technologies.

The third cluster (green) includes countries such as South Africa, Kenya, the UK, etc. In these countries, research is usually focused on the development of sustainable agriculture, biodiversity conservation, and climate change. Research in these countries often focuses on developing agroecological cultivation methods, reducing the environmental impact of agricultural activities, and supporting small farmers. This geographical distribution may be due to specific climatic and geographical conditions, as well as the political priorities of each country.

The fourth cluster (yellow) consists of countries such as Turkey, Pakistan, Egypt, Russia, Ukraine, Czech Republic, Jordan, etc. In these countries, research is usually focused on issues related to food security in the face of complex political and economic conditions. The effectiveness of state support programs for agriculture is studied, and strategies for ensuring food security in conflict and crisis areas are developed.

The fifth cluster (purple) consists of countries such as the United States, Canada, Argentina, Colombia, Chile, and others. These countries have large volumes of agricultural production and food exports. This geographical distribution is due to their significant agricultural potential and large food markets, which affects the intensity of food security research. In these countries, the efficiency of agricultural systems and problems related to food storage and transportation are studied, and strategies for ensuring food security for domestic and foreign markets are developed.

Also, by analyzing the distribution of scientific publications by territorial affiliation and time (Figure 13), the following patterns can be identified:

- earlier research before 2017: during this period, the leading research centers are, in general, countries with developed scientific infrastructures and high levels of economic development, such as the United States, the United Kingdom, the Netherlands, Japan, the Philippines, etc. The high activity of scientists in these countries is explained by their leadership in science and research, as well as the existence of problems in the field of food security that required the study and development of management strategies;

- 2017–2018: during this period, research activity began to spread to other countries, such as Austria, Australia, Italy, Germany, Belgium, Colombia, Denmark, and Romania. The interest of these countries may be related to the increased attention to food security issues in the context of global challenges such as climate change and demographic change;

- 2019–2020: during this period, countries such as Greece, Finland, Taiwan, Vietnam, Ireland, Bulgaria, and Spain became new active participants. This may be due to the growing awareness of the importance of food security in these countries and the development of their own management strategies in this area;

- after 2020: an increase in research activity in countries such as Pakistan, Egypt, Iran, Saudi Arabia, Slovakia, Bangladesh, etc., may be due to global trends, such as the COVID-19 pandemic, which has emphasized the importance of food security, as well as the growing awareness and need for joint efforts to ensure food security in the face of global challenges.

The most crucial stage of the meta-analysis is the analysis of the distribution of scientific publications by keywords or terms and authors (i.e., the contextual analysis). Clustering of "co-occurrence" by "keywords" allows identifying the main aspects and priorities in food security governance research, which are revealed through their frequent correlation in scientific publications.

To create a bibliometric map (Figure 14), bibliographic data from 5,206 scientific articles selected by the search queries "food security management" and "food security management AND public administration" were used, structured by their relevance.

Notably, the larger diameter of the circle in the figure indicates a higher frequency of mentioning the relevant concept as a keyword in combination with the concepts of "food security management" and "food security management AND government."

Figure 13. Spatial and temporal components of bibliometric analysis

As a result of the analysis, 998 units of objects (analyzed keywords) were used, which formed:

- five clusters;

- 88,003 connections (in this type of analysis, this is the joint occurrence of keywords);

- 175,074 of the total strength of connections (in this type of analysis, this is the number of publications in which two terms are used together).

Within the identified clusters, the largest significant red cluster can be identified. Research in this cluster covers critical topics such as food security, agricultural development, sustainable development, food supply, crop production, climate change, agricultural productivity, and water supply. Research focuses on finding effective and sustainable approaches to food security in the face of climate change and limited resources. Researchers also investigate the economic aspects of agriculture, water use, and decision-making in the context of adaptive management.

A particular group of scientific publications within the first cluster are those devoted to ensuring food security in the context of achieving sustainable development.

The interplay between food security and sustainable development has garnered significant attention in recent years as global challenges such as climate change, population growth, and environmental degradation continue to threaten food production and access (Mills et al., 2018; Jägermeyr et al., 2017; Kuzior et al., 2021; Tu at al., 2023; Wang et al., 2023).

The crucial importance of governance practices for achieving the SDGs related to food security, climate change, and biodiversity conservation is emphasized by Jägermeyr et al. (2017) and Lal et al. (2021).

Yerankin et al. (2023) explored the formation of national food security indicators, highlighting the importance of assessing and monitoring food security metrics for sustainable development.

Figure 14. Cluster analysis of scientific publications on the topic of food security management

Agarwal (2018) and Wołowiec et al. (2022) explored the nexus between gender equality, food security, and the SDGs, highlighting the significance of empowering women in agricultural decision-making and resource allocation. The study underscores the pivotal role of gender-inclusive policies and interventions in achieving sustainable food systems and development.

