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Research on Risk Management of Enterprise Data Asset Life Cycle

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Abstract: With the rapid development of the digital economy, data has emerged as the fifth major production factor, following land, labor, capital, and technology. While the value of corporate data assets continues to grow, the risks associated with their management have also increased significantly. This paper examines the key risks encountered during four critical phases of corporate data assets—acquisition, acceptance, application mining, and periodic evaluation—from a full lifecycle perspective. These risks include compliance issues with data sources, ambiguous ownership boundaries, and technology-induced security vulnerabilities. To address these challenges, the paper proposes optimization strategies across four dimensions: enhancing value recognition, ensuring data quality, strengthening security management, and fostering cross-departmental collaboration. The ultimate goal is to establish a comprehensive risk prevention system throughout the entire process, thereby safeguarding corporate data assets and improving the efficiency of data value realization.

1. Introduction

With the rapid advancement of information technology and the internet, data has become a primary source of corporate competitiveness, and data assetization has emerged as an essential pathway for digital transformation. However, the rapid accumulation of data also brings significant risks, such as unauthorized data collection, core data breaches, ownership disputes, and improper disposal of discarded data. These issues not only cause substantial economic losses to enterprises but may also lead to legal sanctions and reputational crises.

Given the persistent shortcomings in enterprises' internal control systems for data assets and the lack of effective end-to-end monitoring mechanisms, this study employs the full lifecycle management theory to delineate four core phases in enterprise data asset management: acquisition, acceptance, application mining, and periodic evaluation. It systematically identifies critical risk points at each stage. Building on this framework, the paper proposes corresponding risk management strategies from perspectives such as value recognition, quality control, technical security, and organizational collaboration. These strategies aim to address management chain disconnections, providing theoretical references and practical guidance for enterprises to establish secure and efficient data asset management systems.

2. Overview of the full lifecycle of enterprise data assets

2.1. Definition of Data Assets

As the lifeblood of the digital economy, data stands as the most vital production factor in the digital economy era. As a critical strategic resource, data plays an irreplaceable role in corporate development. In 1974, Richard E. Peters first proposed the concept of ‘data assets.’[1] Data assets refer to data resources generated through daily operations—including sales, production, R&D, marketing, and customer service—that are owned or controlled by enterprises, expected to generate economic benefits, and measurable in monetary terms[2]. Research on data assets originated from corporate data, with existing studies predominantly focusing on enterprise-level analysis[3]. The completeness and usability of corporate data assets are directly influenced by market value and competitive positioning. The ‘DataAsset Management Practice White Paper (Version 4.0)’ defines data assets (Data Asset) as: data resources physically or electronically recorded, owned or controlled by enterprises, capable of generating future economic benefits.[4]

2.2. Characteristics of Data Assets

Data assets possess multidimensional core characteristics that determine their unique value as new production factors while presenting specific challenges for risk management. Firstly, controllability requires enterprises to establish clear ownership and control rights through technical means and legal mechanisms. Vague control boundaries may lead to ownership disputes and unauthorized usage risks[5]. Secondly, dynamism is a defining feature of data assets, as their content continuously updates with business processes. Data assets exhibit high timeliness, with their value closely tied to time and current market conditions. Data resources that are highly valuable during one period may become worthless in others. The evolving form and value across lifecycle stages demand risk management strategies to adapt to dynamic scenarios. Finally, measurability serves as a critical prerequisite for data assetization. Enterprises must quantify their value using valuation models like cost approach and income approach, providing a basis for resource allocation and benefit measurement in risk management.

2.3. Data Life Cycle

Data asset lifecycle management refers to the systematic control of data resources throughout their entire lifecycle, from generation, storage, application to disposal[6]. While rooted in traditional information lifecycle management, it differs by focusing not only on optimizing storage costs but also on treating data as an "asset" to realize its value while balancing associated risks. This framework provides enterprises with a systematic guidance for data governance, requiring managers to maintain dynamic equilibrium between maximizing business value and minimizing compliance risks at every data flow node. Specifically, the data asset lifecycle encompasses four core stages: collection and acceptance, storage and maintenance, application and mining, and evaluation and disposal, forming a complete closed loop from asset creation, value realization to final exit. This process not only tracks the physical flow of data but also profoundly reflects the economic evolution of data value – from latent potential and explosive growth to eventual decline.

