

## Southeast Asia Trends on Food Security Research: A Bibliometric Analysis

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### Abstract

Food security pertains to the sufficient availability, accessibility, utilization, and consistency of food resources to meet the needs of all individuals in their daily lives. The primary objectives of this study were twofold: first, to delve into the patterns characterizing publications related to food security; and second, to pinpoint the predominant subject areas explored within the realm of food security in Southeast Asian countries between the years 2012 and 2022. The research employed a Bibliometric Analysis methodology, encompassing three key stages: data collection, data analysis, and data interpretation. The primary data source for this analysis was the Scopus database, and the analysis itself was conducted using tools like Microsoft Excel and VOS viewer. The outcomes of this analysis shed light on the trajectory of publications concerning food security in Southeast Asia. Notably, the findings aligned with global trends, illustrating a substantial increase in the volume of food security-related publications. This suggests an augmented awareness and emphasis on addressing food security concerns within the Southeast Asian context. Among the topics scrutinized within the realm of food security, several key themes emerged as focal points. These included climate change, agriculture, rice production, sustainability, and the impacts of the Covid-19 pandemic. Additionally, the study highlighted other noteworthy subjects such as food insecurity, nutritional considerations, poverty alleviation, adaptation strategies, and biodiversity conservation. The complexity of the food security issue necessitates a multidisciplinary approach, indicating that numerous angles need to be explored to comprehensively address the challenges at hand. Nevertheless, it's important to acknowledge certain limitations associated with this bibliometric analysis. These limitations encompass potential biases in citation practices, variances specific to different academic disciplines, and the absence of qualitative insights that could offer a deeper understanding of the topics under scrutiny. Despite these limitations, the study offers valuable insights into the trends and

primary themes encompassing food security, contributing to a better understanding of the multifaceted nature of this critical issue.

**Keywords:** Southeast Asia, Food Security, Trends, Topics, Bibliometric Analysis

### **Introduction**

Food security refers to the condition where all individuals have consistent physical, social, and economic access to safe, sufficient, and nutritious food that meets their dietary needs and preferences for an active and healthy life. It encompasses the availability, accessibility, utilization, and stability of food sources (FAO, 1996). The main challenges of food security are complex and multifaceted, often influenced by factors such as population growth, climate change, economic disparities and global food distribution systems. The most affected group in terms of food security are often vulnerable and marginalized populations, including rural communities, children, women, elderly, low-income urban, people with disabilities, indigenous and small scale of farmers Food security in Asia is a complex issue due to the continent's diverse geography, population density, and economic disparities. While some regions have made significant progress in improving food security, challenges persist in many parts of Asia. Factors such as population growth, climate change, urbanization, and economic inequality contribute to these challenges (FAO, 2019). Research on food security is crucial because it helps us understand the complexities of the challenges involved and informs the development of effective strategies and policies to ensure a stable and equitable food supply for all. Research contributes to identifying the root causes of food insecurity, predicting trends, and evaluating the impact of interventions. It also aids in the development of sustainable agricultural practices, resilience to climate change, and the reduction of food waste. Moreover, research fosters innovation in food production, distribution, and nutrition, which are essential for addressing the ever-evolving nature of food security challenges (FAO, 2021). Therefore, this paper aims to explore the trend of research that has been done through publications in this region, Southeast Asia. This study is attempt to fulfill two main objectives which were (1) to explore the trend of publications on food security in Southeast Asia and (2) to identify selected topics of publications on food insecurity in Southeast Asia within 2003 to 2022. This paper has the originality whereby the topic about food security viewed through publications of food security in Southeast Asia within 2012 to 2022.

### **Methods**

Bibliometric analysis plays a crucial role in helping researchers identify and guide the development of scientific projects. It achieves this by mapping the current state of research, pinpointing gaps and trends, and exploring relevant research subjects (Oliveira et al., 2019). Furthermore, this approach provides an objective way to gauge the publication records of researchers and research groups, offering valuable quantitative insights (Koskinen et al., 2008). The process of conducting a bibliometric analysis involves several main stages to assess and quantify the impact, visibility, and influence of research publications in a specific field. The following is a general summary of these steps, as shown in Figure 1.

