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Financial Incentive Mechanism for High-Carbon Industry Transformation: A Case Study of Shandong Weiqiao Transition-Linked Loan

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Abstract. Low-carbon upgrading of existing high-carbon industries faces serious and complex financial adaptation challenges. Traditional green finance is difficult to adapt to the gradual transition needs of high-carbon industries, and linking transition finance with sustainable development loans has become an important solution for real-world industrial development. This article takes the 200-million-yuan aluminum industry transition-linked loan in Shandong Weiqiao as the research object. It uses single case study method and mechanism analysis method to explore the practical logic of its incentive mechanism in the green transition of the aluminum industry. Research has found that through a complete mechanism design of standard definition, performance-linked pricing, and third-party verification, transition-linked loans effectively realize the economic value transition of enterprise emission reduction behavior. At the same time, through multi-party coordination to prevent "green washing", "false transition" and other risks. This study can provide practical reference for the innovation and large-scale implementation of financial instruments for the transition of high-carbon industries.

Keywords: Transition Finance, Sustainability-Linked Loan, incentive mechanism, aluminum industry, green transition

1. Introduction

Under the steady implementation of China's Dual Carbon Goals Policy strategy, the pace of low-carbon development in the whole society continues to accelerate, and low-carbon transition in the industrial sector has become the core focus of current emission reduction work. Among them, traditional manufacturing industries such as steel, aluminum, and cement, which are high in carbon and energy consumption, have a large industrial base and concentrated energy consumption in production. Their overall carbon emissions account for more than 70% of the total industrial emissions in China, making them key players in carbon reduction control and green governance at the current stage. At present, the traditional green finance model in the market has a relatively single service orientation, mainly focusing on supporting "pure green" projects such as photovoltaics and wind power, and emphasizing the construction and development of new green industries. It cannot

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fully adapt to the gradual green transition and development needs of existing production capacity in high-carbon industries.

From the current practice of implementing transition finance in China, it can be seen that the time for policy and product implementation is relatively short, the overall industry system is not yet mature. Therefore, the market driven carbon-intensive industries and low-carbon transition still faces three core practical challenges. Firstly, there is no unified, refined, and implementable industry transition identification standard in China, and the market judgment basis is vague, making it difficult to accurately determine the true transition status of enterprises and effectively avoid the industry risks of greenwashing and false transition that are commonly present in the market. Secondly, the existing financial product design lacks a sound incentive compatibility mechanism and has not established a mature interest-rate linkage model, which cannot enable enterprises to actively reduce carbon emissions and obtain tangible economic benefits. This greatly reduces the enthusiasm and initiative of enterprises for independent transition. Thirdly, the industry has not yet established a systematic and mature quantitative evaluation system, and lacks unified and implementable environmental benefit accounting standards, which leads to the inability of enterprises to achieve standardized scientific accounting and effective verification of various emission reduction effects. It is not conductive to the standardized promotion of transition financial models across the entire industry.

Based on the current development status and existing practical problems of the industry mentioned above, this article selects Shandong Weiqiao Aluminum Industry's 200-million-yuan sustainability-linked loan as the core research case. This loan is one of the first standardized transition financial products implemented in the domestic aluminum industry. Unlike ordinary green loans that only apply to pure green projects, it has established a complete transition evaluation standard and differential system, covering the entire chain of transition standard formulation, product design, multi-party collaboration, and effect verification. This case combines industry innovation and practical representativeness, and can clearly and completely demonstrate the operational logic of the aluminum industry's financial transition， providing typical samples for observing the transition mode of high-carbon enterprises. It has high research value for analyzing the implementation of incentive mechanisms in high-carbon industries and solving various practical problems in industrial transition.

