Research on Strategies to Improve Operational Efficiency of Catering Enterprises from the Perspective of Data Empowerment

Yanchen Qin[a]
School of Sociology and Social Policy, University of Leeds, Leeds, LS2 9JT, U.K.

Keywords: Data Empowerment, Restaurant Industry, Digital Transformation, Inventory Management, Intelligent Scheduling.

Abstract: In the context of increasing market fluctuation and high operational pressures, the traditional management models in the restaurant industry are facing serious limitations in terms of responsiveness and efficiency. This study explores how digital technologies, particularly big data analytics, artificial intelligence and intelligent systems can empower restaurant enterprises to strengthen operational performance. By analyzing industry issues across inventory management, employee scheduling and customer marketing, this paper proposes three data-driven strategies: dynamic inventory management, intelligent scheduling systems, and precision marketing. The paper will use cases and data to illustrate the effectiveness of data empowerment in reducing waste, optimizing labor resources and improving customer engagement. Furthermore, the paper discusses the institutional safeguards and technological prerequisites necessary for successful digital transformation. The findings offer both theoretical insights and practical frameworks to support restaurant enterprises in their transition toward a data-enabled operational paradigm.

1 INTRODUCTION

In today's rapidly changing market environment, the restaurant industry is facing unprecedented competitive pressure. On the one hand, consumers need more personalized services. It promotes restaurant businesses to continuously optimize their services. On the other hand, rising labor costs and raw material prices are squeezing profit margins. In this context, traditional restaurant management models are gradually exposing their problems such as information lag and slow response (He et al., 2019), making it difficult to meet the demands of modern operations.

With the development of technologies such as big data, artificial intelligence (AI), and the Internet of Things (IoT), data empowerment has become a key force driving industrial transformation. In the restaurant sector, leveraging data technologies to guide operational decisions has evolved from an "optional" approach to a "mandatory" one. For example, restaurants can optimizing their procurement plans based on historical sales data, conducting precision marketing using customer behavior data (Nygaard et al., 2007), and using data models to predict foot traffic for scheduling purposes are all practical examples of data empowerment.

This study aims to explore how restaurant enterprises can enhance operational efficiency through data technologies from the perspective of data empowerment. By analyzing practices from representative domestic and international companies, the research examines the underlying driving mechanisms and paths for strategy implementation. While existing literature widely acknowledges the positive impact of data technologies on operational performance, there is still a lack of systematic studies with universal applicability and practical operability at the implementation level. Therefore, this paper focuses on data empowerment and scene innovation, focusing on the main operational problems faced by catering businesses and how to solve these problems with data empowerment, and further exploring what feasible strategies can be applied to improve operational efficiency.

Methodologically, this study combines literature review and case analysis, focusing on three key dimensions-inventory management, employee

[a] https://orcid.org/0009-0007-7405-8976

Qin, Y.
Research on Strategies to Improve Operational Efficiency of Catering Enterprises from the Perspective of Data Empowerment.
DOI: 10.5220/0013849500004719

In *Proceedings of the 2nd International Conference on E-commerce and Modern Logistics (ICEML 2025)*, pages 554-559
ISBN: 978-989-758-775-7

scheduling, and customer marketing-to propose a systematic, data-driven strategy for optimizing operations.

2 OPERATIONAL SHORTCOMINGS OF CURRENT RESTAURANT ENTERPRISES AND THE DRIVING FORCES OF DATA EMPOWERMENT

Although the restaurant industry has experienced rapid growth in recent years, it still faces multiple challenges in actual operations (Hanaysha, 2016; He et al., 2019), particularly in areas such as refined management, resource allocation, and responsiveness to market changes (Rumore et al., 1999; Al-Abbadi et al., 2020). This section analyzes these issues from four key dimensions-inventory, workforce, technology, and application-and interprets them in relation to the driving forces behind data empowerment (He et al., 2016; Nygaard et al., 2007).

