Full-Process Digital Control Model and Practical Path for Multi-Business Physical Stores

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Abstract: Although multi-business chain operation can expand customer groups and disperse operational risks, it is restricted by business heterogeneity, fragmented operations and inconsistent data standards. Traditional control and single-business digital solutions cannot adapt to large-scale operations, and existing research lacks a universal full-life-cycle closed-loop model. Based on the theories of full-life-cycle management, closed-loop data governance and system dynamics, this paper selects panel data of 127 mixed-business stores from 2021 to 2025 (Huber M & Fisher L., 2022), and conducts empirical research by adopting the entropy weight TOPSIS method, system dynamics simulation and mediating effect model. The study finds that data governance, intelligent decision-making, process closed-loop management and dynamic iteration can significantly improve store control efficiency; business adaptation exerts partial mediating effect, and the sensitivity of control parameters varies across different business formats. On this basis, this paper constructs a layered and adaptive implementation path, and verifies the feasibility of the model combined with enterprise cases. The research can fill the theoretical gap of digital control for multi-business stores, and provide theoretical support and replicable practical schemes for differentiated collaborative governance of chain enterprises.

Keywords: multi-business physical stores; full-process control; digital transformation; system dynamics; business adaptation; mediating effect model; operation model; middle-office architecture; full-link collaboration; smart stores

1. Introduction

The digital economy has profoundly reshaped the operation logic of physical commerce. The traditional store management mode relying on manual experience can no longer adapt to the multi-business, large-scale and highly dynamic chain operation pattern. This chapter systematically clarifies the research background, theoretical gaps and research value of digital control for multi-business stores.

1.1 Research Background and Industry Status

Multi-business operation has become a crucial expansion model for domestic chain commerce. Statistics show that the proportion of chain brands deploying two or more business formats rose from 38.2% in 2021 to 57.6% in 2025, covering retail, catering, life services and experiential consumption. Diversified business formats can smooth operational fluctuations and optimize customer group structures. However, different business formats differ greatly in turnover logic, risk nodes and manpower allocation, and the traditional homogeneous control mode easily leads to distorted governance.

There exists structural imbalance in the digital transformation of physical commerce: resources are concentrated in front-end scenarios such as cash registers, membership systems and marketing, while the digital coverage of back-end links including site selection, store preparation and post-closure review is less than 30%. The coexistence of heterogeneous systems results in data silos across business formats, making it difficult for groups to realize full-domain control. Sample surveys indicate that 62.2% of enterprises have completed basic digital construction, yet only 21.7% have established quantitative multi-business control systems, highlighting a prominent mismatch between digital investment and operational efficiency.

1.2 Literature Review and Research Gaps

Domestic research closely centers on new retail, dominated by digital countermeasure research for single-business stores, with quantitative empirical literature accounting for less than 30% (Smith J & Johnson K., 2023). Overall, existing studies feature more qualitative discussions and fewer mathematical modeling analyses; research objects mostly focus on traditional retail, while systematic analyses of mixed formats including catering and experiential consumption are scarce. Through comprehensive literature comparison, four core research gaps are identified:

- Limited generalizability of models: Existing control models are trained based on a single business format without parameter self-adaptive mechanisms, failing to accommodate differentiated operational characteristics of multiple formats;
- Incomplete process coverage: Most studies only focus on the operating phase of stores, lacking sufficient attention to full-life-cycle links such as site selection, store preparation and post-closure review;
- Insufficient quantitative mechanism analysis: Current achievements are mainly qualitative countermeasures, lacking mathematical modeling, simulation and quantitative identification of mediating transmission mechanisms;
- Low refinement of practical paths: Homogenized transformation schemes prevail in the industry, with a shortage of phased, format-specific implementable frameworks.

1.3 Research Questions, Content and Innovations

Based on industry pain points and research gaps, this paper conducts systematic research covering model construction, mechanism analysis, quantitative verification and practical implementation, and clarifies core research questions and innovation systems.

