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Transparency and Traceability in Food Supply Chain Resilience:

A Two-Decade Bibliometric Mapping and Network Analysis (2010–2025)

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Abstract

This paper presents a comprehensive bibliometric analysis of 947 peer, reviewed articles dealing with transparency and traceability in resilient food supply chains from 2010 to 2025. The study determines the trends of the publication, main authors, institutions, and thematic keywords by employing the Scopus data and the VOSviewer tool.
This research is different from the previously fragmented review works by filling the scientific gap and coupling the digital, technological, and sustainability aspects. The greatest contribution of the article, in fact, is the staging and the conceptual framework of the field which shows the usage of blockchain, digital innovation, and sustainability as the main sources of resilience along with providing a data, driven basis for research and practice in the future.

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Introduction

The disruptions to global food supply chains brought about by changes in global climate, disease outbreaks, conflicts, and changing consumer lifestyles have exposed in turn the significant weaknesses of production, logistics, and distribution networks (Ivanov & Dolgui, 2020). In order to deal with these challenges, transparency and traceability have been raised to the level of indispensable features of the supply chain resilience, thus they facilitate security, visibility, and trust among the stakeholders from the chain of value, that is to say, from the producers to the end consumers ((Behnke & Janssen, 2020; Galvez et al., 2018). In addition, these instruments not only provide a means of better managing disruption scenarios but also serve to win the trust of consumers and meet the requirements of the regulatory authorities in the global food systems.

Still, the topic is getting more and more attention; however, the research on it is fragmented and does not show a full picture of the interrelation between transparency, traceability, and the digital transformation of resilient food supply chains. The authors of the previous works have been accused of concentrating their attention only on one aspect of the issue, i.e., technological enablers such as blockchain or IoT that facilitate the governance of organizations, sustainability objectives, and systemic risk management being ignored alongside technology implementations (Kamble et al., 2019; Toorajipour et al., 2021). This inconsistency raises a need for integrated research in the field to have a deeper understanding of the trends and emerging topics as well as the underlying structures of the intellectual domain.

Thus, this document mainly deals with the issue of a sentence that goes through the aspects of knowledge: How has research on transparency and traceability evolved to be a source of food supply chains resilience, what are the main themes and technological drivers and which knowledge gaps characterize this domain? To find out the answer to such a question, the study conducts a thorough bibliometric analysis of publications from 2010 to 2025, looking at various aspects of the literature such as publication patterns, most productive authors and institutions, and thematic clusters in the field:

- *RQ1: How has research productivity evolved between 2010 and 2025?*
- *RQ2: What are the main thematic and technological drivers?*
- *RQ3: Which countries and institutions lead in this field?*
- *RQ4: What emerging research fronts can be identified from keyword co-occurrence networks?"*

1. Materials and Methods

This review aims to identify the research that has been done in the last ten years on the role of transparency and traceability in food supply chains that are resilient. A bibliometric approach was used to help in this goal. This approach allows for a systematic mapping and quantitative assessment of publication patterns, thematic developments, influential works, and collaborative networks in the field ((Donthu et al., 2021a; Zupic & Čater, 2015).

The data for this study were taken from the Scopus database, which is known for its wide coverage of peer, reviewed journals and its suitability for bibliometric studies ((Chadegani et al., 2013; Mongeon & Paul-Hus, 2016). The search was done on November 23, 2025, using the query ("food supply chain*" AND ("traceability" OR "transparency" OR "resilient*")) AND ("blockchain" OR "digital" OR "IoT" OR "AI") for the titles, abstracts, and keywords.

