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Article

A bibliometric analysis of quality and food safety management in the food development industry

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Abstract: Quality and food safety management (QFSM) presents significant concerns for developing countries worldwide. Researchers have not yet reached a consensus on the most complicated QFSM practices in the food industry. Our study aims to fill the research gap by visualising and analysing 537 articles on QFSM using Biblioshiny. Relevant publications from Dimensions, Scopus, and the Web of Science databases expose the current research status from 1982 to January 2024, without bias. We classified publications about Food Safety Management (FSM) and Food Quality Management (FQM) into four stages: the appearance stage (1982–1995), the stage towards increase (1996–2005), a rapid rise phase (2006–2014), and stable, rapid growth between 2015 and 2024. The review of QFSM recorded 5714 paper references and 1677 authors from 57 countries or regions. The most popular keywords are food quality, food industry, quality, and food safety management. China became the first in the group with 84 publications, while Belgium had the highest citations, with 738 total citations and 49.20 average article citations. The most productive institution is "Abu Dhabi Food Control Authority, Abu Dhabi, United Arab Emirates," while Food Control is the most locally cited source. This study is the first to analyse QFSM resilience using biblioshiny. It is necessary to continue studying the strength of the food industry supply chain related to QFSM. The report identifies critical areas for improvement and future research to assist governments and businesses in developing adaptable food supply networks.

Keywords: food industry; food safety; food quality; HACCP; quality management and biblioshiny

1. Introduction

Quality and food safety management is a critical component of the food industry, ensuring that the food products reaching consumers are safe, nutritious, and high-quality. Recognising the significance of these aspects impacts public health, consumer confidence, and the overall sustainability of the food system (Almaghrabi, 2023). In recent years, concerns surrounding food-borne illness, food fraud, and contamination incidents have underscored the need for robust quality assurance measures and effective food safety protocols (Ismyrlis et al., 2015).

The growing quantity of food industry books on quality and food safety management makes it attractive to track development. Bibliometric studies can help comprehend food industry quality and food safety management. This method yields intriguing outcomes for novel themes (Lim and Kumar, 2024). Bibliometric studies organise information. Statistical approaches can identify new study fields by evaluating scientific quality and understanding present themes (Zupic and Čater, 2015).

Researchers have conducted similar bibliometric studies on total quality management in services from a bibliometric perspective. Zhang et al. (2021) are studying to highlight important areas and address critical topics in the service sector's Total Quality Management (TQM). The researchers want to highlight the services sector's Total Quality Management (TQM) domains and significant topics. Their analysis suggests that executive commitment/leadership is crucial, and managers will know the risks of lacking it. This document sketches the latest and most notable academic findings to help service sector TQM professionals and managers use TQM methodologies, but it does not explain QFSM. This study's limitation is that it only uses Scopus and Webofscience for bibliometric analysis and not other databases. Thus, the sample may not accurately represent this research field. Future studies could include examining TQM or research methods (empirical, quantitative, qualitative). This study does not cover food safety and quality management.

Shen et al. (2021) argue that food safety governance, online food governance, the willingness to purchase safe food, and food safety governance during pandemics were future research directions; they focus only on the government sector. They do this through their bibliometric analysis of food safety governance research. The authors gathered and summarised the literature on food safety governance in this paper. The researchers contend that examining food safety governance in various income-level countries revealed that middle-income countries concentrated on creating stable political structures, while lower-income countries were more concerned with the quantity and safety of food supplies. Higher-income nations emphasised consumer participation in governance, food safety, and nutrition governance.

Öğretmenoğlu et al. (2022) The researcher's aim of their study is to overview the British Food Journal Publications. They say European nations have the most productive and significant writers, organisations, and countries. The primary emphasis of these studies was articles in prestigious journals. Future studies should consider the limitations of this study. This analysis first looks at journal articles from 2010 to 2020. They research the food; they do not look at food quality or safety.

Although the food industry is a source of many exciting advancements, as previously mentioned, there are still gaps in our understanding of quality and food safety management. The reviews and bibliometrics do not cover food quality and safety management (QFSM). Through bibliometrics, our study emphasises gaps in the food industry, food quality management, and food safety analysis. The following research question serves as the basis for our scientific investigation in this bibliometric examination of Food Quality and Food Safety Management Practices in the Food Industry:

- RQ1: What are the literature publication research Annual and stages specific Publications on Quality and Food Safety Management in the Food Industry?
- RQ2: What are the keywords, articles, countries, authors, and institutions most relevant to FSM, QM, and FI?

Food product creation is a crucial area of research and a scientific challenge. This complicated phase requires much input from the business, academia, and regulatory agencies to gain acceptance, development, and procedure. This study contributes to the literature on innovation by highlighting a noteworthy technical innovation in the food industry. The literature shows that the issue we tackle in this work has not yet

been resolved. Comprehending these aspects empowers us to address the diverse food in history. We review the existing body of research on the sufficient facets of food safety and quality management to shed light on the underlying causes by assessing and critically evaluating various scholarly contributions.

The study has been divided into four components by the researchers: The method is covered in Section 2, along with the mapping of the Bibliometrix, search terms, PRISMA, data sources, and data gathering. Section 3 covers the results and discussion of the Biblioshiny data analysis. Ultimately, the investigation concludes in Section 4.

2. Materials and methods

PRISMA guidelines, bibliometric analysis, thematic analysis, and RStudio with Biblioshiny were carefully chosen to offer a thorough and multifaceted analysis of QFSM research. Every approach contributes to comprehending the literature's breadth, patterns, and major themes. These techniques alone have benefits and drawbacks, but taken as a whole, they provide a strong framework for our research. While alternative procedures might be used besides or instead of these, the methods that have been selected are well-suited to our study goals and the characteristics of the data. **Table 1** shows each method's Justification, Advantages, Limitations, and Alternative Methods.

Table 1. Bibliometric, PRISMA, theme evaluation, and R Studio justification, advantages, limitations, and alternatives.

Justification	Advantages	Limitations	Alternative Methods
Bibliometric analysis			
Bibliometric analysis helps forecast discipline trends. It is commonly used to assess discipline-specific research, frontiers, and development patterns (Zupic and Čater, 2015; Vaismoradi and Snelgrove, 2019)	Mapping the collaboration among scientists and developing thematic areas.	Primarily reliant on publication and citation numbers, which may not wholly represent qualitative research. Potential biases may arise from database coverage and indexing procedures.	Scientometric analysis might give more importance to science and technology measures than bibliometric indicators (Zhong et al., 2019).
PRISMA (Preferred reporting items for systematic reviews and meta-analyses)			
Applying PRISMA to literature searches for occupational safety systematic reviews is a helpful tool for authors to create transparent reviews (Trifu et al., 2022).	Improves systematic review clarity and completeness. Lowers bias in study selection. Provides complete literature coverage.	The reliance is on the quality and accuracy of the reporting of original studies.	Systematic reviews can follow the recommendations of the Cochrane Handbook or Meta-Analysis of Observational Studies in Epidemiology (Tawfik et al., 2019).
Thematic evaluation			
Thematic evaluation helps find and analyse research literature themes, trends, and patterns. It clarifies QFSM substance and focus (Naeem et al., 2023).	The study offers qualitative insights into the subjects and themes. Identifies patterns and gaps in the research.	Theme interpretation is based on subjective factors. A manual for comprehensive literature coding is required.	Use qualitative content or grounded theory for comprehensive thematic analysis (Naeem et al., 2023).
RStudio and biblioshiny			
RStudio and Biblioshiny enable advanced data management, statistical analysis, and visualisation. It is chosen for its flexibility and bibliometric analytic capabilities (Fakruhayat and Rashid, 2023).	Integrates with several statistical and graphical applications. Non-programmers can use Biblioshiny.	Requires R programming expertise for advanced features. The user learning curve may be considerable.	Consider alternate tools like VOSviewer for network visualisations or Gephi for complicated analysis (van Eck and Waltman, 2014).