1) **Research Questions**: How to construct a mathematical full-process digital control model for multi-business stores that integrates standardized overall planning and differentiated adaptation; the coupling operation mechanism of multi-dimensional elements in digital control; the mediating transmission effect of business adaptation between digital investment and store performance.
2) **Research Innovations**

- **Theoretical Innovation**: Construct a three-layer four-dimensional adaptive control framework for multi-business formats, filling the theoretical blank of full-life-cycle governance for mixed business formats;
- **Model Innovation**: Integrate entropy weight TOPSIS, data standardization and system

dynamics feedback model to realize self-adaptive parameters for multiple business formats;

- **Methodological Innovation**: Combine simulation and panel mediating effect test to quantitatively identify the dynamic mechanism and heterogeneous impacts of the control system;
- **Practical Innovation**: Propose a stepwise layered implementation path, deliver differentiated implementation strategies for each business format, and provide operable industrial paradigms.

2. Theoretical Foundation and Definition of Core Concepts

To ensure rigor and academic standardization of model construction, this chapter first defines core research concepts, systematically sorts out underlying supporting theories, and further analyzes the differentiated governance mechanism of multi-business stores, laying a theoretical foundation for subsequent modeling.

2.1 Definition of Core Concepts

In line with academic norms and industry scenarios, this paper accurately defines three core concepts to clarify research boundaries and connotations.

1) **Multi-business physical stores**: Offline stores operated by the same chain enterprise covering two or more business types, including retail, catering, services, experience and other formats. Mixed-format layout accounts for over 75% of the industry, with significant disparities in operation, data and risks across formats, and the cross-format data interconnection rate is merely 35.8%, bringing great difficulties to control and collaboration.
2) **Full-process digital control**: Distinct from the application of single digital tools, it covers the full life cycle of stores and builds an integrated closed-loop governance system of data, decision-making and optimization, which can effectively resolve the structural imbalance of 91.3% digital coverage in front-end links and less than 30% in back-end links across the industry. (Lee S & Park H., 2024)
3) **Business adaptive governance**: The core adjustment mechanism of multi-business control. Relying on unified standards, it realizes differentiated adjustments of parameters and algorithms to adapt to business characteristics, solving the problems of homogenized transformation schemes and poor model adaptability, and achieving coordinated control of standardization and differentiation.

2.2 Basic Supporting Theories

The model architecture of this paper relies on four classic theoretical systems that mutually support each other and jointly form the underlying logic of multi-business digital control.

- **Full-life-cycle Management Theory**: Breaks the limitation of traditional store management that only focuses on the operating phase, extending the control scope to the complete cycle of store establishment, construction, operation, iteration and exit, supporting the construction of the full-process system in this paper.
- **Closed-loop Data Governance Theory**: Establishes a circular data mechanism of "collection – cleaning – modeling – decision-making – execution – feedback – iteration", providing theoretical support for multi-business data integration and dynamic optimization.
- **Differentiated Collaborative Control Theory**: Explains the balance mechanism of "headquarters centralization and business decentralization" in large chain organizations, offering a theoretical basis for hierarchical division of labor in the three-layer architecture.
- **System Dynamics Theory**: Depicts the causal feedback and dynamic evolution rules of multiple variables in complex systems, supporting the simulation design and dynamic mechanism analysis of the control model in this paper.

2.3 Analysis of Differentiated Control Mechanisms for Multi-Business Stores

Business formats differ significantly in operational attributes, risk structures and assessment dimensions, so unified control standards cannot meet the diversified demands of each format. By sorting out control characteristic differences of three mainstream formats, the necessity of the business adaptation mechanism can be clearly verified.

Table 1.

Business Format	Core Assessment Priorities	High-Frequency Risk Nodes	Data-Sensitive Dimensions
Standardized Retail Stores	Inventory turnover, sales area efficiency, goods damage rate, SKU turnover rate	Overstocked unsold goods, inventory counting errors, near-expiry losses	Sales data, SKU inventory, loss data, turnover efficiency
Catering Stores	Material loss, labor efficiency, table turnover rate, food safety compliance	Expired raw material waste, unbalanced scheduling, back-kitchen compliance risks	Raw material consumption, working hour data, inspection records, customer complaint data
Life Experience Service Stores	Service quality, customer retention, repurchase rate, word-of-mouth score	Non-standardized services, staff turnover, customer complaints	Service work orders, customer complaint records, member follow-up visits, staff performance

Overall, the core contradiction of multi-business control lies in the conflict between unified standardized systems and personalized business demands. Parameter adjustment through an intermediate adaptation layer is mandatory to realize effective full-domain control and precise management of segmented business formats.

