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AI-Driven Marketing in Agrifood: How Smart Technologies Shape Consumer Choices and Retail Strategies. A Critical Analysis of the Literature

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Abstract. *With the digitalization era, artificial intelligence (AI) is the primary catalyst of agri-food marketing strategies with a significant impact on consumers' buying behavior and business plans of retailers. This article discusses the role of smart technologies towards optimizing the shopping experience, personalizing offers, and reducing the supply chain. One, collaborative filtering- and content-analysis-based recommendation schemes allow personalized marketing campaigns, demand forecasting, and customer satisfaction improvements. Two, machine learning-augmented dynamic price models provide real-time adaptive pricing for the retailer to achieve maximum profitability along with product offer availability. Three, applications of neural networks and deep learning by recommendation engines improve providing more accurate suggestions to optimize customer experience. AI also enables agri-food product traceability by utilizing blockchain, providing consumers with information and increasing product trust when they buy. Problems concerning ethics, privacy, and potential algorithmic price collusion are also identified by the study. By means of critical literature review, the article puts forward benefits of AI deployment in agri-food retailing and suggests directions for development. The findings emphasize the need for clear rules of the right application of AI, and continued potential for innovation in the domain.*

Keywords: agri-food marketing, artificial intelligence, consumer behavior, machine learning, retailers and customers.

Introduction

The agri-food industry is undergoing a relentless transformation due to technological advancements and the increasing use of artificial intelligence (AI) in marketing. The emergence of digital platforms, recommendation algorithms and machine learning technologies has revolutionized the way retailers interact with consumers and run their businesses. In this regard, AI offers unprecedented opportunities for offer personalization, price optimization and supply chain efficiency. The objective of this study is to examine the impact of AI on agri-food marketing initiatives, highlighting benefits and challenges to leveraging this technology. The piece explores how recommendation algorithms influence what people buy, how dynamic pricing strategies

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maximize the revenue for the retailer, and how AI enables losses to be reduced and make the supply chain more transparent. The ethical concerns and risks of marketing process automation are also discussed. Based on a review of literature, this article provides a clear picture of the current and future trends of using AI in agri-food marketing, with a focus on technological innovations and their impact on the retailer-consumer relationship.

Literature review

Traditional vs. digital: how agri-food marketing strategies have changed

Traditional marketing is based on the four pillars of product, price, promotion and placement, thus encompassing the entire process that underpins the sales action while responding to the real needs of consumers (Chi, 2024). Unlike traditional marketing, digital marketing involves the application of multiple tools, for example: websites, advertisements, mobile apps, social media, etc. According to Tam and June, 2025, consumers are constantly engaged given the increased time of use of devices.

Communication channels in traditional marketing include newspapers, magazines, billboards as well as radio or television. These channels are included in conventional marketing strategies and address a wide audience with a limited lifespan (Bassey, 2025; Geraghty and Conway., 2016). Social media, email newsletters and blogs are just a small fraction of the new tools that digital marketing is bringing to the forefront (Geraghy and Conway, 2016). The use of digital media has played an important role on several companies in recent years, and more and more are realizing the value of using social media and the internet (Mirzaei et al., 2012).

Hybrid marketing communication is a new concept that involves the blending of two types of marketing: traditional and digital. Through this way of communication, organizations are able to gain a larger market share and increase their productivity level by reaching a considerably larger number of customers (Bassey, 2025).

Today, agri-food marketing can be defined as the set of organizations and procedures used to create, communicate, deliver or exchange agricultural products of value to customers, partners and society (Țimiraș et al, 2016).