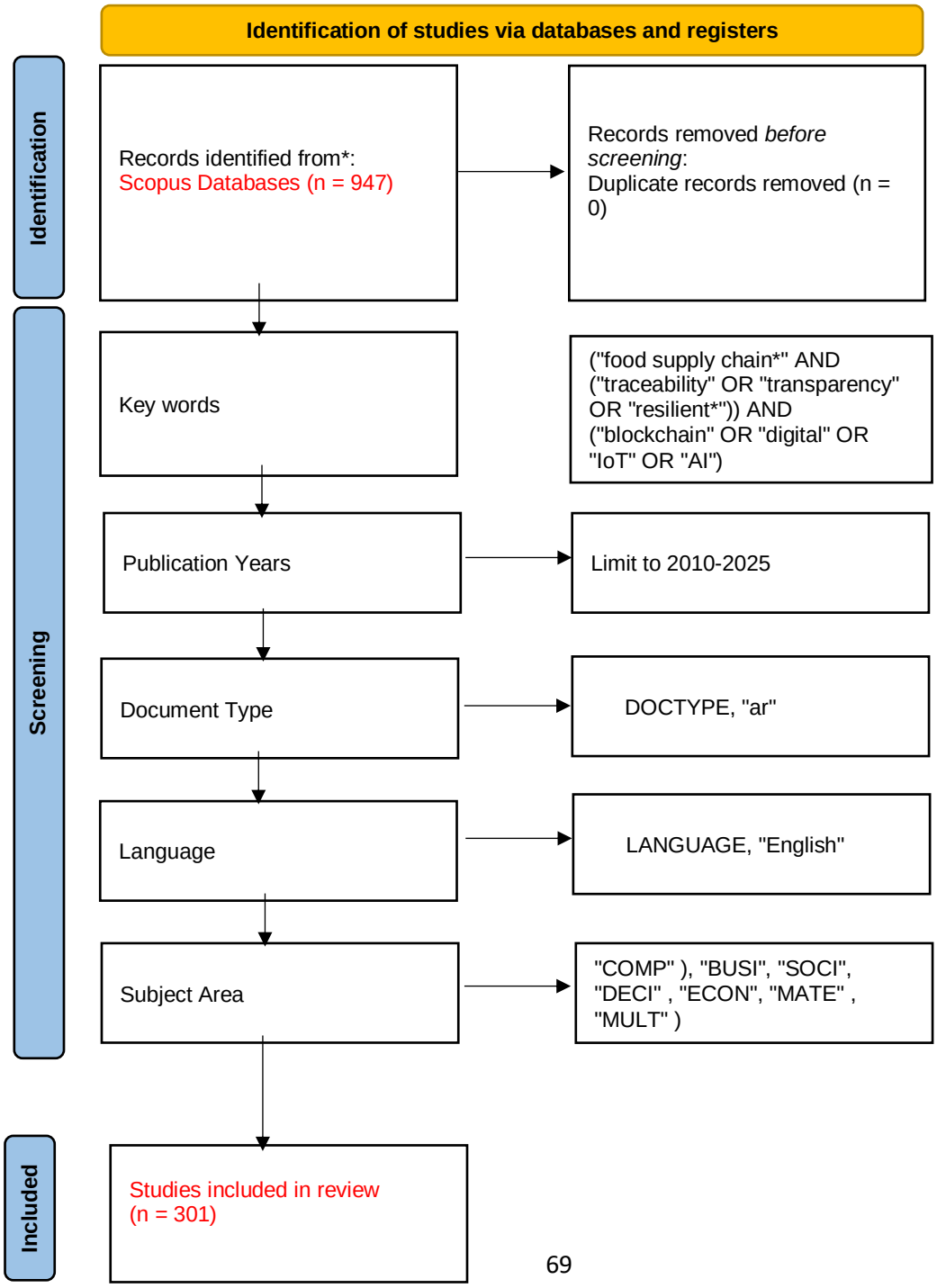
To approve only relevant and quality contributions, the analysis has been restricted to English, language journal articles available in open access, while conference papers and proceedings have been excluded. After that, the manual screening process using predetermined inclusion and exclusion criteria ***(Table 1)*** was performed to discard those records that were out of scope. In the end, 301 publications were kept that together made up the largest and most influential contributions to the study of transparency and traceability in resilient food supply chains.

1.1. Data Source and Search Strategy

The research employed bibliometric analysis, a quantitative method, which is widely accepted as a means to measure and visualize the changes, the intellectual structure, and the collaborative relationships of a specific field of research ((Donthu et al., 2021b; Zupic & Čater, 2015). By implementing this method, it was feasible to locate and examine the core bibliometric indicators that consisted of the most frequent keywords, the most cited and the most productive journals, the top countries, and the institutions leading the discourse on transparency and traceability in a resilient food

supply chain. Moreover, the research examined the country, to, country collaboration pattern and the scientific works production by authors, which reflected the level of international scientific exchange. (van Eck & Waltman, 2014). Besides this, keyword co-occurrence networks were studied to uncover thematic clusters and the new areas of research, whereas journal and author co-citation analyses were carried out to identify the intellectual roots of the field (Cobo et al., 2011). Overall, these different aspects of the analysis gave a detailed picture of the publication trends, the knowledge structures, and patterns of collaboration that define research on transparency and traceability in resilient food supply chains.

Figure 1: PRISMA statement



In order to identify the most relevant studies, the search query was searching for the nearest terms in the titles, abstracts, and keywords of the papers. Several filters were used to ensure that the dataset's quality and relevance were at the required level: the timeframe was chosen to be from 2010 to 2025; only peer, reviewed journal articles in English were considered, while conference papers and proceedings were excluded. The search was mainly focused on specific topics: Computer Science, Business, Management and Accounting, Social Sciences, Decision Sciences, Economics, Materials Science, and Multidisciplinary Research.

Following PRISMA 2020 guidelines, 947 records were retrieved, with no duplicates detected (n = 0). After screening titles, abstracts, and keywords, 301 articles met the criteria and were retained for bibliometric analysis.