3. Current Status of Multi-Business Store Control and Identification of Core Influencing Factors

Based on survey data of multi-business stores, this chapter sorts out the current situation of digital control, summarizes existing pain points and identifies core influencing factors, providing data and theoretical support for subsequent model construction and empirical analysis.

3.1 Sample and Survey Description

This study adopts panel data from 2021 to 2025. The survey covers 27 domestic multi-business chain enterprises and 127 physical stores, yielding 421 valid data entries after data cleaning. The sample covers three major formats: retail (44.1%), catering (31.5%) and experience services (24.4%), featuring balanced structure and strong representativeness. To avoid interference from extreme values, all continuous variables are winsorized at the 1%–99% quantile to guarantee data robustness.

3.2 Statistical Analysis of Current Control Status

Overall, the digital construction of domestic multi-business stores presents structural imbalance, characterized by mature front-end development, lagging back-end construction, insufficient data collaboration and weak full-process closed-loop control capacity. The specific status is as follows:

- **Mature popularization of front-end digitalization**: The digital coverage of front-end modules including store sales and member marketing reaches 91.3%, basic digital tools have been fully deployed, and front-end operation has basically realized digital substitution.
- **Lagging digitalization of back-end control**: The digital rate of full-life-cycle back-end processes such as site selection evaluation, engineering control and post-closure review is less than 30%, and the industry still relies on manual experience and offline ledgers without a formed digital control system.

- **Poor cross-format data collaboration**: Inconsistent data standards across systems of different formats create high barriers to data exchange, with the overall data interconnection rate only 35.8%. Prominent data silos hinder integrated full-domain control.

3.3 Classification and Analysis of Existing Pain Points

Combined with interview results, this paper categorizes core pain points of digital control for multi-business stores into four dimensions: technology, business, management and implementation.

- **Technical Dimension**: Poor system compatibility and weak model adaptability. Store systems are built by multiple suppliers with inconsistent data specifications and interface standards, causing difficulties in cross-format data docking; existing algorithm models are trained based on retail data with low migration accuracy and poor adaptability across business formats.
- **Business Dimension**: Fragmented processes and open-loop control. The industry lacks universal standardized cross-format processes, leading to scattered and separated business links; broken full-life-cycle control chains for stores lack risk tracing and review optimization mechanisms, making closed-loop governance impossible.
- **Management Dimension**: Overemphasis on hardware procurement and neglect of mechanism construction. Enterprises focus on purchasing digital equipment and systems while ignoring supporting institutions and evaluation systems; quantitative standards for store control quality and operational health are absent, making it impossible to effectively assess digital transformation outcomes.
- **Implementation Dimension**: Homogenized schemes and low business adaptability. Generalized transformation schemes are widely adopted in the industry without layered implementation strategies tailored to business differences, failing to match differentiated operational demands of multi-format stores and resulting in poor digital implementation effects.

3.4 Identification of Core Influencing Factors Based on Factor Analysis

To extract core control variables, this paper conducts exploratory factor analysis on 22 store control observation indicators. Test results show KMO=0.762 and Bartlett sphericity test $p<0.001$, proving the data meets the adaptability requirements for factor analysis. (Garcia R & Martinez L., 2023)

After maximum variance rotation, five core common factors are finally extracted: data governance level, intelligent decision-making capacity, full-process business closed-loop management, business adaptation degree and organizational guarantee, covering core dimensions of store control.

Confirmatory factor analysis results show CR>0.7 and AVE>0.5 for all factors, indicating good reliability and validity of variables and a scientific and reliable indicator system, which can serve as core dimensions for subsequent modeling and empirical research.

4. Construction of Full-Process Digital Control Model for Multi-Business Physical Stores

Based on the theoretical foundation, business differentiation mechanism and core factor identification results in previous chapters, this section constructs a four-dimensional three-layer digital control model with mathematical support, dynamic feedback and business self-adaptive characteristics, and builds a complete quantitative system.

4.1 Model Construction Principles and Overall Architecture

To overcome the drawbacks of traditional models including weak adaptability, lack of iteration mechanisms and incomplete processes, this paper sets modeling standards balancing scientificity and

implementability, and forms the overall architecture on this basis.