AI and influencing consumer behavior in the agri-food industry

The agri-food industry has integrated recommendation algorithms to improve marketing strategies, optimize user experiences and streamline farming practices. These algorithms fall into several categories, each with a specific role in data analysis and processing. Collaborative filtering is a popular technique that relies on user behavior and preferences to generate recommendations. It works on the principle that users with similar interests will prefer similar products or services. In this regard, there are two main types: user-based collaborative filtering, which identifies people with similar preferences and recommends products that are liked by other similar users (Xiong, 2023; Mouhiha et al., 2024), and product-based collaborative filtering, which analyzes similarities between items to provide relevant suggestions (Mouhiha et al., 2024; Thomas and John, 2021). Studies show that the use of this type of filtering in online agricultural commerce significantly increases user satisfaction and recommendation accuracy (Xiong, 2023; Mouhiha et al., 2024).

Content-based filtering focuses on product features to make personalized recommendations. This involves matching product attributes to user preferences. For example, a farmer searching for drought-resistant seeds will receive suggestions based on product specifications (Kumar and Kumar, 2024; Kolikipogu et al., 2023). Some systems integrate

semantic information, such as product descriptions or knowledge graphs, to improve the relevance of recommendations (Qiu and Qi, 2024; Xie et al., 2022). Such methods are successfully used in crop recommendation systems, providing farmers with customized options based on soil properties and climatic conditions (Kumar and Kumar, 2024; Kolikipogu et al., 2023).

Hybrid models combine multiple recommendation techniques to improve accuracy and overcome the limitations of each individual method. For example, combining collaborative filtering with content-based filtering can solve the problem of new users or products with no previous reviews (Mouhiha et al., 2024; Elwin et al., 2024). Neural network integration also enables the analysis of complex relationships between users and products, providing more accurate recommendations (Mangat et al., 2024; Huang et al., 2019). Such a system has demonstrated a considerable improvement in the relevance of recommendations in online agricultural platforms (Mouhiha et al., 2024; Tiwari and Asrani, 2024).

Knowledge graph-based models use organized structures to analyze complex relationships between crop, soil, weather, and market requirements. These systems enable a deeper understanding of interdependence in agriculture and provide recommendations based on semantic data. For example, by extracting relationships between crops and soil types, more precise suggestions can be made to optimize agricultural production (Qiu and Qi, 2024; Xie et al., 2022).
Neural networks and deep learning are increasingly used in the agribusiness industry due to their ability to process large volumes of data and identify complex patterns. Models such as DeepCF combine neural networks with collaborative filtering to improve recommendations (Nagaraj and Palayyan, 2024), and RNN and LSTM architectures are being used to analyze sequential data such as crop yield history. These techniques have been successfully implemented in recommendation systems for crop selection, providing farmers with optimized solutions based on historical data and current conditions (Kumar and Kumar, 2024; Tyagi and Ray, 2024).

Explainable Artificial Intelligence (XAI) is becoming essential in agri-food recommender systems as it provides transparency and confidence in the decision-making process. Techniques such as LIME and SHAP are being used to explain the decisions of recommendation models, allowing farmers to understand the reasoning behind the suggestions received (Kumar and Kumar, 2024; Turgut et al., 2024). For example, an XAI crop recommendation system demonstrated high accuracy while providing clear explanations to users (Kumar and Kumar, 2024; Turgut et al., 2024).

Matrix factorization is a traditional method used to reduce the dimensionality of user-product interaction data and is often combined with deep learning techniques to improve performance (Song and Wang, 2022; Huang et al., 2019). Integrating this method with neural networks or knowledge graphs helps to address sparseness and cold-start issues, thus improving the relevance of recommendations (Song and Wang, 2022; Huang et al., 2019).
Specialized models for agricultural applications are developed to meet the specific needs of this domain. Crop recommendation systems analyze factors such as soil properties, climatic conditions and market requirements to suggest optimal options to farmers (Kumar and Kumar, 2024; Kolikipogu et al., 2023; Turgut et al., 2024). There are also systems that recommend farm equipment according to the types of crops and cultivation methods used (Madhumathi et al., 2024). A successful example is a machine learning-based precision farming system that has improved crop yields through personalized recommendations (Madhumathi et al., 2024).

