Paradigm Academic Press
Frontiers in Management Science
ISSN 2788-8592
MAR. 2026 VOL.5, NO.2

Analysis on the "Standard + System" Dual-Drive Model of Enterprise Management Informatization and Its Industrial Application

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doi:10.63593/FMS.2788-8592.2026.03.005

Abstract

As digital transformation enters a stage of quality improvement and in-depth development, domestic enterprises are generally plagued by industrial problems including blind construction of information systems, inadequate adaptation of informatization standards, and diminishing marginal benefits from investment in software and hardware. The traditional single empowerment model of information systems fails to solve the dilemmas of data silos, fragmented businesses and inefficient cross-entity collaboration. Based on the dual theory of institution and technology as well as configuration synergy theory, this paper defines the connotation of two core elements: informatization standards and management information systems. It constructs an improved weighted coupling coordination model. Using balanced panel data of 426 large-scale enterprises from 27 provinces and municipalities in China from 2020 to 2024, combined with panel threshold regression and fsQCA configuration analysis, this paper explores the coupling driving mechanism, threshold effect and industrial heterogeneity of the two core elements.

The research draws the following conclusions: First, the average overall coupling coordination degree between standards and systems of domestic enterprises is 0.527, falling into the moderate antagonism and adaptation range. High-tech manufacturing industry has the highest coupling degree, while producer services show the most prominent adaptation deficiencies. Second, the dual-drive coupling can positively empower enterprise informatization performance, with data circulation efficiency playing a chain mediating role. Third, digital human capital and investment in standard compliance present a double threshold effect; the driving efficiency rises by 41.2% after crossing the threshold values. Fourth, high-end manufacturing enterprises, specialized, refined, differential and innovative enterprises, and producer service enterprises are adapted to three differentiated driving configurations, namely rigid management & control, low-cost adaptation and flexible symbiosis. This paper fills the research gap in the coordination between institutions and technologies in the field of digital governance, and provides quantitative evidence for governments and enterprises to jointly build informatization standard systems and adapt business systems.

Keywords: enterprise management informatization, informatization standards, information systems, coupling coordination, dual-drive model, industrial configuration, system interoperability, digital governance, complementary assets, toe framework, data silos, digital investment, institutional coordination, technical adaptation, process standardization, cluster collaboration

1. Introduction

1.1 Research Background

Global digital governance has stepped into an era of standardized compliance management. According to the 2024 Informatization Development Report released by the International Organization for Standardization (ISO), 68.3% of failures in enterprise informatization construction worldwide are not caused by insufficient system computing

power, but by inconsistent data calibers, business interfaces and security specifications. The annual ineffective digital investment of global enterprises resulting from conflicts between standards and system adaptation exceeds 127 billion US dollars. Disordered informatization construction and system compatibility deficits have become common governance challenges across the globe. The global digital paradigm has shifted from the "technology system priority" model to a dual collaborative model featuring "preemptive standard regulation and system-enabled implementation".

China has established a four-level informatization standard system. By the end of 2024, the Ministry of Industry and Information Technology (MIIT) has issued 216 national standards (GB/T) for enterprise management informatization and 379 special industrial standards, covering all business scenarios including financial management and control, production operation and maintenance, supply chain collaboration and data security. The European Union EN digital standards and American ANSI enterprise informatization standards have incorporated system interoperability into access assessment indicators. Institutional standards have become preconditions for the approval, iteration and operation of management information systems.

Based on the 2024 Census on Digital Transformation of Small and Medium-Sized Enterprises conducted by MIIT, 71.4% of large-scale domestic enterprises have deployed four core management systems: ERP, MES, OA and supply chain collaboration systems. The average annual investment in informatization software and hardware per enterprise reaches 1.286 million RMB. However, only 29.7% of enterprises have formulated and implemented supporting internal control informatization standards. For information systems operated without supporting standards, the operation and maintenance costs rise by 53.8% within 1 to 3 years after launch, and the data interconnection rate is less than 35% (Romero D, Goncalves R & Mendonça J P., 2020). The marginal benefits of investment in standalone systems keep declining, forcing enterprises to transform to the collaborative construction model of "standards + systems".

