

Data-Driven Business Analytics Practices in Haidilao: Artificial Intelligence Applications and Ethical Challenges in Customer Experience Optimisation

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Abstract. This study focuses on Haidilao's Artificial Intelligence (AI)-driven customer experience optimisation practices, aiming to explore how AI technology can enhance customer experience in food service. The study adopts the methods of literature induction and actual case observation (questionnaires, interviews and internal data were not used), and uses the perceived value theory, technology acceptance model (TAM) and service-dominant logic as the analytical framework. On this basis, Haidilao's AI application practices in intelligent queuing, personalised recommendation, automated ordering and intelligent feedback are analysed. In the case of Haidilao, AI-driven personalised recommendation, intelligent ordering and inspection management effectively shorten the ordering and response time and improve process stability and service consistency; customer experience in terms of convenience, fun and interactivity is enhanced. Based on the perceived value perspective, there is a positive correlation between value enhancement and loyalty, while technology acceptance affects customers' willingness to use smart touchpoints (e.g., service robots, recommendation systems). Privacy sensitivity poses an important trade-off with a preference for the "human touch"; customers are more likely to develop positive attitudes when the purpose of data use is transparent and optional. Overall, this case shows that "customer-centric" AI applications can optimise experience while improving operational efficiency, but the benefits depend on the fine-grained management of privacy, emotional service and scenario adaptation.

Keywords: Haidilao; artificial intelligence; customer perceived value; technology acceptance; restaurant digitalisation.

1. Introduction

In the digital economy, catering companies increasingly rely on data-driven business analytics to optimise customer experience. Among them, AI technology has become a key driver for improving service quality and operational efficiency [1,2]. As the application of AI technology expands in areas such as retail and hospitality, scholars and the industry have begun to focus on its impact on customer behaviour. Studies have pointed out that the introduction of AI and automation in the F&B industry can enhance customer experience by improving operational efficiency and customer interaction [1,3]. Leading global F&B brands have invested in applying AI for demand forecasting, menu personalisation and process optimisation. For example, McDonald's and Starbucks have used AI for sales prediction and personalised recommendations to improve customer satisfaction and corporate revenue. Haidilao, a well-known Chinese restaurant chain known for its excellent service, has actively explored digital transformation in recent years, introducing AI technology to improve operations and enhance customer satisfaction. Haidilao opened its smart hotpot restaurant in 2018, taking the lead in applying AI equipment such as robots and robotic arms to the back kitchen and services, which has attracted wide attention. The smart restaurant is equipped with a series of "black technology", including robotic arm stir-frying, automatic pot dispensing, intelligent storage and transmission of dishes, and immersive projection of the dining environment [4]. Through technological upgrades, Haidilao has achieved entertainment and interaction in the waiting area, a high degree of automation in the back kitchen, and digital customisation of dish tastes, which has significantly improved service innovation and customer novelty. In China, these practices prove that AI provides new opportunities for service innovation in the catering industry, which is highly relevant to customer experience

optimisation. One study validated a customer loyalty model for the catering industry in a post-pandemic context and found that service innovation is one of the most critical factors affecting loyalty, suggesting that technological innovation has a significant role in enhancing customer satisfaction and loyalty. At the same time, some scholars have pointed out that there are differences in customer attitudes towards the introduction of AI, with the younger generation tending to readily accept new technologies and pursue digital convenience experiences, while some older customers may be unfamiliar with or distrustful of machine services. In addition, AI applications are accompanied by concerns about data privacy and the degree of service personalisation, which need to be carefully weighed by companies [5-7]. This study focuses on the consumer perspective and selects Haidilao Smart Restaurant as a typical case to analyse the application practice and business impact of AI-enabled food service. Previous studies have mostly focused on staff management or operational efficiency improvement in the catering industry, while the perception and behavioural response to AI at the customer level have been underexplored. To fill this gap, this paper takes consumers as the object of study, without involving employee-level factors, and aims to answer: how the application of AI technologies in foodservice affects customers' perceived value and loyalty; what are customers' acceptance and privacy concerns about these technologies; and how should companies balance technological innovation and customer experience to cope with possible problems.

This paper focuses on literature review and single-case analysis from a consumer perspective: firstly, this paper reviews relevant theories and existing studies (including perceived value theory, TAM and Service-Dominant Logic (SDL), and construct a conceptual model as a scaffolding for the analysis; then, this paper takes Haidilao as a typical case study, and carry out a mechanistic compilation and generalisation of the specific application of AI in customer experience and shop operation, and put forward targeted managerial recommendations in the conclusion section. In conclusion, this paper puts forward target management suggestions.

