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Article

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A BIBLIOMETRIC RESEARCH ON FOOD MARKET SHIFTS. CHALLENGES FOR ACTORS IN THE FOOD CHAIN

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Abstract

This research explores the changes in the food market and the challenges faced by supply chain actors in the context of emerging transformations. The central issue lies in understanding the impact of technological change, the pressures for sustainability, and the evolution of customer preferences towards food production and distribution. The present paper aims to analyse the current state of research carried out on changes and new trends in the food market, at a global level. Through this research, the authors aim to provide more information to the literature, providing a detailed vision of the steps initiated to support industrial challenges, the transition to circular economic models, and the sustainability of food chains in accordance with quality and safety standards. The methodology is mixed, combining bibliometric research to assess the evolution of research in this field and a qualitative analysis to detail the main challenges that include the high costs for the implementation of new technologies, compliance with environmental regulations, and the integration of innovations into existing infrastructures. The results highlight a significant increase in the volume of research dedicated to sustainability and digitalisation in the food sector, reflecting a growing academic interest in these topics. This trend suggests not only a paradigm shift in specialised studies, but also a considerable impact on the strategies adopted by actors in the food chain. This research provides an innovative perspective on changes in the food market through the use of bibliometric analysis, a method that allows the identification and quantification of academic trends in a systematic and objective way. Unlike traditional approaches, the study not only describes changes in the industry, but correlates them with the evolution of scientific research, highlighting how new economic, technological, and social directions are reflected in the literature.

Keywords: food market, supply chain, food market changes, sustainability, technology

JEL classification: Q00, Q01, Q13, Q18, O33

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Introduction

The global food market is a vast and dynamic landscape that covers the production, distribution, and consumption of food products worldwide. It is undergoing rapid transformations such as population growth and food scarcity, both globalisation and the integration of food supply chains, the burden of new regulatory standards, technological and scientific breakthroughs, and changes in food demand and consumer behaviour.

The world's population is expected to grow to nearly 10 billion by 2050 (Roser and Ritchie, 2023). In this context, the research problem is centred on food resources that are becoming increasingly scarce due to factors such as increasing incomes, limited land, high energy prices, and inefficient logistics systems for food distribution in many countries. Consequently, food demand is expected to increase, putting great pressure on food supply, which needs to increase by 70% to feed the expected population in 2050 (Miladinov, 2023; Kousar et al., 2021; Bloom & Canning, 2006).

As consumer preferences evolve, the food sector must adapt to meet: (i) safety requirements that refer to measures that prevent public health risks associated with food consumption, food testing and control, but also the withdrawal of unsafe food from the market; (ii) transparency in the food chain, which refers to the capacity of consumers and authorities to have access to clear information on the origin, production and quality of food, including traceability of products from producer to consumer, through clear, fair and detailed labelling providing information on ingredients, origin, production methods and certifications; (iii) sustainability in the food sector aimed at reducing the impact on the environment and promoting responsible practices in production and consumption (reducing food waste, sustainable use of natural resources, promoting sustainable alternatives such as biodegradable packaging). These requirements are essential for protecting consumers' health, maintaining confidence in the food market, and building a sustainable food system in the long term.

Through this research, we aim to identify the changes and challenges faced by actors in food supply chains in the context of accelerated transformations brought about by digitalisation, sustainability, and consumer demands. In this regard, the authors contribute by providing a new perspective on the evolution and trends in sustainable supply chains, as well as identifying critical areas that allow future improvements.

The article further deals with the literature review, which summarises the main changes in the food market, the research methodology regarding the formulation of research objectives and also here the structure of the bibliometric analysis is described, as well as its purpose of qualitative analysis in the present research, the section of results and discussions where the authors' findings and interpretations are brought forward, ending with conclusions.

1. Review of the scientific literature

Technological innovations are reshaping the food sector, increasing food safety, and creating new challenges: active and smart packaging, nanotechnologies, food 3D printing, portable devices, distributed ledger technologies (DLT), remote sensors and the internet of things (IoT), big data, and AI. The need for standardisation, reliable databases, and transparent data sharing is critical to the successful implementation of these technologies. However, disparities in access to technology, especially for low- and middle-income countries, pose significant risks of intensifying inequalities. To promote equitable technological progress,

investments in infrastructure and capacity development are needed. In addition, a solid scientific foundation is essential for the development of food safety regulations. The relationship between science and technology requires the continuous adaptation of regulatory frameworks to protect public health in the context of changing food systems (Food and Agriculture Organisation, 2023).