2.1 Prominent Issues of Inventory Waste

Traditional restaurant enterprises often rely on chefs' personal experience or historical sales data to make decisions regarding ingredient procurement. This method lacks in-depth analysis of real-time market fluctuations, climate impacts, and other influencing factors. Such an experience-oriented approach often leads to a disconnect between procurement forecasts and actual demand, resulting in imbalanced inventory structures. Some ingredients may expire and will be discarded due to overstocking. Others may run short due to underestimation, directly affecting the stability of menu offerings and the overall dining experience. According to the 2023 China Catering Industry Report, approximately 23% of raw material loss are due to poor inventory management. This not only increases operating costs but also raises food safety concerns, potentially harming brand reputation and customer satisfaction.

2.2 Lack of Scientific Basis in Workforce Scheduling

In daily operations, restaurants often struggle with a mismatch in labor allocation-experiencing staff shortages during peak hours and idle labor during off-peak times. Most restaurants still rely on store managers' experience to make scheduling decisions. This situation is especially pronounced in fast-food chains where customer flow fluctuates frequently. This approach makes it difficult to match staffing with service demand accurately. It also increases employee workload and labor costs. When sudden events or holiday traffic surges occur, the lack of intelligent tools for real-time analysis makes it more complicated to response. As a result, service quality declines, customer waiting times increase, satisfaction declines and return rates increase. Lacking a scientifically and dynamically adjustable scheduling system has become a major obstacle in improving operational efficiency and customer experience.

2.3 Weak Technological Infrastructure

Although some restaurant enterprises have gradually adopted systems such as POS (Point of Sale), CRM (Customer Relationship Management), and supply chain management platforms in recent years, there are still significant data silos persist among these systems. Due to the lack of unified technical architecture and data hub, these systems remain disconnected, making data integration more difficult. Operators often must manually export and compare data across multiple platforms for analysis, which is time-consuming and error prone. Furthermore, the lack of cross-module data synergy hampers the ability to implement truly data-driven strategies in key areas such as marketing, inventory replenishment, and workforce management, undermining the overall efficiency and responsiveness of the enterprise.

2.4 Immature Application of Data Scenarios

With the advancement of digitalization, more small and medium-sized restaurant businesses are beginning to recognize the value of data. They attempt to collect customer data through membership systems, online ordering platforms, and other channels. However, the depth and breadth of data utilization remain at a basic level. On the one hand, there is a lack of internal capabilities for data analysis and technological application. On the other, most enterprises only use data for generating simple reports and sales summaries, without establishing effective customer segmentation, predictive models, or personalized marketing systems. While many companies possess large volumes of customer transaction data, they fail to extract underlying

behavioral patterns or preferences, nor can they conduct targeted marketing or service innovations based on data. As a result, data remains “asleep,” unable to be truly converted into business value.

3 MAIN STRATEGIES

To address the current operational challenges faced by restaurant enterprises-such as inventory waste, inefficient workforce scheduling, and lack of precision in marketing-this study proposes three operational optimization strategies. These strategies are developed in line with trends in data empowerment and the application of technological tools. Focusing on inventory management, employee scheduling, and marketing management. The aim is to leverage data-driven approaches to enhance both operational efficiency and customer satisfaction, thereby helping enterprises gain competitiveness in the market.

3.1 Dynamic Inventory Management

Traditional inventory management in the restaurant industry often relies on chefs’ experience or past sales data for forecasting. This approach typically lacks real-time responsiveness and can result in both over-purchasing and frequent stockouts. To solve this type of problems, this study proposes a data-empowered strategy of “Dynamic Inventory Management” (He et al., 2019). This strategy encourages enterprises to build intelligent procurement forecasting models based on multidimensional data. These models integrate key variables such as historical sales data, holiday data, weather trends, and promotional activities to forecast future sales scientifically. This would optimize inventory allocation.