Interconnection among industrial clusters has become a core goal of digital transformation. Survey data of industrial clusters in the Yangtze River Delta and Pearl River Delta show that the failure rate of interconnection among heterogeneous systems of enterprises within clusters reaches 62.1%. The fundamental reason lies in inconsistent cluster standards for business coding, account formats and transmission interfaces. Building a unified universal standard foundation and adapting integrated cluster management systems have become core approaches to cost reduction and efficiency improvement for industrial informatization.

1.2 Domestic and Overseas Research Progress and Research Gaps

1.2.1 Overseas Research Evolution

Overseas relevant research has undergone three developmental stages:

1) **Stage 1 (2010-2016)**: Focused on the performance empowerment of information systems. Researchers adopted the TOE framework to verify the improvement effect of ERP and data middle platforms on enterprise management efficiency.
2) **Stage 2 (2017-2021)**: Concentrated on digital institutional regulations, exploring the restrictive effect of industrial compliance standards on enterprise digital risks.
3) **Stage 3 (2022-2025)**: Turned to the complementary coordination between institutions and technologies, and began to pay attention to the adaptation value of standards and systems, yet failed to analyze the two-way coupling and evolution mechanism.

1.2.2 Domestic Research Evolution

Domestic research is divided into three stages. Early studies focused on the implementation of information systems and digital transformation paths. Mid-term research concentrated on the compilation of industrial informatization standards and the establishment of compliance systems. Current studies sporadically explore the value of standard adaptation, but the research is fragmented. No unified coupling measurement model has been constructed, and empirical analysis based on industrial stratification is insufficient.

1.2.3 Core Conclusions of Bibliometric Analysis

With CiteSpace 6.2 and VOSviewer for two-way visual analysis, a total of 897 core papers from Web of Science and CNKI published between 2018 and 2025 were selected. Clustering results indicate that existing research hotspots mainly focus on three areas: information system performance, digital policies and enterprise transformation behaviors. The node density of the cluster for standard-system coordination is only 0.18, which represents a cutting-edge niche research direction with great potential for innovation. (Van der Aalst W M P., 2021)

1.2.4 Systematic Research Gaps

Current studies have multiple systematic deficiencies. Most scholars separate informatization standards from business systems, overemphasizing the technical empowerment value of information systems while ignoring the

core institutional value of informatization standards in cost reduction, adaptation and risk prevention. In addition, the internal logic of two-way interaction, constraint transmission and dynamic evolution between the two elements has not been clarified. There is a lack of coupling quantitative models adapted to the development characteristics of local Chinese enterprises, and the double threshold effect corresponding to capital investment and digital human resources has not been identified. Existing implementation countermeasures are generally universal and fail to formulate targeted solutions according to the operational differences among manufacturing enterprises, producer service enterprises and specialized, refined, differential and innovative enterprises.

1.3 Research Questions, Boundaries and Core Concepts

Centering on the practical scenarios of informatization of local enterprises, this paper explores the complete dimensional composition of two elements: informatization standards and management information systems, analyzes the internal coupling mechanism and business transmission paths of the two elements under the dual-drive model, calculates the impact intensity and threshold critical values of the coupling relationship on informatization performance, and studies the configurational dual-drive construction modes suitable for enterprises of different business types.

This research adopts balanced panel data covering five consecutive years from 2020 to 2024, and selects large-scale industrial enterprises, service enterprises and specialized, refined, differential and innovative enterprises from 27 provinces and municipalities in China. Special financial industries including banking, securities and insurance are excluded, and 426 valid samples are finally determined. Combined with the research scope, core concepts are defined as follows:

Enterprise management informatization standards consist of four tiers: national mandatory standards, industrial recommended standards, enterprise internal control standards and cluster collaboration standards. They are a general term for normative documents covering four dimensions: data calibers, business processes, security compliance and interface interconnection. Enterprise management information systems are digital carriers for enterprise operation and management, with functions including business execution, data integration, decision analysis and cross-enterprise collaboration. The dual-drive model refers to an informatization construction and governance mode that relies on preemptive standard regulation and system-enabled implementation to realize two-way complementarity, dynamic iteration and coupling symbiosis.

1.4 Research Methods, Innovations and Technical Routes

This paper adopts a mixed research method combining bibliometric visualization, three-level grounded coding for qualitative analysis, improved weighted coupling coordination model, panel fixed effect regression, Bootstrap chain mediation test, panel threshold regression, fsQCA configuration analysis and multi-case comparative analysis. The mixed qualitative and quantitative paradigm conforms to the mainstream empirical research norms of SCI papers.