2.1. Method and Bibliometrix's mapping

Bibliometrix provides various routines for importing bibliographic data from SCOPUS, Clarivate Analytics' Web of Science, and Dimensions databases, performing bibliometric analysis and building data matrices for co-citation, coupling, scientific collaboration analysis, and co-word analysis (van Eck and Waltman, 2010). The VOSviewer can effectively display the connections among subject topics (Camero and Alba, 2019), while Biblioshiny combines the functionality of the bibliometrics package with the ease of use of web apps using the Shiny package environment. This study uses MS-EXCEL, VOSviewer, and Biblioshiny web applications to map the knowledge of the FQM, FSM, and FI research literature over the last 42 years Because foundational concepts and frameworks for current QFSM tactics arose in the 1980s and gained academic and corporate acknowledgement, we can monitor these developments' early phases from 1982, perform bibliometric analysis, and create data matrices for co-citation, coupling, scientific collaboration, and co-word analysis. Biblioshiny's science mapping workflow for our study comprises three main steps through the suggested science mapping approach provided is depicted in **Figure 1**.

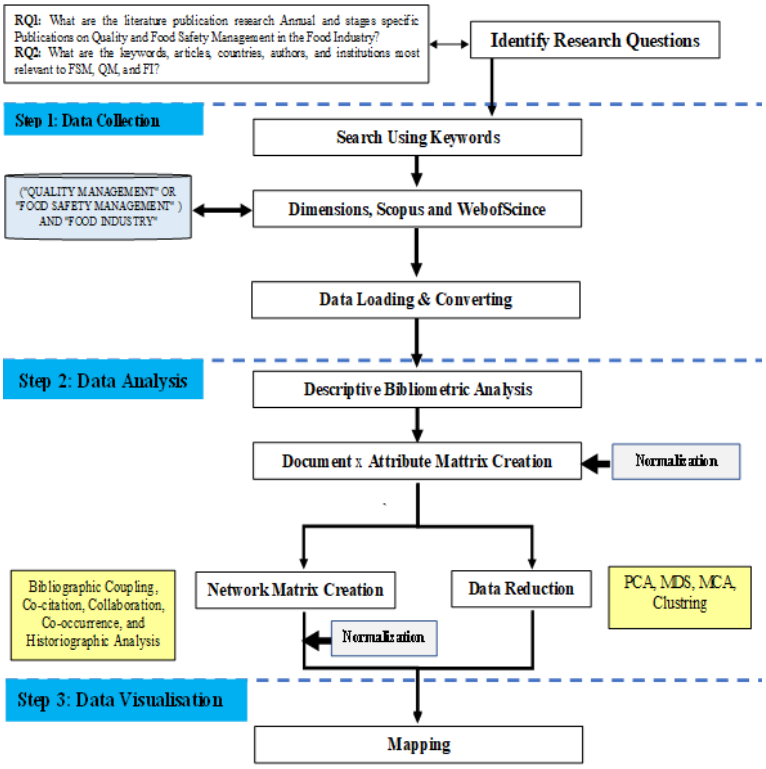

Figure 1. Bibliometrix's science mapping workflow for our study.

Step 1: Collecting data: Bibliometrix is compatible with the following sub-step for data gathering: importing and converting data to an R data frame. We got data from three databases (scopus, web of science, and dimensions) and converted each file to a df using Rstudio (**Figure 1**). Finally, we combined the three files into one xlsx file using R codes from Rstudio. Use MS Excel to access the converted document and eliminate any conferences, book chapters, or books. Explore Biblioshiny's collection of 538 articles just waiting to be seen. Because of their widespread usage among

academics, we relied on Scopus, Web of Science, and Dimensions databases for our research, as they contain the most significant peer-reviewed literature. We identified a group of keywords and searched for them in the paper's titles, abstracts, and keywords. Our investigation was not limited to a single paper. Title-Abs-Key ("food industry" and "quality management" or "food safety management") is the search string to use. We did not impose restrictions on the research's time frame. The initial search method found five hundred thirty-eight scholarly publications from 1982 to 2024, which cover the entire investigation period starting from the year the first document was published.

Step 2: Analysing the data: The three additional stages of data analysis involve normalisation, constructing networks for bibliographic coupling, co-citation, collaboration, co-occurrence analyses, and describing a bibliographic data frame. The bibliometric analysis involved the use of VOSviewer and Rstudio-Biblioshiny software. By employing bibliometric analysis, researchers can examine the field's evolution and identify critical areas of study and knowledge gaps in the QFSM in FI (Ababou et al., 2023). By utilising this information, researchers and practitioners can better understand the challenges confronting the FSM in the food industry and identify potential areas for future investigation and innovation. Bibliometric evaluation can promote cooperation and knowledge exchange among experts to identify influential researchers and organisations.

It can calculate the number of publications based on the source and the country. This method enables us to comprehend the distribution of research findings across academic journals and geographic locations. This tool can identify this sector's most productive writers, organisations, and journals.

Step 3: Data visualisation: Conceptual structure mapping and network mapping are forms of data visualisation. Keyword analysis: VOSviewer was used to analyse the co-occurrence in keyword analysis by visualising the relationships between terms using a network graph. In this investigation, we used biblioshiny mapping to calculate keyword frequency and determine the most frequently used terms. These findings help determine the most extensively researched food business areas, QM and FSM. Content and Cluster Analysis is a method for grouping related elements in a dataset. In this study, we grouped the associated keywords using cluster analysis based on their co-occurrence patterns. A graphical representation of the cluster heatmap that highlights the relationships between the phrases and the clustering of related keywords is the Biblioshiny cluster analysis result. Clustering reveals hidden connections, patterns, and insights in text data analysis beyond what is apparent through reading alone. By using cluster analysis, we identified key themes and clusters. We then suggested potential research areas for the future based on these findings. The researchers achieved this by analysing, assessing, and emphasising the main concepts in the papers.

To give a thorough bibliometric analysis of Quality and Food Safety Management (QFSM) in the food development sector, our study will cover the years 1982–2024. To accomplish this, we organised a research cycle starting with data gathering, then information analysis and visualisation as a last step. Each stage was built on the one before it to guarantee a well-rounded and cogent literature review as shown in **Figure 1**. Step 1: Information gathering, link to data analysis; additional bibliometric analyses are built using the cleaned and merged dataset. Step 2: Data Analysis; Link to the Data

visualisation step below; the knowledge of the dynamics and composition of QFSM research gleaned from these studies informs the visualisation stage. Step 3: Data visualisation and findings relationship; By emphasising the major themes and clusters in QFSM research through visualisations, we may use the results to propose potential lines of inquiry for further study.

Combining and interpreting the findings: We combined the results of the analyses and visualisations to create a cohesive account of the development and status of QFSM research. We integrated the findings from each analytical stage to connect the noted trends, major themes, and research gaps. This comprehensive approach provides recommendations for future study directions and allows for a deeper grasp of the field.

2.2. Source data

Academic reviewers often select the Dimensions, Scopus, and Web of Science databases for their ability to search multiple scholarly journals and use filters for more accurate searches. Among the searches conducted were QM, FSM, and FI. We searched for articles published until February 2024. Even though the aim was to reference current studies, 2024 was ultimately selected. "Quality management," "food safety management," and "food industry" were included as synonyms of the original keywords during further research for improved or additional outcomes. Papers were selected for relevance through author recommendations and reference lists (Levy and Ellis, 2006; Webster and Watson, 2002). The databases and queries, including the updated ones, are shown in **Table 2.** Each row represents the refinement of the search phrase database source, ultimately leading to using the final question of finding relevant articles.

Table 2. The database and keyword searches yielded several articles.

Database source	Query	Result
Dimensions	("quality management" or "food safety management") and "food industry"	470 Documents
Scopus	("quality management" or "food safety management") and "food industry"	320 Documents
Web of Science	("quality management" or "food safety management") and "food industry"	161 Documents
All documents as external data from three databases are		951 Documents
Articles removed because of duplicates		203 Documents
Exclude the book chapters, conference papers, etc.		211 Documents
The Articles included in Biblioshiny analysis		537 Articles

The search across all three databases yielded about 951 studies. The total of 951 is just an estimate because of duplicates in search results. After that, we performed a manual analysis of 951 papers under the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) criteria. These recommendations aim to improve research clarity, completeness, and quality in systematic reviews and meta-analyses. Researchers can reduce the risk of reading irrelevant publications using PRISMA (Page et al., 2021).