2. Literature Review and Theoretical Model

2.1. Conceptual Explanation

Customer perceived value is an important concept in the field of marketing, which is usually defined as the overall evaluation of the utility of a product or service by customers after weighing the benefits and costs they have received. Relevant studies have firstly proposed the theory of perceived value from the perspective of customers, defining it as the trade-off between what customers subjectively perceive as "gain" and "loss". Subsequent studies have shown that higher perceived value can increase customer satisfaction and loyalty, and lead to loyalty behaviours such as repeat purchase and word-of-mouth. In the context of food service, customers' perceived value includes both functional value (e.g., dining efficiency, convenience) and emotional value (e.g., pleasure, novelty), etc. If AI technology can improve the quality of service, customised experience, or entertainment, it is expected to increase the perceived value of the restaurant to the customer and thus enhance their loyalty. For example, one study found that service quality indirectly affects customer satisfaction and loyalty through perceived value in the fast-food industry [8]. Therefore, in this paper, perceived value is used as a mediating variable to examine the mechanism of AI service on customer loyalty.

SDL was proposed by Vargo and Lusch, which advocates understanding the value creation process by focusing on services rather than products. The theory emphasises that enterprises and customers create value together through continuous interaction, and that customers are no longer passive recipients of value, but participants in value co-creation. Compared to the traditional commodity-driven logic, service-driven logic suggests that companies should focus on providing intangible service experiences, customer relationships and long-term value, rather than just selling tangible products. This concept is reflected in the catering industry by the emphasis on customer experience and relationships. Haidilao is renowned for its exceptionally attentive service, and its "smile service" and "face-changing performance" creates a unique intangible value that allows customers to feel the value of the experience beyond the dishes themselves. In the digital era, the

service-driven logic is not outdated, but has been strengthened by technological means: AI technology can be regarded as a new tool to improve the level of service, but the ultimate goal is still to enhance customer participation and value co-creation. For example, Haidilao has developed a personalised soup-based selection system, allowing customers to customise soup bases according to their personal preferences, and recording them into a file for future use, realising customised services with in-depth customer participation. This reflects the concept of "a thousand tastes for a thousand people" in the service-driven logic, i.e., the use of big data and AI to achieve a high degree of personalisation of services. In the analytical framework of this paper, this paper takes the service-driven logic as the macro-guidance and emphasise that the application of technology must be customer-oriented and co-create value through the interaction between AI and customers, rather than overpowering and weakening the service experience.

2.2. Theoretical Model

TAM is a widely used theory in the field of information systems to explain users' willingness to adopt new technologies. TAM suggests that users' intention to use technology mainly depends on two main perceptions, Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Where Perceived Usefulness refers to the extent to which users believe that using the technology will enhance their performance, and Perceived Ease of Use refers to the extent to which users perceive that the level of effort required to learn and use the technology is low. Both positively influence users' attitudes and intentions to use, respectively, and perceived ease of use also enhances perceived usefulness. TAM-based studies have shown that in self-service contexts such as catering, customers' intention to use self-service technology is determined by a combination of perceived usefulness, enjoyment of use and attitude. Therefore, when implementing technologies such as smart self-service ordering and unattended service, catering companies should focus on improving the usefulness and ease of use of the system and adding as much fun as possible to increase customer acceptance and willingness to use [3,5,9]. This study will introduce the dimension of technology acceptance into the model to measure customers' recognition and propensity to use restaurant AI applications (e.g., self-service ordering platforms, intelligent recommendation systems, etc.), so as to examine the applicability of the TAM elements in restaurant consumption scenarios.

3. Haidilao Case

Next, this paper takes Haidilao as the research object to introduce its specific application of AI technology in data-driven business analysis practice. First of all, Haidilao uses AI to analyse massive customer data, including ordering habits, taste preferences, consumption time and other information, and accordingly automatically generates a personalised dish recommendation list for customers' reference. Haidilao has a large digital membership base, providing sufficient data support for personalisation [10]. This intelligent recommendation mechanism can fit customer needs and enhance customer satisfaction and freshness in the ordering process [2,4].

Secondly, by introducing an intelligent customer management system, Haidilao analyses customers' service evaluation and demand feedback in the dining process in real time, and the AI model assists the restaurant to adjust the service strategy in a timely manner to ensure that the customers have good experience in the waiting, dining, and checking out processes. For example, the system can judge whether the service needs to be improved based on the customer's expression or evaluation content and remind the clerk to follow up in a timely manner. In addition, Haidilao launched the "Xiaomei" intelligent telephone robot as early as 2018, which is used to accept customer reservations, queuing and enquiry services. This voice AI assistant has already answered a large number of incoming calls, easing the pressure on the line during peak periods. Although customers and employees felt uncomfortable with the robot in the early stage of implementation, with the improvement of the technology, the system has effectively improved the efficiency of service response [4,9].

Again, Haidilao has developed an intelligent ordering platform, including a mobile application and an automatic ordering tablet with a follow-up delivery system. The application of AI technology optimises the ordering process, improves the efficiency of food preparation and delivery, and reduces manual errors, thus improving operational efficiency and reducing labour costs, enabling customers to enjoy a faster and smoother service experience [3,11].

In terms of shop operation and management, Haidilao has introduced an intelligent AI inspection system. The system automatically monitors the service norms and hygiene conditions of the shops through cameras and sensors and uses image recognition technology to detect problems in a timely manner and notify managers to deal with them. Haidilao's AI shop inspection application achieves continuous detection of key links and automatic alerts of abnormalities, significantly improving efficiency over manual spot checks and enhancing consistency and compliance [12].