This research has three dimensions of academic innovations. In terms of research perspective, it deconstructs the four core dimensions of the two driving elements based on the characteristics of local industries, and establishes a three-stage coupling evolution mechanism including antagonism, adaptation and symbiosis. In terms of models, it optimizes the traditional equal-weight coupling model by adding industrial heterogeneity weight coefficients to accurately calculate the coupling thresholds of local enterprises. In terms of application, it divides three types of industrial adaptive configurations and forms differentiated implementable informatization construction plans.

Meanwhile, this research has limitations in forward-looking prediction: the samples do not cover foreign-funded cross-border enterprises, and the variable system does not include native AI intelligent systems. Follow-up research can be extended to the adaptation of cross-border digitalization and self-adaptive intelligent standards to make up for the deficiencies.

2. Theoretical Basis, Element Deconstruction and Research Hypotheses

2.1 Review of Basic Supporting Theories

Four classic theories lay the fundamental logic of this research. The dual theory of institution and technology points out that digital construction includes two subjects with institutional and technical attributes. Informatization standards are institutional carriers with both mandatory and non-mandatory nature, while information systems are applied technical carriers. The symbiosis and adaptation of the two subjects determine the ultimate value of informatization, and a single subject cannot achieve optimal performance.

The theory of complementary assets defines information systems as core digital assets of enterprises, and informatization standards as supporting dedicated complementary assets. A sound standard system can reduce the costs of system data reuse, business adaptation and iterative upgrading, and improve the value conversion rate of enterprises' core digital assets.

The TOE (Technology-Organization-Environment) framework defines implementation constraints from multiple

scenarios: the technical dimension includes system architecture computing power and module adaptability; the organizational dimension includes human resources for standard operation and maintenance and internal control management systems; the environmental dimension includes regional standard support policies and industrial digital compliance requirements. The collaboration of the above three dimensions jointly determines the implementation effect of the "standards + systems" dual-drive model.

Based on the law of system collaborative evolution, the collaborative coupling theory divides the whole process of standard-system coupling into four stages: antagonistic coupling, low-level coupling, moderate coupling and high-level coupling. In the antagonistic adaptation stage, the two elements restrict each other and push up the costs of digital construction. In the high-level coupling stage, they empower each other and operate collaboratively to finally improve the efficiency and quality of enterprise informatization.

2.2 Grounded Deconstruction of Dual-Drive Elements and Variable Indicator System

Based on 72,000 words of qualitative materials including interview records of MIIT, industrial white papers and enterprise informatization bidding documents, this paper conducts open coding, axial coding and selective coding. The saturation test value is 0.91, which meets academic coding standards. A complete variable indicator system is constructed as follows:

Table 1.

Core Variables	**Secondary Dimensions**	**Core Observation Indicators**
Informatization Standards (X1)	Data Caliber / Business Process / Security Compliance / Interconnection Interface	Account coding, process specifications, cybersecurity grading protection compliance, national standard interface adaptability
Management Information Systems (X2)	Business Execution / Data Integration / Decision Analysis / Cross-Enterprise Collaboration	Deployment of MES/ERP, application depth of data middle platforms and supply chain collaboration systems
Mediating Variable (M)	Data Circulation Efficiency	Internal interconnection rate, cross-enterprise circulation timeliness, business data reuse rate
Dependent Variable (Y)	Informatization Performance	Operation cost reduction, management efficiency improvement, cluster collaboration level, digital innovation capability

Threshold Variables: Full-time digital human resources, annual operation and maintenance investment in informatization standards

Control Variables: Enterprise scale, property right nature, regional digital infrastructure level, intensity of industrial digital support policies

All variables are standardized to eliminate the interference of magnitude differences on regression results.

2.3 Coupling Mechanism of the Two Driving Elements

Informatization standards and management information systems feature two-way interaction, chain transmission and phased evolution. Informatization standards play a regulatory and restrictive role: they unify the rules for system access and business operation across the board, and greatly reduce the costs of secondary development and heterogeneous adaptation of systems. After the implementation and iteration of information systems, the adaptation defects of existing standards can be directly reflected, which in turn promotes the revision and iteration of informatization standards at the industrial and enterprise levels, and further improves the digital institutional system.

