Research on the Construction of Enterprise Data Asset Management System in the Big-Data Era

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Abstract: Based on a survey of 326 enterprises, this paper investigates the status quo of data asset management and identifies key influencing factors including technical platform support and improvement of institutional standards. A management framework consisting of four components-organizational management, institutional standards, value evaluation, and security compliance-is constructed. Four implementation procedures are further proposed: asset inventory, platform construction, institutional improvement, and value exploration. This research provides theoretical support and practical solutions for enterprises and public institutions to leverage data elements.

Keywords: Big Data; Data Assets; Management System; Value Evaluation; Full Life Cycle

1. Introduction

The role of data as a production factor has been defined by the Twenty Measures on Data and the provisions concerning data-asset book-entry. The Interim Provisions on the Accounting Treatment of Enterprise Data Resources issued by the Ministry of Finance came into force in 2024. Since then, data assets have been formally incorporated into enterprises' balance sheets, and enterprise data governance capacity has become a vital dimension of corporate competitiveness. Nevertheless, most enterprises are confronted with intertwined challenges such as ambiguous property rights and inconsistent unified standards. It has become an urgent practical issue to establish a sound governance mechanism for data assets.

2. Empirical Analysis of the Current Status of Enterprise Data Asset Management

2.1 Questionnaire Design and Data Collection

The questionnaire adopts 23 measurement items covering five dimensions: data strategy, organizational structure, institutional provisions, technical systems, and security funding, measured with a five-point Likert scale. Two objective indicators, namely data-asset catalogue coverage and data-quality qualification rate, are also collected. Conducted by industry associations from March to June 2025, the survey distributed 412 questionnaires to data managers in manufacturing, finance and retail industries. After eliminating samples with short response duration and logical errors, 326 valid questionnaires were obtained, representing an effective response rate of 79.1%. Among sample enterprises, 42.6% reported operating revenue exceeding RMB 1 billion, which guarantees good sample representativeness.

2.2 Descriptive Statistical Analysis of Enterprise Data Asset Management Level

SPSS 26.0 software was employed to analyze sample data. Table 1 presents central tendency, dispersion statistics and Pearson correlation coefficients among variables. The results show that the mean value of technical support reaches 3.571, while the mean value for the completeness of institutional standards is only 3.296. This indicates that enterprises have made faster progress in infrastructure construction than in formulating rules and regulations. The data-asset catalogue coverage rate stands at 0.463, implying that more than half of data resources have not been included in asset-oriented management scope.

Table 1. Descriptive Statistics and Correlation Analysis of Variables Measuring Enterprise Data Asset Management Level

Variable	Mean	Standard Deviation	1	2	3	4
1 Data strategic planning	3.642	0.876	1			

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2 Organizational structure adaptation	3.418	0.905	0.613**	1		
3 Completeness of institutional standards	3.296	0.948	0.547**	0.628**	1	
4 Technical platform support	3.571	0.913	0.582**	0.604**	0.663**	1
5 Data-asset catalogue coverage rate	0.463	0.271	0.439**	0.471**	0.522**	0.598**
6 Data-quality qualification rate	0.712	0.186	0.386**	0.412**	0.458**	0.503**
7 Composite score of management level	3.527	0.834	0.671**	0.694**	0.715**	0.738**

Note: N=326; ** denotes significance at the P<0.01 level.

All five dimensions are positively correlated with the composite management-level score. Technical-platform support yields the largest correlation coefficient of 0.738, followed by completeness of institutional standards at 0.715. This demonstrates that both instrumental factors and regulatory factors significantly boost management performance. The correlation coefficient between the subjective indicator of data-asset catalogue coverage and the composite score reaches 0.598, suggesting that asset-oriented transformation is a key manifestation of management maturity.

2.3 Analysis of Key Influencing Factors for Data Asset Management

To further test the net effect of each dimension on management performance, a multiple-linear-regression model is constructed with the composite score as the dependent variable. The overall model is statistically significant; estimation outcomes are shown in Table 2.

Table 2. Multiple Regression Results for Influencing Factors of Data Asset Management Level

Independent Variable	Regression Coefficient β	Standard Error	T-value
Data strategic planning	0.218	0.047	4.638
Organizational structure adaptation	0.186	0.045	4.133
Completeness of institutional standards	0.243	0.044	5.523
Technical platform support	0.276	0.043	6.419
Intensity of data-security investment	0.152	0.049	3.102
Constant	0.417	0.163	2.558
R^2	0.612	Adjusted R^2	0.605
F-statistic	84.273	P-value	<0.001

Note: Dependent variable: composite score of data asset-management level; N=326.

