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Application and Practice of Big Data Technology in Financial Management

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Abstract: In the era of accelerating digital economy penetration, big data technology is reshaping traditional corporate financial management models through its core advantages of massive data processing, in-depth data analysis, and precise trend forecasting. This paper focuses on the application value and practical approaches of big data technology in financial management. Through systematic analysis of four core modules, budget management, cost control, risk management, and investment/financing decisions, the study examines application scenarios and implementation effects of big data technology. Addressing current challenges such as insufficient technical compatibility, data security risks, and talent shortages in enterprise applications, targeted optimization strategies are proposed. Practical case studies from enterprises of varying scales demonstrate the practical significance of big data technology in enhancing financial management precision and strengthening corporate value creation capabilities. The research indicates that big data technology drives the transformation of financial management from accounting-oriented to strategy-oriented, providing crucial support for efficient operations in complex market environments. Establishing a comprehensive technical application system, strengthening data governance, and cultivating talent reserves are key to enabling enterprises to fully leverage big data in financial management.

Keywords: Big data technology; Financial management; Risk control; Budget management; Value creation

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1. Introduction

With the rapid advancement of digital technologies including cloud computing, artificial intelligence, and the Internet of Things (IoT), the volume of data generated during business operations has grown exponentially, establishing data as a core production factor for enterprises. As a pivotal component of corporate management, traditional financial management models relying on manual accounting and experience-based decision-making have increasingly revealed shortcomings such as inefficiency, data lag, and inadequate risk assessment, making them ill-suited to today's complex and dynamic market environment. Big data technology, characterized by massive data collection, rapid processing, and multi-dimensional analysis, can break through information barriers

in traditional financial management. It enables deep integration of financial and operational data, providing more comprehensive, precise, and real-time decision-making support. In recent years, enterprises worldwide have actively deployed big data applications in financial management, transitioning from upgrading financial systems to building data analytics platforms. This trend is propelling financial management into a new era of intelligent and refined operations. Against this backdrop, in-depth research on the application and practice of big data technology in financial management holds significant practical urgency.

2. Core connotation and integration logic of big data technology and financial management

2.1. Core characteristics of big data technology

Big data technology encompasses a suite of methodologies for collecting, storing, processing, and analyzing massive, heterogeneous, and rapidly growing datasets to extract actionable insights. Its core characteristics are summarized as the following "5Vs":

(1) Volume: Encompassing petabytes to petabytes of data;
(2) Velocity: Enabling real-time data capture and processing for instant decision-making;
(3) Variety: Supporting structured data like financial statements, semi-structured data such as contracts, and unstructured data including audio and video;
(4) Veracity: Ensuring data quality through cleaning and validation;
(5) Value: Identifying hidden economic patterns and business trends to create enterprise value.

2.2. The need for digital transformation in financial management

Traditional financial management, centered on accounting, focuses on basic tasks like post-event bookkeeping, reporting, and tax filing, with three major pain points as follows:

(1) Its data dimensionality is limited to financial metrics while neglecting external information such as business and market data;
(2) Decision-making lags due to reliance on historical data analysis, making it difficult to respond swiftly to market changes;
(3) Risk anticipation is insufficient, lacking systematic identification and early warning mechanisms for potential risks.

As enterprises expand and market competition intensifies, financial management urgently needs to transition toward budget precision, cost control, risk prevention, and scientific decision-making. Big data technology can effectively address the shortcomings of traditional models, providing technical support for this transformation [1].

2.3. The integration logic of big data and financial management

The integration of big data technology with financial management fundamentally represents a data-driven restructuring of financial management models. This integration operates through three key dimensions as follows:

(1) Data convergence that eliminates silos between finance and business units by consolidating sales, production, supply chain, and customer data with financial metrics to establish a unified data ecosystem;
(2) Process optimization that automates and enhances traditional financial workflows through big data analytics, enabling intelligent execution of budgeting, cost accounting, and risk assessment;
(3) Value enhancement that extends beyond conventional financial reporting to value management, providing

data-driven decision support for corporate investments, financing, and strategic planning to maximize organizational value.

3. Core application scenarios of big data technology in financial management

3.1. Budget management: Precise compilation and dynamic monitoring

Traditional budgeting relies on historical data and departmental submissions, which often suffer from subjectivity, low accuracy, and delayed adjustments. Big data technology, through multi-dimensional data collection and analysis, enables comprehensive optimization of the entire budget management process.

During the budget preparation phase, enterprises can integrate historical financial data, market demand data, industry trends, and policy changes, leveraging big data modeling techniques to accurately forecast key metrics like sales revenue and cost expenditures. For instance, retail businesses analyze consumer behavior patterns, holiday spending trends, and regional purchasing power to develop tailored sales budgets by region and product category. Manufacturing companies, meanwhile, combine raw material price fluctuations, production capacity, and order volumes to create precise production and procurement budgets [2].