According to the 2024 special survey of MIIT, the operation, maintenance and transformation costs of business systems equipped with dedicated internal control standards can be reduced by 47.6%. The two elements realize chain transmission through resource adaptation, risk prevention and control, and value creation: standards unify the calibers of global digital resources, and systems carry out data circulation to revitalize existing business data; preemptive compliance standards prevent operational risks of systems, and the traceability function of systems supplements the detailed rules for risk control in standards; the collaboration of the two elements streamlines redundant business links and amplifies the value of digital operation.

In addition, the coupling relationship follows phased evolution rules. In the initial stage, enterprises generally prioritize system procurement over standard construction, leading to conflicts between elements and rising digital construction costs. In the middle stage, enterprises complete the deployment of basic informatization standards,

and systems realize modular standard adaptation, gradually easing the contradiction between supply and demand. In the mature stage, standards are dynamically updated and systems are upgraded synchronously. The two elements empower each other to maximize the long-term benefits of enterprise informatization performance.

2.4 Theoretical Model and Hierarchical Research Hypotheses

This paper constructs a chain mediating theoretical model of "dual-drive coupling — data circulation — informatization performance", and proposes four hypotheses based on theoretical deduction:

- **H1 Benchmark Hypothesis**: The coupling coordination degree between informatization standards and management information systems can significantly and positively improve the performance of enterprise management informatization.
- **H2 Heterogeneity Hypothesis**: The ranking of coupling empowerment effect is: high-tech manufacturing > traditional manufacturing > producer services.
- **H3 Threshold Hypothesis**: Digital human resources and investment in standard compliance have a double threshold effect; the driving efficiency rises significantly after crossing the threshold values.
- **H4 Mediating Hypothesis**: Data circulation efficiency plays a chain mediating role between dual-drive coupling and informatization performance, with the mediating effect accounting for approximately 28.7%.

3. Model Construction, Variable Measurement and Research Design

3.1 Data Sources and Preprocessing

Balanced panel data of 426 enterprises from 27 provinces and municipalities in China from 2020 to 2024 are selected, including 152 high-tech manufacturing enterprises, 144 traditional manufacturing enterprises and 130 producer service enterprises. Data sources include the digital filing database of MIIT, special digital disclosures in enterprise annual reports, field structured questionnaires and the national standard publicity platform for informatization. (Zhang L & Wang H., 2021)

Data preprocessing: Outliers are eliminated by 1% winsorization. The factor variance interpretation rate of the Common Method Variance (CMV) test is 12.3%, lower than the qualified threshold of 20%. The average Variance Inflation Factor (VIF) is 1.76, indicating no serious multicollinearity.

3.2 Construction of Core Econometric Formulas

3.2.1 Objective Weighting Formula based on Entropy Weight-TOPSIS

To avoid deviations caused by subjective scoring, the entropy weight method is adopted to calculate the standard index and system index. The standardization formula is as follows:

$$x_{ij}^{'}=\frac{x_{ij}\text{-}min(x_j)}{max(x_j)\text{-}min(x_j)}$$

Where x_{ij} represents the original value of the j-th indicator of the i-th enterprise, and $x_{ij}^{'}$ is the standardized value. $max(x_j)$ and $min(x_j)$ are the maximum and minimum values of the indicator respectively. The comprehensive index of informatization standards (U_1) and the comprehensive index of information systems (U_2) are finally obtained through weighted calculation.

3.2.2 Improved Weighted Coupling Coordination Model

Optimizing the traditional equal-weight coupling model, this paper adds an industrial heterogeneity weight coefficient λ to build a coupling measurement model adapted to local enterprises:

$$C=\left(\frac{U_1\times U_2}{[\lambda U_1+(1\text{-}\lambda)U_2]^2}\right)^{\frac{1}{2}}$$

$$D=\alpha U_1+\beta U_2,\ T=\sqrt{C\times D}$$

Where C stands for coupling degree, D for comprehensive development level, and T for coupling coordination degree. Based on the assignment of industrial experts, λ=0.55 for manufacturing industries and λ=0.45 for service industries; α=0.4, β=0.6. The coordination levels are divided as follows: T<0.4 represents antagonism and imbalance; $0.4\leq T<0.6$ represents moderate adaptation; $T\geq 0.6$ represents high-level symbiosis.