In practice, enterprises can utilize Business Intelligence (BI) systems or professional supply chain SaaS platforms to adjust procurement plans and coordinate across multiple locations, thereby improving the efficiency of using raw material. For example, after KFC introduced a sales forecast-based inventory management system in some of its stores, it successfully reduced food waste and minimized customer complaints due to stockouts, enhancing overall stability and satisfaction.

3.2 Intelligent Scheduling Systems

Traditional employee scheduling is based on subjective judgments by store managers, lacking analysis of customer flow data and employees’ working habits. To improve efficiency and resource utilization, this paper proposes building an “Intelligent Scheduling System” (Hanaysha, 2016). By collecting and analyzing historical customer flow data, trends during holidays and unique events, along with employee attendance preferences and performance records, enterprises can create data-driven scheduling models to optimally allocate human resources by day and time slot.

Taking Haidilao as an example, by deploying a data analysis platform it can access customer reservation information and on-site customer flow data in real time and intelligently allocate personnel positions and shift times based on preset algorithms (Biao & Rojniruttikul, 2023). With predefined algorithms, it intelligently assigns staff roles and shift times. This approach significantly reduces customer wait times during peak hours, improves the dining experience, and increases employee efficiency and satisfaction. This type of systematized scheduling is especially suitable for chain restaurant operations, helping maintain service quality as businesses scale.

3.3 Precision Marketing

In the context of increasingly fierce competition in the catering industry, marketing activities have become the key to improving customer stickiness and conversion rates. Different from the traditional "one-size-fits-all" marketing approach, data-driven precision marketing strategies emphasize customer behavior data as the basis , and through in-depth mining of consumption records, taste preferences, purchase frequency, social media tags and other dimensions, customers are refined AS profiled and classified, and personalized marketing content and push strategies are formulated (Gupta et al., 2024).

Using membership systems and customer management platforms, businesses can categorize users into segments such as weekday high-frequency lunch customers, weekend family diners, or holiday travelers, and push differentiated promotions, personalized coupons, and dish recommendations based on real-time weather, seasonal holidays, and store locations. Furthermore, some leading enterprises have adopted A/B testing mechanisms to experiment with different marketing messages and timing strategies to further improve conversion rates and customer satisfaction. For example, by pushing highly targeted text messages or app notifications, chain brands have significantly increased the response rate of membership activities (Hanaysha, 2022).

Overall, these three strategies offer high practicality and strong potential for implementation, providing a clear pathway for digitalized operations in the restaurant industry. However, successful strategy execution is not instantaneous. It requires a comprehensive support system and robust internal management mechanisms. Particularly during the process of digital transformation, enterprises must also overcome multiple challenges such as organizational restructuring, employee training, technology adaptation, and data security. The next section will further explore the safeguards and potential risks involved in implementing these strategies, offering actionable solutions to ensure that the concept of "data empowerment" can be effectively transformed into sustainable operational performance.

4 IMPLEMENTATION SAFEGUARDS, OPPORTUNITIES, AND CHALLENGES

Although data empowerment offers a new path for restaurant enterprises to improve operational efficiency and service quality, its practical implementation requires comprehensive safeguards and supporting measures. Only by aligning efforts in key areas such as technical capabilities and talent deployment can data strategies be effectively transformed from concept to practice. At the same time, the opportunities and challenges brought about by digital transformation must be properly addressed to ensure steady and sustainable development throughout the process.

4.1 Establishing a Data Management Mechanism

Data management is the foundation of data-driven decision-making. To ensure systematic and standardized data usage, enterprises should set up dedicated data management positions or a centralized data team for data collection, cleansing, modelling, analysis, and output. This team should not only have technical expertise but also be able to work closely with different departments to ensure data accuracy.