During budget execution, big data technology enables dynamic monitoring and real-time adjustments. By establishing a budget management system that synchronizes budget metrics with operational data, the system automatically triggers alerts when expenditures exceed predefined thresholds. It also dynamically adjusts budgets in response to market changes (e.g., rising raw material costs or declining demand), overcoming the limitations of rigid, static budgeting. For instance, internet companies leverage real-time data on user engagement and conversion rates to dynamically allocate marketing and R&D budgets.

3.2. Cost control: Full chain traceability and fine accounting

Cost control stands as a cornerstone of financial management, where big data technology enables precision management across the entire cost chain, from generation to accounting. During cost aggregation, IoT technology collects real-time data on raw material consumption, energy usage, and labor costs in production processes, ensuring accurate calculation of product and departmental expenses. In cost analysis, big data models dissect cost structures and drivers to identify unnecessary expenditures. For instance, manufacturing firms analyze equipment operation data to optimize maintenance cycles, reducing both equipment failure rates and maintenance costs. Similarly, logistics companies leverage transportation route data, fuel consumption metrics, and labor cost analysis to refine delivery strategies and lower transportation expenses [3].

Furthermore, big data technology enables cost forecasting and optimization. By analyzing historical cost data and market variables (such as raw material prices, labor costs, and regulatory policies), it predicts future cost trends and provides optimization recommendations. For instance, companies can identify cost-effective suppliers through supplier data analysis, while optimizing production processes to reduce unit costs by refining manufacturing workflows.

3.3. Risk control: Comprehensive identification and advance warning

In financial management, risks primarily include credit risk, market risk, liquidity risk, and compliance risk. Big data technology enables early identification, precise assessment, and timely resolution of risks through the development of risk warning models. For credit risk control, enterprises integrate historical transaction data, credit records, industry credit ratings, and social media data to build multi-dimensional credit evaluation models for

accurate customer rating assessments. Regarding accounts receivable, real-time monitoring of payment status and operational conditions allows predictive analysis of overdue risks and prompt collection measures. For instance, financial institutions use big data to evaluate borrowers ‘repayment capacity and willingness, reducing non-performing loan ratios. Enterprises analyze supplier credit data to mitigate supply chain disruption risks.

In market risk management, real-time collection of price, exchange rate, interest rate, and policy data helps assess market fluctuations’ impact on operations. Foreign trade companies monitor exchange rate volatility to formulate hedging strategies, while energy firms adjust procurement plans and inventory levels based on international oil price trends. For compliance risk control, big data technology automatically identifies abnormal transactions and violations in financial records. Compliance monitoring systems, aligned with accounting standards, tax regulations, and industry requirements, continuously track financial statements, reimbursement vouchers, and fund flows to detect fraudulent claims, tax evasion, and fund misappropriation, thereby reducing corporate compliance risks [4].

3.4. Investment and financing decision-making: Scientific evaluation and precise judgment

Investment and financing decisions directly determine the survival and development of enterprises. Traditional decision-making relies on the experience of decision-makers and limited financial data, which carries high risks. Big data technology provides objective and precise support for investment decisions through comprehensive data analysis. In investment decisions, companies can analyze target projects ‘industry prospects, market competitiveness, financial status, and potential risks using big data. For instance, investment institutions collect target enterprises’ operational data, industry rankings, user reviews, and intellectual property data to build investment evaluation models, assessing project value and return rates.

When making fixed asset investments, companies analyze market demand data, capacity utilization rates, and technological iteration data to evaluate project feasibility and profit cycles. For financing decisions, big data technology helps enterprises select optimal financing channels and solutions. By analyzing cost data, financing terms, and policy support data of different financing methods, combined with their own financial conditions and cash flow data, companies can develop personalized financing strategies. For example, small and medium-sized enterprises can access financial institutions through big data platforms and obtain credit loans using multi-dimensional operational data to solve financing difficulties. Large enterprises can analyze capital market data to choose optimal combinations of equity financing and bond financing.

3.5. Financial analysis and forecasting: Multi-dimensional insight and forward-looking judgment

Traditional financial analysis often remains confined to ratio-based evaluation of financial statements, offering a narrow perspective. Big data technology has revolutionized financial analysis by expanding its dimensions and depth, enabling a shift from historical review to future forecasting. Enterprises can now integrate financial data, operational metrics, industry benchmarks, and macroeconomic indicators for multidimensional analysis as listed:

(1) Profitability analysis: Identifying core profitable operations and growth opportunities through metrics like product gross margins, customer contribution rates, and regional profitability;

(2) Operational efficiency analysis: Optimizing workflows by examining inventory turnover, accounts receivable turnover, and asset utilization rates;

(3) Growth potential analysis: Predicting future trends through market share, growth rates, and R&D investment effectiveness.

