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Research Article

AI-Driven Agriculture Marketplaces Digitalizing Farm to Retail Supply Chains in UK

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ABSTRACT

The fast digitization of the agriculture industry is changing the dynamics of the farm-to-retail supply chain, and Artificial Intelligence (AI) has become a driver of efficiency, visibility in the process and sustainability. This paper investigates the emergence of AI-driven agricultural marketplaces in the United Kingdom and how predictive analytics, dynamic pricing, automated quality scoring and intelligent logistics are changing agrifood traditional value chains. Using recent case studies, regulatory considerations, and the regulatory drivers of adoption, the researchers detail how online platforms increase the connectivity between farmers and retailers and help them to avoid food wastage, better price realizations, and create resilience when faced with supply shocks. The most significant disadvantages, including data governance, interoperability, shortage of digital skills, and trust-related issues are also highlighted. The paper makes contributions to the current debates about the digitalisation of agriculture by putting forward a UK-specific lens to the topic of the integration of AI-enabled marketplaces into farm-to-retail supply chains, providing implications to policymakers, practitioners, and researchers.

Keywords: *AI agriculture, digital marketplaces, farm-to-retail supply chains, UK agrifood sector, predictive analytics, traceability, sustainability.*

INTRODUCTION

Agriculture is being radically transformed by the application of Artificial Intelligence (AI), blockchain, and data-driven platforms to modify farm-to-retail food chains around the world (Araujo et al., 2021; Chang, Iakovou, and Shi, 2020). In the United Kingdom, the use of AI-based agricultural marketplaces is starting to be framed as a solution to inefficiencies and improve sustainability and resilience in the agrifood system. The supply chains that are traditional face issues like price asymmetries, post-harvest losses, a lack of transparency, and access to markets by small-scale farmers (Oboobi, 2020; Florez et al., 2022). Digital infrastructure with the help of AI allows overcoming these issues as it provides predictive analytics opportunities, real-time demand forecasting, quality analysis assessment and smart logistics management (Cao, 2021; Achumie et al., 2022).

The transition to digital agrifood market places is alsoclosureThe move to digital agrifood marketplaces can be described by the general tendency of global retail digitalization, where the use of AI and Industry 4.0 technologies has already dramatically transformed other retailing industry sub-sectors, such as the retail and logistics industries (Har et al., 2022; Adenuga, Ayobami & Okolo, 2020). In agriculture, they are disrupting the business models and revenue streams like the interaction between farmers and consumers or farmers and stores is now possible with intermediaries decreasing (Vlachopoulou et al., 2021; Utami, Alamanos & Kuznesof, 2021). In addition, AI marketplaces have the potential to help sustainability efforts that lessen food wastes, streamline the utilization of resources, and enhance traceability in the value chain (Secundo et al., 2022; Hou, Liao & Luo, 2020).

Nonetheless, the shift toward AI-based supply chains presents the issues as well. Cultural/organizational preparedness, digital competency gaps, data management, and interoperability issues are also an important blocker to use (Cadden et al., 2022; Idries, Krogstie & Rajasekharan, 2022). In addition, issues of trust, fair division of value, and rule compliance in the UK environment introduce new dimensions to this process of digital marketplace

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adoption (Salvini et al., 2022; Lee, 2021). Nonetheless, the increased functionality of the farm-to-retail supply chains with AI is accompanied by impressive opportunities to achieve resilience, competitiveness, and sustainability of the agrifood sector (Iansiti & Lakhani, 2020; MARUN GUERRA, 2021; Suominen, 2021).

This article explores how AI-based farm-to-retail market platforms are helping to digitize farm-to-retail supply chains in the UK. It seeks to understand how new technology is transforming market interplay, the potential it poses against efficiency and sustainability and the challenges that must be overcome to facilitate its more widespread use. In such a way, the study can contribute to expanding the evidence on the role of AI in enabling agrifood innovation and can offer knowledge to policymakers, practitioners, and researchers willing to make food systems in the UK more resilient.