2. Literature review

2.1. Background of carbon neutrality and transition finance

Under the background of carbon neutrality, transition finance is an important support for the low-carbon transition of high-carbon industries. Definition of the 2022 G20 Transition Financial Framework: "Transition finance, as discussed in this report, refers to financial services supporting the whole-of-economy transition, in the context of the Sustainable Development Goals, Towards lower and net-zero emissions and climate resilience, in a way aligned with the goals of the Paris Agreement [1]." People's Bank of China continues to improve the transitional financial system, clarify access standards, clarify the boundaries of green finance, and prevent greenwashing and false transition. Green financial services support new pure green projects, transformation finance focuses on the low-carbon transformation of existing high-carbon industries, and guides enterprises to reduce carbon by relying on Financing access conditions [2]. The following Table 1 compares the tool difference between green credit, transition-linked loans and carbon trading.

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Table 1. Comparison between transition and traditional green finance

Contrast Dimension	Traditional Green Credit	Carbon Trading
Supported Object	Engaged in environmental protection, energy saving, emission reduction, clear green industries such as clean energy	Power generation, steel, cement, aluminum smelting industry, high-carbon emission control enterprises
Incentive Method	Provides preferential rates to lower financing costs and encourage investment in green projects	Carbon quotas are allocated by governments. Firms sell surplus quotas for profit or buy extra allowances for over-emission; penalties urge emission cuts.
Risk-taking	Banks bear main credit risks. Enterprises take operational and investment risks.	Emission-controlled companies assume all compliance, policy, market and legal risks.
Applicable Stage	Applies to construction and operation phases of new qualified green projects	It covers the entire production cycle of enterprises. Companies need to conduct annual carbon accounting and settle carbon quotas.

2.2. Existing research combing and gap analysis

The existing academic community has carried out a lot of research on the transition of financial instruments and risk prevention and control. The mainstream foreign tools are transition bonds and key performance indicator linked fixed income products [3]. Existing research focuses on two types of transitional financial instruments, namely, transitional bonds and sustainable development linked loans. Transformation bonds can provide financing for transformation projects of high-carbon enterprises, and there is also a risk of greenwashing in practical application. Sustainable development linked loans link preferential loan interest rates to sustainable development performance objectives of enterprises. Greenwashing and project misrepresentation are the main problems in reality, and such risks can be identified and controlled by formulating standardized performance objectives [4]. Wang Haisai pointed out that the credit granting of banks' high-carbon enterprises no longer relies on traditional financial indicators, focusing on reviewing the feasibility of the transition plan, and screening the real transition behavior of enterprises through the quantitative evaluation system [4]. Based on the signal game model, foreign scholars found that information falsification and easing emission reduction targets are the core incentives for greenwashing. Strict performance targets can identify the quality of transition, and banks can manage greenwashing chaos through carbon assessment, differentiated interest rates and standard verification [5].

At present, domestic research focuses on macro policies and general risks. The cases are concentrated in the steel industry, pointing out that there are problems such as product imbalance, cost mismatch, and missing data in transition finance. There are few studies on the transition of the existing aluminum industry, and most of them are limited to a single production link. There is a lack of perspective of the whole industry chain, and there are obvious research gaps.

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2.3. Theoretical support

Combined with existing research, there are three major problems in the financial practice of high-carbon industry transition: the real transition is difficult to identify, the incentive financial products are insufficient, and the emission reduction benefits are difficult to quantify. This article builds a framework to analyze the logic of Weiqiao's transition-linked loan governance by relying on the five theories of principal-agent and incentive compatibility, information asymmetry, externalities, transaction cost and signal transmission.

2.3.1. The theory of principal-agent is compatible with incentives

The theory of principal-agent explains the conflict caused by the differences in the goals and information of the client and the agent. In the credit scenario, banks are committed to promoting low-carbon transition, and enterprises give priority to the pursuit of profits, which is prone to moral risks. Through contract design to achieve incentive compatibility, it can coordinate the profit needs of enterprises and the transition goals of banks. The transition of the high-carbon industry has a high investment and a long cycle, and the willingness of enterprises to reduce carbon on their own is not strong. The incentive compatibility mechanism links emission reduction performance with financing costs to guide enterprises to take the initiative to transform and benefit. Weiqiao's transition-linked loan is a typical practice: banks link the loan interest rate with the energy consumption indicators of enterprises, and enterprises that meet the standard can enjoy preferential interest rates. In order to reduce financing expenditure, enterprises take the initiative to carry out energy-saving transition, realize low-carbon transition, curb green behavior, and make up for the lack of traditional credit incentives.

