Asia Pacific Science Press

Asia Pacific Economic and Management Review
ISSN(O):3005-9275
ISSN(P):3005-9267
Vol. 2 No.6 (2025)

Compatibility Dilemmas and Optimization Paths of Patient Capital Empowering Green Industries Under the Dual Carbon Goals

Yuhang Li [1,2] *

1.School of Economics, Xiamen University, Xiamen, 361005, Fujian, China

2.The Wangyanan Institute for Studies in Economic, Xiamen University, Xiamen 361005, Fujian, China

Corresponding author:Yuhang Li , jcblwbliweib@163.com

Abstract: This study aims to explore how patient capital can facilitate the development of green industries in the context of the "dual carbon" goals, while analyzing the problems existing in their cooperation and proposing solutions. Combining the development needs of green industries with the characteristics of patient capital, this research systematically examines the unique roles of patient capital in three dimensions—time adaptation, risk bearing, and value alignment—through sorting out relevant theories and practical cases. The results indicate that the effective connection between patient capital and green industries currently faces practical obstacles such as insufficient capital scale, information opacity, narrow exit channels, and fragmented policy support. Based on this, the study proposes optimization paths including expanding the sources of patient capital, establishing information sharing platforms, improving supporting mechanisms, and strengthening policy guarantees. The research shows that the in-depth integration of patient capital and green industries can provide important support for the achievement of the "dual carbon" goals. The relevant conclusions can offer practical references for promoting the high-quality development of green industries and enhancing the synergy between capital and industries.

Keywords: Dual Carbon Goals; Patient Capital; Green Industries; Compatibility Dilemmas; Optimization Paths

Published: Dec 16, 2025

DOI: https://doi.org/10.62177/apemr.v2i6.928

1.Introduction

As China's core strategy to address global climate change and promote systemic economic and social transformation, the "dual carbon" goals are not only significant in terms of ecological value—such as reducing carbon emissions and improving the ecological environment—but also in forcing the green transformation of industrial structures, stimulating the vitality of green technological innovation, and building a modern industrial system characterized by low energy consumption, high output, and sustainability. They provide important scenarios and driving forces for nurturing new quality productive forces, while offering Chinese solutions and contributions to global climate governance. As the core carrier for achieving the "dual carbon" goals, the development of green industries urgently requires technological innovation breakthroughs to overcome green and low-carbon technological bottlenecks, diversified capital empowerment to meet long-term investment needs, improved institutional systems to optimize the market development environment, and cross-subject collaboration to form an ecological development pattern, ultimately realizing the organic unity of economic, ecological, and social benefits.

Patient capital, characterized by long-term orientation, risk tolerance, and ecological empowerment, shares an in-depth alignment logic with the development of green industries:

In the time dimension, its long-term investment attribute matches the slow-return characteristics of green technology R&D and green project construction, effectively resolving the maturity mismatch between short-term capital and the long industrial cycle. In the risk dimension, its risk tolerance can cover the high uncertainty of green innovation, providing stable capital support for disruptive green technological breakthroughs. In the value dimension, its orientation of balancing economic and social benefits is highly consistent with the ecological value pursuit of green industries. Through resource integration and cross-subject collaboration, it promotes the formation of a positive feedback loop of "capital-technology-industry" in green industries, becoming a key capital form to address the financing constraints of green industries and activate green innovation momentum.

2.The Unique Value of Patient Capital to Green Industries

2.1 Matching the Long-Cycle Development Law of Green Industries

2.1.1 Aligning with the Iteration Cycle of Green Technology R&D

Core technological innovations in green industries—such as the R&D of new green and low-carbon building materials, breakthroughs in clean coal utilization technology, and advancements in carbon capture, utilization, and storage (CCUS) technology—require a long process of repeated experimentation and optimization, with difficulty in achieving commercial returns in the short term. Patient capital breaks away from the traditional capital's pursuit of short-term gains, supporting technologies from laboratory research to industrial application from a long-term investment perspective, and avoiding R&D interruptions due to funding shortages (Yang, 2025). For example, in the field of nearly zero-energy consumption buildings, the R&D of energy storage technology and low-carbon materials requires continuous investment, and the long-term empowerment of patient capital can ensure the continuity of technological iteration (Yan, 2025).