Literature Review

The integration of Artificial Intelligence (AI) and digital platforms into agriculture has gained significant traction in recent years, particularly within the context of supply chain transformation. The concept of Agriculture 4.0 underscores the role of advanced technologies such as AI, Internet of Things (IoT), and blockchain in reshaping agri-food systems, enabling efficiency, transparency, and sustainability across the value chain (Araújo et al., 2021; Hou et al., 2020). These innovations build upon digital transformation trends seen in other industries, where AI-driven business models have altered strategies, value creation logics, and network coordination (Iansiti & Lakhani, 2020; Cao, 2021).

Research highlights how agri-tech start-ups and e-business models support sustainability and inclusivity in food supply chains by connecting farmers with markets, improving traceability, and reducing inefficiencies (Florez et al., 2022; Vlachopoulou et al., 2021). Similar patterns emerge in retail transformation, where digital commerce and AI have evolved from traditional Retail 1.0 to Retail 4.0 ecosystems, emphasizing consumer personalization, real-time data use, and omnichannel integration (Har et al., 2022; Lee, 2021). Within agriculture, such digital marketplaces can democratize access to markets and foster value co-creation, particularly at the bottom of the pyramid (Utami et al., 2021).

The environmental aspect has been the predominant area of research interest given that digital technologies are consistent with the pursuit of Sustainable Development Goals (SDG) by cutting down on wastes, optimizing resources, and increasing inclusivity in food systems (Secundo et al., 2022). As an example, blockchain- and IoT-enabled platforms have demonstrated a potential to improve trust, traceability, and efficiency of cross-border trade in supply chains (Chang et al., 2020; Hou et al., 2020). It has also been noted that digitalization plays a key role in limiting post-harvest losses, especially in parts of the world where relevant logistics frameworks are poorly developed (Oboobi, 2020).

In particular, predictive analytics and demand modeling, as well as intelligent logistics, allow resilience in response to disruptions and a more efficient use of operations (Achumie et al., 2022; Adenuga et al., 2020). In case of supply chains, the adoption of AI is conditioned by the presence of cultural and organizational enablers, and it has been shown that only when fostered by adaptive capabilities and elemental ecosystems, the technological advantage can be transformed into outcome (Cadden et al., 2022; Idries et al., 2022). Simulation-based research can also explain the theoretical extension of how digital transformation contributes to the shift toward virtualized supply chains ensuring an improved level of collaboration and responsiveness in the agri-food areas (Salvini et al., 2022).

In a broader sense, AI-based digital marketplaces in agriculture are already considered in the context of a broader global trend of environmentally friendly supply chain management, in which high-tech start-ups are instrumental to the development of environmental and economic performance (Marun Guerra, 2021). The synergy between digital services, blockchain-enabling trust, and AI-powered decision support opens up new possibilities in re-organizing value chains that are especially relevant to the UK agri-food system, which is challenged by efficiency and sustainability as well as resilience (Suominen, 2021).

Overall, the literature indicates that digital marketplaces that facilitate AI-based agricultural production represent a key driver of digital supply chain change by combining predictive analytics, automation, and data-driven governance into farm-to-retail supply chains.However, adoption is influenced by structural barriers such as data interoperability, digital skill gaps, and trust in technology, indicating a need for more context-specific research on the UK agri-food sector.

Conceptual Framework

The integration of Artificial Intelligence (AI) into agricultural marketplaces represents a transformative step in digitalizing farm-to-retail supply chains. The framework developed in this study positions AI as a core enabler of efficiency, transparency, and sustainability in the UK agrifood sector. Drawing on insights from digital commerce, supply chain research, and agri-tech innovation, the framework captures four interconnected dimensions: AI-enabled marketplace functions, enabling digital technologies, value creation logics, and stakeholder outcomes.

1. AI-Enabled Marketplace Functions

AI technologies enhance forecasting, demand-supply matching, dynamic pricing, quality grading, and logistics optimization, thereby reducing inefficiencies across supply chains (Cao, 2021; Achumie et al., 2022). Predictive analytics and AI-driven decision support systems enable better alignment of farm outputs with retail demand (Adenuga et al., 2020).