Regression results reveal that the standardized coefficient of technical-platform support is 0.276, significant at the 1% statistical level. Completeness of institutional standards ranks second with a coefficient of 0.243. This verifies the dual-driving logic of technical empowerment and rule-based governance.

The level of data-asset-oriented management can be synthesized via weighted aggregation of each dimension:

$$DAM=0.276X_1+0.243X_2+0.218X_3+0.186X_4+0.152X_5+\varepsilon \quad (1)$$

Where X_1 to X_5 represent standardized scores for technical-platform support, completeness of institutional standards, data strategic planning, organizational-structure adaptation, and security-investment intensity respectively; ε denotes the random disturbance term. Regression coefficients are directly adopted as weights to ensure empirical grounding for the composite index.

2.4 Discussion on Empirical Results

Empirical evidence reflects a widespread phenomenon in enterprises: higher priority is given to tools than to governance. Although technical systems have achieved certain maturity, supporting institutional frameworks lag behind. Deficiencies in institutions reduce the efficiency of translating technical investment into tangible management outcomes. The relatively small regression coefficient (0.152) for data-security investment indicates that security currently functions mainly as a guarantee factor rather than a driving factor for improvement. The 0.463 catalogue-coverage rate demonstrates that nearly half of data resources remain outside asset-oriented transformation channels. These practical findings lay the foundation for framework design in subsequent sections.

3. Design of Enterprise Data Asset Management System in the Big-Data Era

3.1 Overall Framework

To resolve the contradiction of advanced technology paired with backward governance

exposed by empirical evidence, system design shall adhere to the fundamental principles of strategy-oriented guidance, technical foundation, institutional guarantee and value-driven orientation [1]. Corresponding to major influencing factors derived from regression analysis, the framework takes the full life cycle of data assets as the main thread [2]. Four components-organizational management, institutional standards, value evaluation and security compliance-are embedded across all stages from data generation to asset retirement, forming a network-style management structure with hierarchical vertical connections and full-process horizontal coverage. This ensures clear responsible subjects, administrative rules and value attribution for each data asset throughout its lifecycle, as shown in Figure 1.

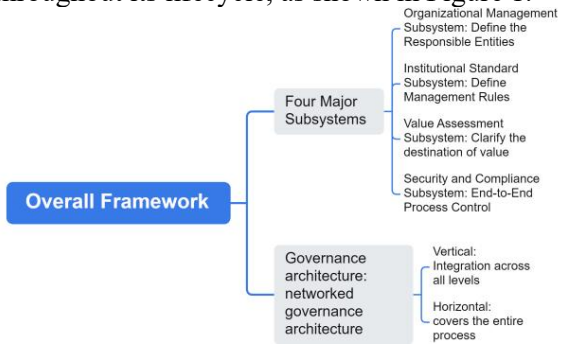

Figure 1. Overall Framework Design

3.2 Sub-System Design

3.2.1 Organizational management sub-system

A three-tier data-governance organizational mechanism is adopted. A Data Governance Committee under the Board of Directors is responsible for formulating strategic guidelines. A Chief Data Officer (CDO) coordinates cross-departmental work and reports directly to the Governance Committee. Each business department appoints dedicated data officers to manage department-level data assets [3]. Monthly joint meetings facilitate information exchange among decision-making, management and execution layers. Major issues are voted on by the Governance Committee, while cross-departmental conflicts are mediated by the CDO to avoid delayed governance caused by departmental barriers. Furthermore, data-asset catalogue coverage and data-quality qualification rates are incorporated into departmental annual performance appraisal with a weighting ratio of no less than 8%, so as to enforce accountability for governance delivery [4], as shown in Figure 2.