The search results used specific filters, including limiting the search to journal articles and conference papers published from 1982 to 2024, written in English, and subjected to peer review. We found 951 records from multiple databases and quickly

eliminated 203 duplicates. The researchers omitted an additional 211 records. After removing duplicates and non-article documents, there are 537 remaining articles. The final selection of 537 studies for bibliographic analysis using RStudio. The systematic research synthesis adhered to strict guidelines to ensure the inclusion of relevant literature in the review. The research on FSM, QM, and FI is shown in **Figure 2** to include in the deep study addressing the research questions from PRISMA.

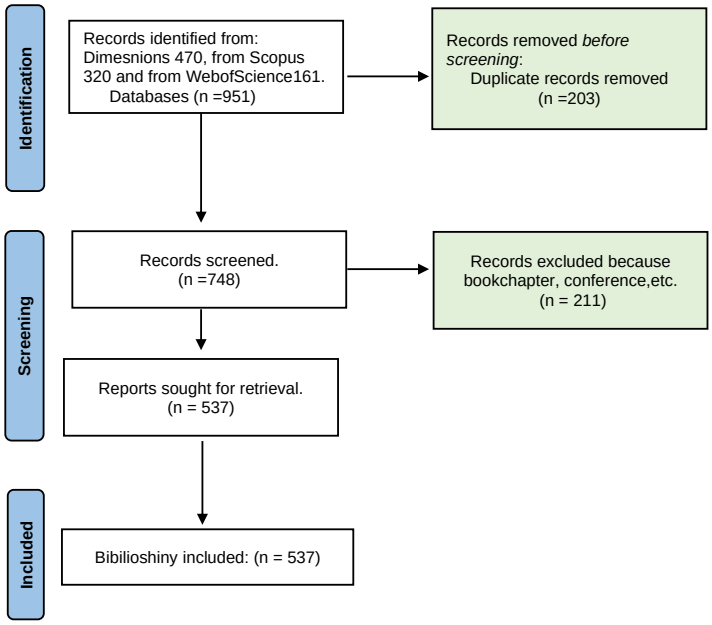

Figure 2. Preferred reporting items for systematic reviews and meta-analyses for our study.

Figure 2 preferred reporting items for systematic reviews and meta-analyses for our study A bibliometric analysis was conducted on (537) articles from the Dimensions, Scopus, and Web of Science databases in this study. The articles covered a range of analyses, including bibliometric analysis, keyword analysis, and publication growth.

3. Data analysis results and discussion

The analysis of 537 documents revealed publishing patterns on FQM, FSM, and FI. To answer our research questions, we looked at the publication trend by looking at total publications by country, area, year, institution, and journal. Following a thorough assessment of the literature from articles, as stated in **Table 3**, the primary data comprises 537 documents drawn from 343 sources, covering the years 1982 to 2024.

The average document age is 9.38 years, with an annual growth rate % of 4.74, and the average citation per doc is 14.42. There are 5714 references in the papers, 2592 Keywords Plus (ID) and 1168 Author's Keywords in content, 1677 authors, and 95 authors of single-authored docs, with 102 being single-authored docs. On average, 3.69 authors collaborate on a single document, with an international co-authorship rate of 5.959 per cent. There are 537 articles; **Table 3** represents our research findings, which include 537 articles over 42 years.

Table 3. The secondary data descriptive statistics from Rstudio-Biblioshiny.

Description	Results
Main information about data	
Timespan	1982–2024
Sources (Journals, Books, etc.)	343
Documents	537
Annual Growth Rate %	4.74
Document Average Age	9.38
Average citations per doc	14.42
References	5714
Document contents	
Keywords Plus (ID)	2592
Author's Keywords (DE)	1168
Authors	
Authors	1677
Authors of single-authored docs	95
Authors collaboration	
Single-authored docs	102
Coauthors per Doc	3.69
International co-authorships %	5.959
Document types	
article	537

3.1. Annual and increased publication

Analysing the distribution of volumes in literature over time allows us to identify trends in studies. **Figure 3** illustrates the yearly articles and publications on FQM, FSM, and FI. As shown, the pattern of articles and citations began in 1982 with only one article, similarly in 1990, and gradually increased, becoming relatively stable since 1995 with seven articles. From 1996 to 2005, the number of citations and articles increased to the top in 2005, with about 11 articles; this shows the issues and that there has been a periodic trend of rising scholarly interest in FQM, FSM, and FI. The number of articles published increased from 2006 to 2014, reaching its peak with 29 articles published in 2014. The period from 2015 to 2024 signifies the final stage. The blue bar shows annual publications, while the red line represents exponential growth. From this perspective, perhaps the importance of quality and food safety management is increasing daily, and authors researching the food industry are increasingly interested in these topics.

From 1982 to 2024, 537 articles on FSM, FQM, and FI were published in Dimensions, Web of Science, and Scopus databases. Because of major changes in the food industry, as shown in **Figure 4**, the thematic evaluation from Biblioshiny regarding the duration of our studies reveals four classifications from 1982 to 1995. The primary keyword used for the first classification pertains to the food industry. The economic aspect relates to the article. From 1996 to 2005, the higher keywords are food industry, quality control, total quality management, food processing, controlled

study, food quality, food-processing industry, food analysis, food microbiology, food poisoning, method, microbiological examination, management, and industry. Keyword analysis thematically from 2006 to 2014 became food safety's higher keyword, while from 2015 to 2024, the higher keyword became the food industry, as illustrated in **Figure 4**.

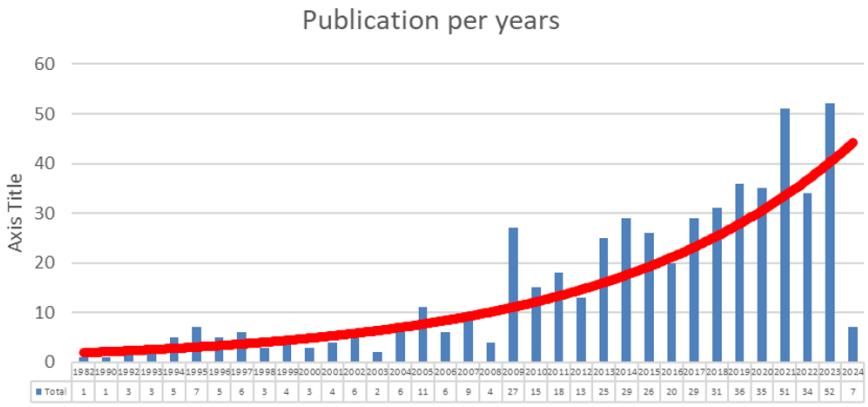

Figure 3. Annual articles published from 1982 to 2024.

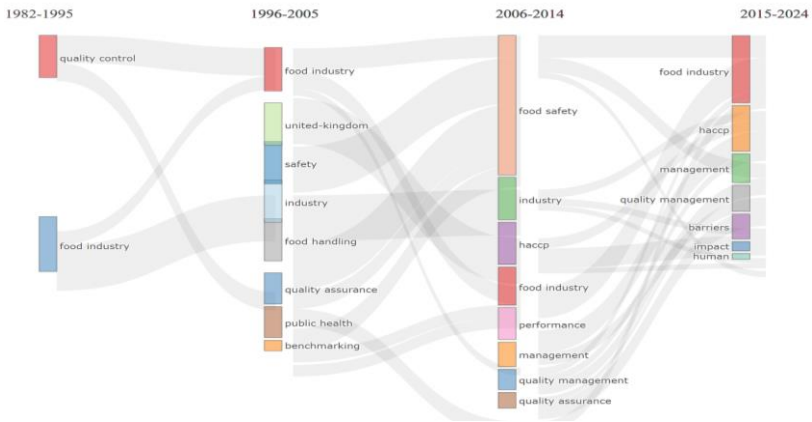

Figure 4. The thematic evaluation keyword classification and duration from Biblioshiny.