Ultimately, the research of this group mainly aims to develop strategies and policies that will promote sustainable agricultural development and ensure the sustainability of the food system in the future. For instance, Dubanych et al. (2023), Yerankin et al. (2023), Ramirez-Rubio et al. (2019) summarized the following strategies and policies that can promote sustainable agricultural development and ensure food system resilience:

- promoting the use of sustainable crop cultivation methods. This may include support for organic agriculture, agroecological practices, and encouragement of efficient soil and water management systems;

- developing agricultural technologies. Innovative technologies such as precision farming techniques, the use of drones for crop monitoring, and modern irrigation systems can make crop production more efficient and sustainable;

- supporting small farmers. Providing access to credit, agricultural training, and technical support can help small farmers increase their productivity and resilience to environmental and economic challenges;

- encouraging the use of water-saving technologies. Programs to introduce efficient irrigation systems and water-saving technologies can help reduce water consumption in agriculture and ensure sustainable use of water resources;

- establishing a legal and policy framework for sustainable development. The introduction of legal mechanisms that promote sustainable agriculture, such as land reform, protection of farmers' rights, and regulation of pesticides and

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fertilizers, can help to preserve the environment and ensure food security in the long run.

Scientific publications belonging to the second (green) cluster focus on the analysis of the social aspects of food security and their impact on poverty and social inequalities (Mullens & Shen, 2023; Hoxhaj et al., 2022; Muharremi et al., 2022). Keywords such as "poverty," "nutrition policy," "food insecurity," "socioeconomics," and "social welfare" indicate the interest of researchers in understanding the relationship between economic, social, and political factors and food availability for the population.

Evaluation of the effectiveness of social programs and policies aimed to reduce poverty and improve access to food for vulnerable groups such as the elderly, children, and women is studied by Tiutiunyk et al. (2022), Richardson (2023), Hoxhaj et al. (2022), Bouchafaa et al. (2023), Santeramo and Lamonaca (2021), and Rakotoarisoa and Mapp (2023).

An equally important group of studies within the second cluster is devoted to analyzing food security governance in crises. For example, Ilychok et al. (2023) analyzed the impact of demographic processes on food security and considered possible solutions to management problems in a crisis. In addition, the terms "COVID-19" and "nutrition policy" in the keywords indicate the relevance of research in the context of current challenges, such as the pandemic and the need to develop effective strategies for managing food security in times of crisis.

Shynkaruk et al. (2023) studied the determinants of economic and food security in Ukraine during the war. They analyzed the impact of such crises on the country's economy and food security and considered possible management strategies to overcome the crisis challenges.

In general, the literature review of these articles indicates a variety of studies related to food security and socio-economic development

As noted by Santeramo and Lamonaca (2021), the state acts as the primary regulator in this area, developing and implementing strategies, policies and programs aimed at ensuring the availability, quality and stability of food for the population.

Research in the third (yellow) cluster focuses on the complex interrelationships between population growth, economic development and food security (El Fallahi et al., 2023; Djamal et al., 2023; Bouchafaa et al., 2023). Keywords such as "population growth," "economic development,", and "policy" indicate the focus of research on the impact of demographic and economic factors on public policy on food security. Zolkover et al. (2022) studied the effectiveness of various economic development strategies and food security policies in the context of developing countries. In addition, the aspects of "environmental protection" and "conservation of natural resources" demonstrate the importance of environmental preservation for sustainable food security. Research in this cluster includes the analysis of the cost-effectiveness of policies aimed at increasing access to food and reducing inequalities in access to food, particularly in the context of population growth and economic development.

Within the purple cluster, scientific publications analyze the impact of various factors on food security (Mazurenko et al., 2023). Keywords such as "air pollution," "health hazard," and "mental illness" indicate the interest of researchers in studying the relationship between the environment and human health and their impact on access to safe food. In addition, the terms "conflict" and "corruption" indicate an interest in analyzing political and social factors that may affect food security, particularly in conflict and corruption.

In the area of food security governance, research in the blue cluster focuses on the role of the state and state measures in ensuring food security. Developing effective approaches to strategic food security management is a key challenge for many countries worldwide. Researchers study different approaches used by governments to ensure food security at the national level. Some of the commonly recognized approaches that attract researchers' attention include the following:

1) Establishing a national food security strategy. Governments develop targeted strategies and action plans to ensure food security. These strategies are usually based on a comprehensive analysis of the state of the agricultural

sector, economic factors, demographic trends, and global trends in food production and consumption. Bilan et al. (2023) and Blikhar et al. (2023) confirm that national strategies based on comprehensive analysis provide better results in addressing food security challenges.

2) Regulating the agricultural sector. Governments use various regulatory instruments, such as subsidies, tax exemptions, and export and import quotas, to ensure stable production and affordable food for the population. As noted by Yerankin et al. (2023) and Abdallah et al. (2021), economic theory, in particular internal market theory, confirms that government intervention in the form of subsidies and other instruments can correct market failures, ensuring food price and production stability.

3) Investing in agricultural technologies and infrastructure. Governments promote agricultural technologies that increase yields and plant resilience to pests and adverse climatic conditions, and invest in improved infrastructure such as irrigation systems, roads, and storage (Bhowmik, 2022; Ramli et al., 2022).

