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Technologies in Agribusiness Supply Chains: A review on Their Role in Enhancing Food Security

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ABSTRACT

Climate change, global disruptions, and unequal food distribution have made food security a critical and urgent global issue. In response, digital technologies offer strategic opportunities to enhance the efficiency, transparency, and resilience of agribusiness supply chains. However, existing research remains fragmented, often lacking thematic integration and a global perspective on how digital innovations contribute to food security. This study aims to systematically map the global research landscape through a bibliometric analysis of 100 Scopus-indexed articles published between 2019 and 2025, focusing on the intersection of digital technology, agribusiness, and food security. Using VOSviewer, five major thematic clusters are identified: blockchain and traceability, digital supply chain platforms, artificial intelligence, sustainability transformation, and data-driven agribusiness. The findings show that technologies such as blockchain, IoT, and AI play a vital role in supporting food system availability, accessibility, and stability. Emerging topics such as circular economy and digital inclusion reflect a shift toward more sustainable and equitable digital food systems. This study not only synthesizes existing academic discourse but also provides strategic insights for future research, policy design, and inclusive technological adoption—particularly in developing regions. As such, it serves as an essential foundation for designing systemic, inclusive, and sustainable digital transformation in agrifood systems to address the urgent challenge of global food security.

Keywords: *Digital technologies, Agribusiness, Supply chain management, Food security, Blockchain*

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INTRODUCTION

Food security is an increasingly complex global challenge amidst the dynamics of climate change, population growth, urbanisation, and disruption of distribution systems due to global crises such as the COVID-19 pandemic (Dimova & Gbakou, 2013; Imathiu, 2017; Keefe et al., 2024). In this context, agribusiness supply chains play a vital role in ensuring the availability of sufficient, safe and nutritious food for all levels of society. However, reliance on conventional distribution systems often leads to inefficiency, waste, and vulnerability to external disruptions (Narayanamurthy et al., 2025).

As the digital era advances, various technologies such as the Internet of Things (IoT), blockchain, artificial intelligence (AI), and big data analytics are starting to be integrated in agribusiness systems (Abiri et al., 2023; Fortes et al., 2020). These digital technologies open up great opportunities to improve the efficiency, transparency and resilience of agribusiness supply chains. Digitalisation not only strengthens the logistical and operational dimensions, but also contributes to the three main pillars of food security: availability, accessibility and stability of the food system(Béné et al., 2021).

However, current research on digital transformation in agriculture is fragmented—often focused on specific technologies or regional case studies—without a comprehensive view of how these innovations interconnect across supply chain functions and food security objectives. Numerous prior studies have investigated the integration of digital technologies in agriculture, such as Abiri et al., (2023) on digital tools for agricultural productivity, and Bigliardi et al., (2025) who reviewed the role of blockchain in enhancing supply chain traceability and efficiency. Other works, including Rejeb et al., (2022) and Steinke et al., (2024) , focused on specific technologies or regional applications, highlighting the benefits of digital transformation for food systems. However, most existing studies tend to examine individual technologies or country-specific contexts without synthesizing broader thematic patterns.

Moreover, although several publications explore the contribution of digitalization to food system resilience (Gebresenbet et al., 2023; Wang et al., 2022), few have systematically mapped how digital innovations intersect with key elements of food security—such as availability, accessibility, and stability—within agribusiness supply chains on a global scale. This study offers a novel contribution by providing the first comprehensive bibliometric mapping of global scientific literature (2019–2025) at the intersection of digital technology, agribusiness supply chains, and food security. Unlike previous research that typically focuses on specific tools or localized cases, this study identifies five thematic clusters that reveal how technologies like blockchain, AI, and IoT are being integrated to support resilient and inclusive food systems. By linking technological advancements with food security dimensions and proposing policy-relevant directions, this research establishes a unique conceptual framework that bridges digital innovation with sustainable agrifood transformation.

The purpose of this study is to systematically map and analyze the global scientific literature on the role of digital technologies in agribusiness supply chains, with a specific focus on their contributions to enhancing food security. Through a bibliometric approach, the study aims to identify dominant research themes, emerging

trends, and thematic clusters, while uncovering how digital innovations such as blockchain, artificial intelligence, and digital platforms are being integrated into agri-food systems. Additionally, the study seeks to explore the implications of these technologies for policy, governance, and equitable adoption, particularly in the context of sustainable and resilient food systems.

RESEARCH METHOD

This study employs a literature review approach based on bibliometric data to explore the role of digital technology in the agribusiness supply chain and its relationship to food security. Data were collected from the Scopus database using the primary keywords "agricultural supply chain," "digital technology," and "food security" as relevance criteria across all sections of the documents. Scopus is widely recognized for its extensive journal inclusion, especially in applied fields such as agribusiness, agricultural economics, and digital technology, making it well-suited for mapping research landscapes in emerging interdisciplinary domains. The search was conducted in April 2025 and yielded a total of 182 scientific articles. The dataset was subsequently sorted to ensure relevance to technological advancements and global policy developments.

