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IMPACT SUSTAINABILITY IN FOOD SUPPLY CHAIN: SCOPING REVIEW

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ABSTRACT

Food supply chains must balance environmental, economic, and social success to survive. Food supply chains must incorporate strategies that lessen their negative effects on the environment, increase economic resilience, and promote social well-being to be viable over the long run. However, food supply chain faces many quality and efficiency issues. Poor cold chain facilities, transportation and logistics inefficiencies, unsuitable handling equipment, poor road infrastructure, and restricted supply chain partner information sharing are major challenges. These cause significant supply chain losses and waste. Based on a scoping review, this study will investigate impact sustainability in food supply chain and a total of 18 article were analysed. This scoping review of the literature was performed utilising two databases, Web of Science (WoS) and Scopus, to ascertain the characteristics of published scientific literature on this subject and to identify the rising topics of sustainability in food supply chain research. This study identified six primary themes and eighteen sub-themes concerning sustainability within the food supply chain setting. The primary themes encompass organizational readiness, technology, Green Practice, policy, sustainable resourcing, and external relationships. The review suggests that the majority of studies focus on the effects of sustainability within the food supply chain. These results imply that organisations might improve food supply chains, especially during unexpected periods, by considering all impact sustainability. It also provides a comprehensive overview how sustainability can impact efficiency food supply chain. Base on the finding sustainability is gaining popularity, but most study focusses on its effects rather than solutions. Future research must focus on pragmatic, sustainable methods to boost the food supply chain.

Keywords: Sustainability, food supply chain, supply chain management, food, sustainable supply chain management, scoping review.

INTRODUCTION

Sustainability research in industry, science, and associations is increasing fast. Definitions and meanings vary, more corporations implement ethical and environmental standards as the idea expands. Information, material, and money transfers connected suppliers to end customers during globalisation (Mastos & Gotzamani, 2022). The Food and Agriculture Organisation (FAO) anticipates that 1.6 billion people would not have enough food in 2022 due to increasing food basic prices (FAO 2022). Fresh food supply systems encounter many problems that affect quality and efficiency. Lack of cold chain facilities, transportation and logistical issues, poor handling equipment, inadequate road networks, and insufficient information exchange among supply chain participants cause significant supply chain losses and waste (Huang et al. 2023). Regulatory bodies, NGOs, community organisations, suppliers, customers, and global competition have forced firms to reassess the balance of environmental, social, and economic issues in their supply chains and embrace sustainable supply chain management methods.

Resilience, eco-friendly practises, and sustainability are essential for fresh food supply chain sustainability (Mahak et al., 2023). Sustainability requires stakeholder accountability, awareness, and consumer participation (Hamam et al., 2021). Sustainability in the fresh food supply chain depends on the Triple Bottom Line (TBL), which includes social equality (social pillar), environmental quality (environment pillar), and financial performance (economic pillar). (Kolling et al., 2022). The environmental dimension concerns natural resource use, pollutant emissions, and environmental impacts. The economic dimension includes profitability, efficiency, and competitive advantage. The social dimension includes gender equality, equitable compensation, and safe and healthy workplaces.

The food sector today prioritises sustainable sourcing and supply chain efficiency. Growing awareness of the need for environmentally and socially responsible activities drives this transition. The Food and Agriculture Organisation (FAO) has noted that greenhouse gas emissions and environmental degradation are linked to the global food system. Water use, natural resource loss, and land use changes, particularly deforestation, are also concerns for the food business. Disaggregating global supply networks necessitates sustainability initiatives beyond rigid boundaries. This also raises a major regulatory issue. Pressure on commercial sectors to address social and environmental challenges has grown in recent years (Hahn et al., 2015). SSCM mandates supply chain enterprises to report profitability, environmental, and social performance (Hahn et al., 2018).

To reach the goal of sustainability in the food supply chain, organisations need to develop a more profound comprehension of the impact factors that can be achieved through sustainability initiatives. Previous studies indicate that there has been a lack of focus on Food Sustainable Supply Chain Management, particularly concerning the factors that affect sustainability. To tackle this challenge, it is essential to assess various factors to comprehend how these obstacles can be surmounted and how sustainability can be realised within the food supply chain.

Based on the abovementioned, the current study is expected to answer two research questions (RQ). First, what factors affect food supply chain sustainability? Second, what are the research themes used in the Food Supply Chain sustainability studies?" is clear and directly relevant to the study objectives? This study will investigate the factors influencing sustainability in the supply chain of the food industry and will also identify the key themes and sub-themes that arise from this analysis. This paper will offer a thorough overview of the extensive studies undertaken on sustainability within supply chain management.

