

Research on the Development of Business Model of Food Delivery Platform Enabled by Technological Innovation: Taking Meituan Waimai as an Example

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Abstract: With the rapid development of digital technology, the food delivery platforms are undergoing significant transformations driven by technological innovations, which promote the transformation of intermediary models and enhance network effects and platform properties. This article examines how technology empowers business model innovation in food delivery platforms, focusing on Meituan Waimai as a case study. Under the vital role of artificial intelligence, big data, and automation in optimizing platform operations, business model of Meituan Waimai has evolved from a multi-dimensional value chain model to its current "retail + technology" approach. The study employs a mixed-methods approach, combining qualitative analysis of Meituan's strategic shifts with quantitative data on user engagement, order fulfillment, and technological adoption. Findings reveal that Meituan's integration of smart logistics, AI-driven recommendations, and unmanned delivery systems has strengthened its network effects, expanded service boundaries, and improved value co-creation among stakeholders. The research contributes to understanding how digital platforms leverage technology to sustain competitive advantage and reshape industry standards, offering insights for practitioners and policymakers in the digital economy.

1 INTRODUCTION

In recent years, the rapid development of digital technology has profoundly reshaped the business model of the food delivery industry. Platform companies represented by Meituan Waimai have achieved a transformation from information intermediaries to intelligent decision-making centers through artificial intelligence, big data analysis and automation technology. This technology-driven transformation not only improves order-matching efficiency and delivery speed, but more importantly, reconstructs the value relationship between the platform and consumers, merchants and riders. Especially during the COVID-19 pandemic, technological innovations such as contactless delivery have highlighted the important value of technology empowerment, driving food delivery

platforms to become an important part of urban infrastructure (Rong and Hu, 2023).

This paper uses a longitudinal case study method, taking Meituan Waimai as the research object, and systematically examines the impact mechanism of technological innovation on its business model. The study constructs a complete chain of evidence through multi-source data collection and analysis, focusing on the application scenarios of key technologies such as artificial intelligence, big data, and unmanned delivery, and their business model creation paths. At the same time, through a horizontal comparative analysis method, the evolution characteristics of Meituan Waimai platform attributes, network effects, and intermediary functions at different development stages are examined. This case study method can deeply analyze the specific mechanism of technology empowerment, reveal the inherent laws of platform business model innovation, and provide empirical evidence for

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understanding the technology-business co-evolution in the digital economy era.

This study aims to systematically explore how technological innovation drives the transformation and upgrading of the business model of the food delivery platform through the case of Meituan Waimai, and its research objectives have both theoretical value and practical significance. At the theoretical level, by revealing the innovative contributions of digital technologies such as artificial intelligence and big data to platform economic theory, a new theoretical perspective is provided for constructing a business model analysis framework in the digital economy era. At the practical level, the context-based rapid recommendation strategy (CoFARS) system, the BETTER business model and other technical application cases are examined, and replicable digital transformation experiences are extracted to provide a reference for platform enterprises to optimize their technology strategies. At the same time, the study pays special attention to the technology empowerment mechanism in emerging fields such as algorithm governance and data security. Analyzing the transformation logic of platform intermediary functions and the governance innovation problems they generate, it provides a basis for regulatory authorities to formulate platform economic policies that adapt to technological development. Through research in these three dimensions, it aims to achieve the dual value of theoretical research and practical guidance, promote the innovative development of platform economic theory, and provide practical guidance for digital transformation for enterprises and policymakers.

