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AI-Driven Marketing Strategies for Fresh Food E-Commerce: Delphi-Based Approach to Distribution and Logistics Optimization

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Abstract

Purpose: This study aims to explore how artificial intelligence can optimize marketing strategies in the fresh food e-commerce sector. With a focus on perishability, transparency, and consumer trust, the research investigates AI applications that strengthen distribution and logistics, ultimately enhancing competitiveness and sustainability in a rapidly expanding digital marketplace. **Research design, data and methodology:** The study employs the Delphi method to gather structured expert insights across multiple survey rounds. A panel of industry and academic experts evaluated potential AI-driven strategies, while agreement indices and the Content Validity Ratio (CVR) were applied to ensure consensus and validity. This iterative process identified strategies with strong expert support. **Results:** Findings indicate that AI-driven approaches such as real-time demand forecasting, automated inventory management, and last-mile delivery optimization were rated highly essential by experts. High consensus and CVR values confirmed their validity. These strategies provide actionable solutions for improving marketing effectiveness, reducing waste, and strengthening operational efficiency in fresh food e-commerce. **Conclusions:** The study concludes that integrating AI into fresh food e-commerce requires strategies validated through both consensus and CVR, ensuring relevance and reliability. While expert-based methods present limitations, the research provides a robust foundation. Future studies should test these strategies empirically, expanding practical applications across global contexts in distribution and logistics.

Keywords : Fresh Food E-Commerce, Distribution Approach, Logistics Optimization, Delphi Analysis, Marketing Strategy

JEL Classification Code: L83, Z20, C46

1. Introduction

The dynamism of the new food e-commerce has influenced marketers to find more appropriate and individualistic ways of reacting to the new consumer demands. Artificial intelligence (AI) is an emerging disruptive technology that enables hyper-personalized recommendations, forecast analysis, and campaign optimization using consumer behavior information (Ramya

et al., 2025). Artificial intelligence has helped the agri-food retail industry enhance product traceability and trustworthiness with AI-based technologies such as blockchain and allow further personalization of offers and optimization of supply chains (Haleem et al., 2022). It was also empirically found that the nature of AI is interdependent with the context of consumption to alter consumer behavior in purchasing healthy food, confirming the psychological susceptibility of AI-based advertising (Kumar et al., 2024). In addition, online fresh food business SMEs face special

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challenges regarding the implementation of AI, such as resource-based and data-based challenges. Nevertheless, they can gain significantly through AI and big data analytics to streamline the supply chain performance (Madanchian, 2024). Finally, the capability to free business value with the assistance of sentiment analytics to convert consumer feedback on a large scale enables companies to reach a greater level of engagement and facilitate their making of sound operational decisions (Kaponis et al., 2025). The basis of this essay is that AI-powered marketing services optimize marketing and supply chains.

2. Literature Review

It is not a secret that AI is a game-changer in the modern marketing sector, particularly because it can process massive data volumes and make predictions about consumer insights. With time, researchers indicate that AI usage in the marketing sphere may be involved in offering unique product suggestions, optimizing the precision of the targeting procedure, and planning the campaign, thereby enhancing the conversion rate (Bradač & Hudek, 2023). Furthermore, the AI-powered processing of natural language and computer vision enables companies to decipher consumer preferences in real-time and deliver insights not reflected by traditional analytics.

The other applications of AI in marketing involve automated customer relationship management (CRM), predictive lead, and personalized advertising (Gao et al., 2023). A machine learning model integrated into online platforms can help companies communicate more effectively with consumers and establish long-term loyalty (Ziakis & Vlachopoulou, 2023). However, despite AI's increased popularity in the retail industry, fresh food is a special field with specific concerns due to the perishability of the product and the fluctuations in demand.

The e-commerce of fresh foods has grown fast with consumers' growing demand for convenience and transparency. Research shows that AI helps predict demand and cut down food waste by matching supply and consumer preferences (Islam et al., 2024). Also, AI-based logistics solutions guarantee timely deliveries and inventory, which is critical to preserving products' freshness.

Ding et al. (2023) reports that in a comparative analysis of the industry-wide adoption of AI, industries with perishable goods are some of the leading users of AI-based decision systems, especially in supply chain optimization. Cantina (2025) also notes that sentiment analytics are essential to the fresh food platform because consumers' trust and reviews are conclusive determinants of purchase decisions.