METHODOLOGY

This scoping review framework is based on the contributions of (Arksey & O’Malley, 2005) and is further enhanced by the guidelines established by (Levac et al., 2010). This method is employed to systematically identify all pertinent materials on the topic, with the objective of offering a comprehensive overview of the concept without exploring the depth of the evidence (Davis et al., 2009). Scoping reviews notably lack a formal quality assessment of the sources (Levac et al., 2010). Based on this as a starting point, five methodological stages in the scoping review process will be conducted according to the description given below.

In Stage 1, the research questions are formulated and evaluated. This scoping review has created two primary research questions: the first investigates the influence of sustainability on the food supply chain, and the second strives to identify the principal themes within this field of study. This review will focus mainly on the food supply chain.

Stage 2 entails the identification of pertinent studies. This scoping review utilised academic journals obtained from two principal databases Web of Science (WoS) and Scopus. Web of Science, created by Thomson Reuters, includes a diverse range of fields such as environmental studies, sciences, social sciences, and technology, featuring over 12,000 active journals, 23 million patents, 148,000 conference proceedings, and more than 40 million records dating back to 1945. Scopus, launched by Elsevier in 2004, offers citation analysis from 1996 and comprises an extensive bibliographic database of scientific, multidisciplinary, and worldwide literature (Sánchez et al., 2016).

The search strategy included a comprehensive search string of keywords related to food supply chain sustainability, i.e., Sustainability, food supply chain, supply chain management, food, sustainable supply chain management combined with Boolean operators OR and AND (Table 1).

Stage 3 emphasises the identification and removal of superfluous elements. The primary selection criterion pertains to the genre of literature pertinent to the research subject. This study exclusively incorporates research articles and conference proceedings, as they are the key sources of analytical evidence. Publications including systematic reviews, review articles, meta-analyses, meta-syntheses, book series, book chapters, and newspaper articles are eliminated. Only English-language publications over the past five years (2019-2023) are included. Furthermore, papers from adjacent disciplines, like agricultural science and biology, are omitted to maintain the relevance of the chosen studies (refer to Table 2).

Stage 4 entails the systematic representation of the data. The data collected will be organised in a table (Table 3) using Microsoft Excel to facilitate thematic and comparative analysis. Data regarding authorship, publication year, key findings, and themes were documented in this format.

Stage 5 involves processes to collate, summarize, and report the results. Common themes and findings from the articles are compiled to understand the impact sustainability food supply chain context and the extent of emerging themes researched under this topic. Other important information that is recorded is location of study, year of publication and other relevant information to the objectives of the study.

Table 1

The search strings

Database	Search String
WOS	TS= "Sustainability" AND " food supply chain" AND " supply chain management" AND "Food" AND " sustainable supply chain management"
SCOPUS	TITLE-ABS-KEY(("Sustainability") AND ("food supply chain") AND (" supply chain management") AND ("food") AND (" sustainable supply chain management"))

Table 2

The inclusion and exclusion criteria

Criterion	Eligibility	Exclusion
Literature type	Research articles	Book series, book, chapter in book
Language	English	Non-English
Timeline	2019-2023	<2019
Subject area	Business, Management and Accounting, Social Sciences, Economics, Econometrics and Finance	Computer Science, Decision Sciences, Engineering, Psychology, Energy, Medicine

FINDING

The following parts present, discuss, and analyse all of the identified papers in terms of their diverse features and aspects.

The search methodology has been extensively detailed previously, and a query of the WOS and Scopus databases yielded sixty four publications. Because there are identical duplicate text articles, the initial database query excludes these articles. Upon additional evaluation, a total of fifteen papers were classified as ineligible due to their titles and abstracts, as well as the topic matter, language, and review formats (including systematics and meta-analysis), being unacceptable. Upon further assessment, it was determined that twenty-one of the thirty-four remaining papers were irrelevant to the objectives of the scope study, resulting in their exclusion from consideration. This decision was reached following a comprehensive review of the papers. Only eighteen papers were relevant and suitable for the objectives of this study, considering the optional reporting aspects for the viewpoint of the systematic review (PRISMA) (Moher et al., 2015). This is established following the selection process in accordance with a rigorous methodology. (Figure 1).

The selection of publications was restricted to empirical research published in journal articles over a five year period, based on various parameters. Prior to the journal review, the conference proceedings were excluded due to insufficient systematisation and transparency stemming from conventional judgements, possibly swayed by the author's subjectivity (Hodgkinson & Ford, 2014). Number of publications categorised by year; the quantity of articles concerning food supply chain sustainability has risen, perhaps attributable to heightened interest and awareness among organisations and academics in sustainability and supply chain management. The number of published publications increased significantly between 2019

and 2023. In 2019 and 2020, only one article was published each year. However, there was a significant rise beginning in 2021, with 5 papers published in 2021, 4 in 2022, and the highest number in 2023 7 articles was reported.