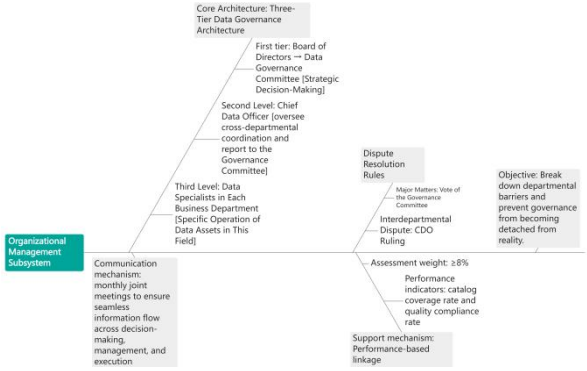

Figure 2. Organizational Management Sub-System

3.2.2 Institutional standards sub-system

Institutional documents are structured in three tiers: fundamental institutions, special administrative measures and operational procedures. The Enterprise Data Asset Management Measures stipulates basic rules for right confirmation, valuation and book-entry. Special measures such as metadata management specifications and data classification-and-grading guidelines define technical requirements. Operational procedures translate requirements of each workflow into concrete operational actions. A hierarchical logic applies: superior rules constrain subordinate detailed provisions [5]. Standard-setting shall align with GB/T 36073 (Data Management Capability Maturity Assessment Model). Enterprises shall conduct annual maturity assessments, whose outcomes drive iterative revision of institutional documents to keep rules consistent with business evolution, as shown in Figure 3.

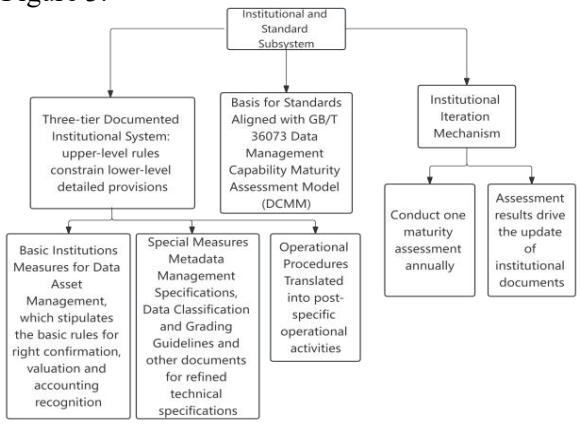

Figure 3. Institutional Standards Sub-system

3.2.3 Value evaluation and operation sub-system

Targeting low asset-transformation rates, three evaluation dimensions are established. Valuation integrates cost-based and income-based approaches. The cost approach calculates historical input expenditures; the income

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approach estimates incremental revenue and cost savings generated by data products; the market approach refers to listing prices on data exchanges to define valuation ranges [6]. Management procedures specify data-product cataloguing and external authorization-transaction workflows. Datasets approved by the Governance Committee may be listed and traded on legitimate data exchanges. Evaluation results are reviewed annually to serve as the basis for amortization. Where valuation gaps from two evaluation methods exceed 30%, cost aggregation in data processing workflows shall be re-examined to prevent overstatement of asset value, as shown in Figure 4.

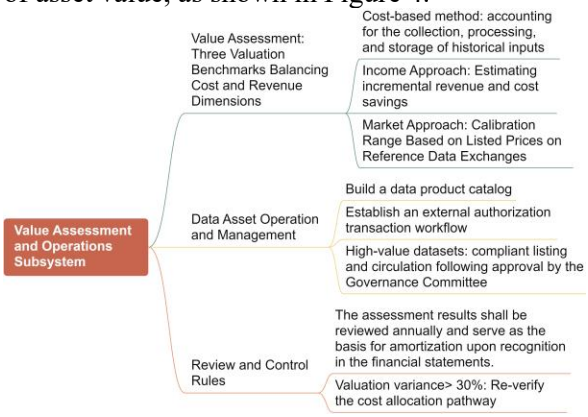

Figure 4. Value Evaluation and Operation Sub-System

3.2.4 Security compliance and risk-control sub-system

Differentiated protection measures are implemented according to data classification and grading. Core data is stored in encrypted form with dynamic desensitization applied; important data complies with domestic-storage requirements; access to general data leaves complete audit trails. Risk management includes annual compliance audits and data-export security assessments. Graded response contingency plans are developed for risks including data leakage, tampering and abuse. Security clauses are embedded into supplier contracts to constrain third-party data access. A closed-loop risk-management mechanism integrates pre-event prevention, in-process monitoring and post-event disposal covering internal and external stakeholders. Risk-disposal outcomes feed back into revision of classification-grading rules and access-permission configuration, enabling security capacity to dynamically upgrade in response to evolving threats, as shown in Figure 5.

