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A bibliometric analysis of emerging research directions in food science and technology based on the Dimensions Database (2014–2024)

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Abstract

Introduction. *This bibliometric study examines publication trends in food science and technology between 2014 and 2024, providing insights into emerging research directions, thematic gaps, and academic productivity.*
Research Methods. *We used the metadata from the Dimensions database identified 9,265 articles, of which 5,650 were selected using the PRISMA protocol.*
Data Analysis*. Statistical analyses were performed using Microsoft Excel and Google Sheets, while VOSviewer was employed to visualize prolific authors, international collaborations, and keyword clusters.*
Results. *The publication trend conformed to a polynomial regression model, reaching its peak in 2021. The United States emerged as the most productive contributor country. Four principal interdisciplinary themes have emerged: food chemistry, industrial practices, administration, and social implications. Technologies such as artificial intelligence (AI) and the Internet of Things (IoT) have been shown to enhance agricultural efficiency, food safety, and personalized nutrition, aligning with Industry 4.0 initiatives aimed at sustainable food systems.*
Conclusion. *The findings indicate a future trajectory propelled by technological innovation, especially in fields such as nanotechnology, foodomics, biosensors, and metabolomics. Prominent keywords including AI, IoT, spectroscopy, and chemometrics reflect a move toward increased automation and digitalization within food science and technology.*

A. INTRODUCTION

Food science and technology have played a significant role in shaping modern civilization, influencing trends in both the agricultural and industrial sectors (Ranjha et al., 2022). The transition from agricultural societies to industrial economies in the 1960s was significantly propelled by advancements in food science and engineering (Barrett et al., 2023). Today, the integration of technology into food science continues to enhance productivity, particularly in addressing challenges that have arisen following the COVID-19 pandemic. However, despite these advancements, food production remains insufficient to meet the demands of a growing global population. This persistent challenge motivates researchers to continue expanding the frontiers of knowledge, seeking innovative methods to produce food with improved qualities and greater nutritional value (Yeung et al., 2018).

Food science and technology are globally important fields, integral to both industrial applications and pioneering research innovations (Rowan, 2021). Attention to and output within this field continue to be crucial across various disciplines (Lillford & Hermansson, 2021). A Google Scholar search returns over six million results, highlighting the extensive coverage of the field across textbooks, book chapters, and scholarly journal articles. This substantial body of literature underscores the wide-ranging and in-depth nature of research within the discipline (Yuan & Sun, 2022). It serves as a valuable resource for bibliometric studies, offering researchers a wealth of information to identify emerging research trends and gaps.

The existing literature extensively documents numerous bibliometric studies related to food science and technology. One such bibliometric analysis, focusing on food packaging, was conducted using the Web of Science (WoS) database for the period from 2000 to 2021 (Akin et al., 2023). They observed an annual publication growth rate of 3.53%. However, this upward trend was increasingly shaped by intensified international efforts toward sustainability. Two primary research focuses were identified: the properties of packaging materials and the mechanical characteristics of containers. Another comprehensive study utilizing the Web of Science database examined the application of chemometrics in food science and technology from 1979 to 2020. This research emphasized the analysis of complex spectroscopic datasets (Aleixandre-Tudo et al., 2022; Aleixandre-Tudó et al., 2020). The study reported a significant increase in the number of funded papers over the past decade, with 81% of publications receiving funding in 2020, and noted that the number of publications has doubled approximately every five years. Additionally, a bibliometric analysis on consumer preferences in food science and technology, also based on the Web of Science database, examined 1,786 articles published between 1993 and 2013 (Kasemodel et al., 2016).

Although these studies utilized the Web of Science (WoS) database, to the best of our knowledge, no prior bibliometric analysis of food science and technology has been conducted using the Dimensions database. In recent years, this innovative bibliographic resource has been employed to generate high-quality systematic reviews, including bibliometric analyses (Herzog et al., 2020). Dimensions, developed by Digital Science, is known to overlap with the Scopus database but places an even greater emphasis on comprehensiveness (Thelwall, 2018). While Scopus and Web of Science (WoS) have traditionally been employed for large-scale bibliometric studies, the Dimensions database emerges as a robust alternative to both. Furthermore, a comparative study of Scopus, WoS, and Dimensions using food science metadata supported the rationale of this research and the use of Boolean operators. Scopus and Dimensions have been confirmed to be compatible bibliometric data sources, given their comparable coverage and similarity in citation counts (Visser et al., 2021). Consequently, this study utilized the Dimensions database.