Rapid changes in the food market, along with sustainability requirements, have led to more research on supply chains and agricultural practices. The study by Xu et al. (2019) presents the sustainability risks along with the challenges of implementing these practices in agricultural areas in emerging countries, being relevant to current research due to the perspective offered on the implementation of agricultural practices in emerging countries and the difficulties encountered by food market actors. Similarly, another analysis compares government incentives for green supply chains, highlighting the high difficulties of coordination (Nielsen et al., 2019). Other researchers evaluated planetary boundaries in absolute sustainability analysis, proposing new strategies to adapt to these boundaries (Ryberg et al., 2020). This research supports the present work, which also focuses on the development of effective integration policies in sustainable supply chains. Expanding the supply chain using sustainable principles also implies new technological and economic requirements for all stakeholders involved (Taghikhah, Voinov, & Shukla, 2019). These aspects are further analysed by the authors of the current paper, who aim to highlight how technological innovations can optimize the supply chain, considering sustainability requirements. Gigli et al. (2019) study a circular economy model for recycling levels, highlighting the importance of cost-benefit analysis in this type of projects. Christiaensen et al. (2021) research the future of agri-food work and present the structural changes needed to meet modern requirements, while Ehlers, Huber and Finger (2021) focus on the impact of digitalisation on agricultural policies. This research supports this paper because, throughout the article, we analyse the role of digital technologies in achieving transparency and efficiency, including the use of circular models to reduce waste and increase resource efficiency. Other studies (Li et al., 2021) highlight the effects of e-commerce adoption by farmers in China, along with the benefits it brings in terms of productivity. In the era of technologies used to reduce greenhouse gases, Goglio et al. (2020) indicate the need for an integrated approach to life cycle assessment.

As far as globalisation is concerned, this has allowed the cross-border movement of products, including food. The food industry is undergoing significant changes. As supply chains expand globally, regulators, food manufacturers, sellers, and consumers have a more uniform approach to safety and quality standards around the world. At the same time, food companies are investing in the integration of their supply chains to improve food safety and traceability, encouraged by government strategies in the field (Duoming and Chin, 2022; Le, 2021). This study is relevant because it shows the growth of academic research on supply chains and agricultural methods to respond to rapid market changes and sustainability requirements, supporting current research.

In terms of food sector regulations, governments are implementing stricter food safety regulations with improved quality standards, closer monitoring, and tougher penalties: food traceability record-keeping requirements, food allergen enforcement, "forever chemicals" regulations, a new Prop 65 short-form labelling requirement, and a growing set of state-by-state bans on synthetic chemicals in food packaging (Sharma, Teret, & Brownell, 2010; Torsys LLP, 2023). Thus, there is a high pressure on food safety, which has an impact on market

dynamics and supply chain compliance, contributing to market changes, a topic presented by the authors of this article.

Consumer preferences in the food sector are changing rapidly due to various factors, including environmental concerns (consumers are increasingly focusing on reducing the environmental footprint of food production), health awareness (the pandemic has heightened hygiene and health awareness, affecting consumers' choices regarding food safety), and transparency and trust (consumers are demanding greater transparency regarding food supply, labelling, and safety). This evolution influences purchasing habits and consumption patterns globally. (Borsellino, Kaliji, & Schimmenti, 2020; Tetra Pak Index, 2020). They contribute to the changes that the food market is experiencing, supporting the objective of the research.

We highlight the following trends in food preferences (Macready et al., 2020; Marcum, 2020): the growing interest in plant-based alternatives for meat, dairy, and seafood is transforming eating habits; the growing interest in urban agriculture; personalised nutrition, based on genetic data, enabled by advances in nutrigenomics. The market for functional or nutraceutical foods is expanding as consumers seek additional health benefits beyond basic nutrition.