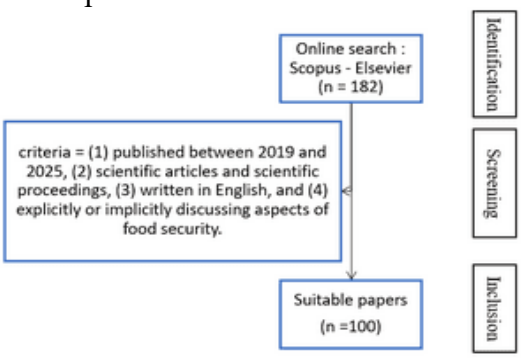

Fig. 1. Flowchart of Literature Identification, Screening, and Inclusion Process

From an initial pool of 182 articles retrieved from the Scopus database, a total of 100 were selected based on a rigorous screening process. Inclusion criteria comprised publication between 2019–2025, English language, document type limited to articles and proceedings, and direct relevance to the intersection of digital technology, agribusiness supply chains, and food security. Articles were excluded if they focused solely on technological development without agricultural application, were books, or discussed non-agricultural sectors. This ensured that the final dataset reflected the most contextually appropriate and scientifically rigorous contributions to the topic.

The screening process was based on the following criteria: (1) publication between 2019 and 2025, (2) document type limited to scientific articles and conference proceedings, (3) written in English, and (4) explicitly or implicitly addressing aspects of food security. This selection process was carried out systematically to ensure that the literature analyzed reflects the latest dynamics in the integration of digital technology within the agribusiness sector. (Mohapatra et al., 2023).

The selected articles were analyzed using descriptive bibliometric analysis. The analysis was conducted in two stages: document analysis and thematic analysis. The descriptive publication analysis in this study includes the examination of publication years and journals. The thematic analysis was carried out using the latest version of the VOSviewer software to visualize the relationships among keywords and to identify thematic clusters. VOSviewer is widely used in literature reviews due to its capability to map conceptual structures and research trends based on keyword co-occurrence within the

metadata of scientific documents. (Chen et al., 2023; Mohapatra et al., 2023).

RESULT AND DISCUSSION

Descriptive Analysis

The document analysis revealed several notable trends in both annual publication output and journal distribution, providing insight into the evolving academic landscape surrounding the intersection of digital technology, agricultural supply chains, and food security. The temporal analysis of publication years demonstrated a consistent upward trend from 2019 to 2024, signaling a sustained and growing scholarly engagement with this research domain. This positive trajectory reflects not only heightened academic interest but also the increasing urgency and practical relevance of digital transformation in supply chains, particularly within the agribusiness sector (Mohapatra et al., 2023).

The surge in publications during this period can be attributed to several converging factors. Firstly, the rapid advancement and integration of digital technologies—such as blockchain, the Internet of Things (IoT), artificial intelligence (AI), and big data analytics have created new opportunities for optimizing supply chain operations. Secondly, global disruptions such as the COVID-19 pandemic exposed critical vulnerabilities in traditional supply systems, prompting an accelerated shift toward digital solutions aimed at ensuring continuity and resilience (Cembalo et al., 2020).

Thirdly, and most importantly, the growing global emphasis on food security has become a central theme driving academic inquiry. Digital technologies are increasingly viewed as enablers of more secure, traceable, and responsive food systems, capable of addressing challenges related to food availability, accessibility, and sustainability. As a result, there is a marked increase in interdisciplinary studies that explore how digitalization can reinforce food supply chains against systemic risks, enhance transparency from production to consumption, and support the achievement of broader food security goals in the face of climate change, geopolitical instability, and socio-economic inequalities. This growing interest reflects a convergence between digital innovation and food security imperatives, which continues to shape the global research agenda and drive the sustained expansion of literature in this field.