The academic community widely recognizes that implementing full lifecycle management is the key pathway to enhancing data asset maturity. In 2019, Ni Wenjing and Hu Zhen emphasized that enterprises should establish a closed-loop security control system covering data collection, storage, processing, transmission, and destruction to strengthen core competitiveness[7]. However, regarding implementation challenges, Gao Shudong further pointed out in 2024 that current enterprises still face shortcomings in building internal control systems for data assets, primarily manifested in the lack of process monitoring and emergency mechanisms. Due to insufficient consideration of data assets' intangible and time-sensitive characteristics, management requirements for R&D, procurement, acceptance, transfer, and disposal have not been effectively integrated into information management systems. This has led to disconnection in management chains and chaotic control throughout the entire process.[8]

The data lifecycle theory not only encompasses all critical stages of data assets from collection to archiving, but also achieves dynamic balance between cost control and value extraction through optimized management of the entire process, while ensuring business compliance and data security. Building on this foundation, this paper adopts the theory as the logical framework for identifying internal control risks. By embedding control activities into every specific phase of data flow, it establishes a phased risk analysis and response framework to address the aforementioned management disconnect issues.

3. Existing Problems of Enterprise Data Asset Life Cycle Risk Management

Based on the full lifecycle theory of data assets, the management process of enterprise data assets can be divided into four core stages: acquisition, acceptance, application mining, and periodic evaluation. Each stage faces different risk challenges due to its distinct business attributes. Without effective process monitoring, it is highly likely to result in disconnection of the management chain and value loss.

3.1 Acquisition Phase

The acquisition of data assets marks the beginning of their entire lifecycle, primarily through three approaches: in-house processing, external procurement, and platform acquisition. However, in practice, enterprises commonly face dual risks of source compliance and quality control at the origin. First, from a compliance perspective, few companies truly own the original data sources, as most rely on secondary processing of customer data or external purchases[9]. As scholars have pointed out, when enterprises fail to clarify legal boundaries of data collection and package data resources that do not meet legal ownership or control conditions as products, it easily triggers legal risks such as illegal scraping, infringement of third-party intellectual property rights, or personal privacy violations. This can render asset ownership invalid from the outset and even lead to severe credit crises. Second, regarding source quality control, the lack of unified data access standards and rigorous project approval processes may lead enterprises to blindly collect high-cost, low-value data or introduce substandard data with inconsistent formats and questionable authenticity. This not only degrades the overall quality of the data asset pool but also creates hidden high-cost risks for subsequent cleaning and maintenance.

3.2 Acceptance Phase

The acceptance process for data assets involves verifying ownership relationships and assessing data quality. This phase serves not only as a physical checkpoint ensuring data quality for archival purposes but also as a legal safeguard for asset ownership confirmation. However, enterprises often fall into the trap of "emphasizing quantity over substance" during this stage. On one hand, acceptance procedures frequently become mere formalities. Due to the lack of effective data quality management mechanisms, inspectors may only check data volume while neglecting substantive tests of credibility metrics like accuracy and consistency, which can easily lead to substandard data passing acceptance and causing data misreporting and transmission distortions in subsequent applications. On the other hand, ambiguity in ownership definition poses another major risk. For externally acquired or collaboratively generated data, failing to clearly delineate boundaries of ownership, usage rights, and revenue rights during acceptance may result in insufficient basis for asset accounting. Such ownership uncertainty not only complicates financial accounting but may also trigger complex legal disputes in future asset confirmation financing or transactions.

3.3 Application Mining Phase

Data mining serves as the pivotal stage in realizing the value of data assets, designed to enhance business agility and decision-making efficiency through algorithmic analysis. However, this phase also represents a high-risk area for information security and algorithmic ethics. Specifically, data undergoes frequent retrieval, analysis, and sharing during this process. Improper desensitization or lack of encryption mechanisms during transmission can easily lead to sensitive information leaks. Moreover, inadequate internal controls may trigger moral hazards. Without dynamic access permission management, internal personnel may abuse data privileges unchecked. Furthermore, algorithmic flaws cannot be overlooked. If mining models contain data bias, their analytical results could mislead management decisions, causing data assets to fail in delivering expected value and instead result in direct operational losses due to misguided strategic orientations.

3.4 Regular Evaluation Phase

As the final safeguard in the closed-loop asset management system, the periodic evaluation phase primarily faces risks of value measurement distortion and delayed identification of asset impairment. Given the highly time-sensitive and dynamic nature of data assets, their value fluctuates with market conditions and application scenarios. Traditional cost-based or income-based valuation methods often fail to accurately reflect their current market value, leading to either inflated or undervalued book values. More critically, without dynamic value monitoring mechanisms, enterprises may fail to promptly identify obsolete data assets, causing inefficient data to occupy storage resources for extended periods and increasing unnecessary operational costs. Finally, for data reaching the end of its lifecycle, the absence of comprehensive destruction and exit mechanisms means retained residual data not only loses value but may also become latent security vulnerabilities, potentially triggering compliance issues like privacy breaches at any time.