Table 1: The inclusion and the exclusion criteria for data screening

Inclusion criteria	AI, Transparency, Traceability, Resilience, Supply Chains, food supply chain
	Computer science, Business, Management and accounting, social science, Decision sciences, Economics, Econometrics and finance, Materials science, Multidisciplinary
Exclusion criteria	Conference papers, proceedings papers, nonindexed publications.

Source: by the Authors

1.2. Data Extraction and Analysis

The VOSviewer software, a program that is usually used in visualizing bibliometric networks, was chosen to reveal the network visualization in the analysis and Excel was used for tabulation and descriptive statistics.

This literature review is being undertaken for several reasons. Initially, Transparency and Traceability for Resilient Food Supply Chains has emerged as a very interesting research area with an increasing number of research people. Therefore, it is essential to explore the thematic structure of such a study area by using an accurate machine learning method that could automatically analyze a large, documented literature data. Besides that, the present research is aimed at helping the provision of knowledge about what has been covered and the trends in the topic.

The bibliometric analysis was carried out in three phases:

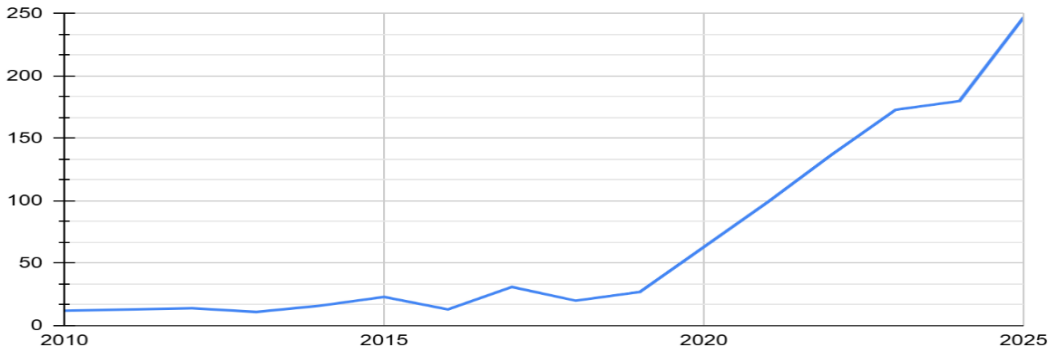
- ✓ Descriptive analysis: yearly distribution of publications, most productive journals, institutions, and countries.
- ✓ Citation analysis: highly cited articles, most influential journals, and co-citation networks.
- ✓ Keyword co-occurrence analysis: mapping thematic trends, keyword clusters, and emerging research areas.

2. Findings

2.1. Publication Trends (2010–2025)

The annual distribution of publications indicates a steady increase from 2010 to 2017, followed by an exponential rise after 2017. Peaks in publication activity coincide with global crises (COVID-19, geopolitical disruptions), reflecting intensified research interest in resilience and digital traceability in food supply chains.

Fig. 2. Distribution of publications by years (2010–2025)



Source: by the Authors

The diagram refers to a steady increase in the number of publications from 2012 to 2025, it reflects the four phases of the scholarly research that dealt with the topic of transparency and traceability in resilient food supply chains over that period. The volume of publications from 2012 to 2017 was minimal, which supports the idea of the topic being at the early stage of development and, thus, not having attracted much scholarly attention.

The time span from 2018 to 2020 depicts a gradual increase in publications that can be explained by the extensive implementation of digital technologies such as blockchain and IoT and by the disruptions caused by the COVID, 19 pandemic that made the need for supply chain visibility more obvious.

The years 2021 and 2022 demonstrate the time of very rapid growth with a very steep upward trend in the number of publications that may be traced back to the academic community's increasing engagement with the concepts of resilience, digital innovation, and sustainability. The production probably remains steady over 2023 and 2024 and then goes up again in 2025, reaching the highest point in the series.

The data shows a clear positive trend which strongly suggests that scholars have focused transparency and traceability as the core issues in their research. These issues, as per scholars, are mainly influenced by technology advances, the regulatory requirements, and the global supply chains increasing vulnerabilities.

2.2. Top Journals and authors (2010–2025)

Table 2. The top 10 highly productive journals on Transparency and Traceability for resilient food Supply Chains in the years (2010–2025)

Journal	TP	TC	Cite Score	The Most Cited Article (Reference)	Times Cited	Publisher
Sustainability (Switzerland)	58.414	450.030	7,7	Heavy Metal Pollution in Coastal Environments: Ecological Implications and Management Strategies: A Review	36	MDPI
Foods	15.626	136.377	8,7	Effects of Cold Post-Fermentation Process on Microbial Diversity and Biogenic Amines in Protease-Assisted Fermented sufu	35	MDPI

