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Implementation Framework and Case Analysis of Digital Transformation in Enterprise Financial Engineering

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ABSTRACT

The deepening evolution of the digital economy and the iterative upgrading of financial technology are driving the digital transformation of enterprise financial engineering, evolving from an optional development direction into an inevitable path for cultivating core competitiveness. Based on national policy guidance and industry practical experience, this paper constructs a targeted four-dimensional framework of "Strategic Guidance - Technical Support - Business Implementation - Governance Guarantee". Combining the core data of six major banks' financial technology investment in 2023 and typical examples of China Telecom Finance Company's transformation, it systematically elaborates on the transformation path, actual effectiveness, and key points of risk prevention and control. Research has shown that digital transformation can effectively improve the operational efficiency and risk management level of financial engineering business, independent control of core technologies and precise data empowerment are the core prerequisites for the materialization of such transformation. The conclusion of this article provides practical guidance for the digital transformation of financial engineering in various enterprises, helping them smoothly complete the transition from process optimization to value reshaping.

KEYWORDS

Corporate financial engineering; Digital transformation; Implementation Framework; Risk Control

1. INTRODUCTION

The 14th Five-Year Plan for National Economic and Social Development and the Long-Range Objectives Through the Year 2035 of the People's Republic of China in 2021 clearly proposes to "accelerate digital development and build a digital China". This top-level deployment anchors the development direction for the deep integration of the real economy and the financial sector, and provides comprehensive action guidance and implementation paths. According to authoritative statistics from the China Banking Association, the total investment in financial technology by the six major state-owned commercial banks in 2023 reached 122.822 billion yuan, a year-on-year increase of 5.38%, and the proportion of technology personnel exceeded 2.9%. Digitization has become the core focus and strategic focus of financial institutions' strategic layout. This continuous increase in technology investment further demonstrates the firm determination of financial institutions to empower their business with technology and reshape the financial service ecosystem.

In the current operation of enterprise financial engineering, pain points such as data silos, cumbersome processes, and lagging risk control have become increasingly prominent in the development of the industry. The 2023 report of the China Banking Association shows that 73% of city commercial banks and financial companies have cross-system data disconnections. The average time for traditional credit approval is 72 hours, a stark contrast to the 24-hour approval benchmark of internationally advanced institutions. This not only seriously impairs the efficiency and quality of

financial engineering services for the real economy, but also gradually puts many enterprises in a passive position in market-oriented competition. Existing research mostly focuses on exploring the fragmented application of technological tools, with little emphasis on building a digital transformation framework that balances systematicity and practicality. There is also a lack of in-depth linkage verification and analysis between mature practical cases and theoretical frameworks [1]. Based on this distinct industry pain point and research gap, this article aims to build a practical transformation framework and verify the effectiveness of the framework through real transformation cases of top enterprises. It provides replicable and practical solutions and path references for enterprises to solve the practical difficulties of digital transformation.