The agri-food industry uses a wide range of recommendation algorithms to optimize decision making and provide personalized solutions. From traditional methods such as collaborative filtering and content-based filtering to advanced techniques such as knowledge

graph-based models and neural networks, these solutions contribute to increased agricultural efficiency and sustainability. As technology evolves, the integration of deep learning and explainable artificial intelligence will continue to revolutionize agri-food marketing and decision making.

The integration of Artificial Intelligence (AI) in the agri-food sector has significantly transformed the interaction between retailers and customers, improving both the efficiency and personalization of shopping experiences. This paper examines the key roles that AI plays in optimizing these interactions, drawing on insights from relevant academic research.

AI technologies enable food retailers to offer personalized experiences tailored to each customer's preferences and behavior. Machine learning algorithms analyze purchase patterns, dietary needs and consumer preferences to generate personalized recommendations. For example, AI-based recommendation systems suggest products based on customers' previous purchases, facilitating a more engaging and satisfying shopping experience (Adhikari and McFadden, 2025; Chabane et al., 2023).

AI-based recommendation systems adapt in real-time, modifying suggestions as consumer behavior evolves. This dynamic personalization contributes to increased customer satisfaction and loyalty (Min et al., 2023; Pure, 2023). The use of IoT devices and sensors in the retail environment also facilitates real-time data collection. AI systems leverage this data to provide personalized in-store experiences, including promotions and discounts tailored to each customer (Ding et al., 2023; Fuentes et al., 2024).

AI-based tools support customers in their purchasing decisions by providing relevant information, especially in areas of interest such as sustainability, health and ethical sourcing. AI can analyze product characteristics and provide detailed information on nutritional content, environmental impact and ethical sourcing. AI-based applications help consumers make healthier and more sustainable choices through personalized recommendations (Casado-Mansilla et al., 2024; Sharma et al., 2021). AI also improves the transparency of the supply chain by providing clear information about the origin and journey of products. This increases consumer trust and loyalty in a context where transparency is increasingly demanded (Anwar et al., 2023; Wendt and Sigurjónsson, 2024).

AI plays a key role in optimizing logistics and supply chain management, ensuring efficient and fast delivery of products. AI algorithms can anticipate fluctuations in demand, allowing retailers to efficiently manage inventory and reduce the risk of stock-outs or overstocking. This provides customers with constant access to the products they want (Trabelsi et al., 2023; Ding et al., 2023). Also, the analysis of historical sales data and seasonal trends contributes to inventory optimization. This improves supply chain efficiency, reduces wastage and ensures delivery of fresh and quality products (Anwar et al., 2023; Fuentes et al., 2024).

Trust is a key factor in the relationship between retailers and customers in the agri-food sector. AI helps to strengthen it by ensuring transparency, consistency and reliability of the products and services offered. AI-based monitoring systems oversee product quality throughout the supply chain, ensuring high standards of safety and quality. This process enhances customer trust and satisfaction (Bordignon, 2022; Taneja et al., 2023). Moreover, AI facilitates communication between retailers and consumers, addressing their concerns about the use of technology in food production. For example, AI can provide information about the safety and benefits of automatically generated recipes, helping to increase their acceptance (Xia and Li, 2024; Nath et al., 2024).

IA supports agri-food retailers in adopting more sustainable and ethical practices, which are increasingly valued by consumers. Supply chain optimization and efficient stock management help reduce food waste. AI also facilitates the efficient distribution of surplus products, having a positive impact on the environment and aligning with consumer expectations of sustainability (Anwar et al., 2023; Fuentes et al., 2024). In addition, AI helps retailers ensure that products are ethically sourced by analyzing supplier data and verifying compliance with ethical standards. This process enhances retailers' reputation and builds trusting relationships with ethically concerned consumers (Wendt and Sigurjónsson, 2024; Kutyauripo et al., 2023).

