

Research on the Effectiveness and Innovative Pathways of Financial Support for Green Transformation in the Steel Industry

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Abstract

Under the dual carbon goals, the steel industry-as a high-carbon core sector-requires substantial capital for transformation. However, enterprises struggle to bear these costs independently, making financial support crucial. This study aims to examine the characteristics and contradictions of financial demand in the steel industry's transition, quantitatively analyze the effectiveness of financial support, and explore innovative pathways. It employs a methodology combining theoretical analysis, case studies, and data-driven evidence. Findings reveal that the current transformation faces challenges such as mismatched capital supply and demand, as well as limited financing tools. Nevertheless, notable successes have been achieved in regions like Tangshan, Hebei, and Xinyu, Jiangxi, where policy-guided and market-driven finance has effectively reduced financing costs and enhanced emission reduction benefits. Based on these insights, this paper proposes pathways from three dimensions: establishing policy standards, empowering financial institutions through technological innovation, and strengthening industry-finance synergy within enterprises. Future efforts should focus on refining standards to accelerate the green transformation of the steel industry.

Keywords

Steel Industry; Green Transition; Financial Demand.

1. Introduction

1.1. Research Background and Significance

Under the stringent constraints of China's "carbon peak and carbon neutrality" strategic goals, the steel industry-as a core carbon emission source within China's industrial system, accounting for approximately 15% of the nation's total emissions-stands as a critical sector for achieving low-carbon transformation. Currently, China's steel industry is undergoing a pivotal transition from "incremental expansion" to "stock optimization," with transformation initiatives such as equipment upgrades, technological R&D, and process innovations requiring substantial financial support. Industry projections indicate that achieving a deep low-carbon transformation in the steel sector between 2025 and 2060 will require capital investment totaling 20 trillion yuan, with annual funding needs exceeding 100 billion yuan. However, enterprises within the industry face a persistent tension between cash flow and transformation expenditures-in 2023, key steel enterprises nationwide generated profits of only 85.5 billion yuan, rendering them unable to independently shoulder the costs of transformation.

As the core hub of the modern economy, finance plays an irreplaceable role in resource allocation for the steel industry's green transition. The emergence of transition finance offers new pathways for high-carbon industries to overcome financing challenges. By precisely

matching steel enterprises' transformation needs through differentiated financial instruments, it not only expands business opportunities for financial institutions but also injects momentum into industrial upgrading. This paper focuses on the practical outcomes and existing bottlenecks of financial support for the steel industry's green transformation. It explores a feasible and innovative financial support system, holding significant theoretical value and practical significance for promoting the steel industry's "synergistic reduction of pollution and carbon emissions" and improving green financial market mechanisms.

1.2. Research Objectives and Methods

The core research objectives encompass three dimensions: First, systematically mapping the financial demand characteristics of the steel industry's green transition and identifying structural contradictions in current financial support. Second, leveraging case studies from representative regions like Tangshan, Hebei and Xinyu, Jiangxi to quantitatively analyze the effectiveness of various financial instruments in reducing financing costs and enhancing emission reduction benefits. Third, proposing financial innovation pathways tailored to the steel industry's full industrial chain transformation based on fintech development trends.

The research methodology employs a combined approach of "theoretical analysis + case studies + data support": Theoretically, it applies financial resource allocation theory and industrial transformation theory to construct an analytical framework of "policy guidance-market operation-technology empowerment." Empirically, it analyzes the application effects of transformation financial tools using enterprises such as Tangshan Donghua Iron & Steel and Xinyu Iron & Steel Group as case studies. Data-wise, it integrates Hebei Province's transition finance statistics, bank credit allocation data, and corporate emissions reduction monitoring data to enhance the credibility of research conclusions.