2. THE CORE DRIVING FORCE BEHIND THE DIGITAL TRANSFORMATION OF ENTERPRISE FINANCIAL ENGINEERING

The promotion of digital transformation in enterprise financial engineering is the result of the triple synergy of top-level regulation on the policy side, business model transformation on the market side, and endogenous development needs on the enterprise side. On the policy side, the State-owned Assets Supervision and Administration Commission of the State Council issued a special notice on internal control management in 2025, which rigidly sets the development requirements for central enterprises to empower the iteration and upgrading of internal control systems through intelligent transformation. The Financial Regulatory Administration of China (FRA) also issued special regulatory requirements for digital capacity building for financial company formats, setting a compliance bottom line for industry transformation. On the market side, the scale of China's digital economy industry is expanding exponentially, reaching 39.2 trillion yuan in 2020, accounting for 38.6% of GDP. The two-way penetration of digital industrialization and industrial digitization has fundamentally changed the service scenarios and operation models of financial engineering. The digital market ecology is forcing enterprises to promote the comprehensive transformation of the financial engineering system to align with the new dynamics of industrial development [2]. At the operational level, the inherent shortcomings of the traditional financial engineering operation mode of enterprises are becoming increasingly prominent: the manual-led operational model has led to a persistent financial mismatch rate of 2.3% for many years, and 62% of financial engineering operation decisions still rely on subjective judgments based on manual experience. Its operational efficiency and decision-making accuracy are far from adapting to the development needs of modern enterprises [3]. From the perspective of industry practice results, enterprises that have completed the digital transformation of financial engineering have reduced their comprehensive operating costs by 30% compared to before the transformation, and their efficiency in risk event resolution has more than tripled. The intelligent anti-fraud risk control platform independently built by Bank of Communications has intercepted over 70,000 suspicious transactions and involved a total amount of 1.4 billion yuan in 2023, demonstrating the practical value of digital transformation through concrete results. From the analysis of industry development characteristics, non-state-owned enterprises have significantly higher subjective initiative in digital transformation than state-owned enterprises, while the eastern and central regions, due to their advantages in gathering technology, talent, and resources, have achieved much better results in the implementation of financial engineering digital transformation than underdeveloped western regions.

3. CONSTRUCTION OF IMPLEMENTATION FRAMEWORK FOR DIGITAL TRANSFORMATION OF ENTERPRISE FINANCIAL ENGINEERING

Based on industry practice accumulation and the inherent texture of digital transformation, this article constructs a four-dimensional implementation framework of "Strategy-Technology-Business-Governance", planning a three-dimensional support system that covers the entire transformation

process and adapts to the financial engineering industry. The strategic dimension requires precise anchoring of transformation positioning, with technology autonomy and deep coupling of industry and technology as the core anchor points, anchoring the direction of long-term value creation, and abandoning the development misconception of technology and business disconnection. China Telecom Finance Company has taken this as its strategic guideline, established four transformation criteria, promoted the comprehensive iteration and upgrading of financial engineering business, and achieved resonance between strategic planning and practical implementation. Building the core technology foundation of "cloud infrastructure matrix+intensive business middle office+full-chain security protection" in the technical dimension, relying on mature technology matrices such as CCB Cloud and ICBC AI Large Model to forge a technological moat. By the end of 2023, CCB's computing power scale will reach 463.34 PFlops, with GPU new computing power accounting for over 20%, achieving flexible scheduling of computing resources and scenario-based implementation of intelligent technology, laying a robust technological foundation for digital business transformation [4]. The business dimension focuses on the process reconstruction and efficiency optimization of core scenarios, covering key links such as fund-intensive management, intelligent credit approval, and dynamic risk prevention and control. It abandons the traditional linear operation mode and achieves full-chain automated iteration and efficiency improvement of core business scenarios through technologies such as RPA process automation tools and blockchain distributed ledgers. In terms of governance, efforts will be made to optimize the organizational structure and risk control system, establish a specialized team of scientific and technological talents, and establish a cross-departmental collaboration mechanism for the integration of technology and business. By 2023, the total number of scientific and technological talents in the six major banks will exceed 94,800, of which 8.6% will be from ICBC, providing solid organizational and talent support for the materialization of such transformation [5]. This four-dimensional framework takes strategy as the guiding coordinate, technology as the solid technical support, business as the value carrier, governance as the compliance bottom line, and constructs a full-chain closed-loop linkage mechanism with clear rights and responsibilities and collaborative efficiency to ensure the steady implementation and orderly progress of the transformation process.