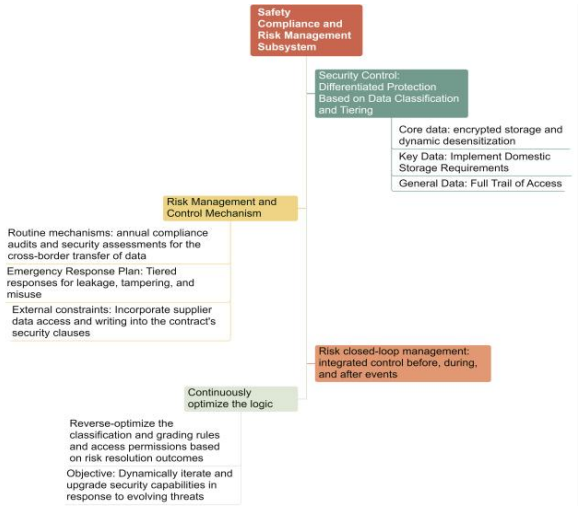

Figure 5. Security Compliance and Risk-Control Sub-System

3.2.5 Full-life-cycle data-asset management sub-system

Serving as the backbone of the whole framework, the full-life-cycle sub-system divides data-asset activities into six phases: collection and aggregation, governance and processing, right confirmation and registration, valuation and book-entry, sharing and circulation, and archiving and destruction. Entry thresholds and quality criteria are defined for each phase. Right-confirmation procedures can only commence when the data-quality qualification rate reaches 95% after governance processing. Cost vouchers and benefit-projection reports are both mandatory prerequisites for valuation-and-book-entry. System logs automatically record cross-phase transitions to establish traceable asset histories covering origin, processing workflows and value status. Each lifecycle phase is mapped to corresponding responsible departments and sub-systems, providing clear temporal and accountability foundations for governance activities, as shown in Figure 6.

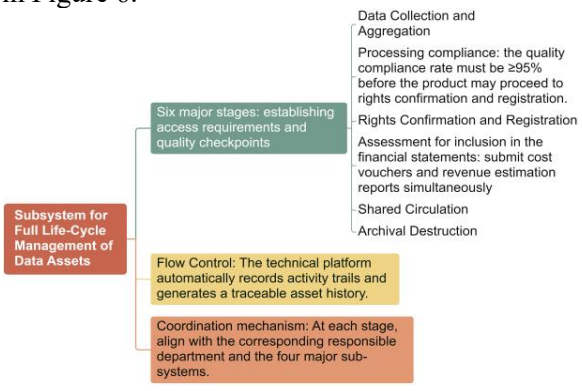

Figure 6. Full-Life-Cycle Data-Asset Management Sub-System

4. Implementation Path for Enterprise Data Asset Management System in the Big-Data Era

4.1 Inventory of Data-Asset Resources and Construction of Asset-Catalogue System

Asset inventory constitutes the foundational starting point. Without a clear overview of existing assets, subsequent right confirmation and valuation cannot proceed. A special working group led by the CDO shall be set up with personnel seconded from information, legal and finance departments. A three-month comprehensive inspection shall be conducted for data resources distributed across heterogeneous business systems, covering structured tables, unstructured documents and streaming real-time data. The scope shall also include cloud-outsourced data and historical archived data to avoid omissions. During inventory, each data resource is tagged by business attributes and sensitivity. Duplicate collection and long-term idle data items are logged in a pending-processing list. An enterprise-level three-tier data-asset catalogue is built, organized by business domain, subject domain and data item. The first-phase catalogue release shall cover at least 80% of data items within core business domains [7].

Once catalogued, assets are formally registered on technical platforms with responsible departments and designated persons assigned for each item. Disputed ownership shall be adjudicated within a time limit by the legal department. For newly-ingested data, the rule of "cataloguing before ingestion" is enforced as a front-end control to prevent unmanaged assets from emerging [8]. The catalogue is updated quarterly to maintain accurate real-time asset inventory, and catalogue-update performance is incorporated into data-officer appraisal. Inventory outcomes are summarized as an enterprise-wide data-asset map visualizing asset-distribution density and value grades across business domains, providing groundwork for platform deployment and data-asset book-entry.