This bibliometric analysis explores the development of food science and technology research from 2014 to 2024, offering a comprehensive overview of the field's progression. The study seeks to help researchers identify global literature trends, reveal research gaps, and generate new research ideas. The research questions (RQ) guiding this study are: RQ1. What is the distribution of relevant publications by year? RQ2. What is the distribution of relevant publications by country? RQ3. What is the structure regarding the most cited authors? RQ4. What is the structure regarding co-author analysis? RQ5. What is the structure in terms of frequently used keywords?

B. LITERATURE REVIEW

Food science and technology emergence

Key research areas in food science and technology encompass several essential fields. Food chemistry, in particular, examines the composition and properties of food components such as carbohydrates, proteins, lipids, vitamins, and minerals. Recent studies have focused on nutrient retention, bioactive compounds, and functional foods (Kontogiorgos, 2021). Food microbiology studies microorganisms in food, including both pathogens and spoilage organisms, with advancements in molecular biology significantly improving our understanding of microbial behavior (Doyle et al., 2019). Food engineering involves the application of engineering principles to food processing and production, with a focus on the design of equipment and the development of innovative technologies such as high-pressure processing (Aguilera, 2018). Sensory science investigates consumer perception of food through the senses, aiming to understand preferences and develop effective sensory evaluation methods. Research on ensuring food safety and quality encompasses hazard analysis, critical control points, risk assessment, traceability systems, and rapid detection methods for contaminants (Schifferstein et al., 2022). Finally, sustainable food production tackles global population growth and environmental challenges by exploring alternative protein sources, reducing waste, and developing environmentally friendly packaging materials (Anis & Norfarizan-Hanoon, 2022).

Bibliometric approach

Bibliometrics has emerged as a powerful tool for analyzing publication trends and patterns, providing valuable insights into the impact of scholarly entities—including papers, researchers, countries, and keywords—primarily through quantitative metrics (Donthu et al., 2021). This method enables the precise tracking of influential studies, the origins of research, and the development of foundational work over time. Additionally, it offers a clear understanding of current research directions by identifying emerging topics and mapping the overall trajectory within a specific field (Öztürk et al., 2024). Moreover, bibliometric analyses can predict future research trends, assisting researchers, funding agencies, and policymakers in identifying areas with potential for growth. In addition, bibliometrics plays a crucial role in identifying research gaps by mapping existing literature and highlighting underexplored topics that warrant further investigation. (Linnenluecke et al., 2020).

Within the field of food science and technology, bibliometric methods are especially valuable for mapping the scope of research across a wide range of sub-disciplines, encompassing areas from food production technologies to nutritional sciences. The metadata in this field encompasses information from journals, conference papers, patents, clinical studies, and reviews. Major bibliometric data sources for food science research include Google Scholar, Scopus, Web of Science (WoS), and Dimensions, with increasing emphasis on the Dimensions database due to its comprehensive coverage and recent updates. This study utilized a novel database from Dimensions.

Dimensions database

Digital Science launched the Dimensions database in 2018, which provides a dynamic approach to analyzing the research landscape (Herzog et al., 2020). The platform offers a user-friendly web interface that enables seamless access to a vast array of information. Researchers can explore publications, monitor funding sources, and access diverse research outputs within a unified ecosystem. Dimensions is distinguished by its extensive coverage of scholarly materials, including over 140 million online citations and 800,000 publications, such as articles, conference papers, and preprints (Visser et al., 2021). The database contains information on 7 million grants, allowing researchers to identify funding opportunities, monitor research projects, and evaluate institutional investments. Additionally, Dimensions offers access to 29 million datasets, supporting data-driven investigations across various disciplines, including genomic analysis, climate studies, and social trend research. The platform also tracks 160 million clinical trials, thereby facilitating evidence-based medicine and informed healthcare decision-making (Hook et al., 2018).