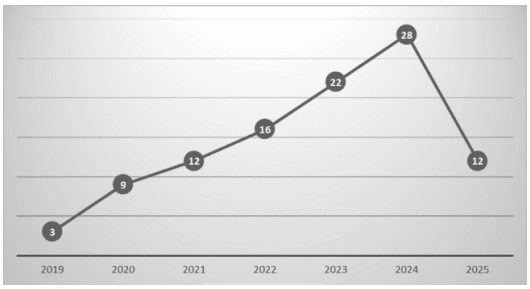

Fig. 2. Annual Publication Trend on Digital Technology in Agricultural Supply Chains (2019–2025)

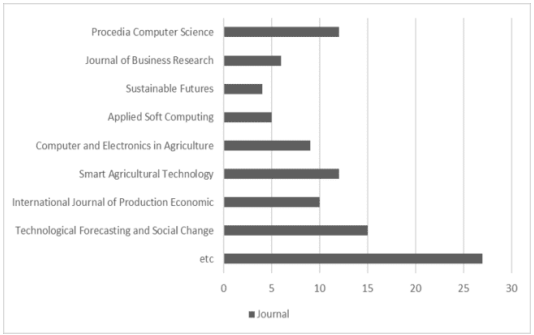

Fig. 3. Distribution of publication analysed

Based on Fig. 2, the research trend shows an increase in the number of publications. In 2019, only 3 articles were found, but this number has continued to increase every year: 9 articles in 2020, 12 articles in 2021, and reaching its peak in 2024 with 28 articles. Meanwhile, in 2025, there was a decline because the year is still ongoing,

so the data cannot yet fully reflect the number of articles for the entire year. This increase is attributed to the global trend toward digitalisation in the agricultural sector, as well as the accelerated adoption of digital technology due to the disruption caused by the COVID-19 pandemic, which has made the need for resilient and transparent supply chains increasingly important(Cariappa et al., 2022; Khan et al., 2022; Lin et al., 2025; Nie et al., 2024; Pellegrino et al., 2022; Samper et al., 2022; L. Ye, 2025). This also indicates that researchers are increasingly focusing on the efficiency and sustainability of agricultural supply chains through the support of technologies such as blockchain, AI, and digital platforms.

Based on the distribution of publications analysed, it is evident that the issue of digitalisation in the agricultural supply chain has attracted attention from various disciplines, as reflected in the diversity of journals from which the articles were analysed. The journals *Technological Forecasting and Social Change, Smart Agricultural Technology*, and *Computer and Electronics in Agriculture* occupy important positions in this discussion, reflecting a futuristic and strategic approach to adopting digital technologies, such as artificial intelligence and blockchain, in supply chain management. The focus of these journals is in line with the agricultural sector's need to respond to global dynamics, such as climate change and market volatility, with technology-based solutions.

Other journals include the *International Journal of Production Economics* and the *Journal of Business Research*, which demonstrate the dominance of economic, business and managerial perspectives. Articles in these journals generally emphasise logistics efficiency, data-driven decision-making, and new economic models in the context of digital technology adoption in agricultural supply chains.

The ‘etc.’ category, which includes nearly 30 articles, represents journals that publish only one or two articles related to this topic. This indicates that research on digitalisation in agricultural supply chains also extends to journals with narrower or more specialised scopes, such as environmental journals, food policy journals, agribusiness journals, and information systems journals. This finding supports the argument that digitalisation of agricultural supply chains is a strategic issue that is not limited to the realm of agricultural technology but also touches on broader social, economic, and environmental dimensions (Rejeb et al., 2022; Sargani et al., 2025)

Thematic analysis

Thematic analysis was conducted using the VOSviewer application with *co-occurrence* analysis to identify thematic structures and interrelationships between concepts and research topics through keywords found in each article. The results of the analysis showed five main thematic clusters in the study with the theme of the role of digital technology in the agribusiness supply chain in improving food security. This mapping produced several interconnected thematic clusters, highlighting the interrelationships between key topics such as blockchain, digital agriculture, supply chain management, sustainability, and digital economy. The size of the nodes indicates the frequency of a keyword's appearance in the literature, while the thickness and direction of the lines indicate the

strength and direction of the relationships between keywords. The keywords 'blockchain,' 'digital agriculture,' and 'sustainability' occupy central positions and have strong connections with various other topics, indicating that these issues are a primary focus in the development of agricultural supply chain digitalisation.

The cluster distribution shows that literature in this field can be grouped into several main areas of focus: digital technology integration (such as AI, IoT, and machine learning), managerial and policy challenges in supply chain digitalisation, and food system sustainability and resilience. This indicates that approaches to agricultural digitalisation are not only technical in nature, but also encompass social, economic, and environmental dimensions (Gebresenbet et al., 2023; Wang et al., 2022). Thus, this bibliometric map not only serves as a tool for understanding research trends but also as a starting point for in-depth exploration of each thematic cluster that has emerged, which will be discussed in the subsequent section.

Blockchain and Tracebility Cluster

The Blockchain keyword is the largest thematic cluster (see Fig.4).