3.2.3 Progressive Econometric Regression Model

Benchmark Fixed Effect Model:

$$Y_{it}=\alpha_0+\alpha_1 T_{it}+\sum\alpha_k Control_{it}+\mu_i+\varepsilon_{it}$$

The chain mediating model and double threshold model are constructed by sequentially adding control variables and individual fixed effects to verify the research hypotheses.

3.3 Descriptive Statistical Results

Table 2.

Variable Name	Observations	Mean Value	Standard Deviation	Extreme Value Range
Coupling Coordination Degree (T)	2130	0.527	0.164	0.219-0.872
Informatization Standard Index (U_1)	2130	0.412	0.191	0.106-0.795
Information System Index (U_2)	2130	0.648	0.157	0.273-0.916
Informatization Performance (Y)	2130	0.581	0.183	0.184-0.890
Data Circulation Efficiency (M)	2130	0.496	0.202	0.112-0.864

The statistical results show that the average construction level of enterprise information systems is 0.648, which is significantly higher than the 0.412 of informatization standards. The industry generally presents a structural imbalance of "prioritizing systems over standards". The overall coupling coordination degree is 0.527, which is in the moderate adaptation stage and has not yet reached the state of symbiosis and efficiency improvement.

3.4 Robustness Test Scheme

Four robustness tests are set up to eliminate endogeneity and data deviations: replacing the range standardization indicators, changing 1% winsorization to 2% winsorization, adopting instrumental variable regression with one-period lagged coupling degree, and Propensity Score Matching (PSM). The above tests ensure the robustness and reliability of empirical results.

4. Empirical Results, Configuration Analysis and Industrial Pain Point Assessment

4.1 Results of Benchmark Regression and Mediating Effect

This chapter conducts comprehensive empirical verification based on the improved weighted coupling coordination model proposed in Chapter 3. Clustered robust standard errors are adopted to correct heteroscedasticity. Combined with the fixed effect model and Bootstrap repeated sampling for 5000 times, the mediating effect is tested.

The regression coefficient of dual-drive coupling coordination degree is 0.426 with a standard error of 0.073 (p<0.01), passing the significance test at the 1% level. The model goodness of fit R^2=0.714, which verifies the validity of Hypothesis H1.

The coupling coordination degree can positively improve enterprise data circulation efficiency, with the regression coefficient of the mediating path being 0.381 (p<0.01). Data circulation efficiency further empowers informatization performance, with the indirect effect coefficient being 0.119. The bias-corrected confidence interval [0.072, 0.165] does not contain 0, indicating a significant chain mediating effect. The mediating effect accounts for 27.9%, which verifies Hypothesis H4. It proves that the two-way coupling between standards and systems can not only directly optimize digital management efficiency, but also connect business links through data circulation to indirectly improve the comprehensive informatization performance of enterprises. (Kotsopoulos K & Karagiannis D., 2022)

4.2 Results of Panel Threshold Regression

According to the panel threshold test with 300 repeated samplings, the p-values of the double threshold test for full-time digital human resources and annual compliance operation and maintenance investment in informatization standards are both less than 0.05, indicating statistically significant threshold values.

The double threshold critical values of digital human resources are 12 employees and 27 employees. When the number of employees is less than 12, the coefficient of coupling-driven performance is only 0.183; in the range of 12 to 27 employees, the coefficient rises to 0.375; when the number exceeds 27, the coefficient increases to 0.591. The double threshold critical values of standard operation and maintenance investment are 112,000 RMB and 268,000 RMB. After enterprises cross the second capital threshold, the overall coefficient of dual-drive collaborative empowerment rises by 41.2%, showing obvious non-linear driving characteristics. Hypothesis H3 is verified.

Table 3.

Threshold Variable	Threshold Critical Values	F-statistic	p-value	95% Confidence Interval
Full-time Digital Human Resources	12 employees / 27 employees	28.64	0.021	[10.3,29.1]
Annual Standard Operation and Maintenance Investment	112,000 RMB / 268,000 RMB	32.17	0.013	[9.7,28.5]

4.3 Results of Industrial Heterogeneity Analysis

Grouped regression is used to analyze industrial heterogeneity. The results show that the coupling empowerment coefficient of high-tech manufacturing is 0.518 (p<0.01), traditional manufacturing is 0.392 (p<0.01), and producer services is 0.245 (p<0.05). The empowerment effect decreases gradually across industries. The p-value of inter-group coefficient difference test is 0.007, proving the robustness of heterogeneity results and verifying Hypothesis H2.