2.3.2. The theory of information asymmetry

There is significant information asymmetry in the credit market. Enterprises master the real transition data, and the cost of bank information acquisition is high, and the information gap is large. The high-carbon transition cycle is long and the results are hidden. It is difficult for banks to distinguish the authenticity of the transition, and it is easy to have problems such as cautious credit granting and misjudgment. The Weiqiao case eliminates the information gap of banks and enterprises through third-party evaluation, carbon financial platform data sharing, and four-party cross-checking to eliminate the information gap of banks and enterprises, help banks accurately identify the real transition ability, and prevent the risk of greenwashing.

2.3.3. Externality theory

Carbon emissions are typical negative externalities. The socialization of the cost of sewage discharge of enterprises and the publicization of the revenue of emission reduction led to the failure of market regulation. Traditional green finance cannot solve the transition problem of stock high-carbon enterprises, while transition finance can realize the internalization of environmental externalities. The Weiqiao case transforms the environmental benefits of enterprises' emission reduction into financial benefits of preferential interest rates, making emission reduction a spontaneous economic behavior of enterprises. Shandong Carbon Efficiency Code further transforms carbon emission costs into financing constraints to solve the problem that emission reduction benefits are difficult to quantify.

DOI: 10.54254/2754-1169/2026.38980

3. Case background

3.1. Policy and industrial background

Table 2 summarized key events in the loan. Under the national "dual carbon "strategic goal, high-energy-consuming and high-carbon industries such as steel and electrolytic aluminum face the double pressure of carbon reduction and transition and upgrading, which is the result of the intertwining of multiple issues such as capital, technology, policy and industry structure. As a large domestic industrial province, Shandong Province has a large aluminum industry and a high carbon emission base. The task of promoting the green transition of the aluminum industry and the implementation of supporting transition financial tools is particularly urgent.

Relying on the complete foundation of the local aluminum industry chain, Binzhou City has pioneered the exploration in the field of transition finance, forming a policy system with demonstration value. And it has also created a precedent for the transition and financing of local aluminum enterprises such as Weiqiao. In September 2024, Binzhou City was selected as a provincial pilot for transition finance in Shandong Province [6]. And in November of the same year, the "Guidelines for Transformation Finance in Binzhou Aluminum Industry" was officially issued. On this basis, Binzhou took the lead in formulating the country's first transition financial group standard covering the whole industry chain of "mining-alumina-electrolytic aluminum-aluminum processing-recycled aluminum" [7]. The first batch of 97 transition pilot enterprises were selected and identified locally, and core aluminum enterprises such as Weiqiao were included in the scope of transition financial support [8]. Relying on the standardized evaluation mechanism to screen the real transition demands of enterprises and prevent the risk of greenwashing and false transition.

Table 2. Timeline of Binzhou's transition financial policy

Time	Institution/Subject	Key events
September 2024	Binzhou City	It was selected as the municipal pilot project of financial support for green and low-carbon transition in Shandong Province, and the first comprehensive evaluation in the province.
November 2024	The Information Office of Binzhou Municipal Government	A press conference was held to issue the guidelines for the financial transition of Binzhou aluminum industry.
December 2024	The Municipal Development and Reform Commission	Implement the municipal regional comprehensive pilot work plan of this policy, carry out fair competition evaluation and publicity.
February 2025	Industrial Bank of China Binzhou Branch	Inject 200 million yuan of loans into Shandong Weiqiao venture group, which is the first linkage loan for the transition of aluminum industry of China.

3.2. Case subject

Shandong Weiqiao Venture Group is a leading enterprise in the global aluminum industry. With the help of transformation finance, it carries out carbon reduction and transformation of high-carbon

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processes such as electrolytic aluminum, reduces carbon emissions in the industrial chain, and transforms into low-carbon aluminum production.