All together, the papers reviewed by Xu et al. (2019), Nielsen et al. (2019), Ryberg et al. (2020), Sharma, Teret, and Brownell (2010), and Torys LLP (2023) provide a cohesive theoretical framework for examining market changes and the difficulties faced by its participants. A basis for understanding the environmental issues affecting food production is provided by Xu et al. (2019), which draw attention to sustainability hazards in agricultural methods, especially in developing countries. Furthermore, Nielsen et al. (2019) highlights the coordination challenges companies face as they adapt to sustainability requirements, focussing on the legislative environment around green supply chains. This is supported by Ryberg et al. (2020), which highlights the natural constraints in which food systems need to operate by introducing planetary boundaries into the sustainability debate. Simultaneously, Torys LLP (2023) and Sharma, Teret and Brownell (2010) provide insights into rising food safety standards, highlighting the role of legislative frameworks in influencing market activities and guaranteeing consumer protection. Together, these studies create an in-depth lens that combines economic, regulatory, and environmental viewpoints, providing a powerful framework for examining revolutionary changes in the food market, as well as the various obstacles their participants face in the pursuit of sustainability and compliance.

2. Research methodology

This research aims to identify and analyse the challenges currently faced by actors in the food supply chain. By documenting them, stakeholders, as well as researchers, in this field can improve current methods and procedures and provide sustainable solutions to better shape activities in the field of food production, distribution, and consumption. Two secondary objectives have been set to achieve the main goal of this work.

Objective 1. The first objective is to analyse the research carried out in this area so far, emerging trends, together with key themes covering the area of the food supply chain. Therefore, the research problem of this objective is to make observations on the evolution of research and concerns in this field over the last 5 years (period 2019-2023). The answer to this question can clarify the purpose of bibliometric analysis by identifying the current state of research and the distribution of articles by country, fields of interest, and authors.

Objective 2. The second objective is to find out the latest research carried out in the field of food supply chains. Responding to this objective through a qualitative analysis of the most cited works, an up-to-date overview is provided for further studies to develop and improve the changes in the food market.

To conduct the bibliometric research, the Web of Science scientific database was used, considered to be a prestigious and complex one, offering free access to the members of the academic communities of higher education institutions. This database has allowed for several filters that can allow for narrowing down your search for better and refined results. The final sample obtained (figure no.1) was analysed using the VOS Viewer tool, version 1.6.20.

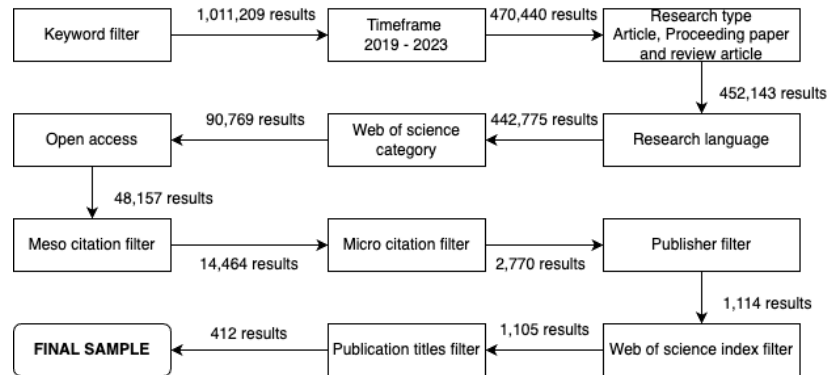


Figure no. 1. The structure of the methodology for the final sample of papers addressing the topic of changes in the food market

The following criteria were used for this study:

A. Inclusion criteria

a) All works that include as the logic of the keywords the one set out below. The "OR" operand allows just one keyword in the keyword chain to be met, while the "AND" operand must find all the fulfilled requirements.

'Food market changes' OR 'food industry trends' OR 'food market changes' OR 'food supply chain challenges' OR 'food supply chain disruptions')

AND

('sustainability' OR 'environmental impact' OR 'sustainable food systems' OR 'carbon footprint' OR 'sustainable practices')

AND

("blockchain" OR "artificial intelligence" OR "AI" OR "digitalization" OR "technology adoption" OR "innovation in the food supply chain")

AND

("consumer preferences" OR "consumer behaviour" OR "health-conscious foods" OR "plant-based foods" OR "organic food demand" OR "ready-to-eat foods" OR "food trends")

b) The time frame for the published works was selected between 2019 and 2023, the last 5 complete years.

c) The types of papers that have been chosen are Articles, Conference papers, Review articles.

d) The language of the works considered is English, as it is internationally recognised.