Thematic evaluation and trend topic analysis: Based on the network approach, the thematic evaluation identifies the four cutting points' time slice number and the field of keywords plus. The trend topic analysis indicates that the use of the term "food industry" is rising. The research distribution of Biblioshiny during the thematic evaluation from 1982 to 2024, as shown in **Figure 4**, can be divided into four stages using the thematic evaluation approach:

3.1.1. The appearance stage, spanned from 1982 to 1995

The single article found in 1982, as depicted in **Figure 3**, the graph excluded any articles from 1982 to 1989, with an additional article published in 1990. The graph did not display the years 1983, 1984, 1985, 1986, 1987, 1988, and 1989, as there was nothing to compare them to. **Figure 3** shows that the first papers were published in 1982, followed by the same number of articles, with only three published in 1992 and 1993. Overall, the increase in research papers is mainly because of the explosive growth of the food industry. In 1994 and 1995, Quality Control and the Food Industry

became popular, and the use of conservation easements exploded. The number of published papers from 1982 to 1995 was only 20 articles, and the higher number in 1995 was seven articles.

As shown in **Table 4**, in the older study Bigalke and Busta, in (1982), under the title "Quality Management Systems for The Food Industry HACCP Approach to Increased Profits", is published in Food Technology in Australia. The Hazard Analysis and Critical Control Point System (HACCP) is a systematic approach to food safety that detects, assesses, and determines control actions to guarantee food safety. The study examines how the food business might save money, cut waste, improve product quality, and boost consumer happiness by implementing HACCP principles.

Table 4. Earliest articles about food industry.

Authors	Title	Source	Year	Total citation	TCperYear
(Bigalke and Busta, 1982)	Quality management systems for the food industry HACCP approach to increased profits	Food Technology in Australia	1982	3	0.06976744

As seen in **Table 5**, there are four articles at the end of this stage. The article titled "Water Quality Conservation for The Citarum River in West Java" was written by Miyagishima et al. (1995) and has the highest city ranking, with 10 citations and a TC per year of roughly 0.33. The authors describe the food safety, defined as the full set of circumstances and measures needed across the food manufacturing and distribution chain to avoid health risks upon consumption, is crucial to public health programmes. They argue that food safety should be prioritised in public health programmes since it protects health. Governments, businesses, and consumers must collaborate on food safety, including quality assurance changes. The health sector should set national and international food safety standards. The WHO's 'Health for All' plan to cooperate with countries and set international standards is important to this effort. The authors conclude that public health programmes must collaborate across industries and borders to ensure food safety.

Table 5. Most cities article in 1995.

References	Paper	Doi	Total citations	TC per Year	Normalised TC
(Miyagishima et al., 1995)	Food safety and public health	10.1016/0956-7135(95)00039-T	10	0.33	2.41
(Thomson and Thomson, 1995)	Quality issues in nine new Zealand hotels: A research study	10.1108/09544789510098579	6	0.20	1.45
(Ho and Cho, 1995)	Manufacturing excellence in fast-food chains	10.1080/09544129550035477	1	0.03	0.24
(Practical et al., 1995)	Guide to quality management systems for the food industry	10.1111/J.1365-2621.1995.TB01402.X	0	0.00	0.00

The following item is titled "Quality issues in nine New Zealand hotels: a research study," it has six citations overall, or 0.20 citations annually. This 1995 paper by Thomson and Thomson (1995) includes an exploratory explanation. The results of this exploratory study, which examined how much the quality movement has impacted a few hotels in the capital city of New Zealand, have brought up several applicable considerations for managers and front-line supervisors. This recording method is

expected to improve the overall understanding of high-quality applications in hospitality settings worldwide.

Another paper by Ho and Cho (1995) titled "Manufacturing Excellence in Fast-Food Chains" discusses finding equity when applying manufacturing excellence to the fast-food industry. They contend that manufacturing excellence was not intended only for factories but for manufacturing companies. It can be used for any business activity. This article concludes that while manufacturing excellence was initially developed for manufacturing enterprises, the fundamental ideas may apply to any corporate activity. The methods are considered best-in-class functioning procedures and help any business succeed. Their applications are infinite. Business executives must use their creativity and faith to adapt them to their needs. Opportunities are constantly present for companies that take this message seriously. They suggested that it be put into practice. A methodical approach to manufacturing auditing must achieve success and reap the rewards other outstanding businesses enjoy. Create a comprehensive business plan that satisfies the requirements by beginning with a basic assessment of the company's goals and strategy by reviewing its current activities, facilities, and surroundings (Arnold and Wade, 2015). No implementation of manufacturing excellence can be successful if the features of each unique firm are not understood.

As a result, the appearance stage spanned from 1982 to 1995. Research emphasises the significance of quality management in the manufacturing and hospitality sectors, accentuating the necessity of best practices and customisation to meet each organisation's specific requirements for success.

3.1.2. The next stage is towards an increase (1996–2005)

Researchers have rapidly developed FSM, FQM, and FI research from 1996 to 2005. The keywords appear related to the article's research; for example, in the article titled "The FDAS reaction to corporate compliance audits" the keywords "quality management" and "food industry" Moore and Garg (1997), the authors contend that the problem-solving technique's adaption was based on the quality management tenets of participation, structure, scientific method, and decision-making. They take action. The first two steps of the problem-solving approach are recognising and analysing the problem, while the last three are creating, putting into practice, and assessing the solution. Data gathering about the problem's history, scope, and effects was a component of the review procedure. Following the evaluation of the situation, a brainstorming session occurred to devise a solution. A debate ensued to establish a consensus on a few chosen actions. While the writers Stank et al. (1999) contended in a different article titled "Effect of Service Supplier Performance on Satisfaction and Loyalty of Store Managers in the Fast Food Industry" that a greater focus on supply chain management has brought attention to the significance of service activities that cross the boundaries between suppliers and customers. Instead of depending on the providers' self-reported performance indicators, they assessed service provider performance during the manufacturing link using customer perceptions.

In the last stage of 2005, there were eight articles, as shown in **Table 6**, all about the primary keywords of the food industry, quality assurance, food handling, safety, and food industry articles the most cited article in the last of 2005 its article titled "Food safety aim an integral part of food chain management". The authors propose

the Food Safety Aim (FSO) as the operational food safety management target. This approach allows for flexibility in how diverse food chains attain equal food safety levels. The idea makes connecting practical food safety management to public health objectives or the right amount of protection easier. Food operations do not have to alter their approach to managing food safety entirely. Currently, there are several novel ideas for food safety control. Many of the ideas, norms, and regulations that have been in use up to this point will still be necessary in the future from an operating standpoint. Planning activities to ensure food conforms with the FSO when consumed is a recent development in food safety management. The current food safety management systems (HACCP, GHP, GMP) and supply chain targets (microbiological requirements, process criteria, etc.) will fulfill the FSO. They will continue to be an essential and indispensable component of food safety management in the future.

Table 6. Most cited article in 2005.

Authors	Title	Year	Total citation	TCperYear
(Gorris, 2005)	Food safety objective an integral part of food chain management	2005	131	6.55
(Gorris, 2005)	Strategic use of private standards to enhance international competitiveness vegetable exports from Kenya and elsewhere	2005	110	5.5
(Taylor and Kane, 2005)	Reducing the burden of HACCP on SMES	2005	61	3.05
(Stringer, 2005)	Food safety objectives role in microbiological food safety management	2005	46	2.3
(Lievaart et al., 2005)	The hazard analysis critical control points HACCP concept as applied to some chemical physical and microbiological contaminants of milk on dairy farms a prototype	2005	32	1.6
(Fielding et al., 2005)	An evaluation of HACCP implementation status in UK small and medium enterprises in food manufacturing	2005	31	1.55
(Stecchini and Del Torre, 2005)	The food safety management system	2005	11	0.55
(Worsfold and Worsfold, 2005)	Increasing haccp awareness a training intervention for caterers	2005	4	0.2

Quality and Food Safety Management (QFSM) in food industry research grew from 1996 to 2005. This research focused on food quality management and problem-solving.

In 2005, the number of published articles became higher than in all years in this stage, and the number of articles in the last stage years, 2005, became 11 articles, and Food Safety Objectives (FSOs) were stressed as crucial to food chain management to end this phase. The widely cited article "Food Safety Aim an Integral Part of Food Chain Management" by Gorris (2005) introduced FSOs as operational food safety targets. Other important 2005 publications covered the strategic use of private standards in vegetable exports, decreasing the HACCP burden on SMEs, and analysing UK food industry SMEs' HACCP implementation status. Quality management and food safety were becoming more critical in the food industry, focusing on compliance and customer safety.

