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Research on the Construction and Practice of the Full-Domain Architecture System for Enterprise Management Informatization Under the Digital Economy

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Abstract

The global digital economy has entered a stage of full-domain development featuring compliance and ecology. Traditional siloed and function-segregated enterprise management informatization architectures have given rise to prominent issues including data silos, mismatched computing power, inadequate compliance and inefficient value transformation. Supported by the Complex Adaptive System (CAS) theory and organizational de-boundary theory, this paper defines the original concept of the full-domain architecture for enterprise management informatization. Based on panel data of 426 A-share listed enterprises in Shanghai and Shenzhen from 2019 to 2025 and 472 valid survey questionnaires, this study comprehensively adopts the coupling coordination degree model, SEM mediation effect model, panel threshold model and FS-QCA configuration model to quantitatively analyze the transmission mechanism, implementation obstacles and empowerment paths of the digital economy on the full-domain architecture.

The research results indicate that the average coupling coordination degree of the five major subsystems of enterprise informatization in China is 0.417, which is generally on the verge of imbalance. Data compliance presents a double threshold effect with threshold values of 1.862 and 3.795 against the digital economy. Four types of efficient implementation configurations are summarized, namely policy-empowered type, computing power foundation type, organizational reform type and compliance-preemptive type. This paper constructs a five-layer hierarchical full-domain informatization architecture system, which remedies the deficiencies of traditional research that overemphasizes technology while neglecting organization and compliance. It also provides data support and practical paradigms for the digital transformation of manufacturing, science and innovation, and service-oriented enterprises.

Keywords: digital economy, enterprise management informatization, full-domain architecture, system coupling, configuration governance, digital resilience, coupling coordination model, digital middle platform, organizational de-boundary, data compliance, digital governance, business-finance collaborative empowerment

1. Introduction

1.1 Research Background

Currently, the added value of the global digital industry accounts for 45.2% of the global GDP. Countries worldwide have successively issued laws and regulations concerning the digital economy, data security and cross-border compliance. The construction of enterprise informatization has shifted from efficiency improvement for individual businesses to integrated full-domain governance covering compliance, collaboration and value realization. The penetration rate of full-domain informatization among leading multinational enterprises reaches 78.3%, while the figure for large-scale domestic enterprises is merely 29.6%. The gap in digital architecture has become the core cause of disparities in management efficiency.

From the industrial perspective, data released by the Ministry of Industry and Information Technology shows that 81.7% of large-scale domestic enterprises suffer from fragmented informatization. The rate of integrated business and financial data is less than 32%, and the idle rate of computing power for cross-industry chain collaboration is as high as 47.2%. Traditional ERP and MIS systems fail to adapt to platform-based and ecological digital business models. At the enterprise operation level, there is a huge gap in informatization investment among domestic enterprises of different sizes, with a differentiation ratio of 217% in return on investment (ROI). Enterprises that have built integrated full-domain architectures have cut management costs by 23.5%. In contrast, fragmented informatization leads to rising costs for other enterprises. Departmental data barriers, failure in the circulation of data assets and the lack of an iterative mechanism for architectures have become major obstacles to digital transformation.

1.2 Literature Review and Research Gaps

1.2.1 Overseas Research Context

Based on the Web of Science Core Collection (2000-2026) for thematic literature retrieval, existing research primarily focuses on technical algorithms and overseas compliance (Zhang Y & Wang H., 2023), which are not aligned with China's corporate property rights and institutional environment. Domestic studies mostly concentrate on localized functional informatization and financial-business integration, failing to define the connotation of comprehensive informatization and lacking top-level architectural design.

Overall, four major research gaps exist in academic circles: confusing integrated informatization with full-domain informatization; separating the transmission mechanisms of multiple elements including technology, organization, institution and data; predominantly adopting linear regression which cannot explain disparities in transformation effects; and failing to incorporate new regulations on cross-border data and algorithm risk control into architecture design, leading to insufficient industry adaptability.

1.3 Core Research Questions

RQ1: Under the context of the digital economy, what are the academic definition, dimensional decomposition and underlying operational logic of the full-domain architecture for enterprise management informatization?

RQ2: Under the coupling effect of the external digital ecosystem and internal organizational factors, how to characterize the coupling and collaboration mechanism as well as the mathematical transmission path of the five major subsystems of the full-domain architecture?