- e) The Web of Science category has been set to consider papers in the field of Business (covers business strategies along with economic challenges relevant to market changes), Economics (includes economic analysis on this research topic), Agricultural Economic Policies (deals with economic policies that have an impact on the field), Green Sustainable Science and Technology (reveals the practices and technologies used in food production), Environmental Studies (deals with topics such as sustainability and the link between market changes and the environment), Public Environmental Occupational Health (considers public health concerning changes in the food market) and Operations Research Management Science (relates to operational efficiency in the studied field).
- f) The "Open access" filter has been set to "All Open access"
- g) The Meso citation has been refined by selecting Sustainability Science, Agricultural Policy, Supply Chain and Logistics, Economics, Climate Change, Nutrition and Dietetics.
- h) Micro-citations included: Life Cycle Assessment, Farmers and the Supply Chain.
- i) The most prestigious editors were selected to add value to the results: Elsevier, Springer Nature, Wiley, Taylor & Francis, and Oxford University Press.
- j) The Web of Science index has been set to contain the following: Science Citation Index Expanded, Social Sciences Citation Index, and Emerging Sources Citation Index.
- k) The Publication title filter was established to contain Journal of Cleaner Production, Agronomy for Sustainable Development, International Journal of Agricultural Sustainability, Sustainable Production and Consumption, Land Using Policy, Food Policy, Renewable Sustainable Energy Reviews and Agricultural Economics.

Since only published studies are considered, bibliometric research methodologies have the potential to be biased in the selection of articles, thus ignoring significant grey literature or unindexed works. In addition, the number of citations – which is a major component of bibliometric analysis – may not necessarily be an adequate indicator of the caliber or significance of the research. Since the Web of Science database contains peer-reviewed and well-known journals that provide a more thorough and uniform collection of relevant literature, it was decided to study only the works indexed in this database to guarantee a high degree of rigour and academic credibility. However, this method omits important research that may not be included in this database, which could restrict the coverage of the analysis.

B. Exclusion criteria

- a) Other databases such as Scopus, IEEE Xplore, ScienceDirect, etc.
- b) Works that were published after 2023, because for 2024 the publications are still in progress, which can lead to an incomplete overview of them.
- c) Articles published before 2019, as this paper aims to present the most recent discoveries and challenges regarding food market changes.

3. Results and discussions

3.1. Bibliometric research on the evolution of changes in the food market

New revolutionary pressures are now affecting food markets, mainly due to changes in consumer tastes, technological advancements, and sustainability concerns. The dynamics of the entire food chain are changing due to profound modifications that create serious difficulties for consumers, wholesalers and retailers, food businesses and agricultural farmers.

The proportion of customers who follow eating patterns that are considered to be healthier and more sustainable is increasing in the demand arena. In this context, the field of the global food market has aroused great interest among scientists from all over the world. As can be seen in Figure no. 2, the number of research carried out in this area has registered a significant increase in 2023.

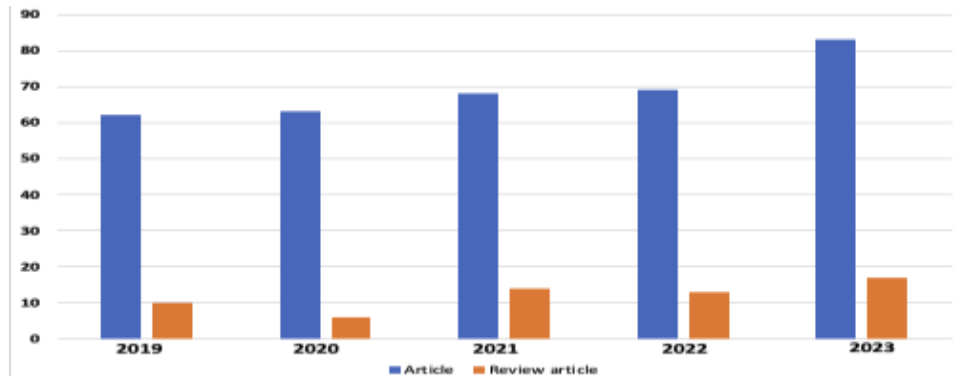


Figure no. 2. Distribution of scientific research in the last 5 years (period 2019-2023) in the global food market

The sample of papers used for this bibliometric research is based on articles and review articles, as presented in Table No. 1. The authors who have addressed this topic have chosen to publish their works in Elsevier Sci Ltd. Therefore, this publisher is an influential player in the field of the global food market and can have a major impact on the direction and evolution of knowledge in this field. It also plays a central role in disseminating results and standardising methodology and terminology.