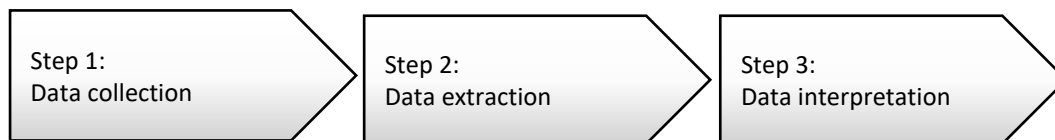


Figure 1. The key steps of bibliometric analysis

### Data Collection

Gather relevant bibliographic data, such as research papers, articles, conference proceedings, patents, or other scholarly outputs from academic Scopus database to collect the data. The Scopus database is importance for the search of bibliographic material related to the subject under study by researchers (Rio-Rama et al., 2018). In this study, the searching proses for data collection was based on this approached: TITLE-ABS-KEY ( "Food Security" ) AND PUBYEAR > 2011 AND PUBYEAR < 2023 AND ( LIMIT-TO ( LANGUAGE , "English" ) ) AND ( LIMIT-TO ( AFFILCOUNTRY , "Indonesia" ) OR LIMIT-TO ( AFFILCOUNTRY , "Malaysia" ) OR LIMIT-TO ( AFFILCOUNTRY , "Philippines" ) OR LIMIT-TO ( AFFILCOUNTRY , "Thailand" ) OR LIMIT-TO ( AFFILCOUNTRY , "Viet Nam" ) OR LIMIT-TO ( AFFILCOUNTRY , "Singapore" ) OR LIMIT-TO ( AFFILCOUNTRY , "Cambodia" ) OR LIMIT-TO ( AFFILCOUNTRY , "Laos" ) OR LIMIT-TO ( AFFILCOUNTRY , "Myanmar" ) OR LIMIT-TO ( AFFILCOUNTRY , "Brunei Darussalam" ) OR LIMIT-TO ( AFFILCOUNTRY , "Timor-Leste" ) ).

### Data Extraction

The searching process resulted about 3,434 documents, clean and preprocess the collected data to ensure accuracy by remove duplicates, correct errors in data, and standardize data formats. The data obtained from the Scopus database was further extracted and processed by using Microsoft Excel and VOS viewer software to create graphical representations of networks, clusters, and trends.

### Data interpretation

A comprehensive report including trends, influential authors, collaborations, and emerging areas by presentation of Citation Analysis, Co-Authorship Analysis, Journal Analysis, Keyword Analysis, Metrics and Indicators, Visualization and Mapping.

## Results and Discussion

### Publications Trends

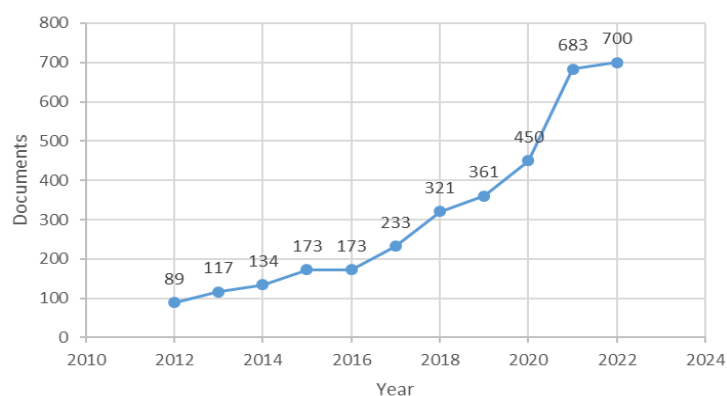


Figure 2. Documents by year

The trends of publications within 2012 to 2022 were presented in Figure 1. The total number of publications retrieved from Scopus database regarding “Food Security” was 3,434. The number of publications has exhibited a consistent and notable upward trend since 2013. Beginning with 89 publications in 2012, there has been a continuous increase each subsequent year. In 2014, the count rose to 117 publications, further expanding to 134 in 2015. This growth continued, maintaining a steady figure of 173 publications in both 2016 and 2017. The pace of growth then accelerated, as seen in the rise to 233 publications in 2017, followed by 321 in 2018. This upward trajectory persisted, with successive years seeing further increases: 361 in 2019, 450 in 2020, and a significant jump to 683 in 2021. The trend culminated in 2022 with 700 publications, underlining the sustained and remarkable expansion in the volume of published documents over the years.