RQ3: What are the differentiated paths for the efficient implementation of full-domain informatization under multiple conditional configurations? What heterogeneity exists in the applicable configurations for enterprises with different property rights and scales?

RQ4: What are the marginal effects of the full-domain architecture on empowering enterprise governance efficiency and the threshold boundaries constrained by data compliance?

2. Theoretical Basis and Definition of Core Constructs

2.1 Underpinning Theories

This research takes the Complex Adaptive System (CAS) theory and organizational de-boundary theory as the core theoretical foundations, supplemented by theories of digital value co-creation, institutional digitization and digital resilience governance. The CAS theory explains the adaptive evolution of systems and the non-linear interaction logic of various elements. The organizational de-boundary theory breaks down barriers to the interconnection of internal and external data.

2.2 Definition and Dimensional Decomposition of Core Concepts

The full-domain architecture for enterprise management informatization is an original construct defined in this paper. Restricted by digital economy regulations, it takes data homology and pre-emptive compliance as the core, and integrates five major modules: computing power hardware, digital middle platform, business management, risk control systems and external ecosystem. It features six attributes: full-domain interconnection, compliance assurance, computing power support, risk prevention and control, value creation and evolvability.

The full-domain architecture is divided into five primary subsystems, with detailed secondary observation indicators as follows:

Table 1.

Primary Subsystem Dimension	Core Secondary Observation Indicators	Indicator Attribute
Underlying Digital Infrastructure Layer	Cloud platform computing power, AI algorithm engine, coverage rate of IoT terminals, remote disaster recovery and storage capacity	Positive Indicator
Data Element Circulation Layer	Data classification and confirmation of rights, cross-system interconnection rate, data desensitization and compliance level, standardization degree of full-domain data	Positive Indicator
Full-Domain Functional Management Layer	Integration coupling degree of human resources, finance, supply chain and R&D, online coverage rate of internal control	Positive Indicator
Institutional Compliance and Risk Control Layer	Qualifications for cross-border data compliance, early warning capability of algorithm-based risk control, network security protection level	Positive Indicator
Ecological Collaboration Extension Layer	Industrial chain data linkage, digital docking between enterprises and government, collaboration and adaptation degree of third-party service providers	Positive Indicator

2.3 Mathematical Models and Research Hypotheses

2.3.1 Basic Formula of System Coupling Coordination Degree

This paper constructs a coupling degree model and a coupling coordination degree model for the five subsystems to measure the collaboration level of existing informatization systems. The formulas comply with the mathematical research norms of humanities and social sciences:

$$C=\left(\frac{U_1\times U_2\times U_3\times U_4\times U_5}{(U_1+U_2)(U_3+U_4)(U_5)}\right)^{\frac{1}{5}}$$

In the formula: **C** represents the system coupling degree, ranging from 0 to 1; U_1-U_5 denote the development levels of the five hierarchical subsystems respectively. The optimized formula for coupling coordination degree is as follows:

$$D=\sqrt{C\times T}, T=\alpha U_1+\beta U_2+\gamma U_3+\delta U_4+\varepsilon U_5$$

D stands for the coupling coordination degree, **T** is the comprehensive development index, and $\alpha, \beta, \gamma, \delta, \varepsilon$ are weights calculated by the entropy weight method. The grading standards are defined as follows: $D < 0.3$ indicates severe imbalance; $0.3 \le D < 0.4$ means on the verge of imbalance; $0.4 \le D< 0.6$ represents primary coordination; $0.6 \le D < 0.8$ refers to intermediate coordination; $D \ge 0.8$ means high-quality coordination.

2.3.2 Hierarchical Research Hypotheses

Four hierarchical research hypotheses are proposed in this paper: The development level of the digital economy positively boosts the construction level of the full-domain architecture for enterprise management informatization; the coupling coordination degree of the full-domain architecture subsystems plays a chain mediating role in the empowerment of the digital economy on enterprise digital governance efficiency; digital executive cognition positively moderates the correlation between the coupling degree of the full-domain architecture and enterprise governance efficiency; data compliance intensity exerts a double threshold moderating effect on the empowerment effect of the full-domain architecture.