- **Core Modeling Principles**: Five dimensions including full-link closed-loop principle, business self-adaptive principle, quantifiable evaluation principle, dynamic iteration principle and engineering implementable principle, ensuring both academic rigor and industrial practicability of the model.
- **Overall Model Architecture**: This paper innovatively constructs a four-dimensional three-layer full-process digital control model. The three-layer architecture realizes overall planning, adaptation and execution across organizational levels, while the four-dimensional dimensions form closed loops of data, algorithms, processes and iteration at the functional level. The two are deeply coupled to form a complete control system.

4.2 Functional Breakdown of the Three-Layer Execution System

The three-layer architecture serves as the core mechanism resolving the "unification-differentiation contradiction" of multi-business control, with clear division of labor and coordinated linkage across each layer.

1) **Headquarters Overall Planning Layer**: Responsible for formulating full-domain standards, building middle-office infrastructure, coordinating resources and general risk control, maintaining the uniformity and standardization of group-wide control.
2) **Business Adaptation Layer**: The core innovation point of the model. Without altering underlying standards, it fine-tunes indicator weights, early warning thresholds, process templates and algorithm parameters according to business formats, enabling one underlying platform to adapt to multiple business types.
3) **Store Execution Layer**: Undertakes front-line data collection, process execution, abnormal reporting and instruction implementation, forming terminal closed-loop units of the control system.

4.3 Four-Dimensional Functional Dimensions and Core Mathematical Expressions

The four-dimensional functional dimensions constitute the core technical kernel of the control system, supported by complete mathematical formulas to realize full-process quantification, calculation and optimization.

1) **Data Governance Dimension**
To address inconsistent indicator dimensions across business formats, extremum standardization is adopted for data normalization:

$$x_{ik}^{'}=\frac{x_{ik}-min(x_{ik})}{max(x_{ik})-min(x_{ik})}$$

After standardization, indicators converge to the interval [0,1], enabling horizontal comparability of cross-format data and providing a standard dataset for subsequent evaluation and regression.

2) **Intelligent Algorithm Dimension**
Adopt the mode of "general algorithm framework + differentiated business parameter set". Set parameter set $\Theta=\theta_1,\theta_2,...,\theta_n$, with the adaptation layer dynamically adjusting parameters based on business types to solve the problem that a single algorithm cannot adapt to multiple scenarios.

3) **Full-Process Business Control Dimension**
Cover the full-life-cycle business set of stores: Set_L={ site selection, store preparation, operation, marketing, supply chain, risk control, customer management, post-closure review } , realizing dead-angle-free full-link control.

4) **Dynamic Iteration Dimension**
Calculate indicator information entropy and dynamic weights based on the entropy weight method to realize self-adaptive updating of the evaluation system:

$$e_j=-\frac{1}{\ln m}\sum_{i=1}^{m}\left(\frac{x_{ij}^{'}}{\sum_{i=1}^{m}x_{ij}^{'}}\right)\ln\left(\frac{x_{ij}^{'}}{\sum_{i=1}^{m}x_{ij}^{'}}\right)$$

Combine the TOPSIS model to calculate the comprehensive efficiency score of each store:

$$S_i=\frac{D_i^-}{D_i^+ + D_i^-}$$

A higher score represents superior comprehensive digital control level of the store, providing quantitative basis for performance evaluation and system iteration.

4.4 System Dynamics Feedback Loops and Operation Closed Loop

Relying on the five core control factors extracted, this paper builds a dual closed-loop system with forward execution and reverse iteration. The forward loop connects front-end and back-end store data through data governance and intelligent decision-making, alleviating the industry-wide low data interconnection rate of 35.8%, and driving business implementation via data (Wang Y & Zhang H., 2024). The reverse iteration loop dynamically corrects operational deviations and optimizes the control system targeting pain points such as less than 30% back-end digitalization and insufficient business adaptability. Among them, business adaptation degree acts as the core adjustment dimension to accommodate operational differences of multiple formats. Combined with business closed-loop and organizational guarantee mechanisms, it achieves dynamically stable operation of the multi-business store control system.

5. Model Simulation and Empirical Test

To scientifically verify model effectiveness and action mechanisms, this chapter conducts dual tests combining system dynamics simulation and panel econometric models, compares model advantages through multi-scenario simulation, and quantifies impact effects and mediating mechanisms via empirical analysis.

5.1 System Dynamics Simulation Design

This paper sets a 60-month simulation cycle and establishes three comparative scenarios corresponding to traditional manual control, digitalization without business adaptation and the complete four-dimensional three-layer model proposed in this paper. Key parameters are listed in the table below.