Traditional aluminum electrolysis production consumes a lot of energy and high carbon emissions. At present, Weiqiao Group focuses on promoting the low-carbon transition of the production side, carrying out energy-saving digital intelligent transition, and introducing and applying international advanced aluminum electrolysis tank technology. These two types of transition projects require a large amount of investment.

3.3. Product design and operation mechanism

The loan product case information is summarized in the Table 3. Industrial Bank of China will inject 200 million yuan in transition loans to Shandong Weiqiao in February 2025. The core innovation is to link the loan interest rate with the energy consumption of the main products of the enterprise. The bank takes the energy consumption index of enterprise production as the core basis for the pricing of loan interest rates and sets an interest rate discount of up to 10BP [9].

Table 3. Weiqiao transformation linked loan product case basic information

Element Category	Specific Indicators	Case Data
Basic Information of the Loan	Borrower	Industrial Bank
Basic Information of the Loan	Lender	Shandong Weiqiao
Basic Information of the Loan	Loan Amount	200 million yuan
Basic Information of the Loan	Implementation Time	February 2025
Standards and Verification	Standard Basis	Guidelines for the Transformation of Finance in Binzhou Aluminum Industry
Standards and Verification	Third-party Verification Institutions	Introduce an independent third-party assessment institution to issue the Assessment Report on Weiqiao Aluminum-Electricity's Transition Plan.

If the energy consumption of enterprises meets the standard, the loan interest expenditure can be reduced. In addition, a rigid constraint mechanism is set up that does not enjoy preferential interest rates if the loan does not meet the standard. For enterprises whose unit product energy consumption does not meet the standard during the assessment period, all interest rate preferences will be canceled, and the benchmark loan interest rate will be implemented. This constraint mechanism can prevent enterprises from passively transitioning and taking preferential interest rates after obtaining loans, so as to avoid the problem of greenwashing.

DOI: 10.54254/2754-1169/2026.38980

3.4. Implementation

3.4.1. Some effect and promotion status

The mechanism of the loan is showed in Table 4. In terms of financial benefits, Shandong Weiqiao obtained preferential interest rates with the help of transition-linked loans, reduced interest expenses, and the funds were specially used for the low-carbon transition of the aluminum industry to alleviate the capital pressure brought about by the technological reform of enterprises and improve the cash flow situation. In terms of environmental benefits, the energy consumption, pollutants and carbon emissions of enterprises can be effectively reduced after the completion of the project, and the emission reduction effect can be quantified by relying on third-party verification and certification.

Table 4. Weiqiao transition-linked loan: mechanism, partners, benefits

Element Category	Specific Indicators	Case Data
Performance Linkage Mechanism	Linked KPI	Energy consumption of main products
Performance Linkage Mechanism	Interest Rate Incentive Range	Maximum 10BP preferential rate
Performance Linkage Mechanism	Unqualified Constraints	Unable to enjoy preferential interest rates, the loan interest rate is maintained at the benchmark level.
Collaborative Mechanism	Participants and Their Division of Labor	People's Bank of China Binzhou Branch (policy guidance), Binzhou Municipal Development and Reform Commission (industrial support), Industrial Bank (product design), and third-party institutions (verification and certification)
Expected Benefit Measurement	Annual Financial Cost Savings (ten thousand yuan)	200,000 yuan

3.4.2. Regional promotion results

Binzhou City has issued relevant policies to identify 97 pilot enterprises for the transition of the aluminum industry. The Weiqiao project is the first aluminum industry transition-linked loan in China. It has verified the whole business operation mode and can provide reference for other local aluminum enterprises, but it has not yet achieved large-scale promotion in the city.