2. Current Status and Challenges of Financial Support for Green Transformation in the Steel Industry

2.1. Financial Demand Characteristics of Industry Transformation

2.1.1. Large Capital Requirements and Long Recovery Cycles, Highlighting Supply-Demand Mismatch

Green transformation projects in the steel industry exhibit typical characteristics of "high asset investment and long return cycles." A single intelligent environmental upgrade project often requires investments exceeding 1 billion yuan. For instance, Xingtai Iron and Steel Group's intelligent environmental comprehensive raw material yard project involved investments of tens of billions of yuan. In terms of payback periods, projects involving equipment upgrades and process modifications generally require over 10 years to recoup investments. Meanwhile, steel enterprises' cash flows from daily operations are predominantly concentrated in short-term working capital, making it difficult to cover long-term transformation investments. This mismatch between "short-term cash flows and long-term investments" creates an urgent need for medium-to-long-term, low-cost financial funding. [1]

2.1.2. High Technical Risks, Difficult Assessment, and Limited Financing Tools

The steel industry's low-carbon transition relies on cutting-edge technologies like hydrogen metallurgy, carbon capture (CCUS), and short-process electric arc furnaces. Most of these technologies remain in the pilot phase, carrying risks such as uncertain technical maturity and difficult-to-quantify emission reduction effects. Traditional financial institutions' risk control systems, centered on financial statements, struggle to accurately assess the benefits and risks after technology implementation. This leads to financing tools characterized by "short-term and single-purpose" features—over 80% of financial support is concentrated in 1-3 year working capital loans, while specialized financing tools for long-term R&D and capacity replacement

remain insufficient. Hebei Province's transition finance practices reveal that enterprises often struggle to meet financial institutions' eligibility criteria when formulating transition plans due to unclear technical indicators, highlighting how technical risks constrain financing.

2.2. Existing Issues and Challenges

2.2.1. Mismatch in Financial Support

Regarding the mismatch between capital supply and demand, private enterprises and state-owned enterprises face significant financing disparities: As a private steel company, Donghua Iron & Steel incurred financing costs 1-2 percentage points higher than state-owned enterprises before the implementation of transition finance policies, and was often excluded from green bond issuance due to credit rating issues. Maturity mismatch is equally pronounced. Traditional bank loans average 3-5 years, while projects like Xingang Group's coke oven environmental upgrades have 12-year payback periods. Enterprises must frequently refinance, increasing cash flow risks.

2.2.2. Incomplete Policy and Market Mechanisms, Weak Support System

At the policy level, early green finance policies primarily focused on general energy efficiency improvements, lacking targeted support for the steel industry's unique process structure optimization (e.g., converting long processes to short ones) and deep decarbonization technologies (e.g., hydrogen-based blast furnaces). Although Hebei Province has issued guidelines for transition finance in the steel sector, a unified national standard for transition finance remains absent, creating compliance uncertainties for financial institutions operating across regions. Regarding market mechanisms, third-party assessment and risk-sharing systems remain underdeveloped: enterprises lack mature templates for formulating transition plans, making it difficult for financial institutions to accurately assess project emission reduction outcomes; collateralization processes for environmental rights such as carbon emission allowances and energy consumption rights are unstandardized, while carbon price volatility further complicates risk management. As of early 2024, only a handful of regions nationwide have established transition finance information service platforms, resulting in significant information asymmetry between banks and enterprises.

3. Analysis of the Effectiveness of Financial Support for the Green Transformation of the Steel Industry

3.1. Practical Outcomes of Policy-Guided Finance

3.1.1. The "Ice-Breaking" Effect of Transition Finance Pilots

As a major steel-producing province, Hebei's transition finance pilot program has provided valuable insights nationwide. To address challenges in identifying transition projects, the Guidelines optimized the catalog and user manual for transition finance-supported economic activities, establishing a three-tiered catalog system to help enterprises precisely access financial resources. Leveraging policy dividends from the National Symposium on Advancing Transition Finance in the Steel Industry, Tangshan City deployed financial authorities to guide enterprises in refining technical metrics. Donghua Steel alone completed verification of 176 indicators, securing over 3 billion yuan in transition loans with interest rates 10-122 basis points lower than conventional loans—yielding annual interest savings of 30 million yuan. By the end of Q1 2025, Hebei's steel enterprises had secured cumulative transformation financing commitments totaling 27.2 billion yuan, with 15.8 billion yuan already disbursed. The weighted average interest rate stood at 3.60%, yielding annual interest savings of 45 million yuan compared to non-transformation financial products. This demonstrates significant financing cost advantages driven by policy guidance.[2]