The future of AI in the agri-food sector looks promising, with continued advances that will further improve the interaction between retailers and customers. The convergence of AI with other emerging technologies, such as blockchain, IoT and digital twins, will increase transparency, efficiency and personalization in the agri-food sector, generating improved customer experiences (Pure, 2023; Fuentes et al., 2024). Future AI applications will also have an increased focus on consumer-centric retail models, emphasizing personalized recommendations, interactive shopping experiences, and real-time feedback mechanisms (Min et al., 2023; Adhikari and McFadden, 2025).

AI plays a complex role in improving the interaction between food retailers and customers. From personalizing shopping experiences and supporting consumer decisions, to optimizing logistics, building trust and promoting sustainability, AI offers varied solutions that significantly improve customer satisfaction and loyalty. As AI technologies continue to evolve, their integration in the agri-food sector will generate further innovation, ensuring effective adaptation to changing consumer needs and expectations.

AI and marketing strategies in agri-food retail

Artificial intelligence significantly affects pricing decisions by using dynamic and algorithmic pricing to respond to demand and competition. AI algorithms, such as Q-learning algorithms and reward learning, are increasingly being used in place of human decision makers in pricing decisions, allowing firms to set the price that maximizes profits by learning market conditions and competitor actions. They lead to supracompetitive pricing, as they often learn to maintain high prices through concentrated collusive behavior in the absence of direct communication, demonstrated in oligopoly models with AI algorithms setting higher prices (Calvano et al., 2020; Calvano et al., 2019).

For example, the German fuel market's adoption of algorithmic pricing software has shown an increase in profit margins, especially in non-monopoly and duopoly markets, where margins can increase by up to 28% when both competitors adopt this technology (Assad et al., 2020). Reward learning techniques such as Deep Q-Networks and Soft Actor Critic have been shown to be very effective in dynamic pricing under competition (Kastius and Schlosser, 2021).

Moreover, the ability of AI to carry out asynchronous and synchronous learning processes influences pricing outcomes, as asynchronous learning may lead to monopoly-level prices, while synchronous learning may encourage competitive pricing (Asker, 2022). Integrating demand learning and dynamic pricing into a state-space framework further enhances AI's ability to optimize prices by predicting future price sensitivity and adjusting strategies accordingly (Chung et al., 2012). In addition, neural networks combined with evolutionary algorithms provide a flexible and robust approach for demand modeling and price policy optimization under various scenarios (Shakya et al., 2012). However, the potential for AI-driven collusion raises concerns for

competition policy, as traditional tools may be inadequate to cope with the new dynamics introduced by algorithmic pricing (Calvano et al., 2019).

Agri-food e-commerce platforms are increasingly harnessing artificial intelligence-driven pricing frameworks to refine their pricing methodologies, augment customer satisfaction, and enhance operational efficacy. A notable model is "DeepPrice," which employs deep learning methodologies, including Convolutional Neural Networks (CNN) and Deep Reinforcement Learning (DRL), to fluidly modify pricing in response to consumer behavior and market indicators, culminating in a 20% elevation in platform revenue alongside enhanced customer contentment (Shi, 2024).