It is recommended to adopt a "headquarters-led + store-level execution" governance framework. Headquarters should define data collection standards, build platform infrastructure, and develop analysis models, while stores focus on front-end data collection and preliminary application. This setup improves management efficiency while maintaining consistency across stores. Additionally, enterprises should develop a "data asset map" to define the use cases for various types of data (e.g., sales, inventory, customer feedback), providing a clear pathway for future data applications and business innovation.

4.2 Clarifying Interdepartmental Collaboration Mechanisms

Data empowerment is not the exclusive domain of the IT department-it is a company-wide initiative requiring cross-functional collaboration. Many restaurant enterprises currently suffer from departmental silos and severe data fragmentation, limiting the effectiveness of data empowerment. To address this bottleneck, companies must promote interdepartmental cooperation and break down the barriers between IT, finance, supply chain, HR, and marketing functions.

Practical steps include forming cross-functional data project teams, where each department has clear responsibilities and objectives. Establishing KPIs and incorporating data usage performance into evaluations for each department can also improve efficiency. Regular holding data meetings will further enhance data literacy and team engagement. Only through the alignment of organizational structure and data strategy can the full value of data be realized.

4.3 Introducing and Integrating Technological Tools

The effective selection and integration of technological tools is critical for achieving data empowerment. For small- and medium-sized restaurant businesses with limited technical foundations, building an in-house data platform may be costly and risky. It is therefore advisable to first adopt comprehensive systems such as Meituan's catering ERP, Keruyun's digital store management platform, or 2DFire's restaurant system. These platforms typically offer integrated modules for sales analytics, procurement and inventory management, employee scheduling, and membership marketing—helping to automate operational data collection and enable closed-loop management. This reduces the technical threshold and cost of implementing data empowerment tools.

During system selection and deployment, special attention should be paid to platform compatibility and integration feasibility to avoid high secondary development costs and disconnected data flows. Open

platforms that support API interfaces and cloud deployment are preferred to ensure seamless data connectivity between different business systems and create a unified data infrastructure within the enterprise.

4.4 Opportunities and Challenges Coexist

As intelligence gradually becomes the mainstream of the industry, data empowerment has undoubtedly brought unprecedented development opportunities to catering companies (Pantano et al., 2020). It supports the integrated goal of "cost reduction, efficiency improvement, and customer acquisition"-by optimizing inventory management to reduce food waste, improving labor efficiency through smart scheduling, and enhancing customer retention and frequency via precision marketing. As chain and large-scale operations become more prevalent, digital capability is increasingly becoming a core competitive advantage.

However, the transformation process also presents several real-world challenges.

First, the initial investment of digital transformation is high. Digital transformation requires substantial funding for system procurement, hardware/software upgrades, data platform construction, and long-term maintenance, which may place financial pressure on small and medium-sized enterprises.

Second, employees resist change. Some frontline employees and middle managers may distrust or lack proficiency in digital systems, exhibiting resistance that hinders system adoption and project progress.

Third, digital transformation faces data security and privacy risks. With large-scale data collection and sharing, safeguarding customer privacy and IT system security is critical to preventing data leaks or cyberattacks.

Therefore, as transformation progresses, enterprises must implement risk mitigation mechanisms, staff training programs, and incentive systems. For example, offering data literacy workshops, creating awards like Star of Data Application, and strengthening cybersecurity infrastructure can improve organizational resilience. These measures ensure the sustainability of the strategy and help enterprises truly harness the competitive advantages brought by data empowerment.

5 CONCLUSION

This paper takes data empowerment as the entry point of research, focusing on how restaurant enterprises can improve operational efficiency and service quality through digital means in the context of technological transformation. Based on a systematic analysis of the industry's current state, it is found that most enterprises face common issues in areas such as inventory, workforce scheduling, and marketing outreach. This study draws on the practices and technological applications of leading companies and proposes three pragmatic and forward-looking core strategies: dynamic inventory management, intelligent scheduling system, and precision marketing operations.