IEEE Access	44.988	402.859	9,0	Brain Tumor Identification and Classification of MRI Images Using Deep Learning Techniques	79	IEEE
Applied Sciences (Switzerland)	49.646	275.395	5,5	Enhancement of EPR Effect for Passive Tumor Targeting: Current Status and Future Perspectives	37	MDPI
Computers and Industrial Engineering	3.166	41.880	13,2	Unlocking the Synergy: Increasing productivity through Human-AI collaboration in the industry 5.0 Era	20	Elsevier
Technological Forecasting and Social Change	2.927	76.934	26,3	AI capability and green innovation impact on sustainable performance: Moderating role of big data and knowledge management	4	Elsevier
International Journal of Logistics Management	272	4.024	14,8	Can smart supply chain bring agility and resilience for enhanced sustainable business performance?	34	Emerald Publishing
International Journal of Production Research	1.597	27.594	17,3	Application of artificial intelligence for resilient and sustainable healthcare system: systematic literature review and future research directions	57	Taylor & Francis
Journal of Cleaner Production	18.950	393.051	20,7	Green and low-carbon matrices for Engineered/Strain-Hardening Cementitious Composites (ECC/SHCC): Toward sustainable and resilient infrastructure	75	Elsevier
Operations Management Research	277	3.408	12,3	A taxonomy of critical factors towards sustainable operations and supply chain management 4.0 in developing countries	33	Springer Nature

Source: by the Authors

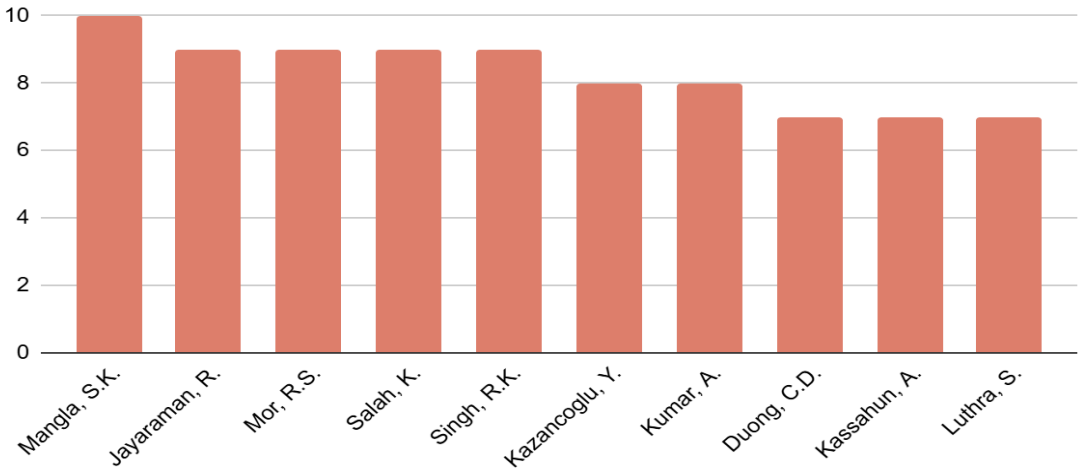
Table 2 shows most influential journals and highly cited articles related to the specified research field, where the bibliometric indicators of the journals including total publication (TP), total citation (TC), citation score and the most cited references in each journal are utilized.

As seen from the table, most of the publication space is tightly gathered in high impact interdisciplinary publications like Sustainability, IEE Access, Journal of Cleaner Production owing to the increased collaboration of sustainability, artificial intelligence, supply chain management and resilience research, Mostly in journals such as Sustainability and IEE Access with the highest citation performances.

This analysis can also emphasize the strong presence of the emerging themes of digital transformation, smart supply chains, sustainability and AI-based resilience. The table shows that most of the highly cited articles are centered on themes like blockchain innovations, Industry 5.0, green innovation, sustainable operations and resilient supply chains, Because of this confirming the continued academic interest into the merging of technological innovation and sustainability-oriented resilience approach. Although most articles in high impact factor journals can be relatively new, the high number of citations in those targeted journals for new setups of AI potential, digital collaboration and resilient

systems, can demonstrate the great readership on these themes. Overall, the table can reflect the multidisciplinary and fast-moving character of the field.

Figure 3. The 10 most relevant authors



Source: by the Authors

The performance scores of the most influential authors in the area are presented in Figure 3. Mangla, S. K. has scored 10, making him the most scientifically influential author. Authors like Jayaraman, R. Mor R. S. Salah K. and Singh, R. K. Another set of authors, R. Jayaraman, R. Mor, K. Salah, R. K. Singh, obtained similar high scores, close to 9, reinforcing their important contributions to research on sustainability, digital transformation and resilient supply chains. In contrast, other authors have achieved slightly lower ratings around 8, whereas authors like Duong, C. D. Kassahun A. and Luthra, S. have attained ratings close to 7.