### Journal analysis of food security research

Table 1

#### *Top ten journals most published of food security research*

Journals	Documents	CiteScore	SJR	SNIP
IOP Conference Series: Earth and Environmental Science	432	0.8	0.197	0.255
Sustainability Switzerland	70	5.8	0.664	1.198
Food Security	45	11.0	1.764	2.379
AIP Conference Proceedings	40	0.7	0.164	0.247
E3s Web Of Conferences	40	1.0	0.182	0.213
Global Food Security	39	15.3	2.173	2.506
Journal Of Physics Conference Series	32	1.0	0.183	0.260
Field Crops Research	25	9.6	1.396	2.001
Acta Horticulturae	23	0.5	0.149	0.167
Frontiers In Sustainable Food Systems	23	5.2	0.879	1.319

Evaluate the impact and reach of journals by analyzing their impact factors, citing patterns, and publication trends helps identify influential journals in the field. From 2012 to 2022, the IOP Conference Series: Earth and Environmental Science stood as the foremost contributor to food security research, publishing a significant total of 432 documents. Following closely, Sustainability Switzerland secured the second rank with 70 published documents. The journal Food Security secured the third spot, publishing 45 documents dedicated to this field. AIP Conference Proceedings and E3s Web of Conferences jointly held the fourth position, each contributing 40 documents to food security research. The sixth spot was claimed by Global Food Security, which published 39 documents, underscoring its substantial engagement in this domain. In the seventh place, the Journal of Physics Conference Series presented 32 documents, followed by Field Crops Research at the eighth position, offering 25 documents contributing to food security research. Acta Horticulturae and Frontiers in Sustainable Food Systems held the ninth and tenth positions respectively, both with 23 documents each. This ranking showcases the prominent journals that have significantly contributed to the advancement of food security research during this period.

**Citation analysis of food security research**

Table 2

*Top ten documents most cited of food security research*

Title	Year	Cited	DOI
Safeguarding human health in the Anthropocene epoch: Report of the Rockefeller Foundation-Lancet Commission on planetary health	2015	1,316	10.1016/S0140-6736(15)60901-1
Temperature increase reduces global yields of major crops in four independent estimates	2017	1,296	10.1073/pnas.1701762114
Soil carbon 4 per mille	2017	1,046	10.1016/j.geoderma.2017.01.002
Simultaneously mitigating near-term climate change and improving human health and food security	2012	910	10.1126/science.1210026
Climate-smart agriculture for food security	2014	907	10.1038/nclimate2437
Ten principles for a landscape approach to reconciling agriculture, conservation, and other competing land uses	2013	819	10.1073/pnas.1210595110
An Overview of Internet of Things (IoT) and Data Analytics in Agriculture: Benefits and Challenges	2018	739	10.1109/JIOT.2018.2844296
Trading-off fish biodiversity, food security, and hydropower in the Mekong River Basin	2012	642	10.1073/pnas.1201423109
Speed breeding is a powerful tool to accelerate crop research and breeding	2018	566	10.1038/s41477-017-0083-8
Contribution of Fisheries and Aquaculture to Food Security and Poverty Reduction: Assessing the Current Evidence	2016	454	10.1016/j.worlddev.2015.11.007

"Safeguarding Human Health in the Anthropocene Epoch: Report of the Rockefeller Foundation-Lancet Commission on Planetary Health": This report focuses on the intersection between human health and the environment during the Anthropocene, an epoch marked by significant human impact on Earth's ecosystems. It addresses challenges such as climate change, biodiversity loss, pollution, and habitat destruction (Whitmee et al., 2015). "Temperature increase reduces global yields of major crops in four independent estimates": This study examines the effects of rising temperatures on the global yields of major crops. It likely investigates how climate change-induced temperature increases can negatively impact agricultural productivity and food security (Zhao et al., 2017). "Soil carbon 4 per mille": This paper discusses an initiative to increase soil carbon content by 0.4% (4 per mille) annually in agricultural soils. The aim is to enhance soil health, boost agricultural productivity, and combat climate change by sequestering carbon dioxide from the atmosphere into the soil (Minasny et al., 2017). "Simultaneously mitigating near-term climate change and improving human health and food security": This paper likely explores strategies that address both climate change mitigation and human health and food security concurrently. Such research typically investigates solutions that offer multiple benefits across different domains, contributing to overall sustainability (Shindell et al., 2012). "Climate-Smart Agriculture for