4. Optimization Strategy of Enterprise Data Asset Risk Management

For the risks identified in the data asset lifecycle, enterprises should develop systematic risk management strategies from four dimensions: value recognition, quality control, technical security, and organizational collaboration.

4.1 Enhancing Value Awareness

Value recognition serves as the foundational logic for data asset management and the core prerequisite for risk control. The quality of corporate assets is fundamentally shaped by business philosophies. Cultivating internal capabilities in data comprehension and application constitutes the critical step in optimizing data resource management[10]. Organizations should systematically identify data sources, legally and strategically differentiate between externally acquired data and internally developed data, and establish a comprehensive data asset management framework. Three systematic approaches are essential for enhancing organizational value awareness: First, building consensus on data asset value. Management must pioneer the shift from traditional perceptions by integrating data value into strategic decision-making, while aligning it with business objectives to create actionable, measurable metrics. Second, developing a data value culture system. This involves tiered training programs: providing strategic-level training that aligns data with business goals, designing scenario-based practical training for operational teams, and strengthening technical training that emphasizes quality-value correlation. Finally, embracing advanced data asset management tools. Given the multidisciplinary nature of data asset management, robust tools are indispensable to ensure traceability of all data assets, enabling enterprises to monitor quality and promptly address deficiencies.

4.2 Ensuring data quality

Data serves as the foundation for building data assets, and its quality directly impacts the quality of data asset supply. Therefore, ensuring data asset quality must begin with safeguarding source data quality. First, standardize data collection processes. For enterprises, data may originate from internal and external sources, and a single dataset might have multiple channels. Data requesters should clarify collection procedures, establish data provision paradigms with suppliers in advance, and define how to handle anomalies[11]. Second, establish metadata standards and develop data cleansing protocols. Data standards provide consistent conventions for data representation, formatting, and definitions[12]. Finally, implement a full-cycle management mechanism covering data collection, processing, analysis, and result presentation. During data collection, automated monitoring tools or visualization platforms can capture real-time raw information like system logs and user behavior records.

4.3 Enhancing Safety Management

In data application and mining processes, risks exhibit high-frequency and covert characteristics, necessitating technological solutions to transition from manual intervention to technical intervention. Continuous optimization of technical architectures and management mechanisms should be implemented to strengthen data lifecycle protection measures. First, promote the application of privacy-preserving computing technologies. In data sharing and cross-entity transactions, actively adopt federated learning and secure multi-party computation techniques to achieve value realization under the premise of "data remaining within domains while being usable but invisible," thereby resolving the paradox between data circulation and privacy protection. Second, implement closed-loop management throughout the entire lifecycle. Enterprises should establish a comprehensive data tracking system to conduct real-time auditing and anomaly alerts for data access, invocation, and analysis. Particularly for the disposal processes, enterprises should develop a standardized data destruction operating procedures (SOPs) to ensure complete physical shredding or logical erasure of discarded data, eliminating residual risks.

4.4 Collaborative Department Management

To address the current disconnect in management chains and lack of internal controls, comprehensive safeguards must be established at organizational structure and institutional culture levels. First, strengthen organizational support for data assets. Historically, corporate data management functions were scattered across technology, operations, and finance departments, leading to coordination challenges. Enterprises should establish unified data governance departments or cross-departmental data governance committees to coordinate enterprise-wide data assets and break down internal "data silos" and management barriers. Second, cultivate versatile talent. Enterprises should enhance digital literacy among financial and business personnel, developing professionals who master both financial processing and data governance to clearly identify risk points throughout the data lifecycle. Third, integrate risk management into performance evaluations. Enterprises should develop data asset management strategies combining short-term and long-term objectives, incorporating compliance practices and security awareness into employee performance assessments. Through institutional constraints and cultural cultivation, implement a clearly defined risk management accountability system.

5. Conclusion

In the digital economy era, data asset risk management transcends technical challenges to become a managerial imperative. Grounded in the full lifecycle theory, this study identifies specific risks across four critical phases: acquisition, acceptance, application mining, and periodic evaluation. It proposes a systematic risk response framework encompassing four dimensions: value recognition enhancement, data quality assurance, security management reinforcement, and cross-departmental coordination. Enterprises must establish end-to-end risk prevention mechanisms to maximize data value while ensuring compliance and security. As technologies like artificial intelligence and privacy-preserving computing advance, data asset risk control will evolve toward intelligent automation, safeguarding corporate sustainability.

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