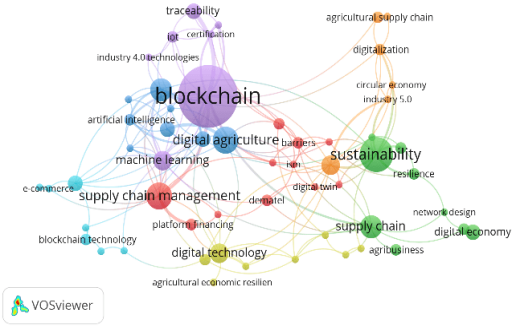

Fig. 4. Keyword Co-occurrence Network Visualization Using VOSviewer

This indicates that research on the role of agribusiness supply chain digitalisation in improving resilience mostly discusses blockchain technology. In this cluster, the keyword blockchain is strongly associated with 'traceability', 'certification', 'IoT', and 'industry 4.0 technologies'. This cluster shows that blockchain occupies a central position in the development of supply chain systems. The combination of blockchain and IoT technologies enables real-time and secure data recording throughout the supply chain(Bigliardi et al., 2022; Longo et al., 2022; Sunmola & Burgess, 2022). This strengthens consumer trust, supports food certification systems, and enhances product safety and quality(Mohapatra et al., 2023). The implementation of blockchain also supports the achievement of Sustainable Development Goals (SDGs), particularly in terms of enhancing accountability within efficient agricultural logistics systems and addressing climate change challenges (Wang et al., 2022).

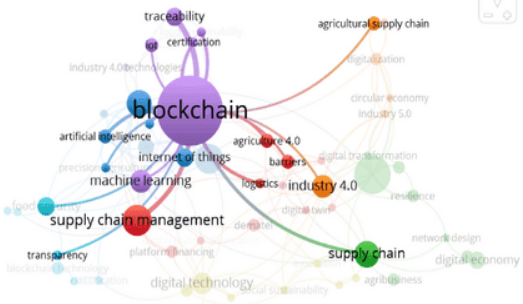

Fig. 5. Cross-cluster Keyword Blockchain

Meanwhile, Figure 5 illustrates the results of the cross-cluster relationship analysis. The keyword *"blockchain"* occupies a central position and demonstrates strong associations with key terms such as *"supply chain management," "artificial intelligence,"* and *"food security."* This pattern suggests that contemporary research on blockchain technologies is inherently interlinked with these domains, reflecting a multidimensional focus. The consistent co-occurrence of these keywords indicates that blockchain is not studied in isolation, but rather as an integrated technological solution aimed at enhancing efficiency, transparency,

and data security within agribusiness supply chains. Specifically, the linkage with *"artificial intelligence"* reflects growing interest in hybrid digital systems, while the connection to *"food security"* underscores the strategic role of blockchain in addressing traceability, trust, and responsiveness in food systems—particularly in the context of global sustainability and resilience challenges (Bigliardi et al., 2022; Gebresenbet et al., 2023; Steinke et al., 2024).

Supply Chain Management Cluster

Cluster with keyword 'Supply Chain Management' is an important cluster that acts as an integrator of digital innovation in the practical management of logistics and agricultural operations. In this cluster, the keyword 'Supply Chain Management' has strong associations with the keywords 'platform financing', 'digital twin', 'barriers', 'ISM', and 'DEMATEL'. These keywords indicate the presence of structural analysis of challenges in integrating digital technology. Studies in this cluster evaluate barriers to digital adoption, including insufficient digital infrastructure, farmer resistance, and limited financing (Anam et al., 2025). Modelling techniques such as DEMATEL and ISM are used to map the relationships between obstacles and design systemic strategies for implementation of supply chain digitalisation (Carissimi et al., 2024). Existing related research also highlights challenges in implementing digital technology, such as insufficient funding, infrastructure, and user resistance to technology in the supply chain sector, which remain the biggest obstacles today.

Fig. 6. Cross-cluster Keyword Supply Chain Management

Fig. 6 shows the results of the analysis of the relationship between clusters of the keyword 'supply chain management', which found a strong association with the keywords 'blockchain', 'platform financing', 'digital technology' and 'food security'. These findings reflect the direction of developments in supply chain management studies and practices, which are becoming increasingly digitised and oriented towards overall system resilience.

The integration of blockchain indicates a focus on transparency and data security in the supply chain process (Hasan et al., 2024), , while the link with platform financing indicates the importance of financing innovation in supporting logistics and distribution efficiency (Mugonya & Hauser, 2022). Meanwhile, the association with digital technology confirms that digital transformation is a key foundation for improving the performance and competitiveness of modern supply chains. Furthermore, the connection with food security underscores the strategic role of supply chain management in ensuring food availability, distribution, and sustainability, especially in an increasingly complex global context (Akpabio et al., 2025). Thus, the clustering of these keywords reflects the multidimensional and cross-sectoral dynamics in the development of supply chain management science and practice in the digital era.