4. KEY TECHNOLOGY APPLICATIONS AND PRACTICES IN DIGITAL TRANSFORMATION

The deep implementation of digital transformation in financial engineering cannot be separated from the scenario-based empowerment and practical application of key technologies. The value realization of technology is not simply a combination of tools, but a deep fit with the logic of financial business. The core focus is on the four core areas of artificial intelligence, blockchain, cloud computing, and big data. In the field of artificial intelligence, ICBC has been deeply involved in the research and development of financial AI technology and the implementation of scenarios, building an AI Large Model system with a trillion-parameter scale, and creating 13 comprehensive digital employees that fit the entire process of financial engineering. They penetrate key links such as fund management and risk control approval, and have accumulated intelligent efficiency gains of over 30,000 people per year; China Post Savings Bank (CPSB) has developed a "Postal Savings Brain" that deeply integrates Large Model technology with financial services. The deployed intelligent RPA robots perform standardized tasks up to 2 million times a year, a 15-fold increase from the previous year, enabling efficient replacement of a large number of repetitive manual operations and significantly reducing labor costs on the operating end [6]. Blockchain technology directly addresses the pain points of cross-border payments, claims and evidence storage in the industry. HSBC's blockchain message self-healing system, which will be launched in 2023, relies on distributed ledgers and tamper-proof technical features to significantly increase the success rate of cross-border payments from 92.7% to 99.8%, significantly reducing message error rates and manual verification costs in cross-border business [7]. Cloud computing technology has built a strong computing foundation for the massive

data processing of financial engineering. Guangyuan Data has developed a professional BI analytics platform that efficiently processes over 1 billion transaction records per day, and can stably support access and operation from more than 4000 terminals, easily adapting to the high-frequency and high-concurrency data processing needs of enterprises. Big data technology has solved the problem of information asymmetry in financial services. The integrated data analysis solution built by Guangyuan Intelligent achieves automatic alignment and fusion of more than 1,000 heterogeneous data sources from multiple sources, and constructs a dynamic label system that meets customer needs for more than 5,000 items. This improves the accuracy of matching financial products with customer needs by 75% and empowers the precision of financial services. The application of technology in the field of financial engineering must always adhere to the core principles of "practical adaptation and iterative optimization", and reject the blind pursuit of cutting-edge technology in haphazard technology stacking. Only by rooting technology in real financial business scenarios can we truly unleash the empowering value of technology and promote the deepening and implementation of digital transformation.

5. TYPICAL CASE ANALYSIS - TAKING CHINA TELECOM FINANCE COMPANY AS AN EXAMPLE

China Telecom Finance Company, as a benchmark model for the digital transformation of central enterprise finance companies, relies deeply on the aforementioned "Strategy-Technology-Business-Governance" four-dimensional implementation framework, steadily promotes the digital transformation of financial engineering, independently develops a new generation of intelligent financial systems, and its transformation effectiveness and practical path have been widely recognized and referenced in the industry. At the strategic level, the company has abandoned the path dependence of purchasing mature products from external sources, firmly anchored the core development goal of "digital intelligence-driven and independent R&D", formed a special technical team to overcome difficulties, and completed the full-process independent research and development of the new core system in 14 months, truly achieving independent control of core technology and system architecture [8]. On the technical level, the company has built an AI middle office and a prototype of a financial private cloud that is suitable for the financial engineering industry of central enterprises. The optimization of the technical architecture has enabled the system's inference response speed to reach three times the industry average, and the disaster recovery capability has been synchronously upgraded to RPO $\leq$ 5 seconds and RTO $\leq$ 5 minutes, successfully meeting the Level-6 (L6) disaster recovery standard of the financial industry and establishing a robust security barrier for the continuous operation of financial business. At the business level, digital transformation has enabled a qualitative leap in core business processing capabilities. The system throughput has significantly increased from 130,000 transactions per day to 1.8 million transactions, and the external payment time has been compressed from the original 3-5 minutes to 10 seconds. The efficiency of fund flow has been increased by 20 times, and the generation of receipts has also achieved minute-level delivery, comprehensively optimizing the business experience within the enterprise and its partners. At the governance level, the company takes digital transformation as an opportunity to improve its digital governance system, strengthen compliance control and risk prevention capabilities, and dynamically monitor the entire business process such as fund management and credit approval through intelligent risk control models, achieving traceability, monitoring, and early warning of the entire business process, effectively mitigating human-induced operational risks and process-related vulnerabilities. This case fully validates the practical value and adaptability of the four-dimensional implementation framework. The "independent R&D + scenario adaptation" transformation model it creates provides a high-quality practical model that can be implemented and replicated for the digital transformation of financial engineering of central enterprise finance companies and similar financial institutions [9].