Table no. 1. Overview of the sample for bibliometric research

Number of document types	Document type		
	Article	Review	Total general
Elsevier	31	9	40
Elsevier Sci Ltd.	228	25	253
Pergamon-Elsevier Science Ltd.	18	3	21
Springer France	26	19	45
Taylor & Francis Ltd.	37	3	40
Wiley	12	1	13
Total general	352	60	412

Through a co-author analysis, out of the 1,742 authors, only 121 have a minimum number of two documents and a minimum number of two citations. Table no. 2 presents those that have more than 80 citations along with their affiliation. As can be seen, this topic is one of the highest rated in the Netherlands at Wageningen University & Research. Since only a small sample of authors met the conditions, it means that there is an emphasis on influence and expertise among these authors. Additionally, this collaborative network can lead to an obvious evolution of knowledge and innovations, as it constitutes a core of research and excellence in the institutions to which they belong.

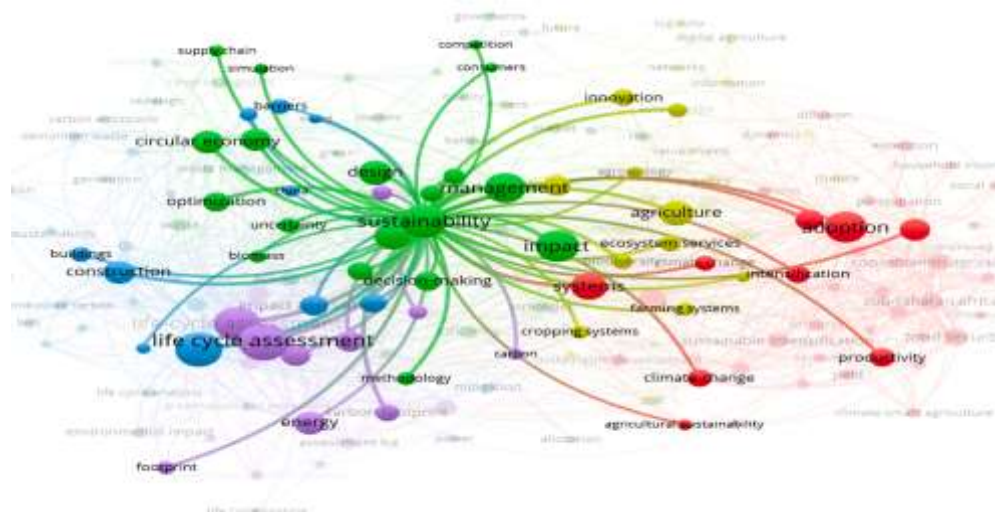
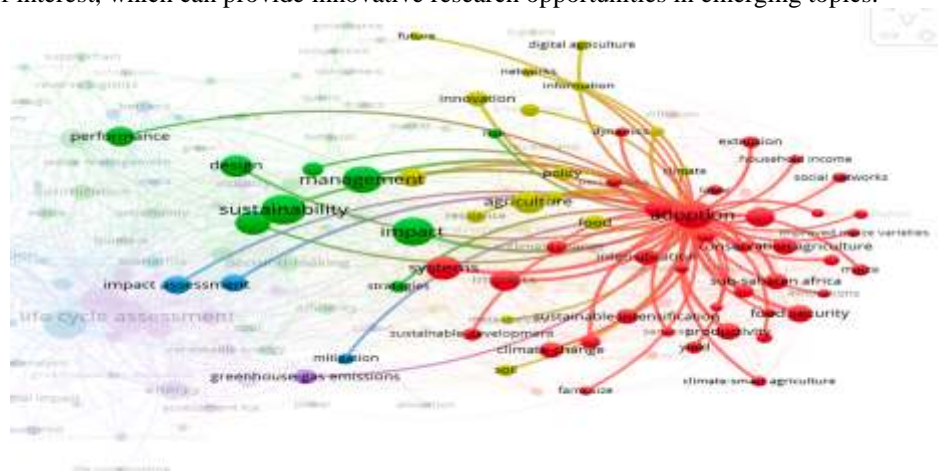
Table no. 2. Top scientific authors based on the number of citations

