Artificial Intelligence–Driven Intelligent Marketing Transformation in the FMCG Industry: A Perspective of Consumer Behavior Prediction and Dynamic Resource Allocation

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Abstract

With the rapid advancement of artificial intelligence (AI) technologies and the full-scale expansion of the digital economy, the fast-moving consumer goods (FMCG) industry is undergoing a profound transformation toward intelligence. Leveraging powerful capabilities in data processing and prediction, AI has been widely applied in consumer behavior analysis, market segmentation, and resource allocation within FMCG enterprises, driving the shift from experience-based to data-driven decision-making and from static marketing to intelligent decision systems. Grounded in intelligent-marketing and dynamic-capability theories, this paper systematically reviews recent progress in AI applications for consumer behavior prediction and dynamic resource allocation, with particular attention to representative practices and key challenges in the FMCG sector. Through case analyses of Unilever and Coca-Cola, the study reveals the intrinsic logic and practical pathways of AI-enabled marketing intelligence. Findings indicate that AI can significantly enhance market-forecast accuracy and resource-utilization efficiency, yet it remains constrained by barriers to data integration, limited model interpretability, and uneven levels of digital maturity among organizations. Finally, the paper proposes future research directions-including multimodal data fusion, explainable AI, and human–machine collaborative decision-making-to provide theoretical and practical guidance for the digital and intelligent transformation of FMCG enterprises.

Keywords

Artificial intelligence, fast-moving consumer goods (FMCG), consumer behavior prediction, dynamic resource allocation, intelligent marketing.

1. Introduction

The FMCG industry is characterized by high consumption frequency, low decision-making costs, and intense competition, with market dynamics changing rapidly. Traditional marketing strategies, largely dependent on managerial experience and historical data, often fail to respond effectively to fast-evolving consumer needs. AI has made it possible for businesses to do real-time analytics and forecasting on large, high-dimensional data sets. This has made decision-making more scientifically sound and accurate. However, many firms still face challenges such as technological fragmentation and data silos, which prevent the full realization of AI's potential. In particular, FMCG products have short life cycles, complex distribution channels, and frequent promotional campaigns, making the dynamic allocation of marketing resources a critical managerial issue [1]. How to embed AI into corporate decision systems to achieve synergy between prediction and resource allocation has therefore become a core research question.

The purpose of this study is to explore the underlying mechanism of AI-enabled intelligent marketing transformation in the FMCG industry. Focusing on two dimensions-consumer

behavior prediction and dynamic resource allocation-it examines the functional pathways and practical effectiveness of AI in marketing management.

The study utilizes intelligent-marketing and dynamic-capability theories to elucidate the ways in which AI improves firms' dynamic decision-making capabilities. Practically, it analyzes representative enterprise cases to reveal AI's implementation models in FMCG marketing and to provide a systematic framework for industry transformation. The research offers valuable insights for building data-driven marketing systems and promoting the digital and intelligent upgrading of the FMCG sector.

2. Literature Review

2.1. Theoretical Foundations

2.1.1. Intelligent Marketing and Digital Transformation Theory

The rapid progress of digital transformation is reshaping the competitive landscape of marketing across industries. Intelligent-marketing theory emphasizes that the core value of artificial intelligence (AI) lies in leveraging algorithms and data-driven models to replace intuition-based decision-making with scientific and predictive processes. Junaid [2] noted that the integration of AI optimizes market insight and customer-relationship management, transforming marketing systems from traditional linear models into intelligent closed-loop systems.

Nguyen et al. [3] argued that as natural-language processing, machine-learning, and recommendation algorithms mature, firms can achieve a higher level of automation in audience identification, dynamic advertising delivery, and personalized content generation. Such capabilities introduce real-time learning and feedback loops that reduce information latency and resource waste. Wang et al.[4] further emphasized that in the fast-moving consumer-goods (FMCG) sector, AI-driven marketing follows a continuous "predict–respond–optimize" cycle. By continuously learning from sales data, online reviews, and social-media interactions, enterprises can dynamically track market trends and build a data-centric "smart-marketing ecosystem." This theoretical perspective provides a systematic framework for understanding how AI accelerates digital transformation in FMCG firms.

2.1.2. Consumer Behavior Prediction Theory

Consumer-behavior prediction theory integrates insights from behavioral economics, psychology, and data science to quantify purchasing motives and decision processes. Traditional survey-based and regression models often fail to capture complex, contextual, and nonlinear relationships, whereas AI-based algorithms extract latent patterns from high-dimensional unstructured data through feature engineering and pattern recognition.