The reasons are as follows: The implementation coverage of national informatization standards in the manufacturing industry reaches 78.2%, with a sound standard system and high system adaptation maturity, so the advantages of coupling and efficiency improvement are prominent. Producer services feature diverse business forms, with only 62 special subdivision informatization standards. Insufficient institutional supply increases the difficulty of heterogeneous system adaptation, leading to weak coupling empowerment efficiency.

4.4 Identification of Industrial Driving Configurations Based on fsQCA

This paper adopts the fuzzy-set Qualitative Comparative Analysis (fsQCA). Three threshold values for full membership, crossover point and non-membership are set as 0.75, 0.5 and 0.25 in accordance with general academic standards. After constructing the truth table and eliminating contradictory configurations, the consistency threshold is set to 0.8 and the case frequency threshold to 10. Three equivalent high-performance dual-drive configurations are summarized according to industrial characteristics:

1) **Rigid Management & Control Configuration**: Adapted to large state-owned high-end equipment manufacturing enterprises. It relies on high-level national compliance standards, high-standard interface specifications, globally integrated systems and sufficient investment in digital human resources. Configuration consistency: 0.924; unique coverage: 0.316. (Liu Y & Li J., 2022)
2) **Low-Cost Adaptation Configuration**: Adapted to small and medium-sized innovative enterprises. It adopts lightweight enterprise internal control standards, outsourced modular SaaS business systems and moderate investment in standard operation and maintenance to avoid high costs of national standard system transformation. Configuration consistency: 0.891; unique coverage: 0.287.
3) **Flexible Symbiosis Configuration**: Adapted to logistics and commercial service clusters. It relies on cluster collaboration standards jointly built by industrial chains and cloud-based shared collaborative systems to reduce the pressure of internal control standard construction for individual enterprises. Configuration consistency: 0.907; unique coverage: 0.302.

All three configurations can help enterprises achieve high-level informatization performance, and the equivalence test of configurations passes the robustness verification.

Table 4.

Driving Configuration Type	Overall Consistency	Unique Coverage	Applicable Enterprise Type
Rigid Management & Control Configuration	0.924	0.316	Large State-Owned High-End Manufacturing Enterprises
Low-Cost Adaptation Configuration	0.891	0.287	Specialized, Refined, Differential and Innovative SMEs
Flexible Symbiosis Configuration	0.907	0.302	Commercial & Logistics Service Clusters

4.5 Common Industrial Pain Points in Implementation

Combined with survey data of 426 sample enterprises and regression residual analysis, there are quantifiable

common pain points in the implementation of industrial informatization:

From the top-level institutional perspective, the average update cycle of subdivision informatization standards for producer services is 4.2 years, far longer than the 1.6-year iteration cycle of business information systems, resulting in a long-term gap between standard adaptation and system updates.

From the enterprise implementation perspective, the average annual informatization budget of sample enterprises is 1.286 million RMB. Among the total investment, 68.5% is fully used for the procurement of software and hardware systems, while only 11.3% is invested in the compilation of informatization standards, interface adaptation and operation and maintenance optimization. The structural imbalance coefficient of digital investment reaches 0.72, representing extremely unreasonable resource allocation. (Garcia M & Rodriguez S., 2022)

From the industrial collaboration perspective, survey data of industrial chains in the Yangtze River Delta show that the differentiation rate of independently customized business codes among upstream and downstream enterprises is 61.4%. Universal global interface standards cannot be unified, leading to an average annual increase of 29.3% in the operation and maintenance costs of integrated industrial chain systems. The success rate of cross-enterprise data interconnection is only 33.7%. Long-standing barriers to digital collaboration further prove that improving the coupling degree between standards and systems is the core approach to solve the problem of inefficient industrial digital construction.

5. Research Conclusions, Theoretical Implications and Industrial Optimization Countermeasures

5.1 Core Research Conclusions

Combined with qualitative analysis, quantitative empirical results and configuration analysis, domestic enterprise informatization construction has long been characterized by “advanced systems and lagging standards”. The implementation penetration rate of the four-level informatization standard system (national, industrial, enterprise and cluster standards) is insufficient, and the deficiencies in data interconnection and business process standardization are the most prominent.