Dimensions is a valuable resource for bibliometric and scientometric research, providing comprehensive coverage, powerful analytical capabilities, and an intuitive user interface (Bornmann, 2018). Its advanced search functions, filtering options, and data visualization tools enable comprehensive analyses, while the integration of publications, grants, patents, and policy documents sets it apart from databases such as Scopus and Web of Science. In contrast to Microsoft Academic and Google Scholar, Dimensions reduces problems related to data noise and self-citations by excluding web-sourced data, thereby ensuring higher data quality (Thelwall, 2018). Researchers utilize Dimensions to assess research impact, productivity, funding landscapes, emerging trends, and societal effects, with support from Altmetrics. These capabilities establish Dimensions as an essential tool for mapping and comprehending the research ecosystem.

C. RESEARCH METHODS

Research design

This study employed bibliometric methods to offer a comprehensive overview of research in food science and technology from 2014 to 2024. The main objective was to analyze publication trends and patterns within this dynamic and multidisciplinary field. We conducted a search of all relevant research publications using the Dimensions database and analyzed the data using *VOSviewer*.

Data collection

Bibliographic data were downloaded from the Dimensions database in both CSV (Comma-Separated Values) and RIS (Research Information Systems) formats. The metadata extraction was conducted on June 26, 2024. A total of 9,265 documents were identified, collectively receiving over 227,000 citations from other publications between 2014 and 2024, averaging approximately 24.5 citations per article. No restrictions were imposed on the number of citations per year. The period from 2014 to 2024 was chosen because 2014 marked a pivotal year when the food industry began actively addressing sustainability challenges related to climate change compliance, environmental concerns, resource depletion, and health issues (Prasanna et al., 2024). These factors led business models to adopt policies focused on reducing their carbon footprint, implementing ethical sourcing practices, minimizing waste, applying green chemistry principles, and improving nutritional quality. Furthermore, 2014 marked the beginning of the development of AI algorithm models in food safety (Z. Liu et al., 2023).

After applying the inclusion and exclusion criteria, the search resulted in 5,650 documents. Figure 1 outlines the criteria used. The Inclusion Criteria (IC) aimed to narrow the search to documents meeting the following conditions: (IC1) screening based on the primary search query, (IC2) publications dated between 2014 and 2024, (IC3) documents written in English, (IC4) content directly related to Food Science and

Technology, and (IC5) only documents classified as 'Journal' types were included. Conversely, the Exclusion Criteria (EC) were applied to remove irrelevant or non-peer-reviewed content. Publications were excluded if they met any of the following conditions: (EC1) written in a language other than English, (EC2) not peer-reviewed, (EC3) unrelated to the subject of Food Science and Technology, or (EC4) classified as review articles, meta-analyses, philosophical works, or framework papers.

The documents were retrieved from the Dimensions database using the primary search query: TITLE-ABS-KEY (food science AND technology)*. The research protocol for this study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart. Only documents classified as 'Journal' types were included in this bibliometric analysis. Conference reviews, journal reviews, textbooks, book chapters, and editorials were excluded in accordance with the criteria presented in Figure 1.

Data analysis

Of the 9,200 documents, 61.4% were journal articles (n = 5,650), 24.7% were book chapters (n = 2,272), 5.2% were edited books (n = 478), and 2.7% were conference proceedings (n = 248). The remaining documents comprised preprints and other types. Statistical analyses were performed using Microsoft Excel and Google Sheets. Bibliometric networks were visualized using VOSviewer Version 1.16.20, an open-source software recognized for its user-friendliness, accessibility, and wide adoption in bibliometric research. The visualization encompassed analyses of co-authorship, keyword co-occurrence, and citation patterns.

D. RESULTS AND DISCUSSION

RQ1. What is the distribution of relevant publications by year?

Figure 2 illustrates a general upward trend in publications related to food science and technology each year since 2014. The lowest number of publications was recorded in 2024, with 486 documents; however, it should be noted that metadata for the entire year was not yet available. At the time of this study, the peak in citations had not yet been reached. The highest number of publications was recorded in 2021, with a total of 1,728 publications. However, from 2022 to 2023, the number of publications remained relatively stable, averaging approximately 900 per year. In contrast, there was a noticeable decline in the number of citations. This decrease is expected, as newer publications naturally accumulate fewer citations due to the citation lag effect. The percentage declines in citations from 2021 to 2022 (67.2%) and from 2022 to 2023 (70.5%) do not necessarily indicate diminished research interest but rather reflect the typical citation delay associated with recent publications.