The exploration of AI-based pricing frameworks for their potential to attain sustainability through the optimization of resource allocation and the alignment of pricing with real-time demand is also underway; however, obstacles such as algorithmic transparency and consumer trust persist (Araf et al., 2025). Real-time analytics, empowered by artificial intelligence, significantly amplify the efficacy of dynamic pricing, particularly within competitive markets, although the sensitivity of customers to price fluctuations can temper these advantages (Awais, 2024). Cross-border e-commerce platforms are increasingly adopting sophisticated pricing frameworks that amalgamate market dynamics, competitive tactics, and consumer behavior via machine learning algorithms to navigate the complexities of international market landscapes (Cheng and Zhang, 2024). Machine learning methodologies, especially Gradient Boosting Machines (GBM), have demonstrated exceptional capability in elucidating intricate relationships and delivering precise pricing forecasts, thereby optimizing revenue streams and bolstering customer satisfaction (Youbi et al., 2023). Furthermore, artificial intelligence and machine learning are instrumental in the formulation of dynamic pricing frameworks that consider consumer preferences and market conditions, thus providing scalable solutions for revenue maximization (Tong and Yang, 2024). Innovations in marketing analytics and revenue management through artificial intelligence, including K-Means clustering and Long Short-Term Memory (LSTM) networks, have exhibited significant advancements in revenue generation, customer satisfaction, and market share (Karunakaran et al., 2024). Additionally, generative artificial intelligence enhances demand forecasting and adaptive pricing, conferring a competitive advantage by refining inventory management and personalizing consumer experiences (Krishnakumar, 2022). Ultimately, data-driven frameworks that incorporate AI methodologies such as Bayesian optimization and rule-based systems proffer efficient and adaptable pricing strategies, achieving considerable improvements in revenue and reductions in inventory costs (Vashishtha et al., 2024). Collectively, these AI-driven models exemplify the transformative potential of artificial intelligence within the realm of agri-food e-commerce pricing, harmonizing profitability with customer satisfaction and sustainability.

Methodology

This paper aims to critically analyze the literature on the use of artificial intelligence (AI) in agri-food marketing, focusing on the impact of smart technologies on consumer choices and retail strategies. The methodology adopted consists of a systematic literature review based on the identification, selection and analysis of relevant sources.

International scholarly databases including Web of Science, Scopus, ScienceDirect, IEEE Xplore, IEEE Xplore, ACM Digital Library, Google Scholar, SpringerLink and Wiley Online Library were used to collect scientific materials. A series of articles published as close as possible

to the present have been selected and studied to highlight the evolution of technology and its necessity in agri-food companies and marketing processes.

The search strategy included the use of keywords such as *"AI in agrifood marketing", "Artificial Intelligence in food retail", "Smart technologies AND consumer behavior AND agrifood", "Machine learning AND predictive analytics AND food industry", "AI-driven marketing strategies AND food retail"*. The queries were performed in titles, abstracts and keywords, using Boolean operators (AND, OR) to obtain the most relevant results. The literature review was based on a qualitative evaluation of sources, thematic categorization of studies and identification of existing gaps.

Results and discussions

The agri-food industry faces significant challenges in adapting to new technological trends and changes in people's consumption behavior.

The implementation of digital marketing strategies and the use of artificial intelligence are necessary solutions to increase efficiency and optimize processes. Studies reviewed in the literature show that digital marketing allows for better market segmentation, personalization of offers and more direct interaction with consumers, contributing to increased brand loyalty and customer satisfaction. On the other hand, the use of AI in supply chain management and pricing strategies brings an important competitive advantage, allowing quick adjustments to market demands and minimizing losses.

A key aspect is the impact of AI on consumer behavior. Recommendation algorithms enable increased personalization of the offer, anticipating customers' needs and offering them relevant products based on their shopping history and past preferences. Thus, food and beverage companies can significantly increase conversion rates and customer satisfaction by using advanced predictive models. Moreover, integrating AI into agri-food e-commerce platforms can optimize the shopping experience through virtual assistants that provide detailed information about products, sustainability and health impacts.

In terms of pricing strategies, the implementation of AI-based dynamic pricing models has demonstrated a significant increase in revenues and better supply and demand management. Advanced algorithms, such as Deep Q-Networks and Soft Actor Critic, optimize prices based on market fluctuations, competition and consumer behavior. However, these approaches also raise ethical issues, regarding transparency and the possibility of algorithmic collusion, which calls for clear regulation and rigorous scrutiny by authorities.