Food Security": This paper discusses an approach that tackles climate change and food security by promoting sustainable and resilient agricultural practices. It aims to balance the need for food production with adapting to and mitigating the impacts of climate change (Lipper et al., 2014). "Ten Principles for a Landscape Approach to Reconciling Agriculture, Conservation, and Other Competing Land Uses": This publication outlines principles for integrating diverse land uses, including agriculture and conservation, within a larger landscape context. The objective is to balance multiple land-use needs while maintaining ecological integrity and sustainability (Sayer et al., 2013). "An Overview of Internet of Things (IoT) and Data Analytics in Agriculture: Benefits and Challenges": This paper provides an introduction to applying IoT and data analytics in agriculture. It discusses the advantages and challenges of using these technologies to enhance agricultural practices (Elijah et al., 2018). "Trading-off Fish Biodiversity, Food Security, and Hydropower in the Mekong River Basin": This study explores the complex trade-offs between conserving fish biodiversity, ensuring food security through fisheries, and developing hydropower projects in the Mekong River Basin (Ziv et al., 2012). "Speed Breeding Is a Powerful Tool to Accelerate Crop Research and Breeding": This study discusses the innovative technique of speed breeding, which accelerates crop research and breeding efforts. By optimizing growth conditions, researchers can produce multiple crop generations in a shorter time (Watson et al., 2018). "Contribution of Fisheries and Aquaculture to Food Security and Poverty Reduction: Assessing the Current Evidence": This study assesses the role of fisheries and aquaculture in addressing food security and reducing poverty. It likely analyzes existing evidence to understand how these sectors contribute to global food security and socioeconomic well-being (Bene et al., 2016).

### Prominent Authors

Table 3

*Top ten prominent author in food security*

Name	Documents	h-index
Sunderland, T.	19	49
Mayes, S.	18	33
Thilsted, S.H.	17	38
Siwar, C.	16	24
Sulaiman, N.	16	13
Rafii, M.Y.	15	41
Allison, E.H.	14	53
Islam, M.S.	14	14
Nelson, A.	14	36
Belton, B.	13	35

Table 3 showcases the top ten prominent authors in the field of food security from 2012 to 2022. The first position is held by Sunderland, T., who has contributed a remarkable 19 documents and boasts an h-index of 49. In the second spot, Mayes, S. is recognized for their 18 publications and an h-index of 33. Thilsted, S.H. claims the third position with 17 published documents and an h-index of 38. Siwar, C. and Sulaiman, N. jointly occupy the fourth and fifth positions, both with 16 published documents. Siwar holds an h-index of 24, while Sulaiman's h-index stands at 13. In the sixth position, Rafii, M.Y. is acknowledged for 15 documents and an h-index of 41. Allison, E.H. secures the seventh spot with 14 documents and an impressive h-index of 53. The eighth position is shared by Islam, M.S., who also contributed 14

documents, with an h-index of 14. In the ninth position, Nelson, A. is recognized for 14 documents and an h-index of 36. Finally, the tenth position is claimed by Belton, B., who has authored 13 documents and holds an h-index of 35. This ranking highlights the significant contributions of these authors to the field of food security research during the specified timeframe.