4) Developing markets and trade. Governments promote the development of domestic and international food markets by creating a competitive environment, reducing trade barriers, and facilitating efficient trade. Singh (2022) shows that making a free, open, and competitive market helps increase productivity and ensure access to food.

5) Social programs. Governments implement social programs to ensure access to food for the most vulnerable groups, such as low-income families, children, and the elderly (Kuzior et al., 2020; Court, 2022).

6) Crisis monitoring and response. Research in the field of crisis management and food safety confirms that effective monitoring and response systems can significantly reduce the risks of food crises. These approaches are based on a large amount of scientific research (Li & Hao, 2010; Yan et al., 2009; Rai et al., 2019; Di Renzo et al., 2015; Ahmad et al., 2022; Dong et al., 2019; Juhászová et al.,

2023) and practical experience in food security management and are recognized as key to achieving food stability and security at the national level.

It is also essential to highlight the studies that emphasize the role of technological approaches in food security management and provision.

For example, Sugandh et al. (2023), Vivek and Dalela (2022), Kuzior et al. (2022), Hadouga (2023), Bhandari (2023) and Gentsoudi (2023) identified the following technological methods of food security management, which the government can use:

- information technology (IT);
- geographic information systems (GIS);
- Internet of Things (IoT);
- artificial intelligence (AI);
- machine learning (ML); and
- blockchain technologies.

In conclusion, in this study, a wide range of databases and resources were used to collect publications, which allowed to get a more complete picture of the literary landscape in the field of food security management.

The study differs from the articles by Abdallah et al. (2021) and Sugandh et al. (2023) in that the scope of the study was expanded by using more databases and resources. This allowed for a more complete picture of the trends in developing issues related to the strategic management of food security. In addition, this study may have a more objective view of the topic, as various bibliometric metrics and tools were used to analyze the data.

While previous studies, such as those conducted by R. Ohlan and A. Ohlan (2023) have provided valuable insights into the broad landscape of food security research, this study delves specifically into governmental interventions and strategies within the realm of food security management.

While some studies provide insights into current research trends and priorities, this study covers a broader timeframe, from 1990 to February 2024. This broad timeframe allows for tracing the evolution of food security governance research and gov-

ernmental approaches over several decades, thereby providing valuable insights into long-term trends and changes in the research discourse.

Also, Mentel et al. (2020), Torero (2021), and Litvinova (2022) focus solely on bibliometric analyses or specific thematic areas within food security. In contrast, this meta-analytic work combines bibliometric analysis with traditional scientific research methods, such as analysis, synthesis, and logical generalization, to thor-

oughly examine strategic food security management. This methodological triangulation enhances the robustness and depth of obtained findings, allowing for a comprehensive understanding of the complexities inherent in this field.

However, the study has limitations, including the time period and specific keywords used in the literature search, which may have led to omitting some important publications or topics.

CONCLUSION

The purpose of this study was to contribute to the scientific debate on strategic food security governance by applying a comprehensive bibliometric analysis that identified the main trends, research areas, and key factors that influence the effectiveness of government approaches to food security in different countries. The bibliometric analysis showed that public approaches to food security governance are central to the academic debate, attracting considerable attention from researchers in different countries.

Identifying distinct research clusters and regional differences emphasizes the multifaceted nature of food security governance, providing valuable insights for policymakers and researchers alike. Based on a bibliometric analysis of scientific publications, textbooks/monographs, and trends, several key factors have been identified that influence the effectiveness of food security strategies: economic conditions, demographic trends, and global patterns of food production and consumption.

The main areas of research in this area are related to agricultural development, sustainable development, and the impact of climate change on water supply and food security. The study also showed that countries in different regions have different approaches and priorities in the area of food security.

The results of the analysis show a wide range of strategies and methods used by governments to ensure food security. These approaches include not only monitoring and controlling food production and supply but also social programs, legal regulation, investment in agriculture, and research. The effectiveness of government approaches to food safety management depends on a comprehensive approach. Based on the analysis of scientific publications, the key, generally recognized, priority areas of state approaches to food security, which are mandatory in an integrated approach, were identified: the development of comprehensive national strategies based on a thorough analysis of agricultural sectors, economy, demographics and global food trends; regulation of the agricultural sector through subsidies, trade quotas, etc.; ensuring environmental sustainability and balanced use of resources, as well as investments in agricultural technologies. In addition, social programs, crisis monitoring, and the integration of advanced technologies such as blockchain are vital. Together, they form a comprehensive framework for government action to ensure food stability at the national level.

AUTHOR CONTRIBUTIONS

Conceptualization: Eldar Guliyev, Bayali Atashov, Aygun Guliyeva.
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Formal analysis: Eldar Guliyev, Bayali Atashov.
Investigation: Eldar Guliyev.

Methodology: Eldar Guliyev, Bayali Atashov, Aygun Guliyeva.
Project administration: Aygun Guliyeva.
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Writing – review & editing: Eldar Guliyev.

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