This study aims to enhance the journal source by selecting high-quality articles published in the past five years for a scoping review. The findings indicate that the most utilised approach is qualitative study. According to the criteria specified above. Table 3 summaries of the eighteen publications of recent research that were selected for inclusion in the scoping review.

Figure 1

PRISMA flow diagram of the study selection process

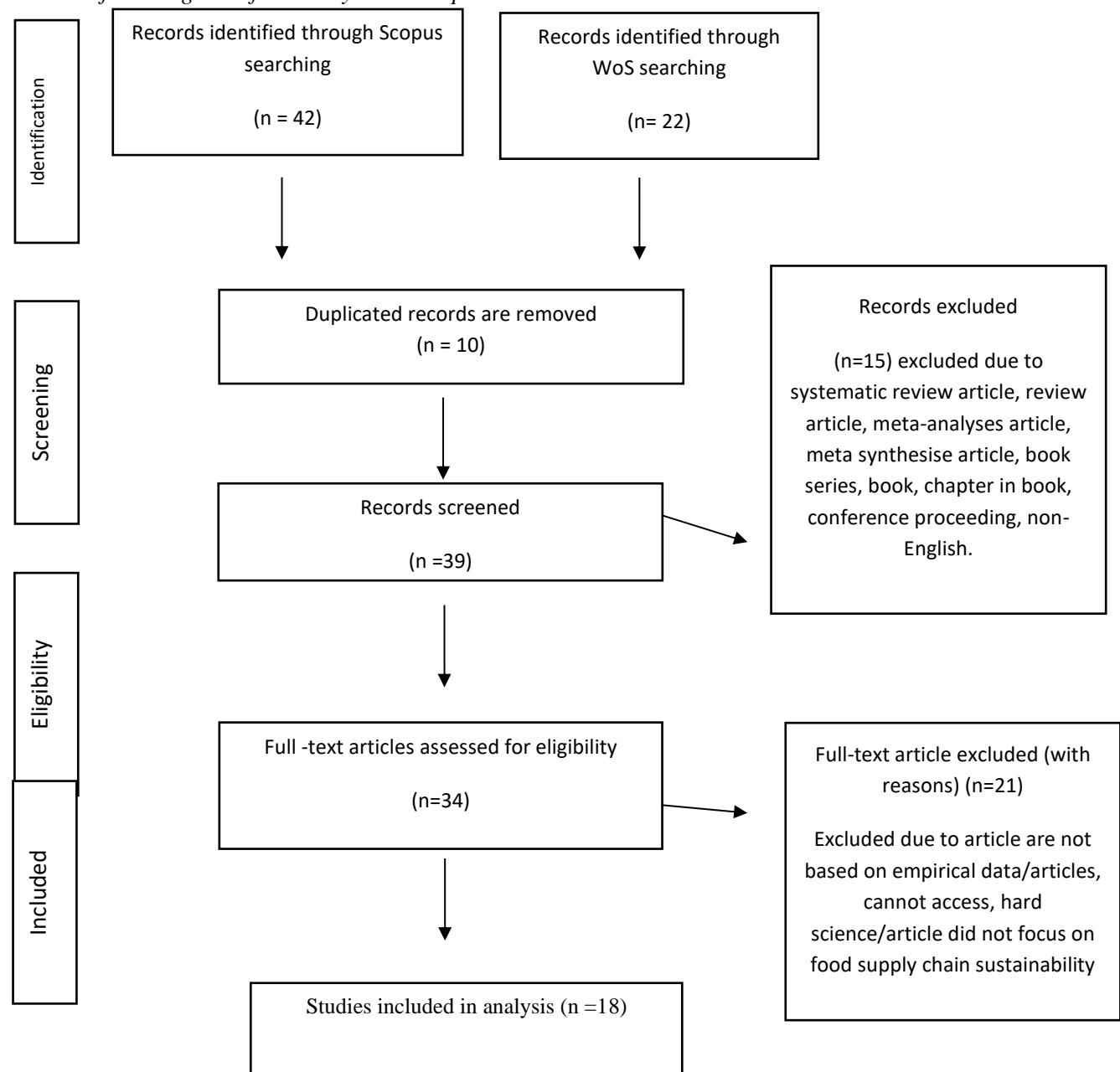


Table 3
Data charting form

No.	Author & Year	Impact	Sub-themes	Theme
1	Asif et al. (2022)	The study found 10 supply chain hotspots that significantly impact the environment: Energy Use, Climate Change, Water Scarcity, Waste Generation, Transportation Emissions, Agricultural Practices, and Supply Chain Complexity. These hotspots were listed in a table with their supply chain impact and position to help enterprises address them. The study reveals that corporations can drastically minimise their environmental impacts by aligning hotspots with science-based green practices. This integration is essential for food supply chain sustainability.	Efficiency	Organization Readiness
2	Mohammad Khani & Mousavi (2023)	As environmental sustainability awareness grows, product recovery activities are in demand, offering new business opportunities and a competitive edge for third-party reverse logistics (RL) providers. These companies are most suited to address supply chain demands with effective services and goods. Companies struggle to find affordable raw materials while meeting public demand for sustainable environmental policies. To improve supply chain performance, RL methods like remanufacturing, recycling, and repairing are necessary. These solutions balance economic, environmental, and social benefits, ensuring supply chain sustainability.	Resilience	Organization Readiness
3	Chkanikova & Sroufe (2021)	Although policymakers must further clarify their role in this regard, they should also acknowledge that various approved plans are integral to the fabric of daily life. Encouraging benchmarking across certifying bodies and promoting their collaboration may enhance the market value of sustainability certificates. Its corollary mitigates the inflexibility of the systems employed by providers, providing some latitude for adaptations in diverse situations, such as restaurants. This diversity ultimately enhances the overall sustainability of supply chain operations.	Collaboration	Organization Readiness
4	Johnson et al. (2022)	It's an organised way to package and rank quality aspects by supply and demand. This typology helps food producers and marketers find competitive advantages and manage quality management's many challenges. Still more crucial However, the typology emphasises the necessity for firms to adapt to changing consumer demands and sustainability issues. As long as managers realise the trade-offs between preserving and modifying quality conventions, they may make decisions that improve supply chain performance and sustainability. Regular Expressions: letting them do their own business and treating short-term losses as long-term losses will maximise rewards. Thus, this is both a supply chain issue and a managerial planning issue for ending the impasse.	Integration	Organization Readiness
5	Wang et al. (2023)	Using structure theory and ecosystem theory, the study develops a comprehensive system of influencing elements and an effect model for sustainable supply chains in live-streaming e-commerce. It also includes practical advice for stakeholders including government agencies and practitioners on how to manage and improve sustainable supply chains in the fast-changing e-commerce world. To grow cross-border agricultural supply chains, the research recommends development pathways that leverage market demand and improve stakeholder cooperation. It also emphasises the importance of supporting measures like finance system and logistical improvements for sustainable supply chains. The findings help support live-streaming e-commerce and cross-border agricultural product supply chains, upgrading industry and improving global agricultural trade.	Digitization	Organization Readiness