### Co-authorship analysis

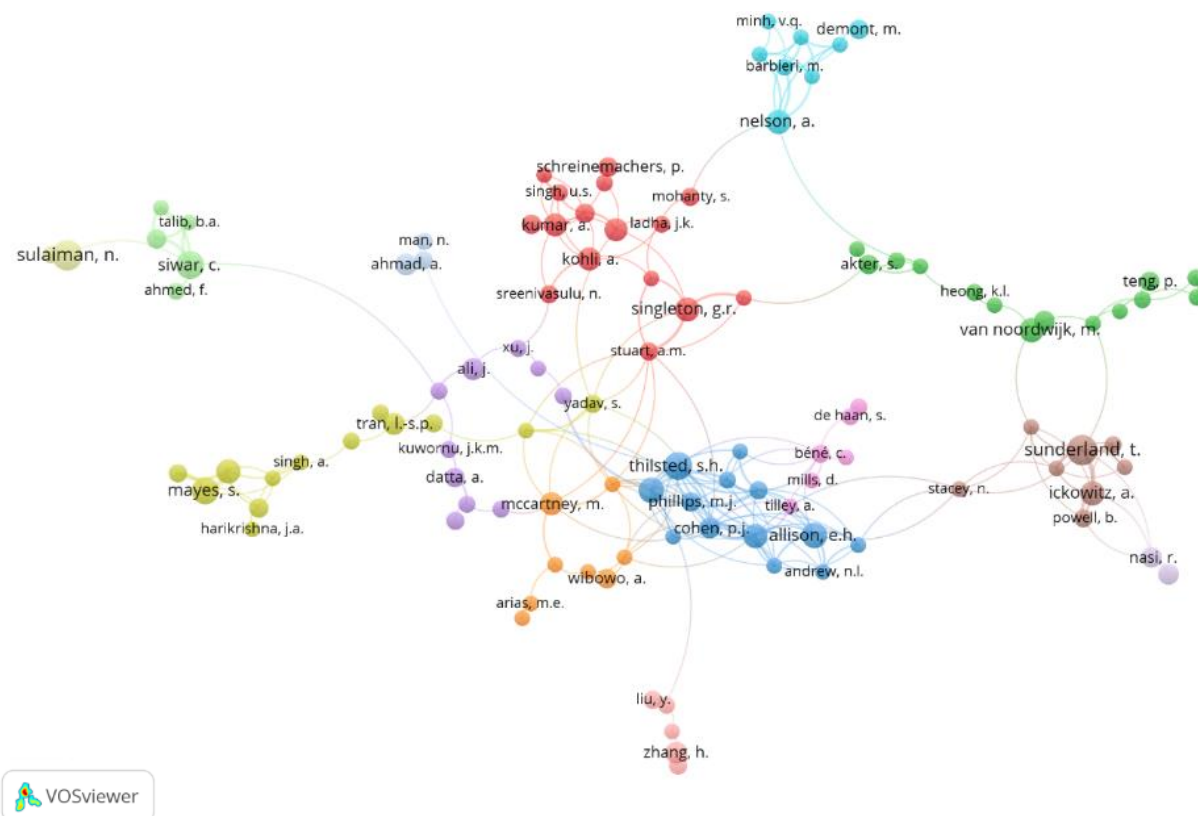


Figure 3. Co-authorship network of authors

Co-authorship networks offer valuable visualizations for studying the dynamics of the scientific community, with authors represented as nodes and collaborative partnerships indicated by links between them. This insightful approach is highlighted by (Krumov et al., 2011). These co-authorship networks serve as informative representations, revealing intricate relationships among authors, countries, and organizations. The network is depicted through a diagram featuring nodes and lines, organized into distinct clusters. These clusters are differentiated by colors, while the size of nodes reflects the prominence and recurrence of keywords. Incorporating the insights from Table 3, which enumerates the top ten prolific authors, the co-authorship network unveils notable clusters of nodes and lines. These clusters are shaped by the collaborative efforts of these prominent authors, showcasing their significant contributions within the network. One of the standout authors, Sunderland, T., is highlighted as a major contributor to the field of food security in Southeast Asia between 2012 and 2022. This author has 167 published documents and an h-index of 49. They are affiliated with the University of British Columbia and originally from Canada. Another

prominent author is Mayes, S., with 147 documents and an h-index of 33. Mayes is affiliated with the University of Nottingham and originally from the United Kingdom.

### Distribution of food security publications in Southeast Asia

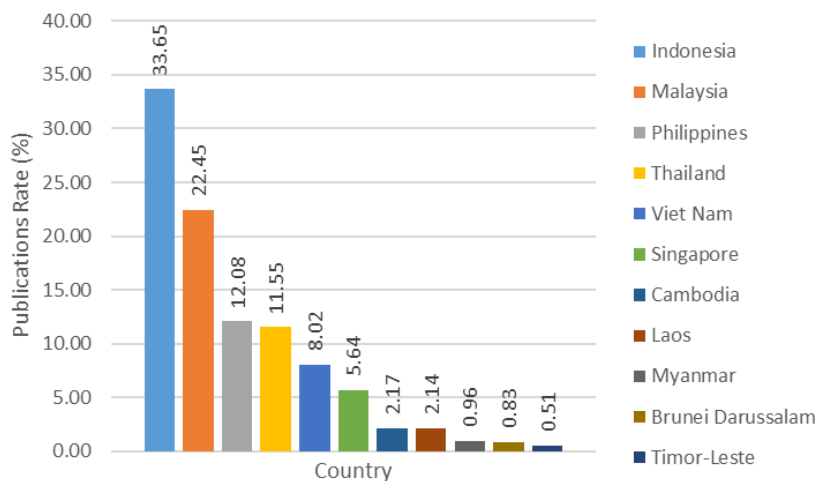


Figure 4. Distribution of food security publications based on countries

Figure 4 presents a pie chart illustrating the distribution of food security publications across Southeast Asian countries from 2012 to 2022. During this period, Indonesia emerged as the frontrunner in terms of publication volume, accounting for 33.65% of the total. Following closely, Malaysia contributed 22.45%, while the Philippines constituted 12.08% of the publications. Thailand held an 11.55% share, and Viet Nam represented 8.02% of the total publications. Contributions from Singapore amounted to 5.64%, and Cambodia's share stood at 2.17%. Similarly, Laos and Myanmar contributed 2.14% and 0.96%, respectively. The publication volume from Brunei Darussalam constituted 0.83%, and finally, Timor-Leste concluded the distribution with a share of 0.51%. This pie chart effectively visualizes the varying levels of contribution among Southeast Asian countries in the realm of food security publications during the specified timeframe.