Table 2.

Parameter Name	Scenario 1 (Traditional Manual Control)	Scenario 2 (Digitalization without Business Adaptation)	Scenario 3 (Complete Model of This Paper)
Data Completeness Coefficient	0.22	0.58	0.84
Business Adaptation Adjustment Coefficient	0	0.10	0.68
Abnormal Early Warning Response Delay (Month)	1.42	0.85	0.31

5.2 Simulation Results and Sensitivity Analysis

Simulation results demonstrate that Scenario 3 achieves significantly superior long-term control efficiency compared with the first two groups, with optimal risk response efficiency, operational stability and cost optimization effects. Sensitivity analysis confirms that the business adaptation adjustment coefficient and data completeness coefficient are the most core sensitive variables of the system, proving that the adaptation mechanism is the key to unlocking the value of multi-business digital transformation.

5.3 Panel Econometric Model and Research Hypotheses

Based on theoretical and simulation conclusions, two core hypotheses are proposed: digital control exerts a significant positive impact on comprehensive store efficiency; business adaptation plays a significant partial mediating effect. Construct the benchmark fixed-effect model:

$$S_{it}=\beta_0+\beta_1 Dig_{it}+\sum\beta_k Control_{kit}+\mu_i+\varepsilon_{it}$$

5.4 Brief Analysis of Empirical Regression Results

To intuitively present quantitative test results, core estimation outcomes of benchmark regression, mediating effect and heterogeneity analysis are summarized in the table below.

Table 3.

Variable	Model 1 Benchmark Regression	Model 2 Mediation (Adaptation)	Model 3 Mediation (Efficiency)	Model 4 Retail Subsample	Model 5 Catering Subsample	Model 6 Service Subsample
Digital Control Index (Dig)	0.327(0.042)	0.281(0.038)	0.234(0.045)	0.381(0.056)	0.274(0.051)	0.216(0.049)
Business Adaptation Degree (Adapt)	—	—	0.331(0.057)	—	—	—
Control Variables & Fixed Effects	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Observations	421	421	421	186	133	102
Adjusted R^2	0.612	0.547	0.643	0.658	0.581	0.524
Mediating Effect Proportion	—	28.4%	—	—	—	—

As shown in the regression results, the benchmark regression yields a core variable coefficient of 0.327 ($p<0.01$), proving digital control significantly improves store governance efficiency. The mediating effect accounts for 28.4%, verifying that business adaptation serves as a vital transmission path. Heterogeneity analysis reveals retail formats gain the strongest efficiency improvement, while service formats are more sensitive to parameter adaptation.

6. Practical Path of Digital Control for Multi-Business Physical Stores

Targeting industry pain points including homogenized digital transformation, difficult implementation and lack of iteration mechanisms, combined with empirical and simulation conclusions, this paper constructs a four-stage stepwise digital control implementation path balancing standardized overall planning and differentiated adaptation, realizing full-process closed-loop empowerment from infrastructure construction to long-term optimization:

1) **Digital Maturity Diagnosis and Infrastructure Construction**: Precisely identify control weaknesses and avoid blind construction. Address the industry-wide low cross-format data interconnection rate of 35.8% and severe data silos by building a full-domain technical middle office, unifying data calibers and interface standards to break barriers of heterogeneous systems and consolidate the underlying foundation of cross-business collaboration.
2) **Differentiated Phased Implementation by Business Format**: The 44.1% retail stores focus on inventory, turnover and goods damage control to improve quality and efficiency; the 31.5% catering stores prioritize material management, food safety inspection and intelligent scheduling to strengthen compliance risk control; the 24.4% experience service stores build a service-oriented digital system centered on service quality, customer complaint management and member operation.
3) **Full-Process Closed-Loop Control Implementation**: Remedy the industry-wide less than 30% digital coverage of back-end links by connecting the full-life-cycle chain of stores. Implement digital control of front-end

preparation and risks, refined mid-stream supply chain and marketing operation, and back-end intelligent risk early warning and performance accounting, forming an integrated full-domain closed-loop control system.

4) **Long-Term Iteration Optimization Guarantee**: Eliminate the drawback of one-off digital construction, establish a dynamic iteration mechanism with monthly monitoring, quarterly optimization and annual review, and adjust indicator weights and algorithm parameters in real time according to operational changes. Match complete institutional, organizational and talent guarantees to promote deep integration of technology, business and management, and sustain continuous optimization and long-term empowerment of the control system.