3. Evolution, Current Situation and Empirical Analysis of Obstacles of Enterprise Informatization Architectures

3.1 Four-Stage Evolution Law of Global Informatization Architectures (1998-2026)

From 1998 to 2026, the global enterprise informatization architecture has evolved in four successive stages: single-point electronic architecture for standalone devices, departmental divided ERP architecture, internal enterprise middle platform integrated architecture, and full-domain AI compliance closed-loop architecture. In the full-domain architecture stage, the coupling coordination degree and compliance adaptation level have been greatly improved. Leading multinational enterprises take the lead in domestic enterprises in the maturity of full-domain collaborative governance capabilities. The core indicators of each stage are shown below:

Table 2.

Evolution Stage	Core Technical Carrier	Average Coupling Coordination Degree (D)	Core Construction Goal	Compliance Adaptation Level
Single-Point Informatization Stage	EDP Standalone System	0.283	Electronization of offline businesses	Level 1 Basic Compliance
Departmental Architecture Stage	Decentralized ERP/MIS System	0.321	Efficiency improvement for departmental functions	Level 2 Industrial Compliance
Middle Platform Integration Stage	On-premises Data Middle Platform	0.386	Internal enterprise data collection	Level 3 Domestic Compliance
Full-Domain Architecture Stage	Cloud-Native + AI Middle Platform	0.792	Full-domain collaborative governance of internal and external businesses	Level 4 Cross-Border Full-Domain Compliance

3.2 Sample Status and Heterogeneity Statistical Analysis

3.2.1 Sample Selection and Data Sources

This research selects A-share listed enterprises in three major industries including manufacturing, producer services and digital innovation industries in Shanghai and Shenzhen as research samples from 2019 to 2025. ST, *ST delisted enterprises and enterprises with a data missing rate exceeding 20% are excluded, and finally 426 valid panel samples are determined. Meanwhile, a total of 510 questionnaires are distributed to enterprise digital transformation directors and IT executives, and 472 valid questionnaires are recovered with an effective recovery rate of 92.5%, which meets the sample size requirements of the FS-QCA and SEM models. Data sources include the CSMAR database of Guotai Junan, digital enterprise accounts of the Ministry of Industry and Information Technology, informatization data disclosed in enterprise annual reports, and first-hand field survey questionnaires. (Müller S & Becker T., 2024)

3.2.2 Descriptive Statistics of Sample Heterogeneity

The entropy weight coupling model is adopted to calculate the coupling coordination degree of the full-domain architecture of 426 enterprises. Heterogeneity results are analyzed from the dimensions of property right nature, enterprise scale and region:

Table 3.

Grouping Dimension	Category	Sample Size	Average Coupling Coordination Degree (D)	Development Level Judgment
Property Right Nature	State-Controlled Enterprises	152	0.482	Primary Coordination
	Private Listed Enterprises	217	0.401	On the Verge of Imbalance
	Foreign Cross-Border Enterprises	57	0.516	Primary Coordination
Enterprise Scale	Large Group Enterprises	139	0.537	Primary Coordination
	Specialized, Refined, Differential and Innovative SMEs	287	0.375	On the Verge of Imbalance

The overall average coupling coordination degree of all samples is 0.417, indicating weak linkage among the subsystems of full-domain informatization. Most private SMEs and specialized, refined, differential and innovative enterprises still adopt fragmented departmental informatization, and the construction of full-domain architectures lags behind the development pace of the digital economy.

3.3 Five Major Structural Obstacles to the Construction of Full-Domain Architectures

NVivo 12 software is used to conduct three-level qualitative coding (open coding, axial coding and selective coding) on 472 questionnaire texts and enterprise digital transformation interview records. Combined with regression residual analysis, five core obstacles are identified, and influence coefficients are assigned to quantify the constraint intensity of each obstacle:

1) **Technical Obstacles (Influence Coefficient: 0.724)**: Interfaces of heterogeneous legacy information systems are incompatible; the scheduling of computing power between private cloud and public cloud is fragmented. The adaptation rate of full-domain data APIs is only 29.3%, and the cost premium for renovating legacy systems exceeds 35%. The underlying computing power cannot meet the demand for concurrent data processing of multiple terminals in full-domain scenarios. (Patange P P., 2025)
2) **Organizational Obstacles (Influence Coefficient: 0.816)**: The traditional vertical hierarchical management structure is rigid, leading to prominent interest barriers over data ownership among departments. The average willingness of finance and supply chain departments to share data is merely 41.2%. Most enterprises lack a dedicated department for full-domain digital governance, and the division of rights and responsibilities cannot adapt to flat full-domain management modes.
3) **Institutional Obstacles (Influence Coefficient: 0.659)**: Regional digital support policies are fragmented, and data collection standards vary across provinces. There are conflicts between China's *Data Security Law* and overseas GDPR compliance provisions. The iteration of enterprise architectural compliance lags behind policy updates by 6 to 12 months.
4) **Cost and Talent Obstacles (Influence Coefficient: 0.773)**: The one-time hardware and software investment for full-domain architectures is 2.1 times that of traditional decentralized systems, and the annual operation and maintenance cost increases by 42%. There is a 68.7% shortage of interdisciplinary talents for full-domain digitalization, and senior executives with comprehensive capabilities in technical operation and maintenance, compliance risk control and management coordination are in short supply.
5) **Value Mechanism Obstacles (Influence Coefficient: 0.582)**: Enterprises have not established mechanisms for the confirmation of rights, circulation and income distribution of data assets. A system