4.2 Build Data-Management Technical Platform to Realize Centralized Data Governance

Empirical results highlight the critical role of platform support, which shall be prioritized in implementation. The platform adopts an architecture of unified foundation with layered decoupling. At the infrastructure layer, data lakes and data warehouses are combined to centralize multi-source data storage; hot-cold data tiering optimizes the trade-off between storage cost and query performance. The capability layer integrates governance modules including metadata management, data-quality inspection and data lineage analysis. The service layer delivers data services to business systems via API gateways, where identity authentication and metering are executed upon each API call to support intra-enterprise data-asset settlement. Platform construction shall reuse existing IT assets to the maximum extent possible [9]. Legacy systems are connected via adapters rather than full reconstruction, with system-integration finished within six months. The construction budget is allocated at 0.5%-1% of operating revenue, prioritizing investment in data-quality inspection and security-audit components. Compatibility and scalability must be validated during vendor selection; unified coding standards are enforced for interfaces to avoid new data silos [10].

After platform launch, a rule library containing thirty quality-check rules (including null-value ratio and domain-violation rate) is embedded into data-processing pipelines. Non-compliant data is automatically blocked from ingestion and triggers rectification notifications. Remedial tasks with department-specific deadlines are escalated to the CDO upon overdue processing. Platform tracking generates quality-performance reports for accountable personnel, combining technical governance with performance incentives. Platform operational status is reported to the Governance Committee quarterly; major architectural adjustments require prior committee review. Access permissions undergo centralized bi-annual audits to revoke accounts for separated employees and redundant privileges.

4.3 Improve Institutional Regimes to Enable Normalized System Operation

Institutional roll-out follows four-step workflows: official release, training, trial operation and revision. The Data Asset Management Measures is formally issued upon deliberation by the Governance Committee, accompanied by supporting regulations for metadata management, data

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classification-and-grading and other domains to align superior policies with operational standards. Targeted training with mandatory passing examinations is provided for all data officers; access privileges are granted only upon full examination pass rates. Training content is differentiated by role: data officers focus on cataloguing and data-quality improvement practices, while department heads focus on institutional responsibilities and appraisal rules.

The trial-operation phase lasts six months. Execution feedback is collected monthly from business departments, focusing on two metrics: timeliness of catalogue updates and closure rate of quality-management work orders. Special inspections are conducted for departments with substantial implementation deviations. Recurring issues are compiled and circulated monthly to prevent repeated non-compliance across departments [11].

After trial operation, revision lists are compiled with each amendment traceable to specific feedback records to ensure evidence-based institutional iteration. Sustained operation relies on appraisal and incentive mechanisms. Data-asset-management indicators are embedded into annual performance commitment letters for department heads, with higher weighting assigned to data-intensive departments. A Data-Asset Contribution Award is established: teams delivering high-value datasets or driving data-product monetization receive bonuses equivalent to 3% of incremental revenue. Institutional constraints are therefore complemented by positive economic incentives to prevent formalistic implementation. Annual evaluations drive cyclic optimization, with evaluation outputs serving as primary inputs for subsequent institutional revision and resource allocation.

4.4 Deepen Data-Value Exploration and Unlock Benefits of Data Assets

Value realization represents the ultimate objective of system construction. Implementation follows the principle of prioritizing internal value creation before external circulation. Enterprises first develop internal-facing data products: for example, manufacturing enterprises deploy predictive-maintenance models leveraging equipment operational data to cut unplanned downtime by over 20%; retail enterprises optimize product portfolios via consumer-behavior analytics to improve inventory turnover. Once internal scenarios mature, high-value datasets with external market potential may be anonymized, pass compliance review, and then be listed for trading on data exchanges or shared collaboratively with industrial-chain partners within data spaces.

Enterprises shall maintain dedicated accounting books for data-product revenue. Monetization income is incorporated into data-asset-operation performance, and asset value is reassessed every year. A value loop of "evaluation-circulation-value-increase-re-evaluation" is formed for sustained appreciation of data assets. Value-exploration workflows interconnect with catalogue maintenance, platform operation and incentive appraisal, transforming the management framework into a continuously benefit-generating mechanism.

5. Conclusion

Empirical findings confirm the general imbalance within enterprises: relatively mature technical infrastructure coexists with backward governance mechanisms. The proposed framework with four interlinked sub-systems integrates institutions, organization, technology and value considerations into a practical holistic governance solution. Four phased implementation pathways translate the conceptual framework into actionable roadmaps. Future research may investigate economic performance of enterprises with formally book-entered data assets to validate long-term effectiveness of this system.

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