3.1.3. Third stage, a period of difficulties that led to a rapid rise phase (2006–2014)

During this time, which began in 2006 and continued until 2014, the total number of publications made during these eight years was 146 articles, and the illustration

clearly shows this. The chart shows that there will be six papers to begin within 2006, and in the last stage, 29 other publications published in 2014 explicitly detailed Food safety, industry, HACCP, food industry, performance, management, quality management, and quality assurance.

Academics have noted that it is essential to study displacement and its relationship to the food industry as a large-scale, long-term safety and quality phenomenon rather than an environmental event. The different arguments associated with food quality issues and food safety are historically specific to do so. As an illustration by Massoud et al. (2010), they believe the food industry is more concerned with safety and quality than other issues.

Other academic researchers' research during this stage presents customer satisfaction regarding the strategy of total quality management (TQM); for example, Kristianto et al. (2012) argue that customer satisfaction has grown. The Quality function deployment (QFD) approach helped to design a competitive product by aligning the company's resources with customers' needs. Jacxsens et al. (2010) explain that two critical principles differ in the food safety performance diagnosis. Besides its usefulness to individual food businesses, the food safety performance diagnosis can also apply to government or sectoral organisations. At the sector level, the tool can benchmark the food safety performance of different food businesses, independent of the type of QA standard(s) implemented. At the governmental level, it could benchmark the food safety performance of different food businesses, independent of the sector or the type of food business.

At this stage, the adoption of the hazard analysis and critical control point (HACCP) system in the food industry appears; for example, the authors Jin et al. (2008) argue that food enterprises without an HACCP system in practice are more sensitive to external factor incentives such as consumer awareness of food safety and extension and support from the government.

3.1.4. Stage four, from 2015 to 2024, the fourth stage is characterised by both stable and rapid expansion

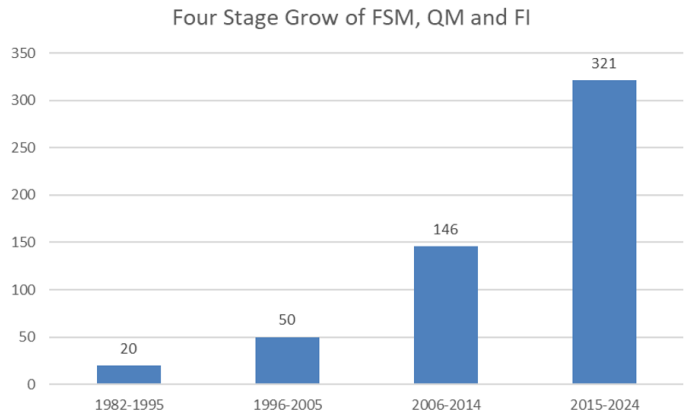

Figure 5. Four stages grow of FSM, FQM and FI.

As illustrated in **Figure 5**, until 2015, the annual total of papers published was only 216 articles. Initially, a more other author became interested in FQS and FQM in 2015, but only during this year, there were 26 articles, which continually increased in 2017, 2018, 2019, and 2020 (29, 31, 36, and 35), and awareness grows year after year.

Figure 3 illustrates that after 2021, 2022, and 2023, there will be the highest number of publications, 51, 34, and 52. A growing number of academics and legal professionals worldwide are focusing on using FQS for FI because of the inherent flaws present in the statute court system.

Recent research has concentrated on QFSM and food safety management processes and the effectiveness of these processes compared to the traditional court system. For example, Osei Tutu and Anfu (2019) explained through a case study about the cottage food manufacturing industry in Ghana, they find that the Lack of understanding of procedures that affect food safety and the infrastructure and equipment required for processing are the main obstacles faced by cottage food firms when inserting place a food safety management system. Strengthening the Food Safety Management System of the Food manufacturing industry requires investments in infrastructure and capacity.

During this last stage, there will be more publications in 2023. The keywords food industry and quality management become Prevalence snowballing, as shown in **Figure 4**, from biblioshiny. During this period, some academics mentioned the role of food safety management; for example, Olaimat et al. (2020), through their studies, explained the implementation of food safety management systems such as Hazard Analysis and Critical Control Points (HACCP) and Good Manufacturing Practices (GMP) is essential to reduce the pandemic risk. We also require cleaning, sanitation, hygienic practices, and active packaging from farm to fork to reduce the pandemic risk.

Academic research has increased because of this situation regarding FQM, FSM, and the food industry from 1982 to 2024, as shown in **Figure 5**. The publication had 20 articles in the initial stage, 50 in the second stage, 146 in the third stage, and concluded with 321 articles in the final stage. The number of published articles annually reached 537, showing an increase.

3.2. Three field plot

Figure 6 shows a visualised and precise representation of prolific scholars, their countries, and the areas of interest depicted with keywords in knowledge management and artificial intelligence. The representation portrays a three-field plot of article contributions by countries, authors, and themes within the field of knowledge management.

In the left column, the depiction of countries is shown in **Figure 6**, while the middle column contains the names of the researchers, and the right column displays the most used keywords. The number of occurrences of the keywords is what we refer to as ‘themes.’ The height of the boxes, along with the thickness of the connecting lines, intensifies the relationship and the connectivity on the side of countries. China has the highest authors’ affiliations, followed by the United Kingdom. In the same order, the Netherlands has the next highest volume of authors, followed by Belgium and Greece. It is observed that the thickness of the line leads from the countries to authors; the giant contributors are “al y m”, and “luning p” are from China; they are interested in food safety, HACCP, and food safety systems. While “Taylor j” is from the United Kingdom and Greece, “Jacxsens I”, has relations with coauthors in the

United Kingdom, Netherlands, and Belgium, who are interested in food safety management and the food industry.

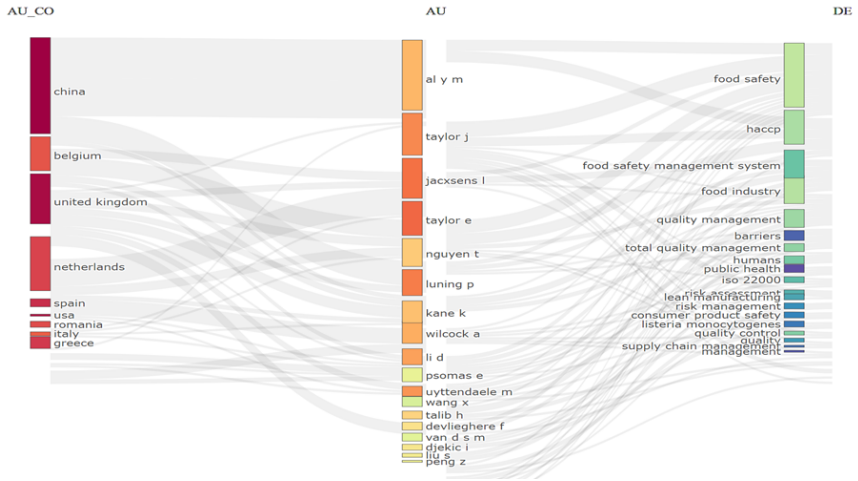

Figure 6. Three field plot country, authors and keyword.

3.3. Thematic MAP

The thematic analysis takes clusters of authors' keywords and their interconnection to get themes. Properties (density and centrality) characterise these themes. The vertical axis represents density, while the horizontal axis represents centrality. These properties measure the relevancy of the topics and differentiate whether they are essential. The higher the number of relations the anode has with others in the thematic network, the higher the centrality and importance, and it lies within the essential position in the network.

Cohesiveness among a node, representing the density of a research field, delineates its capability to develop and sustain itself. **Figure 7** depicts the thematic map of food quality management, food safety, and the food industry, the x-axis relevance degree (centrality), and the y-axis development degree (density), which divides itself into four quadrants (Q1 to Q4). The upper right quadrant (Q1-motor themes) depicts the driving themes; the lower right quadrant (Q4-basic themes) portrays underlying themes; the upper left quadrant (Q2-Niche themes) is the much-specialised themes, and the lower left quadrant (Q3-Emerging or Declining Themes) is the emerging themes.