Author	No. of documents	No. of citations	Total Link Strength	Affiliation
Dogliotti Santiago	3	180	18	Faculty of Agronomy, Universidad de la República, Uruguay
Duncan Jessica	3	180	18	Wageningen University and Research, Netherlands
Gaitan-Cremaschi Daniel	3	180	18	Wageningen University and Research, Netherlands
Klerkx Laurens	4	186	18	Wageningen University and Research, Netherlands
Rossing Walter A.H.	3	180	18	Wageningen University and Research, Netherlands
Countesses Marie E.	2	166	14	Pontificia Universidad Católica de Chile
Huenchuleo Carlos	2	166	14	Universidad Austral de Chile, Chile
Trienekens Jacques H.	2	166	14	Wageningen University and Research, Netherlands
Azapagic Adisa	6	169	9	University of Manchester, UK.
Allen Stephen	3	81	8	University of Bath, England

From a co-authorship analysis, out of the 85 countries, 33 countries resulted in a minimum number of 5 published documents. In table no. 3. The top 10 countries in this ranking are presented. It can be concluded that the sample, which consists of about 30% of the original one, is focused on food market research and these countries are the leaders. The collaboration between them provides research directions and trends. As there is an unequal distribution, there may be a barrier to participation for countries that have less research activity and that can benefit from international collaboration with others that already have a significant presence in the global food market to increase their visibility. The main clusters are in the Netherlands, France, and England.

Table no. 3. The main countries that have addressed the topic

Country	No. of documents	Citations
France	55	1,198
England	53	1,293
Holland	50	1,322
USA	48	1,270
Italy	41	903
Spain	39	557
Germany	38	966
People's Republic of China	36	1,426
Sweden	30	706
Denmark	29	1,129



Also, from this network of keywords, those that have more than 20 occurrences and are presented in Table no. 4, are the most representative for research in the field of the global food market.

Table no. 4. Representative keywords for the topic of the global food market

Keyword	Occurrences	Total link strength	Cluster
Life Cycle Assessment	156	380	3
LCA	72	367	3
Sustainability	67	359	2
Adoption	58	318	1
Management	55	297	2
Impact	60	276	2
Frame	42	258	2
Systems	43	240	1
Construction	32	179	3
Design	36	173	2
Circular economy	32	172	2
Impact	32	168	1
Technology Adoption	29	164	1
Agriculture	35	161	4
Emissions	29	153	5
Performance	29	150	2
Energy	31	149	5
Food security	22	149	1
Environmental impact	25	133	3
Farmers	23	131	1
Technologies	24	125	4

3.2. Qualitative analysis of the most representative studies in the field of the global food market

Through the sample provided by Web of Science for bibliometric research, the top ten based on the number of citations are presented in Table No. 5. Each article also contains the WoS category in which it can be found, for a better knowledge of where this topic is approached and belongs to. Each item in Table No. 5 will be analysed in this section to present the results discovered and the challenges in the food market.

Table no. 5. Top 10 articles in the field of the global food market

No.	Article Title	Authors	Editor / Publisher	No. of Citations	WoS Categories
1	Technology adoption, impact, and extension in developing countries' agriculture: A review of the recent literature	Takahashi, Kazushi; Muraoka, Rie;	Wiley	206	Agricultural Economics & Policy; Economics

No.	Article Title	Authors	Editor / Publisher	No. of Citations	WoS Categories
		Otsuka, Keijiro			
2	An Integrated Hybrid Approach for Circular supplier selection and Closed loop Supply Chain Network Design under Uncertainty.	Govindan, Kannan; Mina, Hassan; Esmaeili, Ali; Gholami-Zanjani, Seyed Mohammad	Elsevier Sci Ltd	204	Green & Sustainable Science & Technology; Engineering, Environmental; Environmental Sciences
3	A critical view on the current application of LCA for new technologies and recommendations for improved practice	van der Giesen, Coen; Cucurachi, Stefano; Guinee, Jeroen; Kramer, Gert Jan; Tukker, Arnold	Elsevier Sci Ltd	168	Green & Sustainable Science & Technology; Engineering, Environmental; Environmental Sciences
4	Redesigning a food supply chain for environmental sustainability - An analysis of resource use and recovery	Krishnan, Ramesh; Agarwal, Renu; Bajada, Christopher; Arshinder, K.	Elsevier Sci Ltd	158	Green & Sustainable Science & Technology; Engineering, Environmental; Environmental Sciences
5	On the sustainable perishable food supply chain network design: A dairy products case to achieve sustainable development goals	Jouzdani, Javid; Govindan, Kannan	Elsevier Sci Ltd	156	Green & Sustainable Science & Technology; Engineering, Environmental; Environmental Sciences
6	Diverse approaches to crop diversification in agricultural research. A review	Hufnagel, Johannes; Reckling, Moritz; Ewert, Frank	Springer France	147	Agronomy; Green & Sustainable Science & Technology
7	Pesticide-free agriculture as a new paradigm for research	Jacquet, Florence; Jeuffroy, Marie- Helene;	Springer France	146	Agronomy; Green & Sustainable Science &