Nonetheless, this decline may suggest a shift in research focus across different subfields of food science and technology. This interpretation is consistent with the findings of a thematic evolution study on food security research, which indicated a progressive narrowing and fragmentation of research topics over time (Hualin Xie, Yuyang Wen, 2021). A comparable shift in research focus was also identified in a bibliometric study on food packaging (2000–2021) utilizing the Web of Science database. The study reported a notable transition from examining general packaging functions to exploring topics related to internet marketing and consumer behavior (Akin et al., 2023).

A polynomial regression analysis was performed to investigate the emerging trend in publications, with the year represented on the x-axis and the number of publications on the y-axis, as illustrated in Figure 3. The regression model was applied to fit the year records from 2014 to 2021, resulting in the statistical equation: $y = 25.7x^2 - 103346x + 104000000$, with $R^2 = 0.992$. This indicates a strong trend towards an exponential increase in publications, underscoring the growing interest in research on the topic. The positive coefficient of x^2 and the R^2 value approaching 1 signify a close fit of the regression model, suggesting its potential for predicting future research publications in the field (Donthu et al., 2021). This observation is consistent with Price's law, which suggests that bibliometric data typically follow an exponential growth pattern in annual publication rates within a given research field (Teli & Dutta, 2020). Price's law proposes that scientific growth generally follows an exponential trajectory, often exceeding the growth rates observed in social phenomena. Furthermore, high-quality publications tend to generate a snowball effect, resulting in increased citations and greater impact over time (Wohlin et al., 2022).

The industrial revolution 4.0 jumpstarted a significant influence in the digital transformation in the early of 2012 (Xu et al., 2021). This ultimately led to the widespread application of internet and communication technologies within the food supply chain and agri-food industry, alongside a redefinition of food consumption and demand, exemplified by innovations such as lab-grown meat and plant-based meat alternatives. These emerging technologies may offer new directions for the food sector, particularly in light of the opportunities arising from the COVID-19 pandemic.

RQ2. What is the distribution of relevant publications by country?

The parameters were set with a minimum requirement of 1 document and 1 citation per country. Out of 115 countries, 108 met these thresholds, leading to the identification of 10 distinct clusters using *VOSviewer* (see Figure 4). European and Asian countries dominate these clusters, contributing 37.4% and 28.9% of the total publications, respectively. The size of each circle reflects the volume of publications. The United States leads in food science and technology publications from 2014 to 2024, with 509 papers, accounting for approximately 9% of all publications in this field within the database. Following the United States are China (318 papers), the United Kingdom (177 papers), Italy (126 papers), Indonesia (120 papers), and Brazil (113 papers).

Consistent with these findings, many researchers in the United States have long advocated for reducing the use of synthetic fertilizers and pesticides, while promoting organic agriculture (Muller et al., 2017). Consequently, research emphasizes agricultural sustainability and new technologies such as genome editing for plant breeding (Shan-e-Ali Zaidi et al., 2019). Similarly, China has prioritized becoming a leader in agricultural research, leading to significant contributions in scientific journals (Gaffney et al., 2019). China’s investment in innovative agronomy has proven effective in small-scale farming operations. This initiative positively impacted agronomic output, resulting in an approximate 10% increase in production. Additionally, fertilizer usage became more efficient, leading to an 18% reduction in excessive nitrogen application over the course of a decade (Cui et al., 2018).

RQ3. What is the structure regarding the most cited authors?

The citation analysis was performed at the author level, applying criteria of at least one document per author and a minimum of 100 citations per document. Out of 14,025 identified authors, 485 met these thresholds. The resulting network exhibited limited node connectivity, indicating a low degree of citation linkage among the papers. This pattern suggests that the field is highly fragmented, encompassing a range of diverse subfields. A similar conclusion was drawn from the global trend in food security research (Hualin Xie, Yuyang Wen, 2021). The potential of information technologies in this field is demonstrated by the fact that 17.7% of the 5,650 reviewed documents focus on information technologies and related topics, including data storage, big data, data science, and artificial intelligence.