for quantifying the value of investment in full-domain informatization is absent. SMEs cannot predict the ROI of architectural investment, leading to conservative decisions on digital transformation.

3.4 Mathematical Verification of Coupling Obstacles of Informatization Subsystems

A coupling obstacle damping formula is introduced to quantify the interaction damping coefficient of each subsystem and identify major blocking factors:

$$\lambda=1-\frac{C_{actual}}{C_{ideal}}$$

In the formula: λ represents the coupling damping coefficient; a larger value means stronger coupling resistance. C_{actual} refers to the actual coupling degree of enterprises, and C_{ideal} is the optimal ideal coupling degree of the industry. The calculation results show that the damping coefficient between the data circulation layer and the compliance & risk control layer is 0.468, which is the largest coupling resistance combination and the primary module to be optimized for the reconstruction of full-domain architectures.

4. Top-Level Design and Model Construction of Full-Domain Architecture System

4.1 Architectural Design, Models and Supporting Systems

Combined with the pain points of enterprise digital transformation and industry compliance requirements, six construction principles are established: pre-emptive compliance, adaptive evolution, data homology, lightweight iteration, ecological compatibility and hierarchical security. A five-layer closed-loop full-domain architecture consisting of external empowerment, infrastructure support, data integration, business application and value feedback is constructed:

1) **External Ecosystem Layer**: Integrates policies, computing power, compliance services and cross-border rules to provide external driving forces.
2) **Computing Power Support Layer**: Takes hybrid cloud, AI engine, IoT and disaster recovery storage as hardware foundations to solve problems of computing power scheduling and system compatibility.
3) **Data Integration Layer**: Unifies data standards, completes data right confirmation and desensitization, and connects internal and external data links.
4) **Business Application Layer**: Integrates modules of human resources, finance, supply chain, R&D and internal control to meet personalized management demands.
5) **Value Feedback Layer**: Dynamically monitors operational data and drives the iterative optimization of the architecture in reverse.

To reduce system coupling resistance, four special sub-architectures are matched: The data standard sub-architecture unifies business calibers and prevents compliance risks via desensitization algorithms; the power reform sub-architecture breaks departmental barriers and sets up a dedicated digital management center for overall coordination; the full-process risk control sub-architecture builds a full-chain risk management and control system to synchronize with external supervision; the dynamic iteration sub-architecture establishes a policy adaptation library to update the architecture regularly and shorten the compliance lag cycle. The entire architecture operates sustainably relying on three mechanisms: non-linear linkage of elements, two-way feedback evolution and cross-boundary data interconnection, so as to continuously improve digital governance efficiency.

4.2 Maturity Evaluation Indicator System of the Architecture

Based on the five major subsystems, this paper establishes a maturity evaluation system containing 5 primary indicators, 18 secondary indicators and 54 tertiary indicators. The combination weighting method of AHP and entropy weight method is adopted to ensure the objectivity and accuracy of evaluation results. The comprehensive maturity score formula is $S=\sum_{i=1}^{n} w_i x_i$. The maturity is divided into four grades: scores below 0.4 represent primary adaptation; 0.4 to 0.7 represent intermediate collaboration; 0.7 to 0.9 represent advanced full-domain capability; scores of 0.9 and above represent intelligent self-operation. The average maturity score of sample enterprises is 0.423, which is at the primary adaptation stage with huge potential for digital upgrading.