The graph is quite evenly distributed and this could suggest that there are too many authors working in the same area rather than having a major influential researcher working solely in the field. Overall, it portrays the different collaborative researchers or institutions working in the field of resilience, transparency and sustainability in supply chains.

2.3. Most Productive Countries and Institutions

Table 3. List of the 10 most productive countries and educational institutions in Transparency and Traceability for resilient food Supply Chains research area

Rank	Country	Educational Institutions	TP
1	India	Indian Institute of Management	428
2	China	State Key Laboratory of ASIC and System, Fudan University	343
3	United Kingdom	School of Management, University of Bath	370
4	Italy	Department of Mathematics and Computer Science, University of Cagliari	126
5	United States	Department of Management, University of Northern Iowa, Postal Address: 262 Curris Business Bldg.	449
6	Malaysia	UKM-Graduate School of Business, Universiti Kebangsaan Malaysia	225

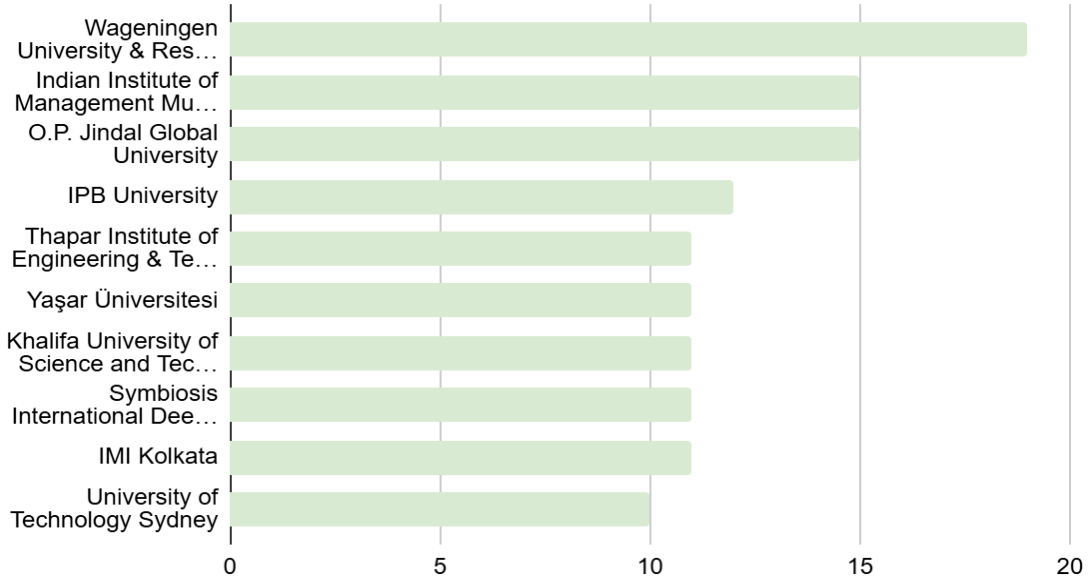
7	Australia	Discipline of Information Systems, School of Management and Marketing, Curtin Business School, Curtin University	162
8	Saudi Arabia	Department of Computer Science, COMSATS University Islamabad	324
9	France	UKM-Graduate School of Business, Universiti Kebangsaan Malaysia	225
10	Greece	Institute of Communication and Computer Systems	356

Source: by the Authors

The result revealed from table 3, show an important global presence of contributions with institutions from India China UK, Italy US Malaysia Australia Saudi Arabia, France and Greece are important players to strengthen the research about supply chain resilience, transparency, and digital transformation. The examples of most well-known schools include the Indian Institute of Management, Fudan University (China), the University of Bath (United Kingdom) and the University of Cagliari (Italy).

Hence, the fact of existence of these different fields of management, information systems, computer sciences, business schools point the multidisciplinary of this area of study. The table in total shows that research on resilient and transparent supply chains is promoted by widespread international collaboration involving fields like technology, management and sustainability.

Fig. 4. Distribution based on affiliation



Source: by the Authors

The distribution from the graphic below, shows the contributions from various continents from Europe, Asia and the Middle East, illustrating the widely spread applications of blockchain solutions in scope to overall supply chain issues. Services ranging from traceability transparency sustainability and digitalization.