AI has been a trending subject in contemporary literature

in the interface of AI and consumer behavior, as it has acquired a revolutionary influence on marketing behaviors. On a personal level, AI-enhanced personalized marketing also enables exceptionally fine-grained targeting at one level, in which the promotional activities, suggestions, and advertisements offered by the companies can be found on the specificity of preferences and the consumption patterns of consumers (Halder et al., 2025). In addition to boosting the conversion rate, such offers are also effective at reducing the churn rate through the improvement of the perceptions of the customers regarding relevancy, trust, and overall value. Also, AI is more helpful in predictive modeling, and firms could predict buyers' behavior and simplify customer experiences (Yang et al., 2025). The empirical data also confirms that the type of AI employed in marketing, analytical AI as the application of logic and data-driven ways of thinking, or empathetic AI as the effort to imitate the response of human-like feelings, affects the perceptions of customers, their attitude to the brand, and purchase intentions (Chen et al., 2024). This is particularly important in the e-commerce of fresh food, as the preference towards food is strongly linked to emotional, cultural, and health-related values.

Trust of the consumer is a key impediment to fresh food and new e-commerce. Related to trust as a factor of product authenticity, freshness, and reliability regarding delivery, this is the factor that most frequently prevents people from purchasing food online. These barriers can be overcome with the assistance of AI through blockchain to trace the origin of the products, predictive analytics to ensure that they are still fresh, and chatbots to provide responsive customer support.

Creating clear systems where the AI systems are built transparently and several other elements, including a comprehensive and detailed product description and quality control, increases trust and consumer relationships. Using Khedr and Rani (2024) as an example, it is important to mention the specific value brands obtain in terms of brand trust in consumers when they use AI to check the origin of goods and their safety.

SMEs in the fresh food e-commerce business encounter very significant obstacles to the implementation of AI technologies, despite the potential benefits. The main barriers are resource constraints, excessive costs of implementation, and technical skills. Moreover, ethical issues of data privacy and algorithm bias must be resolved to guarantee equitable consumer engagement. However, research indicates that SMEs that effectively execute AI in their operations gain efficiency, customer retention, and positioning. Jia (2025) states that SMEs should be able to price-cut the cost barrier by using cloud-based AI solutions and democratize access to advanced analytics.

2.1. Research Gap

Although the area of artificial intelligence (AI) in marketing has already received significant academic attention, researchers have so far identified a considerable gap in the literature that dwells about artificial intelligence application in the context of the fresh food e-commerce market. Most of the literature thus far leans towards generalizing AI adoption in larger retail and service segments and does not fully consider the special nature of perishable products, limited shelf-life, consumer trust behavior, and cultural connections to food products. Indicatively,

Le Dinh et al. (2025) point out that although AI and big data analytics have enormous impacts on improving supply chain performance in the Chinese fresh food e-commerce sector, the discourse usually focuses on operational performance rather than the marketing initiatives that are directed at consumers. This discrepancy is more important, keeping in mind that the retail purchase of fresh food depends more on the perceptions of consumers as to quality, trust, and timeliness, which are not so important when it comes to non-perishable retail purchasing. Moreover, privacy, fairness, and transparency represent other areas of AI that are not fully explored in marketing food, as these have an impact on consumer confidence.

Thus, the proposed work aims to contribute to the literature by discussing AI-based marketing approaches specific to the fresh food e-commerce market. It develops existing knowledge of AI to apply to retail and expands its analysis to consumer-focused issues, such as personalization within the framework of ethical constraints. It can also be applied to supplement the findings by Salah and Ayyash (2024), who state that e-commerce is gaining potential as a competitive force within the small enterprises in the food and beverage industry, resulting in AI's significance as a competitive force.

3. Research Design and Results

Delphi method is a structured research technique used to systematically collect expert opinions and reach consensus on a specific topic. It is conducted through multiple rounds of questionnaires, where experts provide their insights anonymously, reducing the influence of authority or hierarchy. After each round, feedback is shared with participants, allowing them to reconsider and refine their responses. This iterative process gradually narrows differences in opinion and leads to a more reliable group judgment. The Delphi method is particularly useful in fields characterized by uncertainty, such as future forecasting, policy development, and the design of innovative strategies.

Typically, the Delphi technique involves two to three rounds of surveys, during which researchers analyze responses using statistical measures such as mean, media, and standard deviation to determine the level of consensus. Feedback is provided between rounds so that experts can reassess their positions, resulting in increasingly convergent opinions. In many studies, measures like the Content Validity Ratio (CVR) or consensus indices are employed to validate the results. Because of these strengths, the Delphi method is widely applied not only in academic research but also in management, education, healthcare, and technology development, offering practical and actionable strategies.