Themes such as the food industry, total quality management, food safety, and food contamination seen in Q4 are the motor themes and are very important for the field's development. The themes in Q2 Niche themes have developed internal bonds but are still of marginal contribution to the development of the field of the food industry. This finding suggests that themes in Q2, such as the most potential, encompass dataset repository, food quality management, and food safety management. The lower left quadrant (Q3) comprises the qualitative management industry, certification, HACCP, and quality framework. The clusters of the food industry, management, and quality management have a Callon centrality of 23.3625242, 10.3333913, and 1.79570168, a Callon density of 84.73392, 33.6335398 and 17.6819363 with rank centrality and density of 9, 8 and 7, respectively, as shown on the **Table 7**.

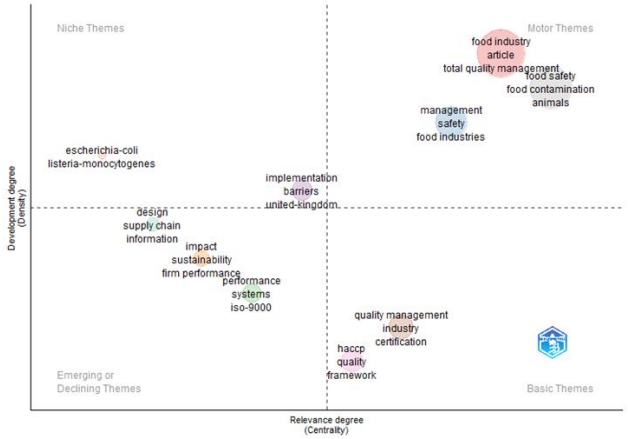

Figure 7. Thematic map of food quality management, food safety, and the food industry.

Table 7. Cluster analysis and main keywoord.

Cluster	Callon Centrality	Callon Density	Rank Centrality	Rank Density	Cluster Frequency
food industry	23.3625242	84.73392	9	10	1294
management	10.3333913	33.6335398	8	8	169
performance	0.37691799	20.3819444	4	3	31
quality management	1.79570168	17.6819363	7	2	67
HACCP	0.94254387	14.9245254	6	1	47
food safety	28.926761	63.4435857	10	9	655
design	0.25634921	22.8174603	2	5	17

3.4. Keyword analysis

3.4.1. Co-occurrence network

The keywords summarise the research paper's content. A high-frequency keyword analysis is one efficient method of directly reflecting the QFSM revitalisation research hotspots. Publication keywords are often employed in bibliometric studies to illustrate the hierarchical knowledge structure within a field.

The study also investigated the co-occurrence network (KCN) keywords to gain further insights into knowledge management trends. This analysis presents the link between keywords, contributing to the field's knowledge structure. The results showcase that, apart from identifying the frequent keywords in the word cloud, a co-occurrence network helps reveal their connections. Analysis of keywords incorporated by authors in publications is an essential tool for investigating trending topics and scholars' focus in the field. Word cloud analysis enables the identification of the topic and focus of that publication quickly with the help of the most frequent keywords used.

A few keywords have a more significant impact on the co-occurrence network. Examining these keywords' colour codes closely suggests that a more considerable keyword, represented by its width, has cohesive connections to other smaller keywords. For instance, in the blue cluster, the food industry is connected to quality management and total quality management, followed by a quality management system belonging to different clusters. The second cluster is red, for instance, regarding food safety, HACCP, and critical success factors. The clusters stated in blue and red are the most

relevant ones to get a clear overview of the present keywords in the study. The construction of a co-occurrence network in **Figure 8** permits us to scout and explore the conceptual structure of the scrutinised research domain.

Figure 8. Keywords have a more significant impact on the co-occurrence network.

Figure 8 plotting the map of the top 10 keywords 277 in the field and analysing the high-frequency keywords were done. The most frequently mentioned terms, accounting for all keywords, Words, Occurrences, and Percentage are included: food safety, 65, 23.46%, and food industry, 62, 22.38%. The terms most often used in food safety and food industry literature are presented in **Table 8** and filtered manually using Biblioshiny tools. Besides quality management and quality control, food safety management, the most often occurring terms in the keyword plus list are food safety, which appears 65 times on average. "Food industry" is the second most frequently used term, with 62 mentions, followed by "HACCP" and other terms. Expropriation is the term that the writers use the most often, followed by quality management, quality control, etc. These terms all have something to do with food quality and safety and food quality management and show how these two factors are related.

Table 8. The terms most often used in FQM and FSM literature.

Words	Occurrences
Food safety	65
Food industry	62
HACCP	37
Quality management	34
Total quality management	20
Quality control	14
Humans	13
Food safety management system	12
ISO 22000	10
Risk assessment	10

3.4.2. Words cloud

The researchers created the word cloud based on frequently used keywords, with more prominent words showing higher usage frequency, as shown in **Figure 9** and supported by prior research (Rha, 2020). Keyword Plus is a distinct algorithm that enhances cited reference searches and broadens search results. Total quality

management, the food industry, and food safety are the topics most commonly shown in **Figure 6** because quality control and the food industry, which aims to promote food quality management through improved food safety, are the areas FI regulates. Scholars have also paid particular attention to quality control, food processing, food quality and handling, and risk management. These studies investigate quality management and the food industry in China, which is higher than in other countries, the largest developing nation. Some literature also examined the food industry, food quality, management, quality control, and contamination. This research concentrated on improving food quality management issues through innovation and related food industry policy legislation, as well as total quality management and food safety performance. To sum up, researchers have examined every keyword in **Figure 9** in the food industry and food quality management so they can use this information as a guide in the future to choose the research niches that interest them.

Figure 9. Word cloud.

Table 8 illustrates the change in keyword-plus instances over time in relevant publications. The graphic shows that the top 10 keywords that took shape from 1982 to 2024 are food industry, food safety, total quality management, quality control, risk assessment, and food contamination; however, in 2024, these terms will see highly rapid growth, along with food industry, food safety and total quality management with the food industry, are most popular keywords among authors 155, 95, 89, 61, 52, 51 continuously. These keywords have the most significant momentum and are rising quickly, as shown in **Table 9**.

Table 9. Word dynamics last ten years.

Year	Food industry	Food safety	Total quality management	Quality control	Risk assessment	Food contamination
2014	78	40	39	41	33	29
2015	90	51	43	43	38	33
2016	97	56	48	49	41	34
2017	104	66	49	51	43	39
2018	114	72	54	54	43	43
2019	124	81	59	58	48	48
2020	129	86	63	58	48	48
2021	138	89	68	60	51	49
2022	149	92	78	60	51	50
2023	152	95	85	61	51	51
2024	155	95	89	61	52	51

3.5. Analysis of source local impact

There are two ways of evaluating a journal's effect on FQM and FSM research. To calculate the primary average citation rate of Food industry publications, divide the total number of citations by the total number of articles (Citation/Article CPA). After that, the Academic Journal Guide ranks the journals (AJG). Citation numbers show a journal's impact, while the number of articles reflects its output. Calculate the significant journals' CPA using the cumulative citations from the database search. Although the Journal of Food Control has 27 published articles on the FSM of FQM, the Journal of Food Control has the greatest CPA in the group, after which comes the British Food Journal, see **Table 10**. However, 15 publications and studies published in the Journal of British Food Control and eight articles published by the International Journal of Food Microbiology, with seven documents and 233 citations for the Journal of Food Protection, were among the most referenced papers on Food safety management.

Table 10. Academic journal guide ranks the journals (AJG).