6	Yazdani et al. (2022)	The research presents a multi-tier sustainable food supplier selection approach aimed at tackling the complexities and uncertainties present in food supply chains. This model improves supplier selection using a two-phase methodology that assesses and ranks suppliers according to sustainability criteria, addressing the common oversight of existing methodologies about the significant impact of sub-tier providers on total supply chain performance. By including sustainability into the selection process, the model promotes eco-friendly practices within the food business, coinciding with the increasing demand for ecological products and the significance of responsible sourcing.	Sustainability	Organization Readiness

7	Ricketts et al. (2023)	The research suggests three procurement activity portfolios that procurement managers can employ to meet sustainability goals, each with different effort, implementation ease, and within-pillar and cross-pillar implications. These portfolios are essential for sustainability co-benefits. Sustainability science's complex systems and linkages are shown by the study's cross-pillar impact assessment complexity. Complexity needs detailed understanding of how strategies interact. The report offers a portfolio-based strategy to sustainable procurement to prioritise a comprehensive set of sustainability goals rather than separate initiatives. This strategy goes beyond reporting obligations to integrate sustainability into organisational processes.	Adaptability	Organization Readiness
8	Kasim et al. (2021)	The research on developing sustainable palm oil in supply chain strategies sheds light on the challenges food companies face when implementing sustainability. It helps understand sustainability issues by revealing the challenges organisations face in incorporating sustainable palm oil into their core strategies, especially downstream, which is crucial for strategy creation and implementation. Consumer demand is vital to corporate survival and sustainability, thus supply chain strategies must match these expectations. The report emphasises the importance of internal commitment, stating that devoted middle management and board members advance sustainability efforts beyond certified palm oil. It also stresses the necessity of cross-functional synergy and departmental communication and collaboration for plan implementation. Finally, stakeholder participation is essential for consensus-building and effective sustainable palm oil supply chain operations.	Alignment	Organization Readiness
9	Singh et al. (2023)	The study of Blockchain Integrated IoT (B-IoT) for the Food Supply Chain (FSC) found various benefits, including technological adoption and supply chain management. It begins with ten key success elements for B-IoT in FSCs, including "top management support," "knowledge management," "technology hardware readiness," "skilled personnel," and "high investment." This identification helps stakeholders focus on the most impactful areas. The grey Decision-Making Trial and Evaluation Laboratory (DEMATEL) technique helps stakeholders make strategic resource allocation and management decisions by improving understanding of these essential success variables' causal links. The findings help FSC partners focus their efforts and improve supply chain efficiency, resilience, and transparency. The report also promotes B-IoT technologies because they improve performance through traceability and transparency, which improves food security and operational efficiency.	Transparency	Technology
10	Ordóñez et al. (2023)	The report highlights the many benefits of blockchain technology in food supply chains, particularly in traceability and transparency. The main benefit is improved food traceability because blockchain transactions are immutable and verifiable. This can boost consumer trust and supply chain efficiency. The study also examines how blockchain, IoT, and Big Data might improve agricultural network security and performance, improving operational efficiency. The study emphasises the need to educate governments, entrepreneurs, and farmers on blockchain's pros and cons. Creating an environment for widespread acceptance of this technology requires coordinated efforts.	Traceability	Technology
11	Da silva et al. (2023)	The impact of sustainability on food supply chain complexity is revealed by study. Managers should focus on slack resources, clean technologies, and effective information transfer to reduce system complexity and improve efficiency and sustainability. The study found that sustainability considerations increase complexity in five areas: multiple elements, dynamically interacting components, element variety, unanticipated variability, and resilience. This paradigm shows how these features affect food supply chain complexity, helping managers make sustainable supply chain decisions.	Optimization	Green Practice