Authors such as Yang Wang, Xiaojie Chen, Yohei Doi, Baolei Dong, and Danxia Gu have received the highest number of citations. They collaborated on a single paper, titled ‘*Emergence of plasmid-mediated colistin resistance mechanism MCR-1 in animals and human beings in*

China: a microbiological and molecular biological study,' which accounts for 3.8% of the total citations from the 5,650 articles analyzed in this study. The 5,650 articles were selected according to the inclusion and exclusion criteria presented in Figure 1, covering the period from 2014 to 2024. This influential study highlights the critical importance of ongoing surveillance and international collaboration in addressing antimicrobial resistance within food science and technology, particularly regarding critically important antibiotics such as colistin. It emphasizes the urgent need for coordinated global efforts to combat pan-drug-resistant Gram-negative bacteria (Y. Y. Liu et al., 2016).

Additionally, a stronger *Total Link Strength* (TLS) was observed for Kelly Bronson. One of her influential papers, published in *NJAS-Wageningen Journal of Life Sciences (Elsevier)*, titled '*Looking through a responsible innovation lens at uneven engagements with digital farming*,' employs a qualitative approach using the Responsible Research and Innovation (RRI) framework to interview designers of smart farming technologies in Canada and the US (Bronson, 2019). The interviews covered aspects of smart farming, big data, and the use of the open online platform *farmOS* for farm management, planning, and record keeping. The findings of this paper highlight that achieving success and equity in digital farming requires more than technological advancement alone. Significant social innovation is essential, involving the collaboration of diverse stakeholders—including corporations, public sector scientists and engineers, government funding bodies, professional associations, activists, and academics—to develop and implement new social practices, policies, and partnerships.

RQ4. What is the structure regarding co-author analysis?

The co-author analysis performed using VOSviewer reveals a broad international network of research collaboration within the field of food science and technology. Applying a minimum threshold of one document and one citation per country, the analysis identified 115 countries, of which 108 met the criteria for inclusion. The findings emphasize the global scope of research collaboration, underscoring the interconnectedness of countries in advancing food science and technology.

The Total Link Strength (TLS) values, representing the intensity of collaboration between countries, highlight the United States as the leading contributor to international research partnerships, with a TLS value of 396. Following the United States are the United Kingdom (315), Germany (248), Italy (231), and China (228), demonstrating their substantial contributions to global research in food science and technology. These countries have produced a high volume of publications and maintain extensive collaborative networks that enhance the overall research output in the field.

Moreover, the analysis reveals 14 distinct clusters within the co-authorship network, with the United States serving as the central node. This indicates that the US plays a key role in fostering collaboration among various research groups and regions. These findings are further supported by the observation that the most prominent countries in food science and technology research are also the most active in international collaboration. Notably, countries with similar geographic locations and climates tend to engage in strong collaborative efforts, often driven by their shared food production methods and agricultural environments. This alignment promotes the exchange of knowledge and resources, especially in tackling challenges related to global food security, sustainability, and technological innovation.

A key challenge confronting global food science and technology research is the need to enhance multidisciplinary collaboration. Addressing complex problems such as food safety, sustainability, and climate change requires expertise from various disciplines, including chemistry, biology, engineering, and social sciences. Countries such as Spain, Germany, and Italy have been particularly active in incorporating chemometric approaches into food chemistry, statistical analysis, and agricultural production, thereby reinforcing their leadership in driving innovations within food science (Aleixandre-Tudo et al., 2022). These countries are engaged not only in pioneering research but have also enacted strategic policies to enhance the sustainability of food systems, aligning with global initiatives to achieve the Sustainable Development Goals (SDGs). For instance, Spain, Germany, and Italy lead in incorporating sustainable practices into food systems, highlighting the critical role of innovation and research in addressing the urgent challenges faced by the global food sector (Lillford & Hermansson, 2021).

RQ5. What is the structure in terms of frequently used keywords?

A detailed keyword co-occurrence analysis was conducted using VOSviewer to identify the most frequently used keywords in the field of food science and technology. The analysis focused on the title and abstract fields of the articles, employing the full counting method. A minimum occurrence threshold of 50 was set for keyword inclusion, ensuring that only terms with high frequency in the literature were considered for further analysis (see Figure 5). Applying these criteria resulted in the identification of 1,081 keywords, of which 732 were directly associated with the core theme of food science and technology. These 732 relevant keywords were subsequently grouped into four distinct clusters—red, yellow, green, and blue—each representing a different thematic area within the field. The clusters highlight dominant research topics and emerging trends.