Sustainability Cluster

Thus, the clustering of these keywords reflects the multidimensional and cross-sectoral dynamics in the development of supply chain management science and practice in the digital era. The green cluster in the keyword co-occurrence network reflects a conceptual convergence around sustainability, resilience, digital economy, and circular economy—four interrelated themes that increasingly dominate contemporary discourse on agribusiness transformation. This cluster highlights the strategic role of digital technologies as enablers and accelerators of systemic change toward more sustainable, inclusive, and resource-efficient agricultural supply chains.

Moreover, the presence of "digital economy" and "circular economy" as key nodes in this cluster reflects a shift from linear production-consumption models to regenerative, closed-loop systems. In the agricultural context, circular approaches—supported by digital platforms—promote the valorization of agricultural waste, resource cycling, and localized production systems that are both economically viable and environmentally sustainable(L. Ye, 2025). Digital marketplaces and decentralized finance (DeFi) solutions further empower smallholder farmers by improving access to capital, inputs, and markets, thereby enhancing both productivity and livelihoods(Sargani et al., 2025).

Scholarly works within this cluster also emphasize the synergy between sustainability and digital inclusion, arguing that the benefits of digitalization must be equitably distributed to prevent widening socio-economic gaps (Zossou et al., 2021). Ensuring that small-scale farmers, particularly in developing regions, have access to digital infrastructure and training is seen as a prerequisite for realizing the full potential of digital tools in achieving food security and sustainability objectives. In essence, the green cluster represents a paradigm shift in agrifood systems, where digital innovation is not merely a tool for efficiency, but a foundational element for ecological resilience, socio-economic equity, and long-term sustainability. This thematic orientation aligns closely with global policy agendas such as the UN Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action) (Gkogkos et al., 2023), (Gebresenbet et al., 2023).

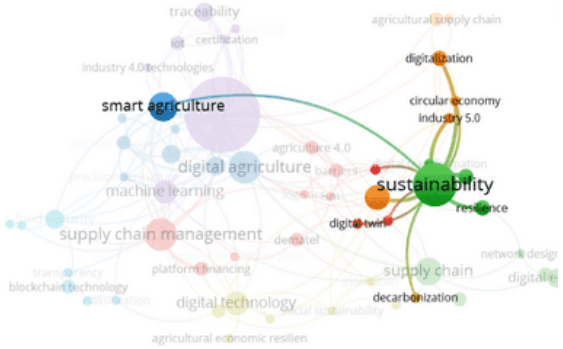

Fig. 7. Cross-cluster Keyword Sustainability

Cross-cluster connectivity centered on "sustainability" in the bibliometric network reveals its pivotal role as a thematic bridge linking diverse research streams in digital agrifood systems. As seen in the visualization, *sustainability* connects robustly with several key clusters, including *smart agriculture*, *digitalization*, *circular economy*, *resilience*, and *supply chain*. This central positioning suggests that sustainability is not treated as a standalone concept, but rather as a cross-cutting objective that integrates multiple technological, managerial, and systemic innovations.

The direct link between "sustainability" and "smart agriculture" reflects the increasing emphasis on precision farming practices enabled by advanced digital technologies such as sensors, data analytics, and automation. These innovations aim to maximize productivity while minimizing environmental impacts, thereby contributing to the twin goals of ecological sustainability and food security. The connection indicates that sustainability in agricultural discourse is being operationalized through *smart, data-driven practices*. Furthermore, strong ties with "circular economy" and "industry 5.0" underscore the evolution of agri-food systems toward more regenerative and human-centered models. Circular principles advocate for the reuse, recycling, and valorization of agricultural inputs and outputs, while Industry 5.0 reintroduces the human element, promoting co-creation between humans and machines for sustainable innovation (Rejeb et al., 2022). These themes collectively signal a paradigm shift from extractive models toward *restorative and inclusive approaches*, with digital technologies serving as key enablers.

The presence of "resilience" as a node closely linked to sustainability suggests an integrated concern for systemic adaptability in the face of climate risks, economic shocks, and supply disruptions. Research in this area frequently explores how digital infrastructure and decision-support tools can improve forecasting, risk mitigation, and rapid response capabilities across agricultural value chains (De Steur et al., 2016; Engås et al., 2023; Zou et al., 2025).

Moreover, the connection between *sustainability* and *digital twin* indicates emerging interest in virtual modeling and simulation technologies for optimizing agricultural operations. Digital twin applications can enable real-time replication of farming environments, supporting better resource planning and sustainability scenario analysis. Taken together, the network configuration illustrates that sustainability acts as a thematic integrator—weaving together technological innovation, systemic resilience, and circular economic logic. Its centrality in the network not only highlights its importance in research priorities but also mirrors policy discourses and funding frameworks that increasingly demand multi-dimensional, tech-enabled solutions to address the complexity of sustainable food systems.