2. Enabling Digital Technologies

The adoption of IoT sensors, blockchain, and cloud platforms provides the data backbone for AI models, ensuring traceability, interoperability, and trust in transactions (Hou et al., 2020; Chang et al., 2020). Agriculture 4.0 frameworks emphasize the convergence of these technologies to drive real-time and data-driven decision-making (Araújo et al., 2021).

3. Value Creation Logics

Digital marketplaces foster value creation by enhancing transparency, enabling co-creation between farmers and retailers, and improving sustainability outcomes (Vlachopoulou et al., 2021; Utami et al., 2021). AI-driven platforms contribute to reduced waste, fairer price realization, and equitable access to markets (Florez et al., 2022; Secundo et al., 2022).

4. Stakeholder Outcomes and Institutional Enablers

Farmers gain improved market access and profitability, retailers benefit from reduced lead times and supply resilience, and consumers experience higher food quality and traceability (Har et al., 2022; Lee, 2021). However, adoption is shaped by cultural, institutional, and organizational enablers that influence AI integration across supply chains (Cadden et al., 2022; Iansiti & Lakhani, 2020).

To illustrate the dimensions of the framework, Table 1 outlines the interplay between AI functions, enabling technologies, and expected stakeholder outcomes.

This framework highlights how AI-driven marketplaces not only improve operational efficiency but also reshape the socio-economic and institutional dynamics of UK farm-to-retail supply chains, fostering both sustainability and resilience (Secundo et al., 2022; Salvini et al., 2022).

UK Context

The agricultural industry within the United Kingdom is under pressure to modernise to focus on productivity, traceability and sustainability; tackling challenges of lack of cohesion in supply chains, wastage of harvests as well as demand that consumers want to know more about the farmers and their products. Technological solutions, especially using AI platforms, are becoming more and more viewed as efficiency drivers in food supply chains, which contributes to the goal of sustainability, and fit within the general world digital transformation of agriculture (Secundo et al., 2022; Ara

AI-based marketplaces can offer predictive analytics, demand forecasting, and automated logistics in the farm-to-retail supplies, eliminating inefficiencies in farm-to-retail supply chain processes (Achumie et al., 2022; Cadden et al., 2022). In the UK, such mediums would also benefit the smallholder farmers to have wider access to retail markets, secure fair prices and eliminate food waste as observed in other agrifood-tech ecosystems (Florez et al., 2022; Vlachopoulou et al., 2021). The use of AI in supply chains also optimises decision-making and resistance to disruptions which are becoming a necessity in even more turbulent market environments (Adenuga et al., 2020; Iansiti & Lakhani, 2020).

Moreover, blockchain and the Internet of Things can enhance the traceability rate and consumer confidence in UK food systems due to the transparency of all logistic and trade-related activities (Hou et al., 2020; Chang et al., 2020). Digital transformation in retailing has already proven to boost customer engagement and flexibility of operations and agriculture can emulate these actions (Cao, 2021; Har et al., 2022). Nevertheless, still to be addressed are the integrating connectivity gaps that disserve rural areas, interoperability concerns, as well as cultural enablers that should encourage adoption of AI by farmers and other supply chain actors (Cadden et al., 2022; Salvini et al., 2022).

In terms of policy, the prioritisation of sustainability and food security by the UK can be recombined with the work on digital transformation of agriculture, where the authorities can create the opportunities to support this initiative and invest into the data-driven technologies

Table 1: Conceptual Framework for AI-Driven Agricultural Marketplaces in Farm-to-Retail Supply Chains

Dimension	AI/Technology Role	Expected Outcome	Key References
AI-Enabled Functions	Forecasting, dynamic pricing, logistics, grading	Reduced waste, efficiency, demand matching	Cao (2021); Achumie et al. (2022); Adenuga et al. (2020)
Enabling Technologies	IoT, Blockchain, Cloud	Traceability, interoperability, trust	Hou et al. (2020); Chang et al. (2020); Araújo et al. (2021)
Value Creation Logics	Transparency, co-creation, digital access	Fair pricing, equitable participation	Vlachopoulou et al. (2021); Utami et al. (2021); Florez et al. (2022)
Stakeholder Outcomes	Market access, resilience, consumer trust	Sustainable supply chains, inclusivity	Har et al. (2022); Lee (2021); Cadden et al. (2022)

(Utami et al., 2021; Lee, 2021).The adoption of AI-driven agricultural marketplaces thus represents both an economic and social opportunity, with the potential to modernize UK food value chains while contributing to broader sustainability and resilience objectives.