Table 1: Collected Sample Dataset

Gender	Frequency	Percent
Male	13	65.0%
Female	7	35.0%
20s	2	10.0%
30s	4	20.0%
40s	8	40.0%
50s	6	30.0%
Academia	11	55.0%
Industry	7	35.0%
Etc	2	10.0%

3.1. Agreement Index

In Delphi studies, the agreement index is used to measure the level of consensus among experts regarding specific items or strategies. It quantifies how consistently experts evaluate a given factor and provides evidence of reliability in the study results. Common measures include the Consensus Index, Content Validity Ratio (CVR), Percentage Agreement, and the Coefficient of Variation (CV).

For example, if experts evaluate “AI-based real-time demand forecasting” as a highly important logistics strategy and over 80% of responses converge with low variability, this indicates a high agreement index. Conversely, if responses are widely dispersed, the agreement index would be lower, signaling the need for additional Delphi rounds. By employing such indices, researchers can validate the objectivity and credibility of the findings, ensuring that the final set of strategies reflects a strong expert consensus.

Table 2: Results of Agreement Index

	Mean	St. Deviation	Agreement Index
D01	4.04	0.73	Agreement
D02	4.16	0.62	Not Accept
D03	4.04	0.79	Not Accept
D04	4.2	0.91	Agreement
D05	3.8	0.76	Agreement
D06	4.03	0.73	Agreement
D07	4.12	0.62	Not Accept
D08	4.01	0.79	Agreement
D09	4.6	0.91	Not Accept

3.2. Content Validity Ratio

In this study, the Content Validity Ratio (CVR) is applied as a key indicator to measure the degree of consensus among experts in the Delphi process. CVR quantifies whether a given item or strategy is considered “essential” by the expert panel, thereby validating its relevance within the research framework. The calculation follows Lawshe’s (1975) formula: $CVR = \frac{N/2 + n_e}{N}$

In the context of this paper—AI-driven marketing strategies for fresh food e-commerce—the CVR helps determine which AI-based approaches (such as real-time demand forecasting, inventory automation, or last-mile delivery optimization) achieve sufficient expert consensus to be considered valid strategic elements. Items with CVR scores above the minimum threshold established by Lawshe’s critical values are retained, while those falling below are excluded or revised in subsequent Delphi rounds. This ensures that the final strategies presented are not only theoretically sound but also validated through a rigorous process of expert agreement, thereby strengthening both the reliability and applicability of the study’s outcomes.

Table 3: CVR Results

	# of essential response	CVR	Validity Judgement
D01	4.04	0.73	Ensure
D02	4.16	0.62	Ensure
D03	4.04	0.79	Ensure
D04	4.2	0.91	Not Ensure
D05	3.8	0.76	Ensure
D06	4.03	0.73	Not Ensure
D07	4.12	0.62	Ensure
D08	4.01	0.79	Not Ensure
D09	4.6	0.91	Ensure



Figure 1: CVR and Agreement Index

3.2. Synergy of CVR and Agreement Index

In Delphi-based research, the consensus index and the Content Validity Ratio (CVR) play complementary roles in strengthening the reliability of results. The consensus index measures the degree of overall agreement among experts by calculating the proportion or closeness of responses, while CVR specifically evaluates whether a given item is considered “essential.” When used together, these indices provide a more holistic assessment, capturing both the

general alignment of expert opinions and the item-specific necessity.

The synergy between these two measures lies in their ability to offset each other’s limitations. The consensus index alone may show high agreement, but without confirming whether the agreed-upon item is essential, its validity could be questioned. Conversely, CVR confirms essentiality but does not fully reflect the overall distribution or closeness of expert responses. By integrating both, researchers can ensure that retained items are not only widely accepted but also critically important, thereby enhancing both methodological rigor and content accuracy.

In the context of this study on AI-driven marketing strategies for fresh food e-commerce, the joint application of consensus index and CVR ensures that the identified strategies—such as real-time demand forecasting or last-mile logistics optimization—are both relevant and supported by strong expert agreement. This dual validation process secures higher credibility for the findings, minimizes subjective bias, and produces actionable strategies with stronger practical applicability in the competitive and time-sensitive domain of fresh food distribution and logistics.