CONCLUSION

This study offers a comprehensive bibliometric assessment of 100 Scopus-indexed article (2019–2025) examining the intersection of digital technology, agribusiness supply chains, and food security. Findings indicate a sharp increase in scholarly output—peaking in 2024—suggesting growing academic interest. A slight decline in 2025 may reflect a transition from conceptual exploration toward applied implementation.

Thematic analysis using VOSviewer revealed five interconnected research clusters: blockchain and traceability systems, digital platforms for supply chain management, AI and machine learning applications, sustainability-driven digital transformation, and data-enabled agribusiness models. Together, these themes highlight how technologies such as blockchain, IoT, and AI are being integrated to enhance resilience, transparency, and inclusivity in global agrifood systems.

This convergence points to the urgent need for adaptive policy frameworks that promote equitable access, especially for smallholders. Recommended strategies include digital literacy initiatives, infrastructure support, regulatory clarity on data and blockchain standards, and incentives for public–private innovation partnerships. Blockchain, in particular, holds promise for enhancing traceability and crisis response across food supply chains.

Future research should prioritize empirical assessments of digital technology's direct impact on food security indicators—availability, accessibility, and stability—along with context-specific case studies from developing regions. By advancing both scholarly and practical knowledge, this study supports ongoing efforts to design a more efficient, inclusive, and sustainable global food system.

RECOMMENDATION

First, policymakers should develop inclusive and adaptive policies that facilitate the adoption of digital tools, particularly among small and medium-scale farmers. This includes investing in rural digital infrastructure, providing targeted subsidies, and delivering digital literacy training programs to bridge the technological divide and ensure equitable access. Second, there is a pressing need for clear regulatory frameworks that address data governance, system interoperability, and the standardization of emerging technologies—especially blockchain. Establishing national standards for traceability protocols and food safety monitoring will help ensure transparency, prevent fraud, and build trust across the supply chain, enabling more resilient and accountable food systems.

Finally, future research should focus on empirically measuring the impacts of digital technology on core food security indicators such as availability, accessibility, and stability. Expanding studies that incorporate spatial data analysis, artificial intelligence, and real-world case studies—especially from developing countries—will ensure that technological interventions are grounded in local realities and contribute to more inclusive and sustainable agrifood systems.

REFERENCES

Abiri, R., Rizan, N., Balasundram, S. K., Shahbazi, A. B., & Abdul-Hamid, H. (2023). Application of digital technologies for ensuring agricultural productivity. *Heliyon*, *9*(12), e22601. https://doi.org/10.1016/j.heliyon.2023.e22601

Akpabio, E. S., Akeju, K. F., & Omotoso, K. O. (2025). E-agriculture and food security in developing countries: beaming the searchlight on Nigeria. *Smart Agricultural Technology*, *10*(December 2024), 100689. https://doi.org/10.1016/j.atech.2024.100689

Anam, M. Z., Islam, M. H., Islam, M. T., Bari, A. B. M. M., & Raihan, A. (2025). A Fermatean fuzzy approach to analyze the drivers of digital transformation in the agricultural production sector: A pathway to sustainability for emerging economies. *Green Technologies and Sustainability*, *3*(3), 100197. https://doi.org/10.1016/j.grets.2025.100197

Béné, C., Bakker, D., Chavarro, M. J., Even, B., Melo, J., & Sonneveld, A. (2021). Global assessment of

the impacts of COVID-19 on food security. *Global Food Security*, *31*. https://doi.org/10.1016/j.gfs.2021.100575

Bigliardi, B., Dolci, V., Filippelli, S., Petroni, A., & Pini, B. (2025). Employing innovation for social sustainability in supply chains: A systematic literature review. *Procedia Computer Science*, *253*, 2595–2604. https://doi.org/10.1016/j.procs.2025.01.319

Bigliardi, B., Filippelli, S., Petroni, A., & Tagliente, L. (2022). The digitalization of supply chain: A review. *Procedia Computer Science*, *200*(2019), 1806–1815. https://doi.org/10.1016/j.procs.2022.01.381

Cariappa, A. G. A., Acharya, K. K., Adhav, C. A., Sendhil, R., & Ramasundaram, P. (2022). COVID-19 induced lockdown effects on agricultural commodity prices and consumer behaviour in India – Implications for food loss and waste management. *Socio-Economic Planning Sciences*, *82*, 101160. https://doi.org/https://doi.org/10.1016/j.seps.2021.101160

Carissimi, M. C., Bin Hameed, H., & Creazza, A. (2024). Circular economy: The future nexus for sustainable and resilient supply chains? *Sustainable Futures*, *8*(December 2023), 100365. https://doi.org/10.1016/j.sftr.2024.100365