Garg et al. [5] demonstrated that the adoption of AI algorithms substantially enhances the multidimensional and dynamic aspects of consumer prediction, particularly in the FMCG context where transactions are frequent and time-sensitive. Models can track behavioral trajectories in real time and forecast purchase propensities with higher accuracy. Zhou and Jiang [6] argued that under the new-retail paradigm, predictive modeling has shifted from static statistical inference to dynamic learning. By integrating multi-source data-such as social-media activity, online-browsing histories, and geolocation data-companies can anticipate consumers' immediate needs. This evolution not only increases the precision of marketing decisions but also redefines traditional market-segmentation approaches, enabling FMCG firms to construct detailed customer personas and design more targeted promotional strategies.

2.1.3. Dynamic Resource Allocation and Dynamic Capability Theory

Originating from strategic-management research, dynamic-capability theory highlights a firm's ability to integrate, reconfigure, and redeploy internal resources amid environmental

uncertainty. Makingl. [7] suggested that AI technologies significantly strengthen firms' capacity for dynamic resource allocation, allowing decision-making to be driven by real-time data rather than static budgets.

He X. [8] further pointed out that AI algorithms can iteratively adjust resource-allocation structures through simulation and feedback mechanisms, enabling simultaneous optimization of advertising budgets, channel resources, and supply-chain inventories. Compared with manual judgment, reinforcement-learning systems autonomously explore optimal solutions, improving operational efficiency and responsiveness. This theoretical lens provides FMCG enterprises with a robust foundation for building rapid-response mechanisms in volatile markets.

2.2. Research on AI in Consumer Behavior Prediction

2.2.1. Data Sources and Analytical Methods

AI-enabled consumer prediction relies on integrating heterogeneous data sources-point-of-sale transactions, loyalty-card records, social-media sentiment, online reviews, and macroeconomic variables. Marketing[9] observed that due to high product-turnover rates and complex distribution channels, FMCG data are highly fragmented. AI facilitates large-scale pattern recognition through data cleansing, clustering, and multimodal-feature fusion.

Malhan [10]. highlighted that neural-network and support-vector-machine models outperform traditional statistical approaches in capturing nonlinear relationships and handling heterogeneous samples Moreover, ensemble-learning models such as XGBoost exhibit strong adaptability in feature weighting and model stability, providing more accurate forecasts of consumption trends. Combined, these approaches allow predictive systems to learn continuously and self-adjust based on incoming data.

2.2.2. Models and Algorithms

Model selection and algorithmic architecture directly determine forecasting accuracy and interpretability. Lajoie [11] found that machine-learning models like random-forest and gradient-boosting trees achieve high accuracy even with limited features, making them effective for sales and market-share analysis.

Gan L C [12] reported that deep-learning techniques expand modeling capabilities in image recognition, textual analysis, and behavioral-sequence mining. Convolutional-neural networks (CNNs) and long-short-term-memory (LSTM) networks have become prevalent in analyzing online reviews, social-media posts, and transaction histories to capture shifts in consumer preferences.

Devnaad et al. [1] emphasized the growing relevance of reinforcement-learning algorithms, which allow firms to adapt pricing and promotion strategies through continuous feedback, effectively transforming AI from a passive analytical tool into an active "decision-making agent.

2.2.3. Application Scenarios and Limitations

Typical AI applications in the FMCG sector include demand forecasting for new-product launches and response prediction for promotional campaigns. Xie L [13] showed that during product-introduction stages, firms face uncertainties regarding market acceptance and rapidly shifting consumer preferences. By integrating historical sales, social-media discussions, and search-trend data, LSTM-based time-series models can detect early inflection points in sales growth. Reinforcement-learning models further simulate market feedback to refine advertising and pricing strategies, reducing commercial risk.

Long C H [14] observed that AI-driven campaign analytics-combining transaction records, loyalty-program data, and social-interaction metrics-enable segmentation-based promotions and personalized recommendations, markedly improving conversion rates and return on investment (ROI). Mulović A T [15] cautioned that data-integration barriers and inconsistent

standards across channels hinder the development of unified cross-platform models. Over-reliance on algorithmic recommendations can also diminish consumers' exploratory engagement with brands, increasing homogeneity in marketing content. Shameek M[16] added that successful AI deployment requires mature data-governance structures and organizational alignment; otherwise, even sophisticated models cannot generate sustainable competitive advantages.

2.3. Research on AI in Dynamic Resource Allocation

2.3.1. Resource-Allocation Models and Methods

AI-driven resource-allocation frameworks combine predictive analytics with optimization algorithms to enhance the dynamic distribution of marketing resources. Gan et al. [12]showed that reinforcement-learning algorithms perform effectively in advertising-budget optimization through iterative exploration of reward structures.