12	Miranda-Ackerman et al. (2019)	The study provides a paradigm for creating green supply chain networks for the processed food industry, focussing on the orange juice agri-food cluster. It stresses the importance of including environmental and social concerns in supply chain choices beyond profit-driven paradigms. This change is necessary to address food production's environmental and social implications. The study also emphasises the necessity of including various stakeholders in decision-making to ensure multiple perspectives. This inclusive approach is essential for a fairer and sustainable supply chain that satisfies everyone's requirements.	Eco-design	Green Practice
13	Guimaraes et al. (2022)	The research finds that social responsibility (96.6% agreement), economic performance (91.2%), and regulatory frameworks (90.5% agreement) enhance food industry sustainability. Lack of government support, high process complexity, and communication gaps limit sustainability efforts. The study emphasises the necessity to understand these factors and impediments to improve corporate sustainability, especially in sustainable supply chain management (SSCM), which is underexplored in the food industry. Understanding these aspects can assist coffee industry management identify blind spots and design tailored sustainability measures for their supply chains. Stakeholder communication and engagement are essential to overcome barriers and promoting sustainability projects.	Regulation	Policy
14	Pietrzyck et al. (2021)	The report on the EU-US Transatlantic Trade and Investment Partnership (TTIP) sheds light on sustainability and trade policy. It shows that EU and US trade specialists have different views on sustainability, with US experts being more optimistic about Free Trade Agreements (FTAs). Differences in perspectives may affect future agreements. The report highlights the need of integrating sustainability considerations into trade agreements, identifying nine SDG-based priorities for trade operations and treaty negotiations. It also suggests that the European Green Deal could operate as a non-tariff barrier to trade and complicate future discussions, especially as it expects a decline in global trade that could hurt the agri-food sector. The research also recommends emphasising sustainability in trade policies and improving EU institution education and capacity building to address sustainability in trade situations.	Diplomacy	Policy
15	Acampora et al. (2023)	The study found that cost reductions, profit growth, external pressures, and corporate risk reduction push agri-food enterprises to adopt sustainable practices. However, high carbon neutrality costs, lack of resources and budget, weak policy framework, and confidence in carbon offsetting techniques are major obstacles. The research also suggests that carbon-neutral certifications and labelling are easier for corporations than internal offsetting or in setting projects. The survey also shows that financial enablers like free or subsidised certifications and supply chain technical assistance help organisations meet sustainable targets.	Mitigation	Sustainable Sourcing
16	Anastasiadis et al. (2021)	The study proposes a systematic method for identifying food supply chain environmental hotspots to address data accessibility and computational complexity. This strategy creates "near real-time assessments" of environmental effects, boosting sustainability decision-making. A case study in the resource-intensive UK poultry industry shows that the methodology can identify major environmental issues. The research divides environmental impacts into emergent, urgent, and less urgent hotspots to prioritise measures by urgency. The methodology gives policymakers and industry stakeholders actionable management insights, enabling faster and cheaper environmental impact assessments and resource allocation, improving food supply chain policy execution and sustainability management.	Assessment	Sustainable Sourcing
17	Alexy et al. (2020)	This study underlines the critical need to fill plastic sustainability knowledge gaps, especially for MPs and nano-plastics. MPs in food and other ecosystems are poorly investigated, but marine MPs are well known. The report suggests plastics value chain management to lessen environmental impact. Although plastics benefit society, their environmental consequences, especially litter and waste, necessitate comprehensive sustainability strategies. Regulations should reduce plastic waste, promote recycling, and increase plastic additive transparency. The project also prioritises creating established MP and NMP detection and measurement methods and toxicological studies to assess their hazards. Global environmental and food monitoring is also stressed to understand particle distribution and effects. Food and water may include MPs, stressing the need for food product data.	Biodiversity	Sustainable Sourcing