### The subject areas of food security publications

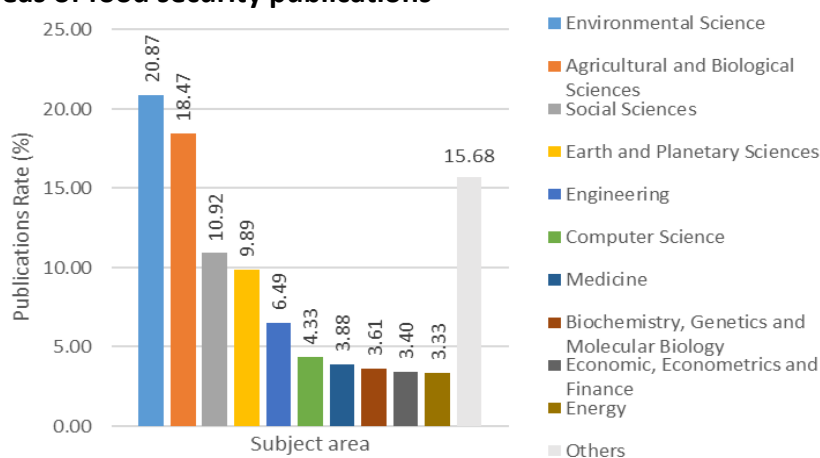


Figure 5. Publications of food security based on subject areas



In the period spanning from 2012 to 2022, research publications were divided into ten distinct subject areas. Notably, the highest proportion of publications fell under the category of environmental science, accounting for approximately 20.87% of the total. Following closely, the field of agricultural and biological sciences represented the second-largest category with around 18.47% of the publications. Social science occupied the third position, comprising about 10.92% of the publications, while earth and planetary science secured the fourth spot with approximately 9.89%. Engineering encompassed around 6.49% of the publications, and computer science constituted about 4.33%. Further down the list, medicine accounted for roughly 3.88%, biochemistry, genetics, and molecular biology made up about 3.61%, economic, econometrics, and finance comprised around 3.40%, and energy represented approximately 3.33% of the total publications within this timeframe.