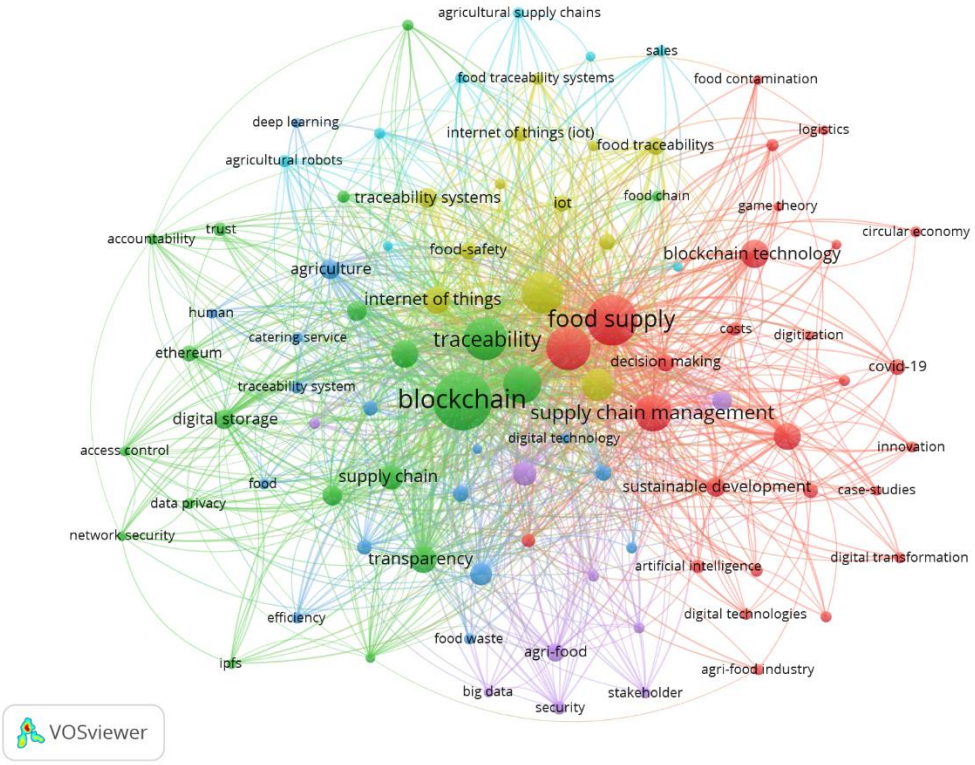
The Figure further summarized the number of publications by the ownership of the institution in the area of blockchain-enabled food supply chain. We can see the largest contribution in the research work is Wageningen University & Research, implying that it is only organization leading the research work

in the area of sustainable and digital agri-food system. Other major institutions are Indian Institute of Management, and O.

P. Jindal Global University, indicating an expanding research activity on blockchain and supply chain innovation at higher-education level in developing economies. Institutions with significant research on the topic are IPB University, Thapar Institute of Engineering & Technology, Khalifa University of Science and Technology, among others.

2.4. Keyword Analysis

Fig. 5. Analysis results of publications by keywords



Source: Author's analysis using VOSviewer, 2025

Figure 5 displays a keyword co-occurrence network created by VOSviewer showing the main research areas of applications of blockchain in food supply chains. The network reveals several interconnected clusters, reflecting the multidisciplinary nature of the field.

The leading nodes (blockchain, food supply, supply chain management, traceability) reflect the main areas of research. These nodes show it is mainly studied as a tool of enhancing product transparency, safety and consumer trust from agri-foods point of view. The close relationship with these three points is robust.

Green cluster (operational and security side), contain supply chain privacy data security, security network, and trust. Blue cluster (technological side), contain linking to internet of things, deep learning, control, and food traceability system, expresses uptrend adoption for smart and digital technologies in

agriculture. Meanwhile, the red cluster is associated with management and sustainability themes, including decision making, sustainable development, digital transformation, and innovation.

Overall, the dense connections among clusters demonstrate that blockchain research is evolving beyond technical applications toward integrated approaches that combine sustainability, digital transformation, and intelligent food supply chain management.

Table 4. the 10 keywords occurrences

Rank	Keywords	Occurrences
1	Blockchain	166
2	Food supply	123
3	Supply chains	86
4	Food supply chain	94
5	Traceability	92
6	Supply chain management	65
7	Food safety	49
8	Smart contact	36
9	Transparency	36
10	Internet of things	35