7. Case Study

To verify the implementation effectiveness of the multi-business digital control model and stepwise implementation path, this paper selects "Yueshang Life", a regional chain enterprise integrating boutique cultural and creative retail and new-style tea beverage business, as the case research object. The enterprise operates 32 offline stores, featuring a typical dual-format mixed operation model highly consistent with the research scenario of this paper, with strong case representativeness and empirical value.

7.1 Transformation Dilemmas and Governance Shortcomings

Before digital transformation, the enterprise suffered typical defects of multi-business chain governance. Dual-format systems operated heterogeneously with separated data calibers, and cross-format data interconnection rate reached only 36.4%, hindering group-wide full-domain integrated control. Meanwhile, the enterprise long adopted a homogenized control mechanism unable to adapt to format heterogeneity: high loss and high risk control demands of tea beverage business versus inventory-heavy and slow turnover characteristics of retail business. Although basic digital deployment was completed, the digital empowerment conversion rate stood below 22%, highlighting a prominent mismatch between digital investment and governance efficiency. Persistent problems including high material loss and delayed risk response remained unsolved.

7.2 Stepwise Digital Renovation Implementation Process

The enterprise strictly followed the four-stage stepwise framework proposed in this paper to promote digital upgrading and reconstruct the full-domain governance system step by step, as detailed below:

1) Accurate diagnosis of digital weaknesses. Evaluate store digital maturity to systematically identify core problems such as lagging data governance, fragmented processes and insufficient business adaptation, and clarify the priority of rectification for each module.
2) Construction of full-domain data infrastructure. Build a unified data middle office, standardize dual-format indicator systems and interface specifications, break heterogeneous system barriers, and realize cross-format data interconnection and full-domain visibility.
3) Differentiated adaptive implementation by business format. Deploy precise control tailored to business differences: optimize retail inventory and goods damage mechanisms, and iterate material accounting and food safety risk control systems for tea beverage business to enhance business adaptation accuracy.
4) Full-process closed-loop dynamic iteration. Construct a full-life-cycle closed-loop control mechanism, dynamically adjust control parameters based on periodic reviews to realize long-term self-adaptive optimization of the governance system.

7.3 Quantitative Implementation Outcomes

After 24 months of implementation and iteration, the enterprise achieved remarkable improvements in control efficiency. The goods damage rate of boutique retail dropped from 4.12% to 2.67% (35.2% reduction), and the material loss rate of new-style tea beverage fell from 8.71% to 5.33% (38.8% reduction); store risk response duration shortened by 73.2%, greatly enhancing risk tracing capacity. Meanwhile, the cross-format data interconnection rate rose to 89.7%, and the digital empowerment conversion rate increased to 67.5%, effectively eliminating the industry-wide disconnect between digital investment and operational efficiency.

This case effectively verifies the practical value of the model and stepwise path proposed in this paper, which can systematically resolve core industry problems including separated multi-business data, homogenized control and inefficient transformation, and accurately match differentiated operational demands of composite business formats. The system can realize cost reduction, efficiency improvement and risk control upgrading with strong implementability and industrial replicability, providing a standardized practical paradigm for digital governance of multi-business chains.

8. Research Conclusions, Management Implications and Prospects

This chapter systematically summarizes core conclusions of the full text, extracts industry management implications, objectively analyzes research limitations and prospects future research directions.

1) **Research Limitations**

This study has four limitations: the research sample adopts data of 27 domestic enterprises and 127 stores (421 data entries), excluding overseas entities and small micro stores in sinking markets with limited scenario adaptability; only structured operational data are adopted without multi-modal data support, leading to insufficient depth of mechanism mining; cutting-edge technologies such as AI and digital twin are not deeply integrated; samples focus on traditional formats with insufficient coverage of emerging composite formats including cultural tourism and medical aesthetics.

2) **Future Research Prospects**

To address existing research limitations, multi-dimensional deepening can be carried out in future research: expand samples covering cross-border enterprises, sinking markets and emerging business formats, expand panel data to more than 600 entries to improve model generalizability; integrate large AI models and digital twin technology to optimize self-adaptive algorithms; introduce multi-modal data to deeply explore control mechanisms; refine store heterogeneous characteristics and continuously improve the intelligent digital control system for multi-business formats.

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