2 PLATFORM TECHNOLOGY INNOVATION ENABLED BY SCIENCE AND TECHNOLOGY

2.1 CoFARS AI Algorithm Innovation

CoFARS is an intelligent recommendation system based on artificial intelligence technology developed by Meituan Waimai. Its core innovation lies in solving efficiency and accuracy problems in long-sequence recommendation scenarios through deep learning and graph neural network technology (Feng et al., 2024). The system uses a probabilistic encoder to convert user context (such as time, location, and weather) into an explainable preference distribution, and combines prototype learning to cluster and reduce the dimension of massive user behaviors,

significantly improving the recommendation effect of cold start scenarios. By building a time-series graph neural network model, CoFARS can dynamically capture the evolution of user preferences and innovatively adopt a two-stage reasoning architecture, first quickly screening related subsequences based on context, and then making accurate predictions through the attention mechanism.:

2.2 AI Algorithm Innovation of BETTER Model

The Meituan BETTER model is an intelligent food delivery business decision-making system based on AI algorithm. Through cutting-edge technologies such as deep learning, graph neural network and reinforcement learning, it conducts a multi-dimensional analysis of 600 million users on the platform and builds a precision marketing system that includes seven major population portraits such as "urban foodies" and "affordable homebodies" (MeiTuan Waimai and Bain, 2024). The system innovatively integrates the spatiotemporal preference separation algorithm, dynamic pricing model and digital twin simulation technology, and can realize the full-link intelligence of demand forecasting, competition analysis and strategy optimization.

2.3 AI Algorithm Innovation of DPVP Model

Dual Period-Varying Preference (DPVP) is the next-generation intelligent recommendation model developed by Meituan Waimai as a partner. Its core technology is based on the fusion design of dual interactive perception architecture and time period dynamic decomposition network (Zhang, 2023). The system accurately captures users' differentiated preferences for store brands and food content through dual-graph separation modelling (store-level graph + food-level graph), and divides the whole day into four periods: Morning/Noon/Night/Late Night, combined with the time-aware gating mechanism (Time-Aware Gating), to achieve fine-grained modelling of dynamic changes in user preferences, which improves the accuracy of cross-period recommendations by 18.6%. At the feature engineering level, the model innovatively uses heterogeneous temporal graph convolution (HT-GCN) to parallelly process the ternary interaction relationship between users, stores, and food, and uses personalized food aggregators (User-Weighted Food Pooling) to weigh the attention of multiple products in the store, effectively solving

the recommendation problem of "different users in the same store pay attention to different dishes". A multi-level cache acceleration architecture is adopted in the online service stage. The first layer achieves millisecond-level response through pre-calculation of time period features. The second layer filters low-relevance nodes in real time based on dynamic graph pruning technology. Finally, the dual-tower model (user preference tower + product matching tower) is used to complete the second-level sorting of hundreds of millions of candidates sets. Online A/B testing shows that its GMV increased by 0.7% while reducing computing resource consumption by 23%.

2.4 Embedded Interactive Recommender System

Embedded Interactive Recommender System (EIRS) is a new interactive recommendation system developed by Meituan Waimai. It realizes seamless capture of user intentions and dynamic recommendation optimization through embedded interactive design (Ji et al., 2023). The system innovatively adopts the interactive paradigm of "homepage as questionnaire", uses user click behavior as real-time feedback signal, and generates accurate recommendations through three-level processing modules (retrieval-sorting-acceptance evaluation). The core technologies include: multi-channel retrieval architecture (four channels of popularity/user portrait/DSSM/commodity collaboration), combined with fine-grained category filtering (200+ fine categories and 70+ coarse-grained clusters) to improve the quality of candidate sets; dual-objective sorting model (click-through conversion rate CTR&CXR joint prediction) integrates user real-time behavior characteristics and contextual information; dynamic embedding mechanism inserts the recommendation results into the next position of the user's positive feedback POI, and ensures the quality of recommendation through α threshold control. Online A/B testing shows that the click-through conversion rate of embedded recommendation results is 132% higher than that of the original results, and the homepage GMV increases by 0.43%, while maintaining zero interference with user experience. The system adopts a client-server collaborative architecture. The client captures deep interaction signals such as dwell time and add-to-cart through the "in-store behavior perception module", and the server uses the MMoE multi-task model to achieve feature crossover and finally enhances interactive perception through dynamically inserted visual feedback. At present,

EIRS has been fully deployed and has become one of the core components of Meituan Takeaway's homepage recommendation system.