Cembalo, L., Borrello, M., De Luca, A. I., Giannoccaro, G., & D'Amico, M. (2020). Transitioning agri-food systems into circular economy trajectories §. *Aestimum*, 199–218. https://doi.org/https://doi.org/10.13128/aestim-8860

Chen, H. Y., Sharma, K., Sharma, C., & Sharma, S. (2023). Integrating explainable artificial intelligence and blockchain to smart agriculture: Research prospects for decision making and improved security. *Smart Agricultural Technology*, *6*(October), 100350. https://doi.org/10.1016/j.atech.2023.100350

De Steur, H., Odongo, W., & Gellynck, X. (2016). Applying the food technology neophobia scale in a developing country context. A case-study on processed matooke (cooking banana) flour in Central Uganda. *Appetite*, *96*, 391–398. https://doi.org/https://doi.org/10.1016/j.appet.2015.10.009

Dimova, R., & Gbakou, M. (2013). The Global Food Crisis: Disaster, Opportunity or Non-event? Household Level Evidence from Côte d'Ivoire. *World Development*, *46*, 185–196. https://doi.org/https://doi.org/10.1016/j.worlddev.2013.02.007

Engås, K. G., Raja, J. Z., & Neufang, I. F. (2023). Decoding technological frames: An exploratory study of access to and meaningful engagement with digital technologies in agriculture. *Technological Forecasting and Social Change*, *190*(February), 122405. https://doi.org/10.1016/j.techfore.2023.122405

Fortes, A. R., Ferreira, V., Simões, E. B., Baptista, I., Grando, S., & Sequeira, E. (2020). Food Systems and Food Security: The Role of Small Farms and Small Food Businesses in Santiago

Island, Cabo Verde. *Agriculture*, *10*(6), 216. https://doi.org/https://doi.org/10.3390/agriculture10060216

Gebresenbet, G., Bosona, T., Patterson, D., Persson, H., Fischer, B., Mandaluniz, N., Chirici, G., Zacepins, A., Komasilovs, V., Pitulac, T., & Nasirahmadi, A. (2023). A concept for application of integrated digital technologies to enhance future smart agricultural systems. *Smart Agricultural Technology*, *5*(March), 100255. https://doi.org/10.1016/j.atech.2023.100255

Gkogkos, G., Lourenço, P., Pechlivani, E. M., Encarnação, L., Votis, K., Giakoumoglou, N., da Silva, J. M., & Tzovaras, D. (2023). Distributed Ledger Technologies for Food Sustainability indexing. *Smart Agricultural Technology*, *5*(July). https://doi.org/10.1016/j.atech.2023.100312

Hasan, H. R., Musamih, A., Salah, K., Jayaraman, R., Omar, M., Arshad, J., & Boscovic, D. (2024). Smart agriculture assurance: IoT and blockchain for trusted sustainable produce. *Computers and Electronics in Agriculture*, *224*(February), 109184. https://doi.org/10.1016/j.compag.2024.109184

Imathiu, S. (2017). Street Vended Foods: Potential for Improving Food and Nutrition Security or a Risk Factor for Foodborne Diseases in Developing Countries? *Current Research in Nutrition and Food Science*, *5*(2), 55–65. https://doi.org/https://doi.org/10.12944/CRNFSJ.5.2.02

Keefe, D. H. S., Jang, H., & Sur, J. M. (2024). Digitalization for agricultural supply chains resilience: Perspectives from Indonesia as an ASEAN member. *Asian Journal of Shipping and Logistics*, *40*(October), 180–186. https://doi.org/10.1016/j.ajsl.2024.09.001

Khan, H. H., Malik, M. N., Konečná, Z., Chofreh, A. G., Goni, F. A., & Klemeš, J. J. (2022). Blockchain technology for agricultural supply chains during the COVID-19 pandemic: Benefits and cleaner solutions. *Journal of Cleaner Production*, *347*(March). https://doi.org/10.1016/j.jclepro.2022.131268

Lin, Q., Jian, Y., Zhang, D., Li, J., & Mao, S. (2025). Exploring the "Double-Edged Sword" effect of the digital economy on sustainable agricultural development: Evidence from China. *Sustainable Horizons*, *13*(September 2024), 100122. https://doi.org/10.1016/j.horiz.2024.100122

Longo, F., Mirabelli, G., Solina, V., Belli, L., Abdallah, C. Ben, Ben-Ammar, O., Bottani, E., García-Gallego, J. M., Germanos, M., González, F. J. M., Lacoba, S. R., Sidhom, L., Vignali, G., & Zacharewicz, G. (2022). An overview of approaches and methodologies for supporting smallholders: ICT tools, blockchain, business models, sustainability indicators, simulation models. *Procedia Computer Science*, *217*(2022), 1930–1939. https://doi.org/10.1016/j.procs.2022.12.393