He X [17] reported that Bayesian-optimization and predictive-control approaches balance multiple objectives-cost, sales, and brand exposure-to construct intelligent, real-time allocation systems. Compared with static budgeting, AI-based models operate through a "learn–feedback–reallocate" loop, ensuring that marketing resources flow flexibly across markets and time periods to meet fluctuating demand and competitive pressure.

2.3.2. Practical Cases and Empirical Outcomes

Empirical evidence confirms the tangible benefits of AI in resource management. C. P L ,Michael M [18] documented that Unilever implemented an AI-based global channel-resource-allocation system integrating sales, climate, and demographic data. Using reinforcement learning, the company dynamically adjusted channel proportions, raising overall efficiency by 18 percent and cutting inventory backlogs by 15 percent.

IRI [19] reported that Coca-Cola's "Smart Distribution Platform" employed deep-learning models to analyze regional consumption intensity, climate conditions, and seasonal festivals, enabling automated scheduling of advertising and logistics. During high-temperature seasons and major sporting events, the system increased inventory and promotional budgets for key markets, boosting ROI by 26 percent and inventory turnover by 19 percent. Artificial [20]concluded that such international best practices demonstrate AI's ability to accelerate decision-making and strengthen supply-chain–market coordination.

3. Discussion

3.1. Challenges and Future Trends

Despite these advances, both academia and industry face persistent challenges. identified major data-integration barriers-heterogeneous data formats and privacy restrictions that limit algorithmic learning. argued that the "black-box" nature of complex models reduces managerial trust, especially in budget and pricing decisions. observed that most AI systems still rely heavily on historical data, lacking real-time responsiveness to sudden market shocks.further noted that digital-transformation maturity varies widely across firms, impeding implementation. Future research should focus on explainable-AI techniques and cross-channel data-standardization to enhance transparency and scalability.

Lin X [21] highlighted the theoretical fragmentation in existing studies-few frameworks integrate intelligent-marketing theory, consumer psychology, and dynamic-capability perspectives coherently. pointed out that many corporate AI initiatives remain limited to isolated business functions, lacking end-to-end coordination and strategic integration. suggested that future scholarship should explore multimodal-data fusion, transfer-learning methods, and AI-ethics governance to balance model interpretability and data security.

Collectively, these directions will foster the sustainable application of AI within the FMCG industry.

3.2. The Relationship between Consumer Prediction and Resource Allocation

Consumer behavior prediction provides firms with forward-looking insights into demand, while dynamic resource allocation serves as the key mechanism that translates those insights into actionable strategies. The integration of these two dimensions forms a data-driven intelligent marketing loop in which predictive models generate market signals and allocation systems deliver real-time responses. Together, they establish an "intelligent decision-making ecosystem" within enterprises. This bidirectional coupling mechanism not only enhances market responsiveness but also accelerates the overall strategic transformation toward intelligent management.

The introduction of artificial intelligence (AI) has fundamentally reshaped the marketing systems of the FMCG industry. By enabling end-to-end empowerment across information collection, data analysis, and strategic execution, AI facilitates the shift from reactive to proactive marketing. Through intelligent algorithms, enterprises can capture early market signals and construct precise, closed-loop marketing processes. Consumer prediction models provide demand-oriented insights, while dynamic allocation systems transform these forecasts into real-time resource adjustments, forming a continuous "prediction–response–optimization" cycle.

AI-driven marketing systems not only enhance operational efficiency but also redefine organizational structures and decision-making logic. Managers are now required to develop competencies in data governance and AI literacy, fostering cross-departmental collaboration to ensure that algorithmic outputs align with strategic objectives. At the same time, the ethical and privacy risks associated with AI cannot be overlooked. Companies must establish transparent data-management frameworks and accountability mechanisms to maintain fairness, trust, and compliance in AI-driven marketing operations.

4. Conclusion

Artificial intelligence has driven a comprehensive transformation of marketing models in the FMCG industry. In consumer behavior prediction, AI enhances demand insight and trend forecasting; in dynamic resource allocation, it increases decision-making speed and precision. Empowered by AI, enterprises have shifted from experience-based decision-making to intelligent operations. The practices of Unilever and Coca-Cola demonstrate that AI contributes to building efficient, flexible, and data-driven marketing systems.

This study enriches the theoretical understanding of intelligent marketing and dynamic capabilities while providing practical guidance for the digital transformation of the FMCG industry. Nevertheless, challenges remain, including data silos, insufficient model interpretability, and limited organizational adaptability. Future research should focus on cross-channel data integration, explainable AI, and human–machine collaborative mechanisms to ensure the sustainable development of intelligent marketing systems.

References

[1] Devnaad S ,Anupam S ,Kumar R S , et al. Artificial intelligence enabled supply chain resilience: insights from FMCG industry[J].Journal of Global Operations and Strategic Sourcing,2025,18(2):414-441.DOI:10.1108/JGOSS-02-2024-0017.