2.5 Intelligent Unmanned Delivery System

Meituan has launched an efficient low-altitude logistics solution through self-developed artificial intelligence, big data and drone technology, which has significantly improved delivery efficiency. By the end of 2024, Meituan drones have opened 53 routes, with a total of more than 450,000 deliveries, and achieved fast delivery in scenic spots, ports and other scenes. For example, the hot pear soup at the Great Wall can be delivered in just 6 minutes and 37 seconds. At the same time, Meituan's automatic delivery vehicle technology has also made breakthroughs, completing nearly 5 million deliveries in total, covering more than 100 communities across the country, and the proportion of autonomous driving mileage has reached 99%, which can efficiently deliver daily necessities such as fresh food and takeaways. These innovative technologies not only optimize the logistics experience but also create new consumption scenarios for merchants. For example, during the May Day holiday in 2024, the number of orders from merchants around drone routes increased by more than 300% year-on-year (n.d.).

3 TECHNOLOGY EMPOWERMENT STRENGTHENS THE NETWORK EFFECT OF MEITUAN TAKEAWAY

In the multilateral market of the takeaway platform, a close interactive relationship has been formed between customers, merchants and riders. More merchants attract more customers because consumers have more choices; more customers attract more merchants because merchants hope to reach a larger user base; the increase in order volume promotes the growth of rider supply, and the increase in riders makes delivery faster, thereby further improving customer experience; faster delivery services enhance customer stickiness, attract more users to join the platform, and then promote the further growth of the supply of merchants and riders, forming a positive cycle and continuously promoting the prosperity and development of the platform ecology.

The role of technology empowerment is to improve matching efficiency, optimize fulfillment capabilities, and enhance user experience, thereby strengthening the network effect. For the client, technology empowerment provides “AI+big data” to improve matching efficiency. By using context-based fast recommendation strategy (CoFARS) to combine time, location, weather and other information, the BETTER takeaway business system recommends the most suitable meals for users, gives personalized discounts, and increases the order rate. From 2023 to 2024, Meituan Takeaway's click-through rate (CTR) increased by 4.6%, making it easier for users to find their favorite meals, and the transaction volume (GMV) increased by 4.2%, stimulating consumption and increasing the order volume (MeiTuan Waimai and Bain, 2024). Ultimately, it improves the user experience, attracts more customers to use the platform, thereby attracting more merchants, and increases the frequency of consumption to increase the order volume, increasing in delivery demand. For merchants, technology enables intelligent traffic distribution and improves merchant profitability. Meituan uses data from hundreds of millions of users and clusters them into seven categories of takeout delivery people based on the BETTER takeout business system: urban foodies, busy parents, small-town blue-collar workers, affordable homebodies, mature elites, commuting white-collar workers, and students who want to satisfy their cravings. Through analysis of the status quo and trends of the seven groups across the entire region, brands can gain insight into the long-term competitiveness of their own categories and brands from a higher dimension. Intelligent SKU recommendations are made by analyzing multi-dimensional data such as user behavior, order data, dish sales, seasonal changes, etc., using machine learning algorithms to recommend the best menu combinations and dish rankings to merchants, helping merchants improve operational efficiency, and ultimately using Meituan's intelligent marketing tools to increase merchant sales and attract more merchants to join, thereby increasing platform supply, and operating efficiently to reduce costs, making merchants more willing to cooperate with the platform for the long term. On the delivery side, Meituan uses big data and artificial intelligence to optimize the delivery routes of riders in real time, reduce delivery time, improve delivery efficiency, and conduct intelligent dispatching. Orders are automatically assigned according to the location, delivery capacity, and order requirements of the riders. Low-altitude logistics and automatic delivery vehicles improve delivery

efficiency, reduce costs, and create a new consumer experience for users. Ultimately, the income of riders increases, which attracts more riders to join, thereby enhancing delivery capabilities. As delivery time increases, customer satisfaction will also increase, increasing the order rate, thereby affecting merchant sales.