Mohapatra, S., Sainath, B., Anirudh, K. C., Lal, H., Nithin Raj, K., Bhandari, G., Nyika, J., & Sendhil, R. (2023). Application of blockchain technology in the agri-food system: a systematic bibliometric visualization analysis and policy imperatives. *Journal of Agribusiness in Developing and Emerging Economies*, *July*. https://doi.org/10.1108/JADEE-10-2022-0237

Mugonya, J., & Hauser, M. (2022). Determinants of quality-based payments for livestock in conflict-prone areas in Kenya. *Journal of Arid Environments*, *200*, 104714. https://doi.org/https://doi.org/10.1016/j.jaridenv.2022.104714

Narayanamurthy, G., Jayanth, R. S. S., Moser, R., Schaefers, T., & Nagendra, N. P. (2025). Data-driven digital transformation for uncertainty reduction – Application of satellite imagery analytics in institutional crop credit management. *International Journal of Production Economics*, *280*(December 2024), 109498. https://doi.org/10.1016/j.ijpe.2024.109498

Nie, Y., Hicks, B., Ferreira, L. P., Halog, A., & Valero, M. R. (2024). Sustainability-Driven Food Supply Chain Design and Optimisation through Digital Twinning. *IFAC-PapersOnLine*, *58*(27), 671–676. https://doi.org/10.1016/j.procir.2024.10.146

Pellegrino, R., Gaudenzi, B., & Qazi, A. (2022). COVID-19 pandemic: Supply chain risk management by integrating Interpretive Structural Modeling and Bayesian belief network. *IFAC-PapersOnLine*, *55*(10), 667–672. https://doi.org/10.1016/j.ifacol.2022.09.481

Rejeb, A., Rejeb, K., Abdollahi, A., Zailani, S., Iranmanesh, M., & Ghobakhloo, M. (2022). Digitalization in Food Supply Chains: A Bibliometric Review and Key-Route Main Path Analysis. *Sustainability*, *14*(1), 83. https://doi.org/https://doi.org/10.3390/su14010083

Samper, M. G., Florez, D. G., Borre, J. R., & Ramirez, J. (2022). Industry 4.0 for sustainable supply chain management: Drivers and barriers. *Procedia Computer Science*, *203*, 644–650. https://doi.org/10.1016/j.procs.2022.07.094

Sargani, G. R., Wang, B., Leghari, S. J., & Ruan, J. (2025). Is digital transformation the key to agricultural strength? A novel approach to productivity and supply chain resilience. *Smart Agricultural Technology*, *10*(February), 100838. https://doi.org/10.1016/j.atech.2025.100838

Steinke, J., Ivanova, Y., Jones, S. K., Minh, T., Sánchez, A., Sánchez-Choy, J., & Mockshell, J. (2024). Digital sustainability tracing in smallholder context: Ex-ante insights from the Peruvian cocoa supply chain. *World Development Sustainability*, *5*(October). https://doi.org/10.1016/j.wds.2024.100185

Sunmola, F., & Burgess, P. (2022). Transparency by Design for

Blockchain-Based Supply Chains. *Procedia Computer Science*, *217*, 1256–1265. https://doi.org/10.1016/j.procs.2022.12.324

Wang, S., Yin, C., Jiao, J., Yang, X., Shi, B., & Richel, A. (2022). StrawFeed model: An integrated model of straw feedstock supply chain for bioenergy in China. *Resources, Conservation and Recycling*, *185*, 106439. https://doi.org/https://doi.org/10.1016/j.resconrec.2022.106439

Ye, F., Liu, K., Li, L., Lai, K. H., Zhan, Y., & Kumar, A. (2022). Digital supply chain management in the COVID-19 crisis: An asset orchestration perspective. *International Journal of Production Economics*, *245*(August 2021), 108396. https://doi.org/10.1016/j.ijpe.2021.108396

Ye, L. (2025). Digital economy and high-quality agricultural development. *International Review of Economics and Finance*, *99*(December 2024), 104028. https://doi.org/10.1016/j.iref.2025.104028

Zossou, S. R. C., Adegbola, P. Y., Oussou, B. T., Dagbenonbakin, G., & Mongbo, R. (2021). Modelling smallholder farmers' preferences for soil fertility management technologies in Benin: A stated preference approach. *PLoS One*, *16*(6). https://doi.org/https://doi.org/10.1371/journal.pone.0253412

Zou, B., Yang, F., & Mishra, A. K. (2025). Using internet technology for business entrepreneurial choice: Evidence from Chinese farming households. *Smart Agricultural Technology*, *10*(December 2024), 100775. https://doi.org/10.1016/j.atech.2025.100775