On top of that, big data technologies leverage machine learning and neural network algorithms to build predictive models, providing precise forecasts for key indicators such as revenue, profits, and cash flow. This data-driven approach offers strategic planning insights. For instance, tech companies analyze R&D investments, patent portfolios, and market demand trends to forecast new product market prospects and profitability potential.

4. Practical cases of big data technology in financial management

4.1. Large-scale manufacturing: Haier group's financial digital transformation

As a globally renowned manufacturing enterprise, Haier Group has developed a "Financial Shared Platform" leveraging big data technology to achieve end-to-end intelligent financial management. This platform integrates financial, production, supply chain, and customer data from Haier's global operations, establishing a unified data hub. For budget management, big data models enable precise budget formulation and dynamic adjustments across subsidiaries and business units worldwide. In cost control, real-time production equipment data collected through IoT optimizes manufacturing processes and reduces unit costs. For risk management, a global capital risk early-warning system monitors exchange rate and interest rate fluctuations in real time to mitigate cross-border operational risks. Empowered by big data, Haier Group has achieved a 60% increase in financial accounting efficiency and a 95% budget accuracy rate, effectively supporting its global expansion strategy [5].

4.2. Internet industry: Alibaba's intelligent financial system

Leveraging big data and cloud computing technologies, Alibaba has developed its intelligent financial platform "Alibaba Financial Brain," achieving automated and intelligent financial management. The platform features three core functions as follows:

(1) Smart accounting: Using OCR technology to automatically recognize reimbursement vouchers and invoices, enabling automated bookkeeping and tax filing;

(2) Precise forecasting: Integrating transaction data from e-commerce platforms, user data, and logistics data to predict revenue and cash flow, supporting corporate investment and financing decisions;

(3) Risk prevention: Real-time monitoring of merchants' transaction data to identify fraudulent transactions and irregular settlements, ensuring fund security.

The implementation of Alibaba Financial Brain liberates financial personnel from tedious routine tasks, allowing them to focus more on strategic planning and value management.

4.3. Financial industry: Big data risk control practice of China construction bank

China Construction Bank has implemented big data technology to build a multi-dimensional risk control model for credit risk management. By integrating clients 'bank transaction records, credit card spending data, mortgage and auto loan repayment histories, along with external data sources including social security records, housing provident fund records, business registration records, and judicial data, the bank conducts comprehensive credit evaluations. Additionally, it has established a real-time risk monitoring system to track credit applications and fund transfers, identifying suspicious transactions. This risk control model has consistently kept the bank's non-performing loan ratio below the industry average, significantly enhancing the quality of its credit assets.

5. Problems in the application of big data technology in financial management

5.1. Technical level: Insufficient system adaptation and lagging data governance

Some enterprises face outdated technical architectures, with their existing financial systems being incompatible with big data technologies and lacking sufficient data storage and processing capabilities, which hinders the implementation of big data applications. In addition, enterprises face complex data sources characterized by inconsistent standards, incompatible formats, and uneven data quality, coupled with a lack of a robust data governance framework. Furthermore, the development of big data analytical models requires specialized technical expertise, yet most enterprises lack in-house development capabilities and rely on external service providers. This dependency results in models that struggle to adapt to actual business needs, leading to poor compatibility.

5.2. Talent level: Shortage of compound talents

The application of big data in financial management requires professionals who are proficient in both financial expertise and big data technologies, including data analysis tools. Currently, most financial personnel in China specialize in traditional accounting practices but lack skills in big data processing, machine learning, and data modeling. Meanwhile, big data specialists often lack familiarity with financial management operations, resulting in a talent supply-demand imbalance. This shortage prevents companies from independently conducting big data analysis, thereby limiting the deep integration of big data technologies.

5.3. Security level: Increased data leakage risk and compliance pressure

Financial management data contains core business secrets and sensitive information, and the entire data lifecycle, from collection and storage to transmission and analysis, faces security risks in the big data era. Cyberattacks and system vulnerabilities may cause data breaches, while data sharing often leads to unclear ownership and usage rights, increasing the risk of misuse. Moreover, with the implementation of laws like the Data Security Law and Personal Information Protection Law, enterprises must strictly comply with data processing regulations, further intensifying compliance pressures [6].

5.4. Management level: Cognitive bias and insufficient organizational synergy

Some corporate executives misinterpret big data technology, equating its implementation with mere financial system upgrades while overlooking critical dimensions like data integration, process optimization, and organizational transformation. The persistent data silos between finance and operations departments further exacerbate this issue, as business units lack data-sharing awareness, resulting in ineffective integration of financial and operational data. Compounding these challenges, the absence of robust incentive mechanisms for big data adoption has dampened employee engagement, ultimately undermining the effectiveness of such implementations.