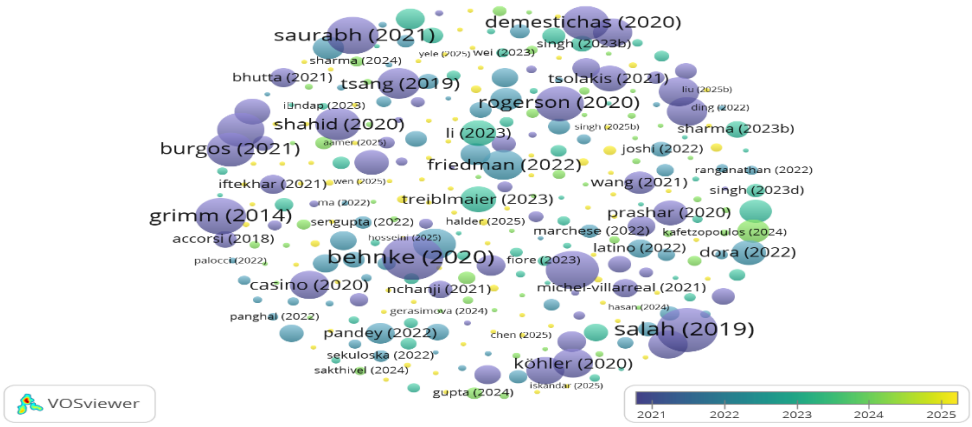
Source: by the Authors

Table 4 details the main conceptual priorities that have shaped the field. The preponderance of "Blockchain" (166 occurrences) is way above all other keywords, thus the distributed ledger technology is the central lens that is being used to assess transparency and traceability. This means that resilience is viewed as a digitally enabled result more than just a human organizational ability. The presence of "Food supply" (123), "Food supply chain" (94), and "Supply chains" (86) confirms that the studies are still sector, specific, which reflects Agri, food systems being vulnerable to safety risks, perishability, and regulatory pressures. Traceability (92) is the main operational lever to raise visibility, accountability and risk management and transparency (36) is frequently regarded as a strategic outcome of digital technologies rather than as a separate research construct. The Supply chain management (65) term reflects that these technologies, based methods are rooted in broader SCM frameworks such as linking operational practices to strategic perspectives. At the same time, Food safety (49) accentuates the regulatory and societal rationale for resilience, i.e. risk reduction and consumer protection.

New technologies like smart contracts (36) and the Internet of Things (35) seem to show a shift towards integrated digital architectures that allow the use of automation, interoperability, and real, time monitoring. Taken together, these trends imply that current studies look at resilience in food supply chains from a technology, based perspective, where blockchain, based traceability serves as the backbone of transparency, helps in compliance with food safety standards, and facilitates quicker, better, informed decision, making.

On the whole, the literature identifies a conceptual schematic where digitalization is the core, traceability is the mechanism, transparency is the strategy, and food safety is the regulatory and societal rationale.

Fig. 6 Analysis results of co-citation network



Source: Author's analysis using VOSviewer, 2025

The overlay visualization the VOSviewer produced makes it much easier for us to understand how the subject of transparency and traceability in resilient food supply chains has evolved over time from various angles such as intellectual to temporal aspects. The node size represents the citation impact of each study, while their spatial proximity indicates the extent of co, citation relationships, thus uncovering the conceptual consistency of the area. A few structurally central, prominently marked positions coincide with major works of Behnke (2020), Grimm (2014), Salah (2019), Rogerson (2020), Tsang (2019), and Khler (2020). By their prominence, these are the studies that theoretically and methodologically, most probably, constitute the field, especially regarding traceability systems, governance mechanisms, and the very first digitally enabled transparency, related discussions.

The color gradient also gives us more clues about the transition in the research theme over time. It is apparent from the color changes that the early foundational works (blue and purple tones, 20202021) were largely focused on building the traceability frameworks, regulatory compliance, and supply chain visibility. On the other hand, the recent publications (green to yellow tones, 20232025) imply a move to the adoption of sophisticated digital solutions such as blockchain, artificial intelligence applications, sustainability metrics, and data, driven resilience strategies. This temporal dispersion catches not only the doubling of publication number but also the shift in the concept from descriptive and system, oriented approaches to technology, enabled resilience and performance optimization.

Moreover, the strong network of interconnected nodes points to an ever-deepening theoretical agreement, with digitalization serving as a connecting factor that links traditional traceability research to resilience and sustainability issues at a higher level. The nonexistence of heavily divided groups in the network means that the field is instead getting more integrated, not separated. In general, the picture depicts a research field that is getting mature and marked by intellectual consolidation, a tech focus, and rapid scholarly growth in the post, 2020 period.

3. Discussion

The different bibliometric results of this research, unveil a number of important points with respect to the thematic structure, technological trends, and the geographical distribution of research on transparency and traceability in resilient food supply chains.

3.1. Contribution Relative to Prior Bibliometric Reviews

Previous bibliometric and systematic reviews on supply chain resilience have mainly focused on the adoption of technology, especially on blockchain, enabled visibility and recovery from disruption (Ivanov & Dolgui, 2020; Queiroz et al., 2025). These studies helped to understand the digital capabilities well, but very often the authors consider transparency and traceability just as the instrumental results of the processes, and not as the central analytical dimensions. Unlike them, this research regards transparency and traceability as the core elements of resilience structurally, which are the characteristics of the socio, technical systems that connect digital technologies, governance mechanisms, and sustainability goals. The thematic clusters uncovered reflect the departure from the technology, centric narratives toward the integrative resilience frameworks where trust, regulatory compliance, and stakeholder coordination get an increasingly significant role. This broader perspective highlights the evolving research frontier that changes to go beyond the isolated technological solutions.