Element	h_index	g_index	m_index	TC	NP	PY_start
Food control	16	27	0.48484848	932	27	1992
British food journal	9	15	0.29032258	283	15	1994
International journal of food microbiology	7	8	0.25925926	292	8	1998
Journal of food protection	7	7	0.29166667	233	7	2001
Comprehensive reviews in food science and food safety	4	4	0.28571429	246	4	2011
Foods	4	5	0.36363636	145	5	2014
International journal of quality and reliability management	4	4	0.14285714	71	4	1997
Total quality management and business excellence	4	5	0.17391304	63	5	2002
Trends in food science and technology	4	5	0.14285714	309	5	1997
Worldwide hospitality and tourism themes	4	10	0.28571429	125	20	2011

As a result, as with the journal of Food Control, a higher number of publications does not always imply a higher number of citations. The evaluation of academic communities and educational sources heavily relies on using journals. Journal rankings represent a journal's position within its area, the comparative difficulty of publishing in that publication, and the notable and favourable correlation with it. People in some countries use them to measure the amount of research they do. **Figure 10** illustrates source growth as appeared from 1982 to 1991, stable not increasing, but from 1991 to 2024, the British Food Journal, Food Control, International Journal of Food Microbiology, and Journal of Food Protection increased, while the high growth for Food control from 2012 to 2021.

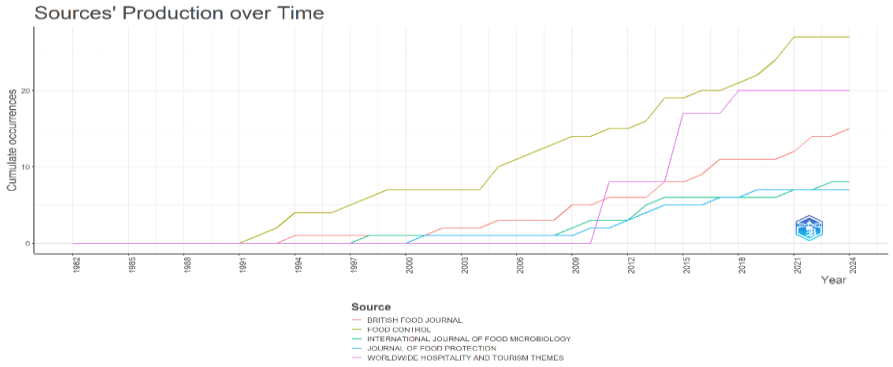

Figure 10. Source growth from 1985 to January 2024.

3.5.1. Top ten most relevant sources

Only ten top source agencies will own the most prolific journals. The findings of the top 10 most relevant sources that have focused on publishing research articles on the FSM, FQM, and IF are shown in **Figure 11**. It is based on the Scopus, Dimensions, and Web of Science data retrieved from 1982 to 2024 and beyond. The most relevant source mentioned was Food Control. Pertinent other sources include Worldwide Hospitality and Tourism Themes, British Food Journal, International Journal of Food Microbiology Journal of Food Protection, Quality—Access to Success Foods, IOP Conference Series Earth and Environmental Science, Total Quality Management and Business excellence TQM journal. **Figure 6** shows the most active sources represented by one Food Control with 27 articles, the Worldwide Hospitality and Tourism Themes with 20 articles, the British Food Journal published 15 articles, and the TQM Journal with five articles only.

Among these top 10 relevant sources, further investigation shows that Food Control is the most locally cited source. Next, the British Food Journal emerges as the most locally cited source, ranking highly for the global index with 27. The International Journal of Food Microbiology aligns with a worldwide index of 15, while the Journal of Food Protection boasts the highest normalised local citation of 7. The highest total citation is the Food Control, with 932 citations and year of publishing, which started in 1992.

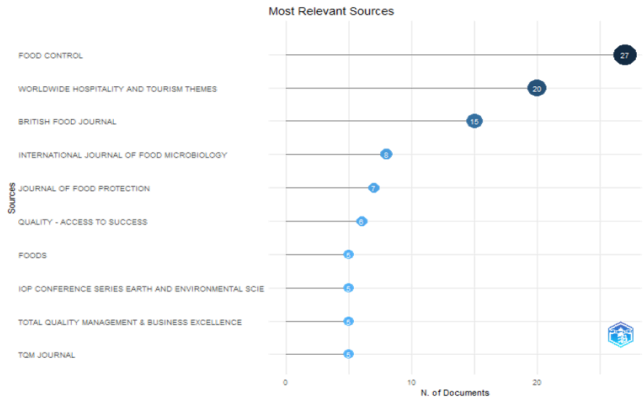

Figure 11. Top source agencies will own the most prolific journals.

Figure 11 shows a visualised and precise representation of prolific scholars, their countries, and the areas of interest depicted with keywords in knowledge management

and artificial intelligence. The representation portrays a three-field plot of article contributions by countries, authors, and themes within the field of knowledge management.

The countries are depicted in the left column, the researchers' names are in the middle column, and the right column displays the most used keywords. The number of occurrences of the keywords is what we refer to as 'themes.' The height of the boxes, along with the thickness of the connecting lines, intensifies the relationship and the connectivity on the side of countries. China has the highest authors' affiliations, followed by the United Kingdom. In the same order, the Netherlands has the next highest volume of authors, followed by Belgium and Greece.

It is observed that the thickness of the line leads from the countries to authors; the giant contributors are "al y m" and "luning p" from China. They are interested in food safety, HACCP, and food safety systems. While "Taylor j", is from the United Kingdom and Greece, the Jacxsens I have relations with coauthors from the United Kingdom, Netherlands, and Belgium, who are interested in food safety management and the food industry.

3.5.2. Clustering sources using Bradford's law

According to Bradford's Law Academic Journal Guides (AJG) in 2018 were utilised to assess the quality of the listed studies in the journal quality analysis. It rates journals' quality and categorises them into zones, as illustrated in **Table 10**. Scholars commonly use AJG ratings to advance their Food safety management and food quality management in food industry science careers. The findings show that most FQM and FSM research, comprising 27 publications and 932 citations, was published in the Journal of Food Control publications. Twenty articles in the Journal of Worldwide Hospitality and Tourism Themes have a Rank 2, and the Journal of British Food Journal ranked 3 with a frequency of 15 in Zone; this is quite interesting. Researchers were most interested in Zone1 journals in the last four years, with 27,47,62, 70, and 77 articles, respectively. The top 11 most authoritative studies, as assessed by AJG, come from 4% of the food industry and food quality management publications in Zone1 journals, as mentioned in **Table 10**.

The significance of regulatory norms and ethical guidelines becomes apparent when looking at the contents of frequently mentioned sources as shown in **Table 11**. All sources are closeted to three zones as illustrated in **Table 12**; the higher frequency in Zone 1 and Zone 2 is equal, while Zone 3 has only 177 frequency as shown in **Figure 12**, the sum of Ran, freq, and cumfreq for all sources.

Table 11. Zones of all sources.

Row Labels	Sum of Rank	Sum of Freq	Sum of cumFreq
Zone 1	561	180	4108
Zone 2	13300	180	38153
Zone 3	45135	177	79473
Grand Total	58996	537	121734

Table 12. Journal Rank, Cumulative Frequency, and Zone.

SO	Rank	Freq	cumFreq	Zone
Food control	1	27	27	Zone 1
World 0 Wide Hospitality and Tourism Themes	2	20	47	Zone 1
British Food Journal	3	15	62	Zone 1
International Journal of Food Microbiology	4	8	70	Zone 1
Journal of Food Protection	5	7	77	Zone 1
Quality - Access to Success	6	6	83	Zone 1
Foods	7	5	88	Zone 1
IOP Conference Series Earth and Environmental Science	8	5	93	Zone 1
Total Quality Management and Business Excellence	9	5	98	Zone 1

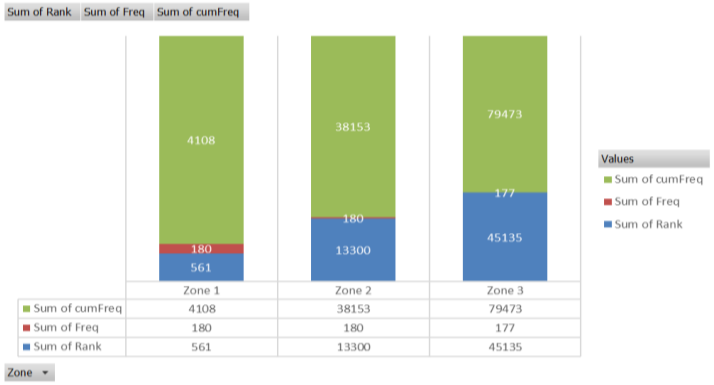

Figure 12. Clustering sources using Bradford's Law, and three Zone Freq, and Rank with a cumulative article frequency for each zone.