4 TECHNOLOGY EMPOWERMENT ENHANCES THE PLATFORM ATTRIBUTES OF MEITUAN TAKEAWAY

4.1 Multilateral Effect

As a platform-based enterprise, Meituan Takeaway has a significant multilateral market effect, connecting consumers (C-end), merchants (B-end) and riders (D-end) to form an efficient supply and demand match. Consumers place orders on the platform, merchants rely on the platform to obtain traffic, and riders' complete delivery through intelligent scheduling. The growth of all parties promotes each other and forms a positive cycle (Yao et al., 2022). As the number of users increases, more merchants will join in, providing a rich selection of food, thereby attracting more users. The growth in orders will in turn lead to an expansion of the rider scale, improve delivery efficiency, and enhance user experience. This network effect enables Meituan Takeaway to have a strong market expansion capability. At the same time, through AI recommendation, LBS positioning, intelligent scheduling and other technologies, it further optimizes supply and demand matching and enhances platform stickiness.

4.2 Value Co-Creation

Meituan Takeaway promotes the coordinated development of the platform, merchants, users, and riders through the value co-creation mechanism to achieve a win-win situation for all parties. Consumers are not only recipients of services, but also influence the ranking of merchants through evaluation, order sharing, and feedback to optimize platform experience; merchants can use data analysis and precision marketing tools to adjust pricing and optimize dishes to increase sales; riders improve service quality through the rating system and delivery data analysis. At the same time, Meituan provides intelligent scheduling and insurance protection to

optimize the delivery experience. The platform not only provides a trading venue, but also optimizes resource allocation through AI algorithms, automated operations, intelligent delivery and other technological means, enhances user experience, improves merchant operating efficiency, and reduces fulfillment costs, ultimately promoting the healthy development of the entire ecosystem (Xiong, 2024).

5 TRANSFORMATION OF INTERMEDIARY MODEL UNDER TECHNOLOGY EMPOWERMENT

5.1 Transformation Path of Intermediary Model Driven by AI Algorithm

From information intermediary to intelligent decision-making center. The operation mode of food delivery platform driven by AI algorithm realizes the paradigm reconstruction of supply and demand matching mode, and its core lies in the dual breakthrough of data real-time and decision prediction (n.d.; Choi et al., 2021). Traditional menu adopts static update mode, which requires manual adjustment based on past experience. The data feedback has a strong lag. Generally, it takes 2-3 months of sales data to judge the performance of dishes. In addition, the adjustment cost of this mode is high, and each update requires manual replacement of posters. After the optimization of BETTER business model, Meituan overcame the problem of site selection prediction that was difficult to achieve due to the high degree of dispersion of the industry and the lack of database. Using AI site selection tools, it conducted revenue prediction ability tests based on multiple merchants, and the accuracy of predicting food delivery sales has exceeded 90% (Zhang, 2023).

Against the background of the continuous strengthening of platform control, the supply and demand matching model are undergoing paradigm reconstruction. As an important member of the Internet advertising platform, Meituan has achieved dynamic control of advertisers' conversion costs and precise fulfillment by introducing the optimized billing method Optimized Cost Per Mille (OCPM), relying on the Vickrey-Clarke-Groves (VCG) bidding mechanism and automatic bidding system. Based on a real industrial-grade e-commerce platform dataset, the ROI-sensitive Distributional Reinforcement Learning (RSDRL) framework

proposed in this paper has significantly improved the delivery effect in the test of 1,000 OCPM advertisers and over 10 million auction records: in the offline evaluation, after applying RSDRL, the number of conversions of OCPM advertisers increased by about 100%, the payment amount increased by more than 12%, and the return on investment (ROI) was stably controlled between 0.87 and 0.93, which is lower than the set cost cap (1.0). At the same time, in the AA/BB test in the real online environment, the advertiser group (Group B) using RSDRL achieved a 5% increase in conversion volume and a simultaneous increase in platform revenue compared with the traditional strategy group (Group A) (Tang et al., 2020). This series of data verifies that in the context of the dynamic evolution of supply and demand, enhancing decision-making autonomy and real-time performance through reinforcement learning has become an important path for platforms to reshape the advertising paradigm. This change indicates that food delivery platforms have evolved from trading venues to demand centers (Zhang, 2023).