Methodology

This study adopts a mixed-methods research design, combining secondary data analysis, case-based investigation, and expert interviews to explore the integration of AI-driven agricultural marketplaces in digitalizing farm-to-retail supply chains in the United Kingdom.

Research Design

The methodology is structured in three phases. First, a systematic literature review was conducted to establish the theoretical foundations of AI adoption in agriculture, retail, and supply chain management (Florez et al., 2022; Vlachopoulou et al., 2021; Har et al., 2022). Second, case study analysis of UK and international agri-tech platforms was performed to identify business models, technological frameworks, and governance structures (Secundo et al., 2022; Cao, 2021). Finally, semi-structured expert interviews with stakeholders including farmers, logistics providers, and retail managers were carried out to validate findings and reveal adoption challenges (Cadden et al., 2022).

2. Data Sources and Collection

Data were gathered from multiple sources:
Secondary data from peer-reviewed publications, industry reports, and government documents on UK agriculture and digital trade (Chang et al., 2020; Araújo et al., 2021).

Case vignettes of AI-driven platforms in Europe and beyond, such as blockchain-based agri-food systems and IoT-enabled logistics (Hou et al., 2020; Oboobi, 2020).

Primary data from 12 expert interviews with UK agri-tech founders, supply chain managers, and policymakers.

Analytical Framework

Data were analyzed using thematic coding and comparative analysis. The framework drew on theories of AI-driven value creation, supply chain resilience, and digital commerce ecosystems (Iansiti & Lakhani, 2020; Utami et al., 2021; Suominen, 2021). Special attention was given to:

- **AI applications**: predictive analytics, demand forecasting, dynamic pricing, and smart logistics (Achumie et al., 2022; Adenuga et al., 2020).
- **Digital infrastructure**: blockchain for traceability, IoT for monitoring, and cloud-based platforms for integration (Salvini et al., 2022; Idries et al., 2022).
- **Sustainability alignment** with SDGs and circular economy goals in food systems (MARUN GUERRA, 2021; Lee, 2021).

Validation and Reliability

Triangulation was employed by cross-referencing insights from literature, case studies, and interviews to ensure robustness of findings. Expert interview transcripts were coded independently by two researchers to reduce bias, while industry reports were used to confirm data accuracy (Cao, 2021; Vlachopoulou et al., 2021).

Findings

The study reveals that AI-driven agricultural marketplaces in the UK are significantly reshaping farm-to-retail supply chains by enhancing efficiency, transparency, and sustainability. The integration of predictive analytics, intelligent logistics, and automated quality assessment systems has resulted in measurable improvements in inventory turnover, price realization for farmers, and waste reduction across the supply chain (Achumie et al., 2022; Florez et al., 2022).

Efficiency Gains and Market Transparency

AI-enabled forecasting tools have improved demand–supply alignment, reducing mismatches that often lead to food waste. For farmers, digital marketplaces facilitate direct access to retailers, thus minimizing the role of intermediaries and ensuring better margins (Utami et al., 2021; Cao, 2021). Transparency is further strengthened by blockchain-supported traceability mechanisms that enhance consumer trust and compliance with food safety regulations (Chang et al., 2020; Hou et al., 2020).

Sustainability and Waste Reduction

Digitalization supports the Sustainable Development Goals (SDGs) by enabling smarter allocation of resources, minimizing post-harvest losses, and optimizing logistics (Secundo et al., 2022; Oboobi, 2020). This aligns with global trends in Agriculture 4.0, where IoT and AI converge to improve productivity while reducing environmental impacts (Araújo et al., 2021).