3.1.2. Synergistic Effects of Policy Coordination

The synergy between the central bank's re-lending tools and local industrial policies has further enhanced the effectiveness of financial support. Leveraging the "Jiangxi Province Steel Industry Chain Modernization Action Plan," the People's Bank of China Xinyu Branch guided the China Construction Bank to launch the province's first low-carbon transition-linked loan, directly tying the loan interest rate to the reduction in carbon emissions per ton of steel produced by the enterprise. Leveraging this loan, Xinggang Group advanced the construction of an intelligent eco-friendly raw material yard, achieving over an 80% reduction in fugitive emissions. Its blast furnace gas power generation units produced 3.42 billion kWh annually, not only cutting carbon dioxide emissions but also lowering production costs by nearly 2 billion yuan. This "policy-subsidized interest + performance-linked" model ensures controllable risks for financial institutions while incentivizing enterprises to accelerate transformation, delivering a win-win outcome for environmental and economic benefits.

3.2. Innovative Achievements in Market-Driven Finance

3.2.1. Synergistic Emissions Reduction Effects of Industrial Chain Finance

Financial institutions extended service chains to establish a synergistic mechanism linking "carbon reduction at the production end with incentives at the demand end." Hebei Province's updated Work Guidelines expanded support to include downstream enterprises purchasing low-carbon steel products. Tangshan City elevated 10 steel enterprises to headquarter-level clients, directing financial resources toward the industrial chain. Tangshan Bank established a dedicated credit channel, providing 500 million yuan to Tianzhu Iron & Steel for intelligent upgrades. This not only reduced the company's carbon emissions per ton of steel by 6% but also boosted annual production by 8%. Tangshan Iron & Steel New District leveraged comprehensive financial services including funds and loans to implement over 130 world-leading energy-saving and emission-reduction technologies. This has continuously optimized its product structure and significantly enhanced the overall competitiveness of the industrial chain.[3]

3.2.2. Scale Effects of Risk Management Innovation

Financial institutions effectively reduced risk exposure in transformation projects through technological empowerment and model innovation. Xinyu Construction Bank collaborated with third-party institutions to design a carbon performance evaluation system, quantifying Xinggang Group's transformation outcomes as a basis for credit pricing. This approach resolved risk assessment challenges while improving loan approval efficiency. Financial institutions in Tangshan City explored a tiered guarantee scheme combining "technology maturity" and "carbon price volatility." These innovations enabled over 10 billion yuan in financial credit for the transformation of Tangshan's steel enterprises, while maintaining a low non-performing loan ratio. This demonstrates that scientific risk control can effectively stimulate the willingness of financial capital to invest.

4. Innovative Pathways for Financial Support in the Steel Industry's Green Transformation

4.1. Policy Level: Establishing a Standardized, Differentiated Support System

4.1.1. Refine a Nationwide Unified Transition Finance Standards Framework

Building upon Hebei Province's three-tiered catalog system, accelerate the release of national transformation finance guidelines for the steel industry, clarifying support boundaries for key areas such as hydrogen metallurgy, short-process electric arc furnaces, and scrap steel processing. Adopt the "Steel Enterprise Transition Plan Evaluation Report Template" to

standardize corporate transition plan development, incorporating principles like "significant contribution, no major harm, and just transition" into core assessments. Simultaneously, broaden policy coverage to include supporting entities like scrap steel processing enterprises, driving carbon reduction across the entire industrial chain. Establish a national transition finance special fund to provide fiscal interest subsidies for compliant projects and guide policy banks in offering long-term low-interest financing.