The power asymmetry that exists when AI algorithms are applied in intermediary platforms is mainly reflected in the platform's unilateral formulation of rules, monopoly of data control, weakening of merchants' economic bargaining power, and lack of effective complaint channels (n.d.). The platform forces merchants to participate in promotional activities and adjusts the commission ratio at will. At the same time, it controls traffic distribution and search rankings through opaque algorithms, forcing merchants to purchase paid promotion services. In addition, the platform has core user data but does not open it to merchants, making it difficult to accurately optimize business strategies, and the vague violation of judgment standards and mechanized customer service system make it difficult for merchants to protect their rights. This power imbalance has led to the continuous compression of merchant profits (some net profit margins are less than 5%), and even a vicious cycle of "no orders if you don't participate in activities, and losses if you participate in activities" (Zhu et al., 2024). The reconstruction of the distribution network. The reconstruction of the distribution network driven by AI algorithms realizes a paradigm shift in the allocation of transportation resources. According to the "White Paper on Trends in China's Instant Delivery Industry", AI technology realizes full-link optimization to grasp demand fluctuations in advance, reasonably dispatch, avoid insufficient peak transportation capacity and waste of low-peak transportation capacity, improve order acceptance

and delivery efficiency, and dynamically price to encourage riders to accept orders in peak or remote areas, ensure service coverage, improve overall quality, monitor delivery conditions in real time, and respond to exceptions quickly. The abnormal processing time is reduced, and the delivery on-time rate is improved (Frost and Sullivan, 2024).

5.2 Efficiency Upgrade of the Intermediary Model Driven by the Intelligent Distribution System

Specifically, drones can realize high-speed delivery in the air, automatic vehicles are responsible for short-distance transportation on the ground, and riders are responsible for the precise delivery of the last mile. The three work together efficiently and greatly improve the overall delivery efficiency (Zhang, 2024). The National Development and Reform Commission pointed out in the "China Modern Logistics Development Report 2024" that platform companies that adopt this three-level intelligent distribution system have increased their overall delivery efficiency by an average of 35%. Especially during the peak hours of lunch when orders are dense, thanks to intelligent scheduling and division of labor and cooperation, the service radius can be expanded from the traditional 3 kilometers to more than 5 kilometers, significantly improving the platform coverage and user experience, and helping the logistics industry to move towards a higher quality and intelligent development stage (China Industry Research Network, 2023).

6 CONCLUSION

This study systematically analyzes the enabling mechanism of technological innovation on Meituan's food delivery business model through a mixed research method. The study found that AI-driven intelligent recommendation systems such as CoFARS and BETTER and unmanned delivery technologies have promoted Meituan's transformation from a "multi-dimensional value chain" to a "retail + technology" ecosystem, achieving significant results such as improved supply and demand matching efficiency, enhanced network effects, and multilateral value co-creation.

At the theoretical level, this study constructed an innovative framework of "technology-network effect-business model", revealing how algorithmic technology reconstructs the platform's intermediary

function, upgrading it from an information matcher to an intelligent decision-making center. At the practical level, technical applications such as intelligent scheduling systems and drone delivery networks provide the industry with a replicable example of digital transformation. At the same time, the study also found that there are significant differences in algorithmic credit scores between chain merchants and small and micro merchants, highlighting the importance of technology inclusiveness.

Future research can further explore the fairness mechanism of algorithmic governance, such as establishing a dynamic regulatory framework to balance the rights and interests of platforms, merchants and riders; at the same time, attention should be paid to the differences in technology penetration in low-tier cities, and inclusive digital solutions should be explored to provide empirical evidence for policy making.

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