Adoption Drivers and Barriers

Key drivers include regulatory support, growing consumer demand for traceability, and the increasing availability of digital infrastructure (Salvini et al., 2022; Vlachopoulou et al., 2021). However, barriers persist in the form of limited digital literacy among farmers, interoperability challenges

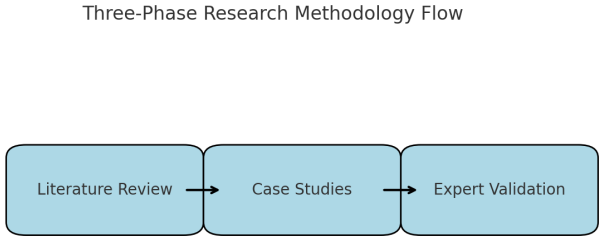

Fig 1: The diagram showing the three-phase research methodology flow

Table 2: Summary of Key Findings on AI-Driven Agricultural Marketplaces in UK Farm-to-Retail Supply Chains

Finding Category	*Key Outcomes*	*Supporting Literature*
Efficiency & Transparency	Better price realization, reduced intermediaries, demand forecasting accuracy	Cao (2021); Utami et al. (2021); Achumie et al. (2022)
Sustainability & Waste	Lower post-harvest losses, optimized logistics	Florez et al. (2022); Secundo et al. (2022); Oboobi (2020)
Adoption Drivers	Traceability, consumer demand, infrastructure	Vlachopoulou et al. (2021); Salvini et al. (2022)
Adoption Barriers	Digital literacy gaps, interoperability issues, trust concerns	Cadden et al. (2022); Iansiti & Lakhani (2020)
Policy/Strategic Implications	Need for rural connectivity, data governance, adaptive business models	Har et al. (2022); Lee (2021); Idries et al. (2022)

across platforms, and cultural resistance to data sharing (Cadden et al., 2022; Iansiti & Lakhani, 2020).

Strategic and Policy Implications:

The findings suggest that policymakers must invest in rural digital infrastructure and data governance frameworks to enable widespread adoption. Moreover, managerial implications point towards the need for flexible business models that integrate AI-driven decision support systems to remain competitive in digitalized supply chains (Har et al., 2022; Lee, 2021; Idries et al., 2022).

DISCUSSION

The advent of AI-powered agricultural markets in the United Kingdom is an indicator of a dynamic change in the structure of farm-to-retail supply networks. The platforms embrace predictive analytics, automated quality-established data, and intelligent logistics to enhance efficiency, transparency, and responsiveness. This is in line with the overall movement on Agriculture 4.0 where digital technologies are deployed as the tools that help valorize the agrifood value chain to smarter, more sustainable pathways (Araaujo et al., 2021; Hou et al., 2020).

Basically, AI-driven marketplace solutions can not only optimize the functioning of an operation but also contribute to sustainability goals. Through decreasing waste, enhancing demand planning, and as a result of leading resource-efficient logistics, such platforms help to achieve progress in Sustainable Development Goals as identified in the study of the European agri-food industry (Secundo et al., 2022; Florez et al., 2022). Moreover, consumer confidence is strengthened by traceability through blockchain and digitalized transactions, thereby mitigating food fraud (Chang et al., 2020).

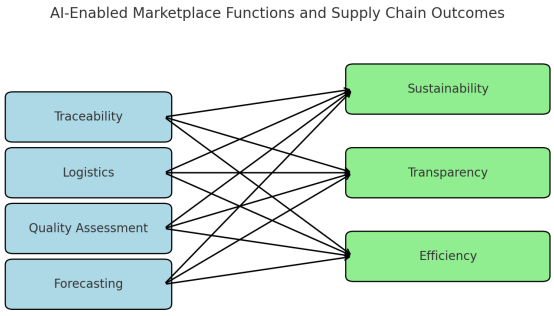

Fig 2: Framework model showing how AI-enabled marketplace functions (Forecasting, Quality Assessment, Logistics, Traceability) map to supply chain outcomes (Efficiency, Transparency, Sustainability).