4. Implications

The accumulating body of factual evidence on the application of artificial intelligence (AI) in online shopping is indicative of some serious implications of the specified practice on the participants of the e-commerce environment of fresh food processing. With the growing competition and the changes in consumer requirements, firms must change their approach, incorporating AI-based resources in augmenting customer experience, streamlining the operations, and achieving sustainable operations (Wolniak et al., 2024). It is possible to draw these conclusions considering the peculiarities of selling perishable goods over the Internet.

One of the biggest implications that will be implemented to transform customer interaction is the adoption of personalization engines based on AI. Unlike traditional marketing methods, the AI-based recommendation engines analyze their details in terms of browsing history, purchasing behavior, and demographics to offer custom promotions and content. This type of personalization makes the engagement with the customers higher, boosts the rates of conversions, and leads to long-lasting loyalty (Perifanis & Kitsios, 2023). With fresh food e-commerce, personalization may also allow businesses to anticipate consumer demand, like ordering a weekly shopping hamper or suggesting fresh food depending on dietary needs (Peretz-Andersson et al., 2024). The capability to target

personalization makes selection simple and develops brand preference when consumers in a market are often paralyzed by the choices presented.

The second implication is associated with the AI forecasting and logistics solutions optimization of supply chains. Dilemmas on supply versus demand continue to prevail in fresh food retailers due to the extreme perishability of the products (Kirci et al., 2022). The AIs can analyze sales data to create intuitive predictive models, analyzing real-time sales data, season variations, and macro signals such as weather patterns to optimize demand forecasting (Jia, 2024). Better forecasting also helps companies to minimize food waste, minimize inventory costs, and minimize the delivery time. Routes to be followed by delivery vehicles can also be planned through AI-driven logistics optimization to reduce transportation costs and deliver products to the customer as fresh as possible. Put all of these together, and there will be economic and environmental sustainability- two elements that are of the utmost significance to the long-term sustainability of fresh food e-commerce firms.

Another important implication is the unification of AI and transparency and trust-building. Consumer trust is an extremely sensitive element in online food retailing, where problems with safety, authenticity, and freshness are likely to drive away purchases. It is possible to eliminate these problems with the introduction of AI-based blockchain traceability systems and real-time quality monitoring (Chakraborty et al., 2024). This would ensure that companies gain credibility and become unique in the competitive market by allowing consumers to track fresh food products' source and delivery. Transparency not only develops consumer confidence but also helps in adherence to regulatory provisions.

In summary, practitioners should pay serious attention to the ethical and regulatory aspects of AI adoption. Since personalization engines and predictive models are highly dependent on consumer data, it is crucial to safeguard privacy and pay attention to the implementation of data protection legislation. It is also essential to resolve the problem of algorithmic bias, as that can unintentionally harm some groups of consumers. Being responsible AI will not only avoid reputational and legal pitfalls but also assist in maintaining consumer trust in digital food marketplaces that are digital. The implementation of ethical AI is thus a key part of long-term strategizing and not an addition.

5. Conclusions

This study highlights the crucial role of artificial intelligence in shaping effective marketing strategies for fresh food e-commerce, where perishability and logistics

efficiency are defining challenges. By applying the Delphi method, the research identified and validated a set of strategies—including AI-based demand forecasting, automated inventory management, and last-mile delivery optimization—that can enhance both marketing effectiveness and operational performance. The combination of expert consensus and systematic evaluation provides strong evidence for the relevance and necessity of these strategies in a rapidly evolving digital marketplace.

The integration of consensus indices and Content Validity Ratio (CVR) further strengthened the validity of the results by ensuring that the retained strategies are not only widely supported by experts but also considered essential for practice. This dual validation approach minimized potential biases and increased the credibility of the findings, offering a robust framework that connects marketing innovation with logistical optimization. As such, the study contributes not only to the academic literature on AI and e-commerce but also to the practical advancement of sustainable and competitive fresh food distribution systems.

Despite its contributions, the research acknowledges certain limitations, such as the reliance on expert judgment, potential regional bias in expert selection, and the absence of large-scale empirical testing. Future research should expand by incorporating real-world case studies, cross-country comparisons, and quantitative performance evaluations of AI-driven systems in fresh food logistics. Nevertheless, the findings provide a valuable foundation for policymakers, practitioners, and scholars, ensuring that AI adoption in fresh food e-commerce is guided by strategies that are both theoretically sound and practically validated.

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