3.2. From Digital Tools to Governance-Oriented Resilience

Most of the biggest and highly repeated references of blockchain along with related keywords undoubtedly revealed that the concept is at the core of the literature. The co-occurrence patterns, however, show that blockchain is nowadays often associated with sustainability, food safety, and governance issues. It marks the change in the perception, that is, digital technologies are no longer regarded just as mere products but as institutions capable of providing transparency and thus, accountability.

Their study goes along with the recent resilience theories that acknowledge that apart from efficiency, adaptability, coordination, and legitimacy are also equally important elements. Therefore, the subject of research is acknowledging that resilient food supply chains are essentially those that combine technological infrastructures and governance frameworks.

3.3. Transparency, Sustainability, and Food Safety as Interlinked Pillars

Supply chain research has shifted significantly due to the mutual influence of sustainability, food safety, and traceability. One of the major transformations has been the introduction of transparency which acts as a fundamental mechanism allowing environmental, social, and safety objectives from resilience strategies to be quantified. It goes along with the concept that resilience should be more than just the ability to survive a disruptive event but also the capacity to maintain the highest ethical, environmental and consumer standards in an uncertain situation.

Conclusion and Future Research Directions

This look at food supply chains shows how transparency and traceability are growing fast. Digital tools, sustainability goals, governance models, and resilience strategies shape the field. Research from 2010 to 2025 covers many areas. It's a mix of disciplines that's changing quickly. These factors drive innovation in real-time tracking and accountability. Food systems are being rebuilt nowadays with more data and oversight.

It should be mentioned that the research has gradually transitioned from mere surveillance of food safety and enforcement of regulations to a comprehensive picture where transparency and traceability become the tools for change adaptation risk reduction, trust building among stakeholders, and supply chain stability strengthening on the long run. In this context, the data even support the results of the earlier studies that traceability as a fundamental measure of food safety and quality control has been highlighted however at the same time, they also extend the work of the authors who were in recent

times considering transparency and traceability to be the two main pillars of the resilient and sustainable agri-food systems.

This study shows how resilience is not just what happens when one tech choice is made, it's shaped by how digital tools meet day-to-day operations and the larger institutional setting. But it ties transparency and traceability to resilience theory, linking operations management, information systems, and sustainability education into a multi-level model. The brainwork structure of the subject is clearly laid out, offering both practical takeaways and deeper theoretical roots. Resilience emerges from the mix of technology, how organizations act, and what rules the institutions follow. This view adds value to the existing literature by suggesting that transparency and traceability are not only technical or regulatory tools but are evolving and systemic means of enabling resilience. From a practical perspective, the findings show that government agencies can use transparency technologies as a tool to make food safety and sustainability regulations more effective enforcement. Supply chain managers and producers, on the other hand, can treat traceability systems not only as risk management tools but also as strategic means of gaining better operational visibility and stakeholder trust. Meanwhile, consumer access to accurate product information is enhanced, thus boosting their confidence in the origin, quality, and integrity of the food products.

From a managerial standpoint, the results indicate that transparency might well emerge as a key principle around which future designs of food supply chains are organized. Therefore, prioritizing investments in data infrastructures, interoperable digital systems, and technology-enabled visibility as strategic issues for the long run is the right way to go. Such investments will be instrumental in enhancing flexibility, disruption preparedness, and resilience performance. When it comes to policy, the research underscores the importance of having effective, modular, and interoperable regulatory frameworks not only promoting transparency but also making it easier to share information and coordinate among local and global food systems. Since agri-food supply networks are facing increasing cross-border complexity, regulatory fragmentation, and sustainability challenges, such regulatory frameworks are crucial.

The paper however besides mentioning the good parts, points out lots of interesting ideas for research that lies ahead. It says that there must be a lot more research into how technologies like generative artificial intelligence can be used for predicting disruptions, making adaptive decisions, and setting up predictive traceability. Also, the researchers of the future should think about how much the models of food supply chain resilience are incorporating the factors of environment, society, and governance (ESG). Plus, they should investigate how worldwide standards and policy moves such as those of the EU Green Deal, ISO, and FAO influence these models as time goes by. Besides technological capabilities, resilience is also shaped by trust cooperation institutional arrangements, and decision-making practices among different supply chain actors. Therefore, more research should be dedicated to the human, behavioral, and governance aspects of transparency and traceability.

In general, the literature reveals a completely transformed understanding of the concept. Currently, the traceability and transparency of food supply chains are seen as the basic pillars of a well-functioning and sustainable food systems, contrary to obsolete view that considered them as secondary or optional features. Consequently, further investigations should aim at developing even deeper and more sophisticated ones, which besides demonstrating the intricacy of policy systems, would also bring out the ethical aspects of technology governance in the sustainability context. On the other hand, neglecting these moves and factors means that, not only is it a question of when, rather than if, resilient and efficient, yet also transparent, trustworthy, and sustainable food supply chains are hardly a possibility in a world that is continuously and rapidly growing in complexity, and uncertainty.

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