The red cluster, identified by VOSviewer, comprises 54.9% of the total keywords and primarily represents themes related to social implications. It serves as a connection between the scientific aspects addressed by the green and blue clusters, encompassing keywords that directly affect social issues. Furthermore, a prominent keyword within this cluster is "food security," which highlights the connection between international stability and human well-being. This is particularly relevant given the increasing issue of food waste, which is projected to rise by more than 40% between early 2005 and the end of 2025.(Zhang et al., 2018). Advancements in food processing technologies, nanotechnology, the Internet of Things (IoT), and Artificial Intelligence (AI) have proposed potential alternative solutions (Tian et al., 2016). These keywords are closely associated with food supply chains, food safety, sustainability, and waste management. Additionally, these technologies are extensively utilized in the area of food nutrition to tackle dietary challenges. The application of AI in this domain has been shown to improve nutritional precision and aid in the prevention of type 2 diabetes (D. D. Wang & Hu, 2018). AI applications have emerged as essential tools in food safety assessment, particularly in predicting the toxicity of food ingredients. These technologies offer alternatives to traditional methods such as animal testing and dietary assessment software (Miyazawa et al., 2022).

Furthermore, AI and IoT technologies have been demonstrated to predict crop yields, monitor food quality through remote sensing, personalize nutrition, and improve food safety (de Abreu & van Deventer, 2022). However, as shown in Figure 5, these two keywords are positioned at the periphery of the cluster, indicating weaker connections with other keywords. This suggests potential for future research to establish new links, especially with keywords located on the edges of each cluster.

The yellow cluster, although constituting a small proportion (2.7%) of the total keywords, exhibits close connections with the red cluster. Despite its limited size, it occupies a central position among the four clusters and represents an administrative theme. The strongly correlated variables within this cluster establish links to all other thematic clusters. The development of new food products is inherently connected to moral and ethical considerations within the food industry. Food ethics has been employed as a key decision-making framework in this sector (Lugo-Morin, 2024). Moreover, the food industry has long sought innovative, gentler processing techniques to preserve nutrients, non-nutrient compounds, and sensory attributes (Sharma et al., 2024). Many Muslim countries have also focused on developing halal food technology (Zin et al., 2021).

The green cluster represents a food chemistry theme, covering methods, chemical properties, compositions, nutraceuticals, and functional foods, and accounts for approximately 21.9% of the total keywords. Notably, the application of chemical techniques, such as spectroscopy combined with chemometric analysis, has demonstrated significant effectiveness in the analysis of food adulteration and authentication (Aleixandre-Tudó et al., 2020). The primary keywords within this cluster are summarized in Table 1, highlighting the increasing convergence of food chemistry and advanced analytical methods. Additionally, medical innovations, including the application of ultrasound in food processing, have been widely documented within the food industry (Chavan et al., 2022). This method supports fat crystallization (Taha et al., 2024), assists meat tenderization (Alarcon-Rojo et al., 2015), and facilitates antibacterial action (J. Wang et al., 2024).

Aligned with these advancements, food authenticity has become a critical concern, especially as the global use of spectroscopy expands. Food authenticity pertains to the integrity of food, ensuring it matches its origin, identity, and stated claims. Recently, deep learning algorithms have been employed to verify food authenticity (Deng et al., 2024). A review of various deep neural network models demonstrates promising results in enhancing food traceability and ensuring authenticity (Y. Wang et al., 2024).

Keywords associated with the industrial practices are found in the blue cluster, which accounts for 20.5% of the total keywords. Notably, nanotechnology and nanoparticle research have gained prominence, especially in the areas of food packaging and pathogen detection, with the development of various innovative nanosensors for identifying pathogenic bacteria (Alafeef et al., 2020). Nanostructured materials have been engineered to encapsulate food components, enhancing the solubility and stability of nutrients during both production and storage (Jagtiani, 2022). Furthermore, the impact of foodomics is clearly reflected in this cluster. Central terms within foodomics include genomic enhancement, molecules, and food products (Valdés et al., 2022). Future research is anticipated to integrate chemometrics, bioinformatics, and nanotechnology with IoT and AI, demonstrating a shared focus within the field of food science and technology.