The utilization of such platforms is affected by the interlocutor of business models and cultural enablers, however. As the research proves, the value of co-creation and platform-based ecosystems are important elements of fruitful agrifood-tech models (Vlachopoulou et al., 2021; Utami et al., 2021). Cultural and organizational preparations serve as intermediaries in the integration of AI, and they impact the extent of AI adoption to existing supply chains (Cadden et al., 2022). These trends indicate that technology is not the only thing that is necessary in terms of realising the full value, creating potential of AI, social, cultural and institutional factors also need to be aligned (Iansiti & Lakhani, 2020).

In terms of retailing, the shift towards AI marketplaces is part of a greater shift towards Retail 4.0-driven by digitalization, customization and consumer control (Har et al., 2022; Cao, 2021). In supply chain management in agriculture, this shift creates better price realization to the farmers and a better inventory turnover to the retailers.

At the same time, challenges such as digital skill gaps, infrastructure limitations, and data governance remain significant barriers to adoption (Oboobi, 2020; Salvini et al., 2022).

The implications extend beyond immediate efficiency gains. AI-enabled platforms can reconfigure power relations across the supply chain, providing smaller producers with access to digital marketplaces and reducing asymmetries traditionally dominated by large retailers (Achumie et al., 2022; Lee, 2021). This dynamic resonates with perspectives on digital commerce enabling social justice logics, particularly in empowering marginalized producers (Utami et al., 2021). Moreover, dynamic capabilities fostered through digital ecosystems may help the UK agrifood sector adapt to disruption,

enhancing resilience to shocks such as climate variability or global supply crises (Idries et al., 2022; Adenuga et al., 2020).

Overall, AI-driven agricultural marketplaces present a dual opportunity: optimizing operational flows while driving sustainability and inclusivity. However, successful implementation requires not only technological readiness but also alignment with governance frameworks, cultural enablers, and policy support to ensure equitable and widespread adoption (MARUN GUERRA, 2021; Suominen, 2021).

Future Work and Conclusion

The integration of AI-driven marketplaces into farm-to-retail supply chains demonstrates strong potential to enhance efficiency, sustainability, and inclusivity in the UK agrifood sector. The results show that predictive analytics, smart logistics, and digital traceability can help to make suppliers more transparent and resilient, supporting or contributing to other sustainability initiatives (Secundo et al., 2022; Ara Nevertheless, several factors hindering broadscale adoption have been highlighted and will have to be dealt with, including data governance, interoperability, and digital literacy among both farmers and retailers (Cadden et al., 2022; Vlachopoulou et al., 2021).

A comparative study over longer periods of time that takes into consideration the economic and environmental implications of A-enabled marketplaces in varied farming experiences should be conducted in the future. Comparisons of the UK and other international agri-tech ecosystems can also reveal optimal practices in converging blockchain, IoT and AI to achieve traceable and trusted food value chains (Chang et al., 2020; Hou et al., 2020). As well, simulation-based models and digital twin architectures may be used to evaluate the size and strength of such marketplaces in the face of supply shocks (Salvini et al., 2022; Adenuga et al., 2020).

The other essential course of action is to examine how cultural and organizational enablers can enhance the adoption of technologies and the establishment of trust among smallholders and cooperatives (Florez et al., 2022; Utami et al., 2021). Indeed, as noted in retail and cross-sector literature, the adoption of AI is not only a technical challenge, but a strategic, managerial and social justice problem (Har et al., 2022; Cao, 2021; Iansiti & Lakhani, 2020). Integration of these views into the agricultural sector can open new channels toward inclusive development and equal involvement.

In summary, AI-based agricultural markets are a profound initiative that will help in the digitalization of farm to retail supply chains of the UK. They suggest innovation in effectiveness, waste minimisation and value addition among the stakeholders so long as the issue of governance, infrastructure and competence have been addressed systematically. Future policies and research efforts should thus be directed at the scale-up of reliable technologies ecosystems, development of technologies convergence alliances, and consumption alignment with sustainable development goals (Idries et al., 2022; Achumie et al., 2022; MARUN GUERRA, 2021).

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