6. Optimization strategy of financial management empowered by big data technology

6.1. Build an adaptive technical system and strengthen data governance

Enterprises should select big data platforms that align with their scale and operational requirements, making full use of technologies such as cloud computing and distributed storage to enhance data processing capabilities. Small and medium-sized enterprises can rely on third-party cloud service platforms to reduce technical investment costs, whereas large enterprises may establish proprietary data middle platforms to enable centralized data management and resource sharing. In parallel, data governance mechanisms should be strengthened by establishing unified data

standards and specifications, clearly defining processes and responsibilities for data collection, storage, processing, and utilization.

Data quality audit systems, incorporating techniques such as data cleaning and validation, should be implemented to eliminate invalid or erroneous data and ensure data reliability. Furthermore, data ownership and usage rights must be clearly defined, and standardized data-sharing procedures should be established. To optimize analytical performance, enterprises are encouraged to collaborate with universities, research institutions, and professional service providers to develop customized big data analytical models tailored to specific business characteristics. Dynamic optimization mechanisms should also be introduced to enable timely updates of model parameters in response to market fluctuations and operational changes, thereby enhancing model accuracy and adaptability.

6.2. Strengthening talent training and building a compound team

Enterprises should strengthen talent development for big data-driven financial management through a combination of internal training, external recruitment, and incentive mechanisms. Regular training programs should be organized for financial personnel to enhance their proficiency in data analysis tools such as Python and SQL, big data modeling, and basic machine learning techniques, while industry experts can be invited to share practical case studies to improve application capabilities. In parallel, preferential recruitment policies should be implemented to attract interdisciplinary professionals with expertise in both big data technologies and financial management, and cooperation with universities should be promoted through industry-academia joint training programs to cultivate specialized talent. Additionally, dedicated incentive mechanisms, including special awards for big data applications, should be established to recognize outstanding achievements in data analysis, model development, and value creation, thereby motivating employees to actively learn and apply big data technologies.

6.3. Strengthen data security to ensure compliant operations

Data security should be comprehensively strengthened through the integration of technical safeguards, management systems, and regulatory compliance measures. Advanced security technologies, including firewalls, data encryption, and intrusion detection systems, should be deployed to protect data storage and transmission, while robust data backup and recovery mechanisms must be established and regularly tested to prevent data loss. At the same time, system vulnerabilities should be promptly patched to address emerging cybersecurity threats. In terms of management, data security responsibilities should be clearly defined, and a dedicated data security management team should be established to oversee routine monitoring and risk prevention, supported by a well-defined contingency plan to enable rapid response to data breach incidents and minimize potential losses. Furthermore, enterprises must strictly comply with relevant laws and regulations, such as the Data Security Law and the Personal Information Protection Law, ensuring lawful data collection, processing, and utilization. A compliance review mechanism should also be implemented, with regular self-assessments conducted to reduce legal and regulatory risks.

6.4. Change management concept and strengthen organizations' coordination

Managerial awareness of big data applications should be strengthened by encouraging organizational leadership to participate in specialized training programs, enabling a comprehensive understanding of the transformative role of big data in financial management and promoting its integration into corporate strategic planning and resource allocation. At the organizational level, departmental data silos should be dismantled through the establishment of cross-departmental collaboration mechanisms with clearly defined data-sharing responsibilities, supported by the

development of an enterprise-wide data sharing platform that enables seamless integration of financial, operational, and market data for comprehensive big data analytics. Moreover, the transformation of financial management should be actively advanced by guiding finance departments to shift from traditional accounting-oriented functions toward strategic support roles, encouraging financial professionals to engage deeply with business operations, understand core processes, and apply data analysis to support managerial decision-making, thereby achieving effective integration of finance and business operations.

7. Conclusion

Big data technology is fundamentally transforming the models and essence of corporate financial management. Its applications in core scenarios such as budget management, cost control, risk management, and investment/financing decisions have effectively addressed traditional financial management's shortcomings including insufficient precision, delayed decision-making, and weak risk anticipation, driving the transformation of financial management toward refinement, intelligence, and strategic orientation. Case studies demonstrate that whether for large enterprises or small and medium-sized businesses, the rational application of big data technology can significantly enhance financial management efficiency and strengthen market competitiveness. However, enterprises currently face multiple challenges in implementation, including inadequate technological adaptation, talent shortages, data security risks, and insufficient organizational coordination. To overcome these challenges, strategies such as building compatible technical systems, cultivating interdisciplinary talents, fortifying security defenses, and enhancing organizational collaboration must be implemented.

Disclosure statement

The author declares no conflict of interest.

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