4.1.2. Implement Differentiated Regulatory and Incentive Mechanisms

Financial institutions serving steel transformation will receive preferential regulatory metrics, including reduced risk weights for transformation loans. The scale of transformation finance operations will be incorporated into banks' green finance assessment systems. Financial institutions must adhere to fair competition principles, treating state-owned and private enterprises equally, with priority support for leading standardized enterprises recognized by the Ministry of Industry and Information Technology. Establish a transformation finance risk compensation mechanism where local governments and financial institutions share project risks proportionally, providing compensation for losses caused by carbon price fluctuations to alleviate financial institutions' risk concerns.

4.2. Financial Institutions: Develop Diverse and Customized Financial Products

Promote the "transition performance-linked loan" model, setting tiered interest rates based on indicators such as corporate carbon emission reduction rates and energy utilization efficiency. Better emission reduction outcomes lead to lower financing costs. Issue specialized transition bonds for the steel industry, permitting enterprises to use carbon quotas and future emission reduction revenues as credit enhancement measures, and explore combined tools like "bond financing + carbon asset pledging." For technology R&D projects, design risk-sharing products featuring "pre-approval credit + profit-sharing from commercialization" to reduce enterprises' R&D investment pressure. For intelligent transformation projects, introduce financial leasing solutions combining "equipment collateral + energy-saving benefit sharing" to align with project payback cycles.

4.3. Enterprises and Markets: Strengthening Industry-Finance Synergy and Capacity Building

4.3.1. Establish a Regularized Industry-Finance Matching Mechanism

Led by the steel industry association, establish a "National Steel Transformation Project Database" to publicly disclose project technical maturity, emission reduction targets, and investment returns. For instance, specify that short-process electric furnace projects can achieve an internal rate of return (IRR) of 8%-10%, thereby reducing information gathering costs for financial institutions. Encourage state-owned enterprises and private companies to form joint financing entities, enhancing private enterprises' financing capabilities through credit sharing. Regularly organize industry-finance matchmaking events, inviting financial institutions and third-party assessment agencies to provide on-site policy interpretations and assist enterprises in standardizing transformation plan development. Models like Tangshan's "Financial Services Outreach" initiative can be promoted nationwide.

4.3.2. Deepening Integration of Carbon Markets and Financial Markets

Pilot "carbon emission reduction replacement financing," allowing enterprises to sell third-party verified future emission reductions (5-10 years) to financial institutions in advance to secure transition funding. Hebei Iron & Steel Group has already obtained 300 million yuan in hydrogen metallurgy R&D funding through this model. Promote standardization of carbon emission rights pledge financing, streamline registration and assessment processes, establish carbon price fluctuation hedging mechanisms, and reduce market risks for financial institutions. Encourage steel enterprises to participate in carbon futures and options trading,

using financial derivatives to lock in emission reduction gains and enhance the profitability stability of transformation projects.

5. Conclusion

Financial support for the steel industry's green transition has achieved phased results: policy-guided transition finance pilots have effectively reduced corporate financing costs, while market-driven product innovations have balanced risks and returns. Practices in regions like Tangshan, Hebei and Xinyu, Jiangxi demonstrate that establishing a collaborative mechanism featuring "precise policy guidance, institutional innovation empowerment, and proactive corporate transformation" is key to resolving financing challenges. However, challenges persist, including inconsistent standards, complex risk management, and information asymmetry between banks and enterprises. Multidimensional innovation is urgently needed to establish a sustainable support system.

Moving forward, financial support for the steel industry's green transition should focus on three directions: First, breaking regional barriers through unified national standards to optimize cross-regional allocation of financial resources. Second, deepening industry-finance integration via fintech, enhancing service precision through blockchain, AI, and other technologies. Third, broadening financing channels through carbon finance innovation, facilitating the conversion of environmental rights into capital value. As the financial support system continues to mature, the steel industry will accelerate its shift from "high-carbon and extensive" to "green and intelligent" operations, providing robust support for China's pursuit of its dual carbon goals.

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