The study demonstrates that if restaurant enterprises systematically introduce data analysis tools, establish complicated data management mechanisms, and tailor their strategies based on localized business scenarios, they can effectively overcome the limitations of traditional operational models. On one hand, data-driven approaches help reduce operational costs such as raw material waste and labor redundancy, thereby improving overall efficiency. On the other hand, they also enhance customer experience, strengthen brand loyalty, and improve responsiveness to market changes. Together, these benefits support the dual goals of "cost optimization" and "value creation," providing an intrinsic driving force for sustainable business growth.

In the future, with the popularization of technologies such as artificial intelligence, algorithm optimization, and digital twins, data empowerment in the catering industry will move from simple applications to deep intelligence. Data will not only improve logistics management, supply chain collaboration, and operational forecasting, but will also go deeper into areas such as menu innovation, customer emotion perception, and customized experiences, continuously expanding the digital capabilities of enterprises.

At the same time, enterprises must continue to strengthen the cultivation of a "data culture" applying transformation across multiple dimensions, including company concepts, organizational mechanisms, and employee skill development. This is essential to transit from "passive response" to "proactive innovation."

In conclusion, data empowerment is not a short-term tactic, but a profound transformation of the operational paradigm. Only by seizing the chance of digital age, restaurant companies can achieve higher

development and become technology-driven industry leaders through continuous investment.

REFERENCES

Al-Abbadi, L. H. M., Alshawabkeh, R., & Rumman, A. A. (2020). Knowledge management processes and innovation performance: The moderating effect of employees' knowledge hoarding. *Management Science Letters*, 10(7), 1463–1472.

Biao, L., & Rojniruttikul, N. (2023). Impact of digital technologies, modern infrastructure, self-service learning experience, and customer satisfaction at Haidilao Restaurant in China. *Proceedings of the 2023 5th International Conference on Management Science and Industrial Engineering (MSIE 2023)* (pp. 1–8). ACM.

Gupta, M., Dheekonda, V., & Masum, M. (2024). Genie: Enhancing information management in the restaurant industry through AI-powered chatbot. *International Journal of Information Management Data Insights,* 4, 100255.

Hanaysha, J. R. (2016a). Testing the effects of food quality, price fairness, and physical environment on customer satisfaction in fast food restaurant industry. *Journal of Asian Business Strategy,* 6(2), 31–40.

Hanaysha, J. R. (2016b). Examining the effects of employee empowerment, teamwork, and employee training on organizational commitment. *Procedia - Social and Behavioral Sciences,* 229, 298–306.

Hanaysha, J. R. (2022). Impact of social media marketing features on consumer's purchase decision in the fast-food industry: Brand trust as a mediator. *International Journal of Information Management Data Insights,* 2(2), 100102.

He, Z., Cheng, T. C. E., Dong, J., & Wang, S. (2016). Evolutionary location and pricing strategies for service merchants in competitive O2O markets. *European Journal of Operational Research*, 254(2), 595–609.

He, Z., Han, G., Cheng, T. C. E., Fan, B., & Dong, J. (2019). Evolutionary food quality and location strategies for restaurants in competitive online-to-offline food ordering and delivery markets: An agent-based approach. *International Journal of Production Economics*, 215, 61–72.

National Information Center. (2023). *Digital development report of China's catering industry*. National Information Center.

Nygaard, A., Haugland, S. A., & Myrtveit, I. (2007). Market orientation and performance in the service industry: A data envelopment analysis. *Journal of Business Research,* 60(11), 1191–1197.

Pantano, E., Pizzi, G., Scarpi, D., & Dennis, C. (2020). Competing during a pandemic? Retailers' ups and downs during the COVID-19 outbreak. *Journal of Business Research*, 116, 209–213.

Rumore, N., Zhu, Z., Tanner, J., & Scheuerman, L. (1999). Effectiveness of competitive strategies in fast food markets: An analysis of customers' preferences. *Journal of Restaurant & Foodservice Marketing,* 3(3–4), 39–47.