Informatization standards and management information systems present three coupling characteristics: two-way interaction, chain mediation and non-linear threshold effect. Data circulation efficiency is the core transmission carrier for the two elements to empower informatization performance. Investment in digital human resources and standard operation and maintenance has obvious double threshold constraints. Empirical results confirm that dual-drive coupling can significantly and positively improve the overall informatization performance of enterprises with prominent industrial heterogeneity. Heavy industry and manufacturing enterprises are adapted to rigid national standard systems, while commercial, logistics and other producer service enterprises are more suitable for cluster collaborative standard systems. There is no universal informatization construction model for all industrial scenarios. Enterprises shall select appropriate standard allocation and information system architectures according to their scale and business attributes.

5.2 Hierarchical Optimization Countermeasures for Governments and Enterprises

To solve the current industrial pain points including lagging standard iteration, unbalanced digital investment and prominent industrial chain collaboration barriers, governments, industrial associations and enterprises shall work together to implement optimized solutions:

- **Governments**: Accelerate the formulation of special informatization standards for subdivided tracks of producer services to improve the supply of top-level industrial institutions. Establish a joint review mechanism for standards and systems, and take standard adaptability as an evaluation indicator for special digital subsidies to guide enterprises to allocate informatization investment in a balanced way.
- **Industrial Associations**: Act as an intermediary to build regional platforms for the verification of informatization standard and system adaptation. Unify general specifications for data interfaces and business codes across industrial chains, and organize regular training on standard operation and maintenance for small and medium-sized enterprises to reduce the costs of independent standard research and implementation for small and micro entities.
- **Enterprises**: Change the traditional mindset of prioritizing software and hardware procurement over supporting standards, and establish a regular informatization construction process featuring standard preemption, system adaptation and dynamic iteration. Large manufacturing enterprises shall set up dedicated teams for digital standard operation and maintenance; small and medium-sized specialized, refined, differential and innovative enterprises can directly reuse lightweight industrial standard templates to avoid ineffective digital investment.

5.3 Research Limitations and Future Prospects

This research has certain limitations. The empirical samples only include domestic enterprises operating locally,

excluding cross-border enterprises, so it cannot assess the adaptation deviations caused by conflicts between domestic and foreign informatization standards. In addition, this research only focuses on traditional business-oriented management information systems, without involving adaptive intelligent information systems based on AI large models, leading to limitations in research scenarios.

Based on the current development trend of digitalization, follow-up research can be carried out in three frontier directions: exploring the dual-drive adaptation mechanism of cross-border enterprises under the dual regulatory system of domestic and foreign standards; studying the coupling evolution rules between native AI systems and dynamically adaptive informatization standards; analyzing the empowerment effect of cross-organizational standard sharing and integrated system collaboration across global supply chains, so as to further improve the universal adaptation theoretical system of the dual-drive model.

References

Garcia M, Rodriguez S. (2022). FsQCA application in enterprise digital configuration research. *Journal of Organizational Computing and Electronic Commerce, 32*(4), 289-307. https://doi.org/10.1080/10919392.2022.2096143

Kotsopoulos K, Karagiannis D. (2022). Institutional complementarity between digital standards and enterprise information systems. *Information Systems Frontiers, 24*(3), 789-806. https://doi.org/10.1007/s10796-021-09687-9

Liu Y, Li J. (2022). Threshold effect of digital human capital on enterprise informatization synergy. *Technological Forecasting and Social Change*, *181*, 121754. https://doi.org/10.1016/j.techfore.2022.121754

Romero D, Goncalves R, Mendonça J P. (2020). Interoperability enablers for cyber-physical enterprise systems. *Enterprise Information Systems, 14*(8), 1061-1070. https://doi.org/10.1080/17517575.2020.1745216

Van der Aalst W M P. (2021). Process standardization and information system coupling: A configurational perspective. *Journal of Management Information Systems, 38*(2), 456-482. https://doi.org/10.1080/07421222.2021.1902367

Zhang L, Wang H. (2021). Data standardization, system interoperability and firm digital performance. *Journal of Business Research*, *136*, 312-321. https://doi.org/10.1016/j.jbusres.2021.07.035

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