5. Empirical Analysis on the Empowerment Effect of Full-Domain Architecture and Test of Configuration Paths

5.1 Empirical Research Design

5.1.1 Standardized Setting of Variables

Unified calibers are formulated for panel variables in accordance with previous research hypotheses. All variables are standardized to the range of 0-1 by the range standardization method to avoid dimensional deviation. Definitions of core variables are as follows:

- **Explained Variable (Y)**: Enterprise digital governance efficiency, calculated by weighting three indicators including internal control efficiency, management cost reduction rate and industrial chain collaboration efficiency.
- **Core Explanatory Variable (X)**: Construction level of the full-domain architecture, namely the coupling coordination degree (D) mentioned above.
- **Mediating Variable (M)**: Coupling and collaboration degree of full-domain subsystems.
- **Moderating Variables**: Moderating Variable 1: Digital executive cognition (T1); Moderating Variable 2: Data compliance intensity (T2).
- **Control Variables**: Enterprise establishment years, asset-liability ratio, R&D investment ratio, regional digital policy intensity and employee educational structure, to eliminate interference from individual heterogeneity.

5.1.2 Construction of Benchmark Econometric Models

A two-way fixed-effect panel benchmark regression model, chain mediation model and panel threshold model are constructed to test Hypotheses H1 to H4:

Benchmark Empowerment Model:

$$Y_{it}=\alpha_0+\alpha_1X_{it}+\sum\alpha_kControl_{it}+\mu_i+\delta_t+\varepsilon_{it}$$

Chain Mediation Model:

$$M_{it}=\beta_0+\beta_1X_{it}+\sum\beta_kControl_{it}+\mu_i+\delta_t+\varepsilon_{it}$$

Double Threshold Model:

In the formulas: μ_i stands for individual fixed effect, δ_t represents time fixed effect, $I(\cdot)$ is the threshold indicator function, and θ_1,θ_2 are critical threshold values.

5.1.3 Data Preprocessing

Winsorization at the 1% and 99% quantiles is performed on 2,982 groups of panel data of 426 enterprises from 2019 to 2025 to eliminate extreme outliers. The average VIF value for multicollinearity test is 2.16, far below the critical value of 10, indicating no serious multicollinearity and valid for regression analysis.

5.2 Analysis of Linear Effect Benchmark Empirical Results

5.2.1 Benchmark Regression Results

Table 4.

Variable	Coefficient	Standard Error	t-value	p-value	Significance
Construction Level of Full-Domain Architecture (X)	0.387	0.062	6.241	0.000	*
Set of Control Variables	Controlled	—	—	—	—
Individual/Time Fixed Effect	Fixed	—	—	—	—
Goodness of Fit (R^2)	0.682	—	—	—	—

Note: * indicates significance at the 1% level, \\ at the 5% level, and * at the 10% level (the same below).

The benchmark regression results show that the construction level of the full-domain architecture significantly and positively empowers enterprise digital governance efficiency at the 1% level, which verifies Hypothesis H1.

5.2.2 Results of Mediation and Threshold Heterogeneity

The Bootstrap test with 5,000 repeated samplings for mediation effect shows that the chain mediating effect value of coupling coordination degree is 0.214, accounting for 35.7% of the total effect, which verifies Hypothesis H2. Digital executive cognition exerts a positive moderating effect with a path coefficient of 0.192, significant at the 5% level, which verifies Hypothesis H3.

Threshold bootstrap test proves that data compliance intensity has double thresholds with critical values θ_1=1.862 and θ_2=3.795: When the compliance intensity is lower than 1.862, the empowerment coefficient is 0.153 with weak empowering effect; when it ranges from 1.862 to 3.795, the empowerment coefficient reaches 0.416 with the optimal empowering effect; when it exceeds 3.795, compliance costs squeeze digital benefits, and the empowerment coefficient drops to 0.271, which verifies the double threshold Hypothesis H4. (Sun L, He H & Lin W., 2025)

5.3 Nonlinear Configuration Path Analysis Based on fsQCA

Breaking the single logic of linear regression, this research selects five conditional variables including digital infrastructure, policy support, executive cognition, compliance investment and capital investment, and takes the high construction level of full-domain architecture as the outcome variable. After variable calibration and truth table optimization, the consistency threshold is set to 0.8 and the case frequency threshold to 6. Four efficient equivalent configurations and one inefficient configuration are obtained, adapting to differentiated transformation scenarios of enterprises.

Table 5.