E. CONCLUSION

A bibliometric analysis of the Dimensions database, covering the period from 2014 to 2024, has identified emerging trends in food science and technology. The results indicate that publication patterns conform to a polynomial regression model, with future research opportunities and gaps lying in establishing connections among the four different keyword clusters. Patterns of international collaboration reveal robust partnerships among countries including the United States, the United Kingdom, Germany, Italy, and China. These nations have enacted targeted policies that emphasize organic agriculture, support agricultural sustainability, and foster the adoption of innovative technologies in agronomy. The ongoing advancement of artificial intelligence (AI), nanotechnology, and biosensors offers promising research opportunities, particularly in addressing issues related to food authenticity, health, and sustainability. However, despite the broad scope of the field, this study has certain limitations. A more detailed analysis at the institutional level has yet to be undertaken. Furthermore, the study did not perform a comparative evaluation of the Dimensions database against other major databases such as Scopus, Web of Science (WoS), and Google Scholar. Future research using the Dimensions database is encouraged to explore sub-disciplines like food packaging, food microbiology, and nutraceuticals in greater depth.

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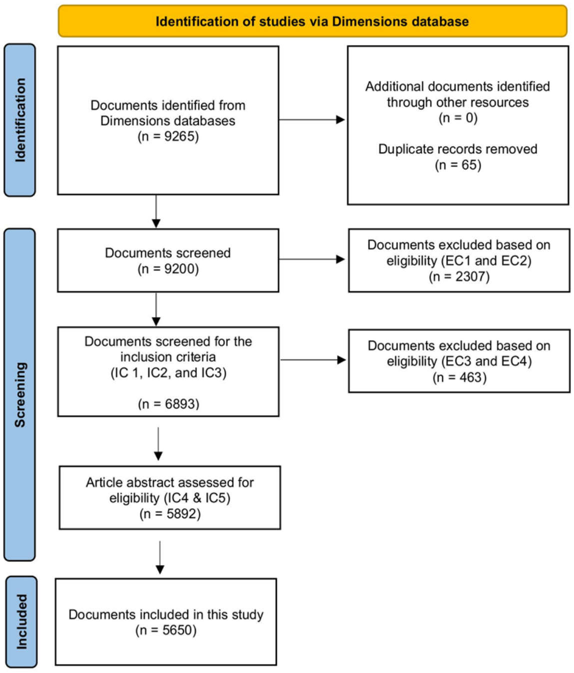

Figure 1 The PRISMA flowchart utilized in the bibliometric analysis
Source: Research data, 2024

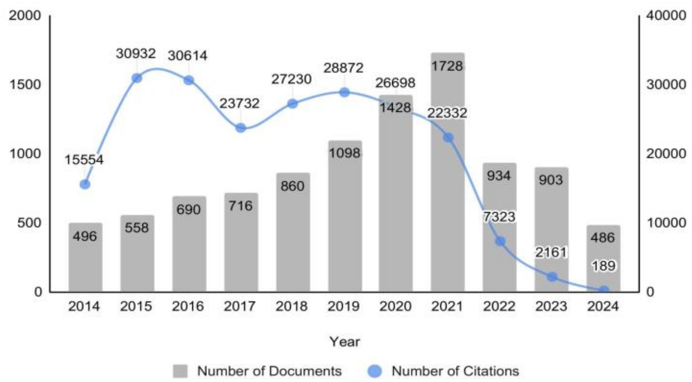

Figure 2 The distribution of publications and citations on food science and technology over time
Source: Research data processed from the Dimensions database, 2024

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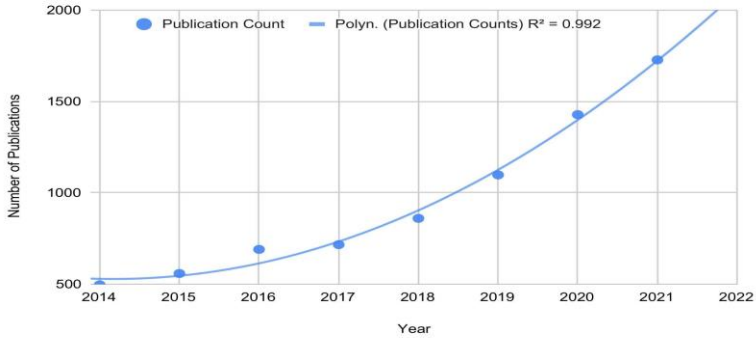