No.	Article Title	Authors	Editor / Publisher	No. of Citations	WoS Categories
		Jouan, Julia; Le Cadre, Edith; Litrico, Isabelle; Malausa, Thibaut; Reboud, Xavier; Huyghe, Christian			Technology
8	Characterizing diversity of food systems in view of sustainability transitions. A review	Gaitan-Cremaschi, Daniel; Klerkx, Laurens; Duncan, Jessica; Trienekens, Jacques H.; Huenchuleo, Carlos; Dogliotti, Santiago; Contesse, Maria E.; Rossing, Walter A. H.	Springer France	142	Agronomy; Green & Sustainable Science & Technology
9	Prospective Environmental Impact Assessment (premise): A streamlined approach to producing databases for prospective life cycle assessment using integrated assessment models	Sacchi, R.; Terlouw, T.; Siala, K.; Dirnaichner, A.; Bauer, C.; Cox, B.; Mutel, C.; Daioglou, V.; Luderer, G.	Pergamon-Elsevier Science Ltd	125	Green & Sustainable Science & Technology; Energy & Fuels
10	Decision support for collaboration planning in sustainable supply chains	Allaoui, Hamid; Guo, Yuhang; Sarkis, Joseph	Elsevier Sci Ltd	121	Green & Sustainable Science & Technology; Engineering, Environmental; Environmental Sciences

According to the review by Takahashi et al. (2020), the implementation of agricultural technologies in developing countries can improve productivity and reduce food insecurity. The main challenges are high costs, limited access to infrastructure, and lack of training. The

main limitation lies in the development of accessible solutions adapted to local requirements to support farmers in their adoption.

Govindan et al. (2020) apply a hybrid methodology to select suppliers and design a circular supply chain, considering uncertainties. The findings show that this approach contributes to increasing sustainability and reducing waste through resource recovery. The main challenges are related to the integration of risk factors in operational decisions and the optimisation of costs in circular supply chains.

The analysis by van der Giesen et al. (2020) is related to the LCA (Life Cycle Assessment) methodology. It is suggested that the application of this to new technologies is limited by inconsistency and lack of transparency. The challenges here are the adoption of LCA for emerging technologies and the management of the complexity of the data to accurately reflect its environmental impact.

A redesign model for sustainability is proposed in the research of Krishnan et al. (2020), by looking at resource use and recycling in food supply chains. Their findings suggest that resource recovery can reduce waste and carbon emissions, but the main challenges are integrating recycling costs and adapting logistics to optimise the supply chain in a sustainable way.

Another research (Jouzdani and Govindan, 2021) presents a case study of the dairy industry to develop a sustainable supply chain for perishable foods that meets the Sustainable Development Goals. Their findings illustrate that this model can minimise waste and improve resource efficiency, but the main problems are related to logistical complexity and maintaining the quality of perishable products throughout the chain.

A review research explores different methods of cultural diversity, assessing the benefits and limitations of each approach (Hufnagel et al., 2020). The findings highlight that cultural diversity can improve agricultural resilience, but is limited by specific resource and knowledge requirements. The main challenges are the adaptation of these practices to different climate areas and providing financial support for farmers.

A new paradigm in agricultural research is proposed by Jacquet et al. (2022). This consists of pesticide-free agriculture, which can provide new ecological and health benefits. The findings indicate that this model can reduce pollution and ensure healthier crops. However, the challenges are still present and given by the development of effective alternative solutions and support for the transition of farmers to this pesticide-free model.