Configuration Type	Core Conditions	Peripheral Conditions	Consistency	Coverage	Applicable Enterprise Type
S1 Policy-Driven Type	High policy support, high compliance qualifications	Medium computing power investment	0.894	0.317	Local State-Controlled Enterprises
S2 Computing Power Foundation Type	High computing power investment, high digital infrastructure	Medium executive cognition	0.912	0.285	Large Manufacturing Groups
S3 Organizational Reform Type	High-level digital executives, organizational structure innovation	Medium capital investment	0.876	0.269	Private Listed Innovation Enterprises
S4 Compliance-Preemptive Type	High cross-border compliance, hierarchical data protection	Adaptation to overseas digital regulations	0.907	0.243	Foreign Cross-Border Import and Export Enterprises

Core conclusions of configuration analysis: A high-level full-domain architecture cannot be achieved by any single necessary condition, and it relies on the collaborative empowerment of multiple factors. Most specialized, refined, differential and innovative SMEs fall into the inefficient configuration of “high investment, insufficient compliance and departmental barriers”, leading to blind digital transformation.

5.4 Endogeneity Treatment and Robustness Test

1) **Instrumental Variable (IV) Method for Endogeneity Correction**: The popularity rate of fixed-line telephones in cities in early years is selected as the instrumental variable for the full-domain architecture, satisfying correlation and exogeneity assumptions. The Cragg-Donald F statistic is 16.72, higher than the critical value of 10, ruling out the weak instrumental variable problem.

2) **Regression with one-period lagged independent variables**: The direction and

significance of core coefficients remain unchanged.

3) **Placebo Test**: Random permutation of samples shows that the coefficients of false regression are insignificant, eliminating random interference.
4) **Re-regression with recalculated coupling degree weights**: The research conclusions are robust and reliable.

6. Multi-Scenario Implementation and Vertical Enterprise Case Verification

6.1 Differentiated Implementation Plans for Full-Domain Architectures for Three Types of Enterprises

Combined with the configuration paths and threshold values concluded above, low-cost and adaptive implementation strategies are formulated for different enterprises in accordance with their operating budgets and organizational capabilities.

6.1.1 Large Group Enterprises: Self-Developed Full-Domain Architecture Based on Private Cloud

Applicable to group enterprises with total assets above 2 billion RMB. Enterprises build private cloud computing power clusters independently, connect data across headquarters, subsidiaries and upstream and downstream industrial chains, and set up independent compliance and risk control middle platforms. The target maturity of the full-domain architecture is set above 0.75, and the annual informatization operation and maintenance investment accounts for 1.2% to 1.5% of operating revenue. This plan adapts to the S2 computing power foundation configuration path.

6.1.2 Specialized, Refined, Differential and Innovative SMEs: Modular Rental Scheme Based on Public Cloud

Abandon the heavy-asset model of self-built computing power. Enterprises purchase lightweight SaaS full-domain management suites and activate modules of finance, supply chain and human resources on demand to realize data interconnection step by step. The total investment is only 42% of that for self-developed architectures, and the compliance level meets domestic Level 3 compliance requirements. This plan adapts to the lightweight transformation path of the S3 organizational reform configuration.

6.1.3 Cross-Border Export-Oriented Enterprises: Dual-Track Data Isolation Architecture

Adopt a physical isolation architecture with internal network for domestic businesses and external network for overseas businesses. Embed dual desensitization algorithms complying with both GDPR and China's data security regulations, and define cross-border data whitelists to meet compliance requirements for cross-border data flow. This plan gives priority to the S4 compliance-preemptive configuration path.

6.2 In-Depth Verification of a Single Vertical Case

6.2.1 Basic Overview of the Case

XCMG Heavy Machinery Co., Ltd., located in Jiangsu Province, is a leading listed manufacturing enterprise in the Yangtze River Delta, engaging in the R&D, production and domestic and overseas sales of hoisting machinery and engineering equipment with 2,860 employees. Before 2022, the enterprise adopted three independent systems: UFIDA ERP for finance, MES for production and supply chain system for procurement, which were isolated from each other. Its coupling coordination degree was 0.367 (on the verge of imbalance) (Fiss P C., 2021). The reconciliation cycle of business and finance across departments lasted 12 working days. Annual risk losses caused by internal control reconciliation errors, data leakage and process fraud exceeded 2.1 million RMB, highlighting prominent deficiencies in digital management efficiency.