6. RISK IDENTIFICATION AND CONTROL STRATEGIES FOR TRANSFORMATION

The digital transformation of enterprise financial engineering is by no means a smooth road. Various potential risks increase step by step with the depth of transformation. Even a slight omission may backfire on business efficiency and hinder the overall transformation process. Precise prevention and control of the three core risks of technology, data, and compliance cannot be avoided. It is even more necessary to build a full-process and three-dimensional risk control loop to find a dynamic balance between accelerating transformation and risk prevention and control. The concentration of technical risks is reflected in the breeding of system security vulnerabilities, the hidden danger of "bottleneck" in core technologies, and the insufficient adaptability caused by external technology dependence, which may even lead to fatal problems such as system downtime and data loss. This requires enterprises to build a high-level disaster recovery system of "active-active in the same city + multi-active across regions". The cross-regional disaster recovery solution tested by China Telecom Finance Company provides a practical reference paradigm for the industry to avoid technical risks [10]. The data risk originates from pain points such as multi-source data fragmentation and uneven data quality, coupled with compliance concerns about data privacy breaches. It is necessary to establish a comprehensive data governance system, from collection, cleaning, management to application process standardization. The unified indicator platform of Guangyuan Data can break down barriers to data circulation, significantly increase enterprise data utilization from 31% to 89%, effectively activate data assets, and address the issue of value underutilization [11]. Compliance risks arise from the dynamic iteration of regulatory policies and regional regulatory differences, coupled with the difficulty of regulatory coordination in cross-border business. It is necessary to establish an in-depth policy tracking and rapid adaptation mechanism, link business and technical departments to iterate system functions, and ensure that the entire transformation process adheres to the industry's compliance red lines. In addition, the problem of insufficient supply of interdisciplinary talents who understand both financial engineering and digital technology is prominent, with a talent gap rate of over 40% in the industry. Through internal training and external recruitment, and improving talent incentive mechanisms, Bank of Communications has achieved a year-on-year increase of 33.3% in the number of scientific and technological personnel in 2023, building a solid talent foundation for transformation. The core of risk management lies in building a dynamic closed-loop mechanism of "Prediction-Monitoring-Disposal-Review" to achieve coordinated promotion and mutual enhancement of transformation progress and risk control effectiveness.

7. CONCLUSION

The digital transformation of enterprise financial engineering is not just a mere piecemeal optimization of individual links, but a systematic change that runs through the entire chain of strategic top-level design, technology base construction, business scenario iteration, and governance system improvement. Each step of exploration needs to rely on the four-dimensional framework constructed earlier to steadily advance and find a precise balance between innovation breakthroughs and risk prevention and control. Based on the practical accumulation of the six major banks' deep cultivation of financial technology and the benchmark experience of China Telecom Finance Company's transformation, from the perspective of quantitative results and practical feedback, digital transformation can not only achieve multiple gains in operational efficiency, precise cost compression, and strengthened risk control, but also confirm that the three elements of independent control of core technology, precise empowerment of data elements, and closed-loop risk control are the key to breaking through the bottleneck of transformation and building a successful foundation.

In fact, digital transformation brings financial engineering not only the optimization and upgrading of traditional processes, but also the deep reshaping of value creation models, promoting enterprises

to gradually transform from simple fund managers and operators to strategic partners that support group strategy and empower business development. In the future, enterprises need to focus on the deep coupling between AI Large Models and core scenarios of financial engineering, the implementation and in-depth application of information innovation technology in key links, balancing technological innovation and cost control, and continuously iterate and optimize the transformation path. This study focuses on financial institutions and subsidiaries of state-owned enterprises. Although it can provide accurate references for similar institutions, it has not yet covered the financial engineering transformation practices of non-financial enterprises and small, medium, and micro enterprises (SMMEs). In the future, it may be expanded to these fields to further enrich the research dimensions and application scenarios. Overall, the implementation framework and case analysis conclusions constructed in this article can provide practical guidance for the digital transformation of financial engineering for different types of enterprises, helping them achieve high-quality development amid the digital economy era.

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