The diversity of food systems is presented by Gaitán-Cremaschi et al. (2019). It explores how transitions can support sustainability. The main conclusion is that various food systems offer adaptable solutions, and the main problem is to identify the most effective transition practices to ensure the necessary political and financial support.

Environmental impact using integrated assessment models to create prediction databases in LCA is also explored (Sacchi et al., 2022). This model can improve the prediction of environmental impact; however, challenges include collecting reliable data and integrating these models into industrial practices.

The research of Allaoui et al. (2019) focuses on creating decision-making support for collaboration planning in sustainable supply chains, highlighting how these tools can improve cooperation and efficiency. The findings indicate that these systems can support

sustainable goals, but the challenge is the adoption of technologies to facilitate collaboration between stakeholders in the supply chain.

The research provides unique but related strategies for improving the sustainability of agricultural and food supply systems. Takahashi et al. (2020) focus on removing barriers to the adoption of agricultural technology in developing countries, highlighting issues such as exorbitant prices and inadequate infrastructure, which are closely related to the difficulties in putting sustainable methods into practice that other authors have addressed. Both Govindan et al. (2020) and Krishnan et al. (2020) highlight circular supply chains and resource recovery, demonstrating how waste reduction and resource optimisation can promote sustainability.

They, however, highlight distinct obstacles; Govindan et al. (2020) have difficulties in optimising costs, while Krishnan et al. (2020) face difficulties with logistical modification and integration of recycling costs. The complexity of life cycle assessment (LCA) and predictive models for environmental impact assessment is introduced in the work of van der Giesen et al. (2020) and Sacchi et al. (2022), who highlight issues such as data transparency and model integration into industrial operations. According to Jouzdani and Govindan (2021), the difficulties of logistic complexity and preserving the quality of perishable items in sustainable supply chains support the need for more accurate environmental forecasting. Last but not least, the research of Gaitán-Cremaschi et al. (2019) and Jacquet et al. (2022) highlights the importance of cultural variety and pesticide-free agriculture in sustainable agriculture, each of which poses unique difficulties for supporting and adapting farmers. Together, these studies show that, while there are several paths to sustainability, they are all linked and have common obstacles, such as expenses, logistical difficulties, and the need for improved data integration along the supply chain.

Conclusions

The article highlights the dynamics of research on changes in the food market, highlighting the role of digitalisation, sustainability, and consumer behaviour transformations. Through a bibliometric approach, the analysis provides a clear perspective on the main research directions and challenges faced by actors in the food chain.

The research results indicate an increase in academic interest in new economic paradigms, emphasising the need for adaptive strategies on the part of the industry. Among the main challenges identified are increased safety and transparency requirements, the integration of digital technologies, and the transition to more sustainable practices. In this context, the article offers both a theoretical contribution, through the mapping of the literature, and an applicative contribution, through recommendations meant to support the strategic decisions of industry actors.

This article points out a notable increase in the number of studies in the field of sustainability and supply chain optimisation, organic farming, and impact assessment of emerging technologies in the context of high pressure to respond to environmental and resource challenges. Recent studies illustrate that more and more initiatives to adapt supply chains to circular models, integrate pesticide-free farming methods, and crop diversity have the potential to reduce ecological impact and support food security. However, these initiatives

face significant challenges, including high implementation costs, the need for adequate infrastructure, and the adaptability of local conditions specific to each area.

Research conducted in the field of sustainability and supply chain optimisation highlights a clear direction of implementation of innovative and environmentally friendly solutions that meet global requirements to reduce environmental impact and conserve resources. Adapting agriculture to crop diversity, transitioning to pesticide-free practices, and integrating forward-looking environmental assessments contribute not only to the resilience of food systems, but also to the improvement of the socioeconomic conditions of the farming community. These changes come with a significant transformation of policies and continued support for investments in infrastructure and technology. As these initiatives grow, collaboration between the public sector, the research community, and private industry becomes essential to achieve real sustainability in food supply practices and chains.

Taking into consideration the rapid evolution of the food sector under the influence of dynamic factors (legislative and technological changes, economic, social, and political crises), the results require frequent updates to remain relevant. In addition, the identified trends reflect the major directions in academic research, but their applicability depends on specific contexts (regional markets, niche food sectors). However, these limitations may turn into opportunities for future research that could include complementary methods such as interviews with industry experts, applied case studies, or econometric analyses of the impact of changes in the food market.

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