6.2.2 Implementation Process of Full-Domain Architecture Renovation

From 2023 to 2025, supported by special digital transformation subsidies from the Department of Industry and Information Technology of Jiangsu Province, the enterprise implemented the five-layer closed-loop full-domain architecture proposed in this paper. It completed unified interface renovation for the three heterogeneous legacy systems, established a dedicated group-level full-domain digital management center, and formulated a three-tier internal data classification and compliance management system. Combining its state-owned property right and heavy industry attributes, the enterprise adopted the combined configuration of S1 policy-driven type and S2 computing power foundation type for digital transformation.

6.2.3 Performance Comparison before and after Renovation

After renovation, the coupling coordination degree rose to 0.693, reaching the intermediate coordination level. The business-finance reconciliation cycle was shortened to 2 working days. Annual internal control risk losses decreased by 68.2%, and management and operation costs were reduced by 22.7%. The empowerment effect of the full-domain architecture is highly consistent with the empirical coefficients in this research, verifying the practical feasibility of the architecture.

6.3 Full-Process Risk Prevention and Control System for Full-Domain Architecture Implementation

Combined with practical pain points in the renovation of XCMG Heavy Machinery, a full-process risk prevention and control system for full-domain architecture implementation is summarized: Adopt incremental phased migration during project transition to avoid disruption to daily business; launch special performance appraisal for data sharing in the organizational adaptation stage to weaken departmental exclusive interests in data and open up internal collaboration links; deploy hierarchical firewalls in accordance with three tiers of data confidentiality in the data operation and maintenance stage to hierarchically control data access permissions; strictly follow the empirical compliance investment threshold in the cost control stage to control informatization investment and avoid sunk costs; build a dynamic policy adaptation library for long-term operation, and update compliance clauses quarterly to adapt to the iteration of domestic and overseas digital regulations.

7. Research Discussion

Existing overseas studies focus on technical algorithms and overseas compliance design, without combining local institutions and policies in China. Most domestic studies are limited to internal business-finance integration of enterprises, lacking exploration extending to industrial chain and enterprise-government collaboration, and the connotation of full-domain informatization has long been ambiguous.

Based on local Chinese scenarios, this paper improves the research framework and distinguishes integrated informatization from full-domain informatization. Empirical results prove that the five subsystems of the full-domain architecture form a dynamic coupling relationship, and data circulation and compliance & risk control are the main blocking links. Simply upgrading hardware and computing power cannot achieve successful transformation, and the collaboration of multiple elements including organization and institution is indispensable.

This research also confirms that compliance investment has obvious boundaries: the empowerment effect of digital transformation declines when compliance intensity exceeds 3.795, and the optimal range for compliance construction is 1.862 to 3.795, correcting the misconception that more compliance investment brings better results.

8. Research Conclusions, Management Implications, Limitations and Prospects

8.1 Core Research Conclusions

This paper defines the connotation of the full-domain architecture and constructs a five-layer closed-loop system. The overall average coupling coordination degree of the 426 sample enterprises is 0.417, staying on the verge of imbalance, and the problem is most prominent among private enterprises and specialized, refined, differential and innovative SMEs.

The digital economy effectively boosts the construction of full-domain architectures. System coupling degree, executive cognition and compliance threshold play mediating, moderating and constraining roles respectively. Four differentiated transformation paths are summarized, and it is concluded that heavy-asset self-developed architectures are not suitable for private SMEs.

For practical application: Governments can unify data standards, open public computing power, implement differentiated subsidies and improve cross-border compliance services. Enterprises shall select transformation plans in accordance with their scales, reasonably control compliance investment and break internal data barriers. Service providers can launch customized industry systems and leasing services to reduce the transformation pressure on SMEs.

8.2 Future Research Prospects

Considering the limitations of this study and the development trend of industrial digitalization, subsequent research can be further explored from four perspectives. From the technical perspective, multimodal generative AI large models can be integrated to construct an adaptive and iterative intelligent full-domain architecture, so as to quantitatively assess the incremental enabling effect of intelligent algorithms on architectural maturity. In terms of application scenarios, differentiated cross-border digital regulations across China, Europe and America can be compared to develop full-domain information architectures applicable to multinational enterprises. Methodologically, dynamic QCA and spatial panel econometric models can be employed to investigate the spatial correlation between the development of regional digital economy and the construction of enterprise architectures. From the value perspective, a measurement model for data asset right confirmation can be established to precisely calculate the overall benefits brought by full-domain architectures, covering data asset appreciation, cost reduction and risk prevention.

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