18	Soma et al. (2021)	A new fish value chain in Kibera has improved food security by increasing the availability of affordable, small-sized fish, addressing hunger (SDG2) and promoting sustainable urban living (SDG11). The project's success depends on local ownership and community involvement, which helps solve implementation challenges quickly. Community leaders built trust, collaboration, and inspiration in the network. The project has also produced sustainable trading opportunities, demonstrating the importance of rural-urban community group and network connections in fish food system flexibility and sustainability. The study highlights the need for context-specific institutional frameworks to strengthen food systems and the relevance of community leadership in promoting transformation and food security, particularly in Sub-Saharan Africa.	Cooperation	External Partnerships
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DISCUSSION

In a scoping review, sub-themes and overarching themes are identified to systematically address the research question concerning the predominant theme in this field of study. The review identified six main themes, each containing several specific aspects, leading to a total of eighteen sub-themes. In this section also will discuss impact sustainability to food supply chain management based on the findings.

Organisational Readiness

Mitigating environmental and social implications in food supply chains necessitates a combination of cultural, operational, and technological competencies to attain sustainability. A robust organisational culture prioritising quality management, customer orientation, and supplier collaboration enhances economic, social, and environmental results in fresh food supply chains. The extended resource-based view (ERBV) and institutional theory assist producers in implementing transformational strategies to tackle resource scarcity and environmental issues (Adams et al., 2022). Crises such as Ukraine's martial law underscore the necessity of robust procurement strategies that transcend mere compliance to match with global sustainability objectives. Resilience and integration facilitate risk reduction, optimal supplier selection, and reverse logistics to diminish environmental impacts and improve competitiveness. Digital technologies such as blockchain and digital twins improve transparency, efficiency, and supply chain resilience, facilitating sustainable supply chain management (SSCM) and aligning stakeholders to mitigate inefficiencies. Collaborative frameworks and certifications, including EurepGAP and UTZ, promote confidence and common sustainability norms. Walmart's blockchain-based supplier monitoring system demonstrates the successful incorporation of sustainability in procurement, minimising waste and enhancing responsiveness. Robust corporate culture, interdisciplinary collaboration, and proactive planning facilitate comprehensive sustainability throughout organisational tiers. Organisations may establish sustainable food supply chains by adopting adaptation, digitisation, collaboration, and alignment, so assuring long-term environmental and social responsibility while maintaining resilience as corporate citizens.

Technology

Technology, especially traceability and transparency tools, is revolutionising food supply chains by improving sustainability, efficiency, and safety. Blockchain, IoT, and AI are helpful in enhancing traceability, mitigating fraud, and guaranteeing product authenticity, thereby fostering stakeholder confidence (Adekunle et al., 2024; Vern, 2024). Blockchain enables stores to monitor products such as poultry and oranges for contamination management, whereas projects like the Grassroots Farmers Collective disseminate authenticated agricultural data (Galvez et al., 2018). The Internet of Things enhances blockchain by providing real-time monitoring of temperature and humidity, thereby insuring food

quality during storage and transportation. These technologies collectively offer a safe and transparent data management platform that improves operational efficiency, minimises intermediaries, and promotes responsible sourcing. Adoption obstacles encompass storage capacity, bandwidth constraints, and legal issues, with the authentication of IoT data being essential for system integrity (Nuševa et al., 2024). Through the facilitation of real-time monitoring, demand forecasting, and data exchange, technology synchronises food supply chains with socio-economic and environmental sustainability objectives.

Green Practice

The concept of Green Practice focusses on minimising environmental effect and enhancing the efficiency and sustainability of food supply chains via waste management, green procurement, and reverse logistics (Jeremić et al., 2024). Green transportation, characterised by energy-efficient vehicles and optimised distribution routes, is essential for reducing carbon footprints (Durgaprasad & Prasad, 2022). Collaboration between suppliers and logistics providers enhances sustainability via the exchange of best practices, despite considerable initial investments presenting hurdles. Green Supply Chain Management (GSCM) methods, including eco-design, green sourcing, and sustainable packaging, enhance environmental, economic, and social outcomes, as evidenced in the Indian food processing sector. Eco-design, bolstered by multi-criteria decision-making systems, minimises waste and improves resource efficiency. Slack Resources (SR) and Clean Technologies (CT) enhance sustainability by financing innovations and adjusting to evolving demands, however an overemphasis on social responsibility may lead to inefficiencies (Hiz et al., 2019; Baker & Nelson, 2005). Strategic reserves safeguard the environment and economy during disruptions like as the COVID-19 pandemic. Ultimately, green supply chain networks, exemplified by the model created for the orange juice agro-food cluster, enhance sustainability by including environmental factors into supply chain frameworks.