Figure 3 The trend analysis of publication counts
Source: Research data processed from the Dimensions database, 2024

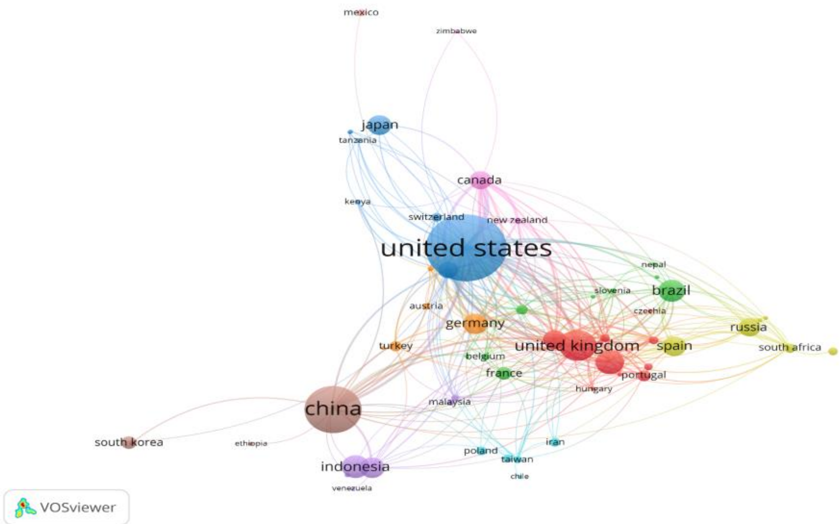

Figure 4 The country co-authorship network
Source: VOSViewer, 2024

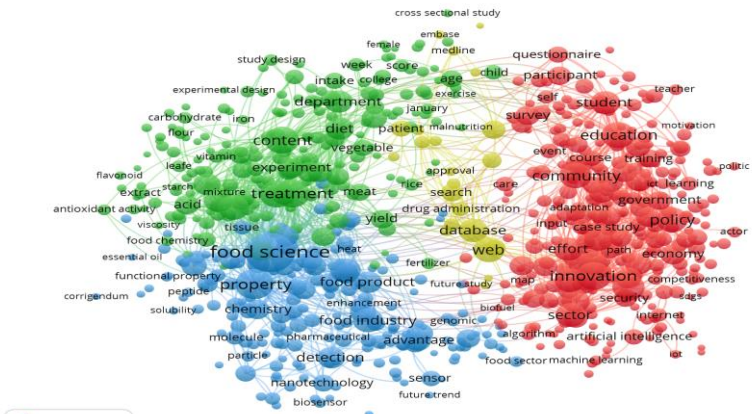

Figure 5 The Structure That Appears Related to Frequently Used Keywords
Source: VOSViewer, 2024

LIST OF TABLE

Table 1 The co-occurrence of title and abstract keywords across the clusters

Green Cluster: Food Chemistry Theme	Blue Cluster: Food Industry (Industrial Practices) Theme	Yellow Cluster: Administrative Theme	Red Cluster: Social Implications Theme
Acid	Biosensor	Approval	AI
Antioxidant	Detection	Drug administration	Algorithm
Carbohydrate	Enhancement	Database	Biofuel
Content	Food industry	Search	Care
Essential oil	Food product	Web	Course
Extract	Functional property		Economy
Fertilizer	Genomic		Education
Flavonoid	Heat		Event
Food chemistry	Molecules		Government
Intake	Nanotechnology		ICT
Iron	Particle		Innovation
Malnutrition	Peptide		Internet
Meat	Pharmaceutical		IoT
Nutrition	Sensor		Machine learning
Rice	Solubility		Map
Treatment	Tissue		Motivation
Vegetables			Policy
Viscosity			Politics
Vitamin			Security
Yield			SGDs
			Student
			Survey
			Teacher
			Training

Source: Research data, 2024