[2] Junaid M . The Convergence of the Metaverse, Artificial Intelligence, and Marketing[J].Human Systems Management,2025,44(6):1058-1060.DOI:10.1177/01672533251331502.

[3] Nguyen M K ,Bui M T T ,Pham T T H , et al. Fostering employees' AI adoption in strategic marketing planning and decision making: a mixed-method study in Vietnam[J].Cognition, Technology & Work,2025,(prepublish):1-34.DOI:10.1007/S10111-025-00838-1.

[4] Wang X ,Wang Y ,Li N , et al. Low-code AI enabling marketing innovation: The mediating role of marketing ambidexterity[J].Journal of Digital Management,2025,1(1):12-12.DOI:10.1007/S44362-025-00015-4.

[5] Garg V ,Bohara S ,Srivastav A . AI-driven sustainability marketing transforming consumers' perception toward eco-friendly brands[J].Discover Sustainability,2025,6(1):984-984.DOI:10.1007/S43621-025-01934-Y.

[6] Zhou C ,Jiang B . How do consumers react to AI-generated green marketing content? A hybrid analysis using PLS-SEM and text mining[J].Journal of Retailing and Consumer Services,2025,87104431-104431.DOI:10.1016/J.JRETCONSER.2025.104431.

[7] Making Science sells cloud and cybersecurity unit to Lutech to focus on digital marketing and AI[J].Worldwide Computer Products News,2025

[8] He J ,Luo Y ,Wang T . iDigiChat: intelligent digital marketing service chatbot for providing efficient customer services using artificial intelligence[J].Scientific Reports,2025,15(1):33074-33074.DOI:10.1038/S41598-025-14722-5.

[9] Marketing Expert Reveals 18 Secret Strategies Used by Entrepreneurs Making $120K+ Monthly Through AI and Automation[J].M2 Presswire,2025,

[10] Malhan M . Bridging the engagement gap in B2B marketing education: Integrating storytelling and AI[J].The International Journal of Management Education,2025,23(3):101279-101279.DOI:10.1016/J.IJME.2025.101279.

[11] Lajoie L P . Content marketing as a propaganda vehicle for a romantic-managerial conception of artificial intelligence[J].Critical Perspectives on Accounting,2025,102102810-102810.DOI:10.1016/J.CPA.2025.102810.

[12] Gan L C ,Lee Y Y ,Liew W T , et al. Cognitive and affective factors in AI virtual influencer marketing: A stimulus–organism–response and pleasure–arousal–dominance model approach[J].Digital Business,2025,5(2):100150-100150.DOI:10.1016/J.DIGBUS.2025.100150.

[13] Xie L . Research on the Transformation of Enterprise Marketing Strategy Driven by Artificial Intelligence[J].Pacific International Journal,2025,8(2):DOI:10.55014/PIJ.V8I2.802.

[14] Long C H ,Quan A N P ,Tra X H N , et al. Factors affecting customer engagement and brand loyalty in Vietnam FMCG: the moderation of artificial intelligence[J].Cogent Business & Management,2024,11(1):DOI:10.1080/23311975.2024.2428778.

[15] Mulović A T ,Antonija M ,Biljana M . Tools of Artificial Intelligence Technology as a Framework for Transformation Digital Marketing Communication[J].Tehnički glasnik,2024,18(4):660-665.DOI:10.31803/TG-20240708161118.

[16] Shameek M ,Kumar R S ,Tinu J . Developing artificial intelligence enabled Marketing 4.0 framework: an Industry 4.0 perspective[J].Qualitative Market Research: An International Journal,2024,27(5):841-865.DOI:10.1108/QMR-06-2023-0086.

[17] He X . Research on the Marketing Transformation Path of Household Appliance Enterprises under the Background of Artificial Intelligence[J].Modern Economics & Management Forum,2023,4(5):DOI:10.32629/MEMF.V4I5.1495.

[18] C. P L ,Michael M . Leveraging decision-making AI within marketing operations transformation[J].Journal of AI, Robotics & Workplace Automation,2023,2(2):115-120.

[19] IRI launches first always-on Marketing Mix Effectiveness platform for FMCG brands - powered by AI[J].M2 Presswire,2019

[20] Artificial Intelligence Comes to the Rescue for the Retail Industry; AI applications include chat bots, marketing, and supply chain optimization and will help strengthen customer relationships and create growth opportunities, finds Frost & Sullivan's Digital Transformation team[J].M2 Presswire,2017,

[21] Lin X ,Ruan W .Research on the Marketing Transformation of Insurance Industry Under Generative Artificial Intelligence Technology[C]//Shanghai Sanda University;Shanghai Regulatory Bureau ofState Administration for Financial Regulation,2023