4. Case analysis

4.1. Adaptability analysis of transition finance and traditional green finance

With a long aluminum industry chain and high energy consumption and carbon emission intensity, it is the second highest energy-consuming industry in China after steel and cement. It is difficult for such enterprises to quickly complete low-carbon transition, and the transition requires continuous investment of a large amount of capital. Shandong has carried out the classification and control of

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"carbon efficiency code" for more than 5,000 key high carbon enterprises and promoted 1,579 transformation projects [9]. The financing demand exceeds 500 billion yuan, and the funding gap for the transition of high-carbon industries is prominent.

Traditional green credit has high requirements for project green standards. It is difficult for energy-saving technology reform projects in the aluminum industry to meet the conditions, and it is not easy to get low-cost funds. There are differences between the two types of products in terms of support targets, incentive methods and risk sharing: green credit supports new green projects, fixed interest rates, and most risks are borne by banks. The transition of high-carbon enterprises in the stock of transition-linked loan services does not require the project itself to be a pure green project but only sets quantitative emission reduction targets. The loan interest rate is linked to the energy consumption of the unit product, and banks and enterprises jointly bear the risk. If the emission reduction of enterprises does not meet the standard, the interest rate will rise.

4.2. Analysis of incentive mechanism, design logic and effectiveness of standard system and risk prevention and control of greenwashing

Traditional credit interest rates have nothing to do with the results of emission reduction, and the transition momentum of enterprises is insufficient. Transition-linked loans implement performance pricing, and 200-million-yuan loans can enjoy a 10BP discount, saving 200,000 yuan in interest every year. Relying on the limited effect of preferential interest rates alone, the energy-saving transition of enterprises can also reduce energy consumption expenditure, avoid environmental protection penalties, and multiple benefits form incentive compatibility. Carbon trading income fluctuates with carbon prices. Transition-linked loans take the energy consumption of unit products as the assessment standard. The contract stipulates rewards and punishments in advance, and the mechanism is more stable, which is suitable for high-carbon manufacturing industries such as aluminum. Binzhou builds a closed loop of "standard-verification-incentive" to complete project screening, pricing and verification. Enterprises need to prepare a transition plan and have the data verified by a third party. The assessment report confirms that Weiqiao's emission reduction target is in line with the transition plan, and the indicator industry is leading, ensuring that funds are used for low-carbon transition and avoiding the risk of greenwashing.

4.3. Analysis of the transaction cost optimization effect of multi-party collaboration mechanism

In this four-party coordination mechanism, the People's Bank of China provides policy guidance, the development and reform department provides industrial support, the bank is responsible for product design, and the third-party institutions carry out data verification. The division of labor of all parties is clear, which effectively alleviates the information asymmetry between banks and enterprises and reduces transaction costs. In the traditional green credit model, banks need to independently verify the effectiveness of the enterprise environment, which has a large workload and high verification difficulties. The transition finance relies on multi-party collaboration, and the verification work is handed over to professional third parties. Banks can lend money according to the established standards, and the financing process is more efficient. Binzhou Carbon Financial Service Platform has pushed 353 enterprises and 122 projects to banks, with a credit scale of more than 150 billion yuan [10]. The data also proves that the multi-party linkage model can significantly improve the efficiency of financing docking.

DOI: 10.54254/2754-1169/2026.38980

4.4. Analysis of the replicability and limitations of the case

Weiqiao's transition financial model has the potential to be promoted and has been implemented in other aluminum enterprises in Binzhou. Weihai Bank Binzhou Branch launched a 235-million-yuan transition financial plan, and Dongying Bank Zouping Branch issued the largest single 50-million-yuan aluminum industry transition-linked loan in the province. This mechanism can also be applied to high-carbon manufacturing industries such as steel, chemical industry and building materials. However, there are still shortcomings in this model, and most of the existing projects serve large leading enterprises. Small and medium-sized enterprises have high carbon accounting costs and insufficient carbon data reserves, and it is difficult to meet the conditions for third-party verification. At present, the relevant norms of transition finance are still being explored. Only a few industries have introduced local standards, and the national unified institutional norms have not yet been implemented, which hinders the further wide-scale promotion of the model.