Policy

Comprehensive solutions for food supply chain sustainability focus on balancing food quality, environmental protection, and social equity to create resilient systems. Effective policies address food loss and waste (FLW), which threaten food security and the environment, through accurate measurement, reduction strategies, and support for ecologically sound agriculture and consumer behaviour changes (Mattas et al., 2021). Sustainable Supply Chain Management (SSCM) integrates sustainability across supply chains, with governments enforcing compliance through audits, targets, and penalties, driving collaboration and environmental accountability. Harmonized regulatory frameworks and international diplomacy are crucial for addressing global challenges like food security, resource depletion, and climate change. Diplomatic efforts promote climate-smart agriculture and precision techniques to improve resource efficiency and environmental resilience. The EU's agricultural policies highlight the importance of global trade rules and quality standards, though differing sustainability perspectives between regions, such as the EU and US, underscore the need for legal alignment and cultural understanding to develop cohesive, sustainable trade strategies.

Sustainable Sourcing

Sustainable sourcing emphasises minimising the ecological footprint of food production while augmenting social and economic advantages. This entails endorsing local and organic products, enhancing supplier management, and adopting sustainable shipping procedures to fortify food systems and minimise waste (Anindya et al., 2024). Given that one-third of the world food supply is lost or wasted, systemic solutions such as standardised data collecting and targeted interventions are essential for sustainability and meeting

global climate objectives like carbon neutrality. Agri-food enterprises are implementing low-carbon strategies, conducting lifecycle assessments, and adhering to ethical labour standards to reduce environmental impacts and enhance profitability (Birkenberg & Birner, 2018). Biodiversity is essential for healthy agricultural systems, tackling ecological issues including soil health and pollination. Nonetheless, challenges such as micro-plastics in supply chains underscore the necessity for circular economy models and pollution mitigation techniques. By tackling these interrelated challenges, sustainable sourcing promotes robust food systems and enhances environmental and social sustainability.

External Partnerships

External relationships are essential for promoting sustainability in food supply chains by facilitating collaboration among many stakeholders. Transitioning from philanthropic organisations to strategic, competency-focused collaborations, these partnerships foster innovations in sustainable practices and mitigate the environmental effects of industrial food production (Andra, 2022). Programs such as the Barilla Sustainable Farming initiative demonstrate how horizontal collaboration improves sustainable agriculture (Pancino et al., 2019). Performance frameworks demonstrate that enhancements by a single partner advantage the entire supply chain, underscoring the interdependent character of these collaborations (Shashi et al., 2018). Mechanisms such as social capital enhance cooperation, eco-innovation, and sustainability (Canto et al., 2021). Governance models, such Food Policy Councils, illustrate the efficacy of collaborative problem-solving and multi-stakeholder partnerships in mitigating food waste and advancing sustainability. Collaborative co-creation among smallholders, academia, and enterprises enhances resource optimisation and aligns stakeholder interests for enduring sustainability. Nonetheless, reconciling social rationalities that emphasise communal welfare with individual rationalities centred on self-interest and performance is essential for equitable and sustainable food systems. Figure 4 shows an overview of the theme that has been adapted from the overall findings.

Figure 2
Framework themes for Food Supply Chain Sustainability



IMPACT SUSTAINABILITY IN FOOD SUPPLY CHAIN MANAGEMENT

The findings identify ten critical hotspots that will impact sustainability in the food supply chain, including energy consumption, climate change, water scarcity, and waste generation, all of which have substantial environmental repercussions, highlighting the necessity for food enterprises to implement science-based, sustainable practices. Integrating these practices with environmental goals is crucial for maintaining the sustainability of the food supply chain. With the rise in sustainability awareness, the need for product recovery activities, including remanufacturing, recycling, and repair, is escalating, creating new business prospects for third-party reverse logistics providers. Reinforcement learning approaches facilitate the equilibrium of economic, environmental, and social advantages, hence promoting a more sustainable food system. Policymakers play a crucial role in advancing sustainability by fostering collaboration among certifying organisations to augment the value of sustainability certificates, so permitting increased flexibility in the implementation of sustainable practices across food industries, including restaurants. The findings also emphasise the necessity of addressing sustainability issues across various segments of the food supply chain. Food producers and marketers can employ sustainability-oriented typologies to identify competitive advantages and address quality management challenges while meeting consumer demands. Effective supply chain management necessitates strategic decision-making that reconciles trade-offs between maintaining and modifying quality standards to improve performance and sustainability. The integration of sustainable practices in procurement, coupled with the implementation of technologies like Blockchain Integrated IoT (B-IoT), can improve the resilience, transparency, and traceability of supply chains. Improving collaboration, logistics, and stakeholder support is crucial for promoting sustainability in sectors like e-commerce and cross-border agriculture. Managing sustainable palm oil supply chains requires addressing complexities while integrating social responsibility and environmental considerations, which are crucial for long-term success. The significance of stakeholder collaboration, regulatory support, and innovative technologies in the development of sustainable food supply chains is crucial for meeting market demands and promoting global environmental objectives.