### The Affiliations of publications

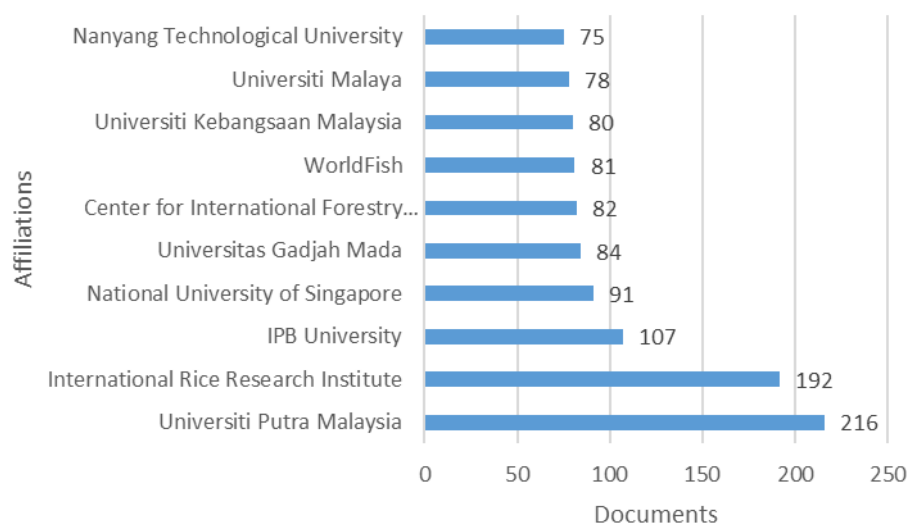


Figure 6. Top ten affiliations of food security publications

Based on Figure 6, the institution that exhibited the highest level of affiliation in terms of published documents was Universiti Putra Malaysia, making a substantial contribution of 216 documents. The subsequent prominent contributor was the International Rice Research Institute, which had a notable input of 192 documents. IPB University secured the third position with a total of 107 documents, closely followed by the National University of Singapore with 91 documents. Other noteworthy affiliations included Universitas Gadjah Mada, which presented 84 documents, the Center for International Forestry with 82 documents, and Worldfish with 81 documents. Similarly, Universiti Kebangsaan Malaysia accounted for 80 documents, Universiti Malaya for 78 documents, and Nanyang Technological University for 75 documents. The institution with the highest number of publications in the realm of food security was Universiti Putra Malaysia due to its robust commitment to research and innovation across domains such as agriculture, biotechnology, and environmental science. The International Rice Research Institute emerged as an influential global agricultural research and training organization dedicated to enhancing the well-being of rice farmers and consumers. Furthermore, IPB University stood out with its strong emphasis on agricultural sciences and natural resources management. This distribution underscores the diverse affiliations and their respective noteworthy contributions to the advancement of research in the field of food security within Southeast Asia.