Another major benefit of artificial intelligence in agribusiness is supply chain optimization. AI can analyze historical data and seasonal trends to predict demand and adjust stocks accordingly. This not only reduces the risk of oversupply or shortages, but also helps reduce food waste, which is crucial in a global sustainability context. By integrating AI with other emerging technologies, such as blockchain and the Internet of Things (IoT), the traceability of agri-food products can be improved, giving consumers greater confidence in the provenance and quality of products.

Artificial intelligence has the potential to revolutionize agri-food marketing through a range of innovations that improve consumer interaction, streamline commercial strategies and optimize supply chains. One such innovation is the use of personalized virtual assistants for the agri-food sector. They can function as advanced chatbots capable of providing specific real-time recommendations on food products, sustainable farming methods or market trends. These intelligent tools improve consumer interaction and provide relevant information for consumer decision-making.

Another innovative direction is the use of AI-based emotional analytics in marketing strategies. By integrating artificial intelligence with sentiment analysis from social networks, emerging trends and consumer preferences can be quickly identified. This allows companies to adjust marketing messages and promotion strategies in real time, ensuring that they are aligned with market expectations and requirements. Augmented reality (AR) combined with artificial intelligence can also bring a new dimension to the promotion of agri-food products. Consumers could be able to interact virtually with products before purchase, exploring their features and benefits in a digital environment. This technology can be used in interactive promotional campaigns, facilitating decision-making and increasing consumer confidence. This method involves collecting and interpreting data from online reviews, social networks, surveys and other digital sources, using natural language processing (NLP) and machine learning algorithms to detect the predominant emotions of consumers. By assessing public sentiment towards a product or a previous campaign, companies can adjust promotional messages according to the general tone of the feedback received. For example, if analysis shows increased consumer concern about sustainability, companies can tailor advertising campaigns to highlight their green initiatives and ethical production practices. AI systems can identify consumers' emotional patterns and generate tailored responses, whether it's personalized virtual assistance, product recommendations based on previous emotional preferences, or adjusting the tone of brand communications based on consumers' moods. This approach helps improve user experience and increase brand loyalty.

Augmented Reality (AR) can be used to give consumers the ability to scan a product and instantly receive detailed information about the production process, quality certifications and supply chain sustainability. This transparency can increase consumer confidence and positively influence the buying decision. Another application of AR combined with AI in agri-food marketing is the creation of interactive virtual stores, where consumers can digitally explore agri-food products before purchasing them. This not only enhances the shopping experience but also facilitates informed decision-making. For example, through an integrated AI assistant, customers can receive personalized suggestions on which products best suit their lifestyle or dietary needs.

Advanced personalization of offers through AI is also an innovative strategy with major potential. Intelligent algorithms can analyze shopping history, nutritional preferences and seasonality of consumption to create personalized promotional offers. This approach increases conversion rates and customer loyalty by offering them products and services that align with their specific needs. Additionally, integrating AI with blockchain can help increase transparency in the agribusiness industry. A combined AI-blockchain system can ensure full traceability of products, providing consumers with detailed information about their origin, processing and distribution. In this way, companies can build trust with their customers, promoting sustainability and social responsibility in the agri-food sector.

Conclusion

Artificial intelligence is transforming agri-food marketing practices at its very center, providing new solutions to personalizing the consumer experience, price optimization and supply chain optimization. Recommendation algorithms enable retailers to predict customer requirements and build greater customer loyalty, while dynamic pricing models help with quick market response.

In addition, the union of AI with emerging technologies such as blockchain and IoT facilitates tracing of products and business process transparency, hence establishing customer trust. However, the widespread use of AI raises ethical and legal concerns such as algorithmic collusion and data privacy. Well-established regulations and ethical governance mechanisms need to be in place for

the complete harnessing of AI potential for agri-food marketing. The study stresses the need to embrace a balanced approach that harmonizes technological advancement with social responsibility so that AI yields maximum advantages while risks are effectively managed. In summary, the agri-food marketing of the future depends on the wise and ethical integration of AI, offering new opportunities to increase competitiveness and improve the retailer-consumer relationship.

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