IMPLICATION

This study comprises a scoping review of 18 articles. The study linked sustainability to the food supply chain, evaluating the results in the context of sustainability. Organisations now perceive sustainability not merely as charitable efforts, but as a strategic imperative for competitiveness in both domestic and global markets. The sustainability of the food supply chain has significant environmental, social, and economic consequences essential for maintaining long-term food security, equitable resource allocation, and responsible environmental stewardship. This study's research topic, "What factors affect food supply chain sustainability?" offers crucial insights for organisations aiming to ensure sustainability within the food supply chain. Several managerial implications warrant attention based on the data obtained.

The food supply chain, which includes cultivation, processing, transportation, and waste management, is a significant contributor to global greenhouse gas emissions and requires a substantial number of resources in terms of the environment. These emissions are the result of the use of fossil fuels in machinery, refrigeration, transportation, and methane emissions from livestock. In a social context, sustainability must consider the effects on labourers and communities. Building the resilience of the local food system can reduce the susceptibility to global disruptions, including extreme weather, pandemics, and geopolitical tensions. Additionally, supporting local farmers can enhance food security and sustainability.

In terms of economics, the enforcement of more stringent regulatory frameworks regarding emissions, resource use, and waste management is underway. Companies that adopt sustainable practices are eligible

for favourable policies, subsidies, and tax incentives. Supply chain transparency is being improved by technological advancements, particularly in blockchain and traceability, which ensure sustainable and ethical practices at every stage. Consequently, consumer trust and regulatory compliance are being cultivated. The demand for products that are sustainably sourced, which is fuelled by the growing awareness of food miles, organic production, and ethical procurement, increases the pressure on companies to implement sustainable practices in order to meet market expectations.

LIMITATION AND RECOMMENDATION

This scoping review has various limitations, like most studies. Some limitations of this research should be highlighted. In the eligibility phase, the titles and abstracts of the articles were read, and those that presented sustainability concepts related to the supply chain or its components and covered one or all of the pillars of sustainability (environmental, social, and economic) were selected. This scoping review used the specific keywords Sustainability, food supply chain, supply chain management, food, and sustainable supply chain management, to select the articles from the Scopus and Web of Science database. While this identified nearly 70 articles, using different keywords may have a different outcome. Additionally, only two database was used, although these databases contain the main publishers, the authors acknowledge that the search process could have omitted relevant searches due to limited access by the institutional portal. so next study can explore others such as Wiley, ScienceDirect, ProQuest and compare their findings, and although many analyses were identified, other methods of bibliometric analysis and systematic literature review may offer different insights into the specific context. Thus, we suggest that researchers apply different bibliometric methods when addressing this research domain and model of relationships between factors impact sustainability food supply chain has not been empirically tested.

CONCLUSION

This scoping review indicates that sustainability significantly affects the food supply chain, suggesting to organisations that competitiveness extends beyond the product and that sustainability can also influence organisational performance. Sustainable food supply chains are crucial for maintaining long-term food security, economic stability, and environmental conservation. Throughout the years, the food supply chain has encountered several issues, including resource inefficiencies, elevated carbon footprints, biodiversity depletion, and socioeconomic injustices. Sustainable methodologies prioritise waste reduction, emission mitigation, and the advancement of resource-efficient techniques that safeguard ecosystems while fulfilling the dietary requirements of an expanding worldwide populace. The implementation of sustainable agricultural techniques, environmentally friendly packaging, efficient logistics, and fair-trade models is essential for tackling these difficulties. Furthermore, the shift to circular food economies, characterised by waste reduction and resource reutilization, is essential for promoting sustainability. Technological advancements and innovations, such precision agriculture, blockchain for traceability, and renewable energy in logistics, present viable avenues for attaining these objectives. This scoping review identified six factors that may impact the sustainability of the food supply chain. The elements include organisational readiness, technology, environmentally friendly practices, policy, sustainable sourcing, and external relationships. The integration of sustainability within the food supply chain can be assessed by several factors, which function as indicators. Conversely, the data indicates that the preponderance of research is conducted in developing country rather than in developed countries. This signifies that developing country prioritise sustainability within the food supply chain. This is supported by factors including government involvement, environmental accountability, and applicable sustainability legislation. Consequently, there is a necessity for heightened focus on research about the sustainability of food supply networks in

developing countries. This aims to decrease the disparity between organizations in developing country and develop country, so allowing these organisations to remain competitive in the global market.

CONFLICT OF INTEREST

The Author affirms the absence of any conflict of interest.

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