## Co-occurrence analysis

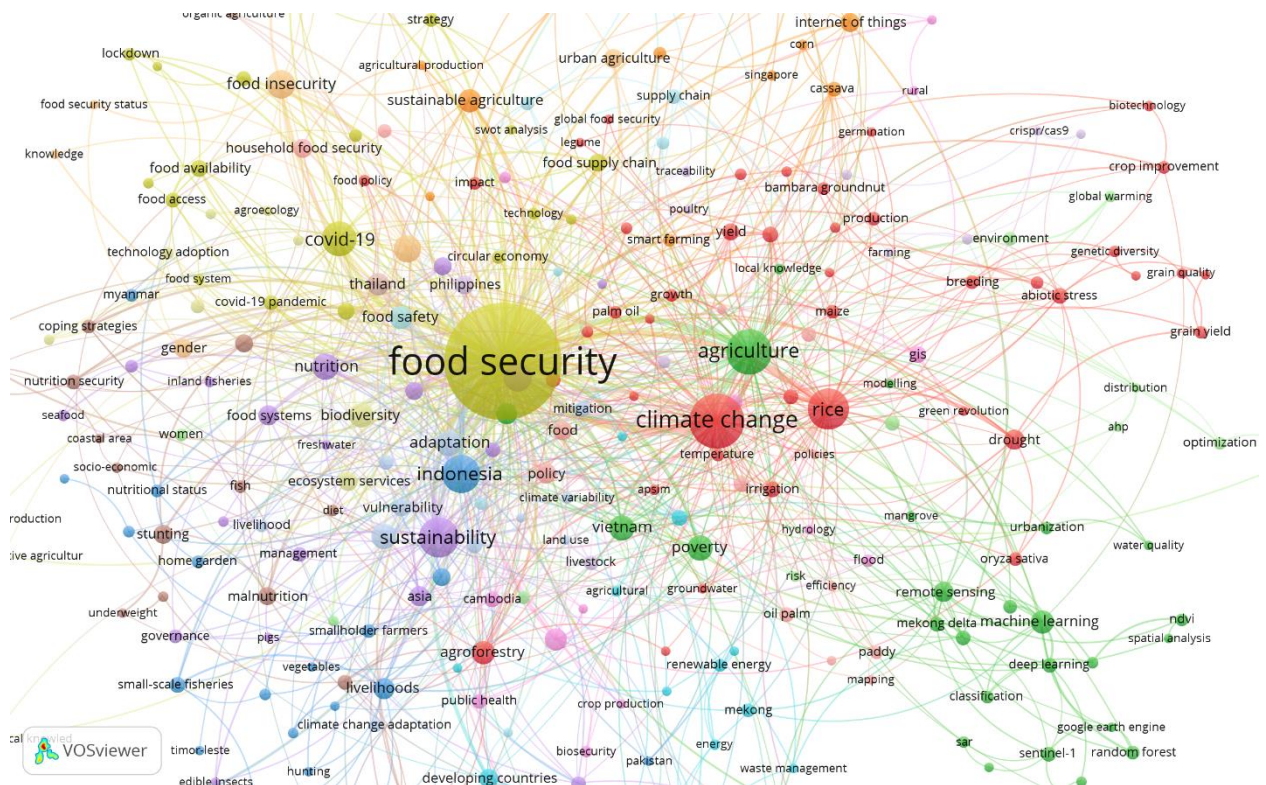


Figure 7. Network of co-occurrence keywords

Based on the co-occurrence analysis depicted in Figure 5, the prevailing keywords identified were climate change, agriculture, rice, sustainability, Covid-19, food insecurity, nutrition, poverty, adaptation, biodiversity, and others, as shown in the keyword composition. This insight delves into the focal points that have been extensively explored within the context of Southeast Asia. A predominant theme among these is climate change, which is notably intertwined with traditional food security. This interrelation serves as a foundation for reinforcing adaptability and formulating effective adaptation strategies in anticipation of future shifts (Wesche & Chan, 2010). The subsequent topic that has garnered significant attention pertains to agriculture. Within this realm, interventions in the agricultural sector and the interconnectedness of various sectors hold promise for bolstering food security (Farrukh et al., 2020). Another noteworthy focus revolves around rice. Efforts to enhance food security in Asia entail public rice breeding programs that incorporate attributes widely preferred in different sub regions, such as softness in Southeast Asia and slenderness in South Asia. These efforts must be tailored to account for geographical variations and specific preferences (Custodio et al., 2016). The discourse on sustainability constitutes the fourth salient theme. It's essential to incorporate a long-term temporal perspective in evaluating food security (Berry, et al., 2015). Meanwhile, the initial global assessment of the impact of COVID-19 on food security underscores that food systems adapted amidst the pandemic, albeit at substantial costs. Widespread disruptions in activities affected the majority of stakeholders. The fifth topic of significance pertains to Covid-19. The pandemic had adverse repercussions on food accessibility and availability, leading to alterations in dietary practices

and exacerbating food insecurity, particularly in the most vulnerable regions (Jafri, et al., 2021).

Other notable themes that emerged from the keywords include food insecurity and policy implications specifically relevant to Southeast Asian countries dealing with food insecurity challenges (Ly et al., 2020). The issue of nutrition is closely intertwined with food security, where national governmental policies and initiatives play a crucial role in implementing strategies like food fortification and targeted supplementation to alleviate the significant burden of micronutrient deficiencies in Southeast Asia and other global regions (Tulchinsky, 2015). Poverty is another key topic related to food security. Research in this area highlights that 31% of non-food-poor households in rural areas face vulnerability to food poverty, indicating a high likelihood of falling into food poverty in the future (Bui & Hoang, 2020). Adaptation is an essential response to food security concerns. To address these issues, interventions need to go beyond considering food security as a result of mere food availability. They should also incorporate factors such as the cultural acceptability of food, a deeper understanding of challenges related to hybrid maize cultivation, and the preservation of seed diversity that local livelihoods and food security depend on (Kyeyune & Turner, 2016). Biodiversity emerges as a critical mechanism for long-term action in ensuring food security. On a regional scale, the trade-off between biodiversity and food security, observed globally, is influenced by diverse regional contexts (Prudhomme, 2020).

### **Conclusions**

The study effectively addressed its objectives of examining the publication trends related to food security in Southeast Asian countries between 2012 and 2022, as well as identifying the key topics discussed during this period. The research revealed a significant increase in food security publications from 2012 to 2020, with a particularly steep rise in 2021, followed by a return to normal levels in 2022. This pattern indicates a heightened emphasis on addressing food security issues, highlighting its importance and relevance in Southeast Asian countries. Among the countries in Southeast Asia, such as Indonesia, Malaysia, the Philippines, Thailand, Vietnam, and Singapore, there was a notable upward trajectory in the publication of food security-related research. This growth underscores the region's recognition of the necessity to address food security challenges. The second objective of the study aimed to pinpoint the most prevalent topics related to food security during the specified timeframe. Through keyword analysis, the study identified several central themes closely linked to food security. These included climate change, agriculture, rice production, sustainability, and the impacts of the Covid-19 pandemic. Additionally, other pertinent topics contributing significantly to food security discussions encompassed food insecurity, nutritional aspects, poverty alleviation, adaptation strategies, and biodiversity preservation. Although various subjects are explored within the realm of food security, the study focused on elucidating the most prominent themes, especially within the context of Southeast Asia. In conclusion, the study affirms that food security is a global concern, with collaborative efforts among countries playing a pivotal role in mitigating its adverse effects. In the Southeast Asian region, the Association of Southeast Asian Nations (ASEAN) serves as an active entity in addressing food security concerns, taking proactive measures to initiate and coordinate programs that prepare for both current and future challenges. The study emphasizes the importance of this regional cooperation in tackling food security issues effectively.

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