In the supply chain and internal operations, Haidilao also actively uses AI technology to improve efficiency and control quality. For example, the company has established an intelligent site selection system based on big data, whereby clicking on a certain area in the system can retrieve information such as local population density, business district environment and the layout of existing shops, and score potential sites according to Haidilao's standards, so that site selection-which previously required extensive on-site scouting by large field teams-can now be completed by a small group of employees. In addition, in 2023, Haidilao officially launched the "KPAD" kitchen management system, which digitally controls raw material purchasing, inventory and production with the help of the Internet of Things and algorithms, improving the accuracy and efficiency of ingredient management. Each dish is affixed with an electronic tag (RFID) to track the production time and shelf life, and the system will automatically warn of the approaching expiry date; some smart shops also use robotic arms in the back kitchen to assist in the preparation of dishes, and deliver them via conveyor belts or robots, thus ensuring food safety and food delivery efficiency. At the same time, through the linkage of the inventory system and ordering system, Haidilao is able to launch time-limited offers for slow-selling dishes to speed up inventory consumption and avoid waste, and its supply chain digitisation initiatives have helped more than 600 shops across the country to reduce slow-selling and waste and improve turnover [12]. These AI-enabled internal management tools effectively reduce operational risks and ensure the consistency of shop product quality.

In addition, Haidilao has deployed AI-driven intelligent robots in some of its shops, including food delivery robots and welcome robots, which can take on tasks such as delivering dishes and guiding customers to their seats, which not only reduces the work intensity of frontline employees, but also brings novel and interesting experiences to customers and enhances the technological sense of service [3,5,9].

Through the above multi-faceted AI practices, Haidilao has achieved significant improvements in operational efficiency and customer satisfaction. For example, the company uses deep learning models to improve the customer feedback mechanism, more accurately match consumer needs and implement personalised marketing, thus enhancing customer loyalty and sales performance. According to public data, Haidilao's operating revenue reached 42.755 billion yuan in 2024, a year-on-year increase of 3.1%, and its net profit was 4.7 billion yuan, a year-on-year increase of 4.6% [10]. These results are partly due to its data-driven refined operation and also show that AI-enabled business analytics can effectively optimise customer experience and create significant business value. At the same time, Haidilao focuses on balancing technology applications with customer privacy and experience. According to public reports, the face recognition welcome system it had developed was stopped due to privacy and security considerations because it might cause discomfort to customers, which shows that it is equally important to respect customers' feelings and information security while pursuing intelligence. Overall, the case of Haidilao proves that data and AI-driven business analytics has a broad prospect in the catering industry, which not only improves the operational performance of the enterprise, but also provides a useful reference for the digital transformation of the industry.

4. Conclusion

Taking Haidilao as a typical case, this paper provides an in-depth consumer perspective analysis of the practice of AI to promote the development of catering enterprises. By introducing the perceived value theory, TAM and SDL, this paper constructed a conceptual model of AI-enabled customer experience, and conducted a mechanistic analysis and cross-checking based on case evidence. The main conclusions are as follows: the application of AI technology can significantly enhance customer perceived value and loyalty, as exemplified by the smart service practice of Haidilao smart restaurant, which fits the trend of digital transformation in the catering industry. Customers are generally open to AI in restaurants, but they are concerned about the balance between privacy and experience, and they want to balance efficiency and emotion, convenience and privacy, so restaurant companies need to consider these psychological expectations. Under the case study framework, perceived value explains the mechanism of the relationship between AI services and loyalty, and privacy sensitivity and interaction preference reflect possible moderating effects, providing insights for companies to accurately implement policies. Despite the positive results of Haidilao's AI practices, the ensuing ethical and managerial challenges cannot be ignored. In this regard, this paper suggests that in the process of promoting AI application in the catering industry, it should adhere to the core objective of enhancing customers' perceived value and satisfaction, and reasonably balance the efficiency and emotional experience; when introducing technologies such as intelligent recommendation, automated ordering, and service robots, it is necessary to pay simultaneous attention to the protection of data privacy and the construction of user trust, so as to make the use of transparent, controllable, and selectable; in parallel, the industry should promote data-technology integration while strengthening privacy governance and ethical safeguards; make the front-office service and back-office management form a closed loop; finally, combine the scale of various types of shops with the characteristics of the customer base, and gradually deploy high ROI AI scenarios to ensure that the technology investment can be transformed into sustained business value and good customer reputation.

Due to objective limitations, this paper still has some shortcomings, leaving room for further research: it is mainly based on public secondary data and published studies, lacking internal data and first-hand interviews; it is developed with a single case, with limited extrapolation; it is mostly a cross-sectional description, which is difficult to reflect the long-term and dynamic effects; it focuses on the consumer's point of view, with insufficient attention paid to the employees, the organisation, and the technical operation and maintenance; it is biased towards the principles in the discussion of privacy and compliance, and it lacks quantitative tests. This study relies solely on publicly available secondary sources and does not collect, store, or process any personally identifiable information (PII) or other sensitive personal data; if user reviews are quoted, they are aggregated anonymously. This paper can be improved by obtaining real operational data, conducting multiple case studies and tracking research.

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