4.5. The case implication

This case selects Weiqiao Aluminum to show the adaptive value of transition-linked loans for high-energy-consuming industries such as aluminum. Traditional green credit only supports pure green projects, and it is difficult to serve the stock technology reform of the aluminum industry, while transition-linked loans do not require complete decarbonization of the project, which just matches the long-term transition finance needs of high-carbon industries.

Corresponding inspiration can be obtained from case practice. Binding loan interest rates and emission reduction performance can stimulate the endemic motivation of enterprises to reduce carbon. Relying on Binzhou's local transition financial guidelines and third-party verification mechanisms, the problem of greenwashing can be curbed. Multi-party subjects work together to share the environmental assessment work, alleviate information asymmetry, and improve the financing docking efficiency of transition projects.

5. Conclusion

This article explores the case of high-carbon manufacturing transition-linked loans and analyzes the incentive mechanism of transition finance. Research shows that the incentive effect of the tool comes from clear transition standards, performance linkage pricing and third-party verification. The mechanism links the achievements of low-carbon transition of enterprises to the cost of financing, so that energy conservation and emission reduction actions can bring economic benefits to enterprises. This promotes the coordination between the profit demand of enterprises and the requirements of low-carbon development and fully mobilizes the enthusiasm of high-carbon enterprises to actively transform and upgrade.

This case has several practical implications. First, for policymakers, they can promote regional transition norms and carbon financial platforms to improve the high-carbon industry transition system. Second, for financial institutions, they can rely on multi-party coordination mechanisms to alleviate information asymmetry and reduce loan transaction costs. Third, for high-carbon enterprises, they can carry out energy-saving technology reform, which can save interest expenses and broaden green financing channels.

Several limitations should be acknowledged to the case study. First, as a single-case study, the universality of the conclusion is limited. Second, post-disbursement data on energy consumption and emission reduction verification are not yet available, which limits the empirical evaluation of the

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environmental benefits of loans. Third, the research object is limited to large enterprises and does not cover small and medium-sized high-carbon enterprises. Future research could adopt cross-industry multi-case comparative studies such as steel, cement and chemicals, and introduce longitudinal data to track the dynamic changes of transition effects.

References

[1] Tandon, A. (2021). Transition finance: Investigating the state of play: A stocktake of emerging approaches and financial instruments. *OECD Environment Working Papers, 179*, 1–75.
[2] Xia, B., Ma, Q., & Pan, Y. J. (2025). Design of sustainable performance targets: Mitigating greenwashing in sustainability-linked loans. *Energy Economics, 150*, 108843.
[3] Wang, H. S. (2026). Transitional finance under the constraints of "double carbon": How does the customer transformation plan in high-carbon industries affect bank risks and returns. *Northern Finance*, (6), 67–74.
[4] Xia, B., Li, J., & Ma, Q. (2026). Blockchain-enabled green loans: Mitigating greenwashing through inventory and emission signaling. *International Journal of Production Economics, 295*, 109983.
[5] Xia, B., & Ma, Q. (2026). Green credit pricing mechanism optimization and policy incentives. *Operations Research and Management Science, 35*(2), 88–97.
[6] Li, H., & Zhang, Y. (2025). Transition finance instruments and high-carbon industry transformation: Evidence from China's aluminum sector. *Journal of Sustainable Finance & Investment, 15*(2), 210–228.
[7] Chen, Y., & Liu, W. (2025). Policy incentives for transition finance in high-carbon sectors: A comparative study. *Climate Policy, 25*(4), 512–528.
[8] G20 Sustainable Finance Working Group. (2022). *G20 transition finance framework.* G20 Sustainable Finance Working Group.
[9] Shandong Province Development and Reform Commission. (2025). *Guidelines for transition finance in the aluminum industry of Binzhou City.* Shandong Province Development and Reform Commission.
[10] Xinhua News Agency. (2025). *People's Bank of China is studying and formulating financial standards for the transformation of seven industries, such as shipping and chemical industry.* Xinhua News Agency.