3.6. Leading institutions and their countries

Corresponding authors are senior researchers or group leaders with some or much experience in the submission and publishing process of scientific research. **Figure 13** illustrates the TOP 20 corresponding authors' countries; China became at the top with 37 articles, SCP 35, MCP 2, FREQ 0.06 and MCP ratio 0.05; the second country USA 27, 26, 1, 0.05 and 0.03, and third country its United Kingdom, 22, 18, 4, 0.04 and 0.18 continues while the blue colour representing the SCP it is a single country publication, the red colour represents the MCP multiple country publications.

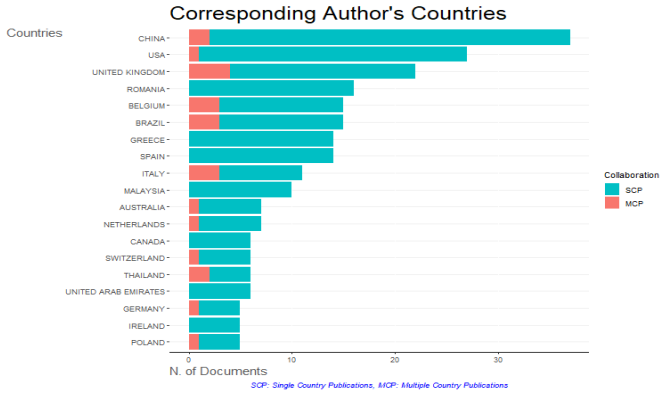

Figure 13. Top 20 corresponding authors countries.

The top ten nations in the food industry's scientific production are shown in **Table 13**. China becomes the first group with 84 publications, followed by the UK with 55 and the USA with 39 articles. While the top cited countries represent different situations, Belgium has the highest citations, with 738 total citations, and the average citation for the article in Belgium is 49.2. The second country, Chin, has 669 citations and an average of 18.1 article citations, as shown in **Table 13**. The countries with the fewest FQM and FSM articles were Singapore, Slovenia, Sweden, and Tanzania, with around ten documents belonging to different countries out of one. The investigation revealed a lack of research in Tunisia, Ukraine, and Zimbabwe.

Table 13. Top ten nations for scientific production in the food industry.

Region	Freq	Country	Tc	Average article citations
China	84	Belgium	738	49.2
UK	55	China	669	18.1
USA	39	United Kingdom	640	29.1
Brazil	29	Greece	416	29.7
Spain	26	USA	384	14.2
Greece	24	Ireland	378	75.6
Netherlands	24	Italy	262	23.8
Romania	23	Spain	236	16.9
Belgium	16	Netherlands	177	25.3
Italy	16	Brazil	171	11.4

Institutions for FSM and FQM research production consider documents, citations, and citation impact. The most productive institution is "Abu Dhabi food control authority, Abu Dhabi, United Arab Emirates," as shown in **Table 14**, it's top ten most active academic institutions and countries in the FQM, FSM, and FI field, with 16 documents published. It is a highly productive financial institution. Wageningen University (11), Ghent University (10). Our result indicates that the countries are cooperating intimately.

Table 14. Higher document citations from countries and institutions.

Affiliation	Articles
Abu Dhabi food control authority, Abu Dhabi, United Arab Emirates	16
Wageningen University	11
Ghent University	10
Notreported	8
University of Florida	8
Wageningen University and Research	6
Food Technology Department, University Federal of Vicosa, 36570000, Vicosa, Minas Gerais, Brazil	6
Ibn to fail University	6

4. Conclusion

This study contains a compilation of food safety and quality management governance research from Dimension, Scopus, and Web of Science core collections. Our comprehensive literature search, aimed at understanding food safety and quality management implementation in the food industries, involved Diemsion, Scopus, and Web of Science databases. The distribution of research on Biblioshiny during the thematic evaluation from 1982 to 2024 is as follows: The appearance stage spanned from 1982 to 1995. Stage towards increase (1996–2005), a period of trials led to a rapid rise phase (2006–2014), and stable, rapid growth occurred between 2015 and 2024. The citation frequency increased over time, which is closely related to the development of this research field.

The thematic map Cluster's main keywords are food industry, management, performance, quality management, HACCP, and food safety. The keywords such as food safety, food industry, HACCP, and quality management are 65, 62, 37, and 34, respectively. With word cloud, the higher word dynamic for the last year, 2024, are the keywords food industry and food safety.

Analysis of Sources' Local Impact People in some countries use them to measure the amount of research they do. As a result, the growth of sources from 1982 to 1991 was stable. However, from 1991 to 2024, there was an increase in the British Food Journal, Food Control, International Journal of Food Microbiology, and Journal of Food Protection. Notably, Food Control experienced high growth from 2012 to 2021.

As we cluster sources using Bradford's Law, we classify all sources into three zones. Zone 1 has the highest frequency, while Zone 2 has equal frequency. However, Zone 3 only has a frequency of 177, which is the sum of Ran, freq, and cumfreq for all sources. For the top 20 countries with corresponding authors' countries, China came at the top with 37 articles, the second country was the USA, and the third country was the United Kingdom. The top ten nations are displayed for scientific production regarding the food industry, production, quality, and safety management. China is the first group, with 84 publications. While the top cited countries represent different situations, Belgium, with the highest citations, has 738 total citations, and the average citation for the article in Belgium is 49.2. The second country, Chin, has 669 citations and an average of 18.1 article citations.

Institutions study the management of quality and food safety by analysing documents, citations, and their impact. The most productive institution is "The Abu Dhabi Food Control Authority, Abu Dhabi, United Arab Emirates". It has the top ten most active academic institutions and countries in the food industry's quality and Food Safety Management field. The food industry's most productive institutions are Wageningen University and Ghent University. Our result suggests that the countries collaborate widely. The words related to food safety and quality management practices are gaining more and more attention, such as continuous improvement in the food industry.

Consistent with the abstract analysis, most articles studied food safety and quality. Scholars felt that government institutions, universities, consumers, the media, and industry associations needed to collaborate to participate in food safety governance under the global food safety and quality management governance framework. Upon

examining food safety governance across various income brackets, while middle-class countries prioritised the establishment of stable political frameworks, lower-income countries were more concerned with food quantity and supply safety. Conversely, higher-income nations emphasised consumer participation in governance, nutrition, and food safety.

The study's contribution, Historical Perspective and Patterns: This study offers a clear perspective on how QFSM research has developed and matured over the past forty years by breaking the history of QFSM practices into four stages. Conversely, the thematic analysis and keyword: Major research themes, including HACCP, managerial performance, and food industry practices, were found through our keyword analysis and thematic mapping. Summarises the main areas of interest and new directions in QFSM research. Regarding institutional and geographic insights, China led the way in terms of publications produced, and Belgium had the most citation impact for the most productive nations and establishments for QFSM research. The Abu Dhabi Food Control Authority was the most productive organisation, and it showed the important contributions made by particular areas and organisations. The global collaboration is important. By outlining the worldwide network of scholars and institutions that contribute to this subject, the study highlights the significance of international collaboration in promoting QFSM methods. The study is not without flaws, however. These include the potential for relevant studies that have not been included in the selected databases or those published in languages other than English to have been left out. Notwithstanding these drawbacks, our analysis offers insightful information on the state of QFSM research and lays the groundwork for future investigations to enhance the quality and safety of food control procedures worldwide. Additional research using expert interviews and different bibliometric approaches is advised to solve these issues and improve knowledge of the efficacy and resilience of QFSM.

Author contributions: Conceptualization, BZ and QHH; methodology, BZ and QHH; software, QHH; validation, HHAT, BZ and QHH; formal analysis, QHH; investigation, HHAT and BZ; resources, BZ; data curation, BZ and QHH; writing—original draft preparation, QHH and BZ; writing—review and editing, HHAT, BZ and QHH; visualization, BZ; supervision, HHAT; project administration, HHAT and BZ; funding acquisition, BZ. All authors have read and agreed to the published version of the manuscript.

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