2.1.2 Adapting to the Value Release Cycle of Green Projects

Green industry projects, such as forest carbon sink projects and mine ecological restoration projects, exhibit significant lag in environmental and economic value realization, requiring long-term operation to convert ecological value into economic value. By reconstructing the "time logic" of capital value appreciation, patient capital provides continuous funding supply for projects across the start-up and growth stages, matching the full-cycle needs from investment to output (Lan et al., 2025). For instance, seedling cultivation and afforestation projects in forestry require several years or even decades to form stable carbon sink capacity, and the long-term investment of patient capital can ensure the steady progress of such projects (Wang et al., 2025).

2.1.3 Supporting the Continuous Upgrade Cycle of Green Industries

The transformation and upgrading of green industries cannot be achieved overnight; it involves multiple stages such as traditional technology substitution, industrial chain restructuring, and market awareness cultivation. Patient capital can provide capital support throughout the entire industrial life cycle, helping industries develop from low-end to high-end and from fragmented to clustered, adapting to the long-term process of industrial upgrading (Chen et al., 2025). In the green and low-carbon transformation of the coal industry, the shift from high-carbon mining to clean utilization requires long-term financial guarantees, and patient capital can effectively resolve the maturity mismatch problem during the transformation process (Wang et al., 2025).

2.2 Bearing the High-Uncertainty Costs of Green Industries

2.2.1 Tolerating the High Failure Risk of Green Technology Innovation

Disruptive green innovation is characterized by high investment and high failure rates, as new green technologies face numerous unknown obstacles in the industrialization process. With its risk tolerance, patient capital has a higher acceptance of technological innovation failures and is willing to bear the trial-and-error costs during R&D (Zhang et al., 2025). Unlike traditional capital that pursues short-term returns and avoids high risks, patient capital can provide a "fault-tolerant space" for green technology innovation, promoting the realization of disruptive green breakthroughs (Zhuang, 2025).

2.2.2 Resisting Green Market Volatility Risks

In the early stages, green products face problems such as high incremental costs, insufficient market awareness, and unstable demand, leading to significant uncertainty in market expansion. Through resource integration and ecological empowerment, patient capital helps green industry enterprises optimize resource allocation, expand market channels, and alleviate operational pressure caused by market volatility (Meng, 2025). Meanwhile, the long-term holding strategy of patient capital can reduce the impact of short-term market fluctuations on enterprise operations, ensuring stable business operations (Wang et al., 2025).

2.2.3 Hedging Potential Risks of Policy Adjustments

Under the "dual carbon" goals, policies related to green industries may undergo dynamic adjustments, bringing policy uncertainty risks to industrial development. By constructing a cross-cycle investment framework, patient capital dynamically adjusts investment strategies in line with policy orientations, helping enterprises hedge against the impact of policy fluctuations (Yang, 2025). In addition, patient capital can promote enterprises to strengthen collaboration with governments and research institutions, enhancing their ability to predict and adapt to policy changes (Sun, 2025).

2.3 Anchoring the Symbiosis of Green Industries and Economic Value

2.3.1 Balancing Economic Benefits and Ecological Efficiency

The core goal of green industries is to achieve the coordinated win-win of economic and ecological benefits, which is highly consistent with the characteristics of patient capital—"slow work yields fine products"—and its focus on long-term returns and social benefits (Meng, 2025). Traditional capital often focuses on short-term economic returns, which may lead industries into the misunderstanding of "prioritizing economy over ecology." In contrast, patient capital not only pursues long-term stable investment returns but also values ecological benefits such as energy conservation, emission reduction, and carbon sink enhancement, promoting green industries to achieve the dual goals of "economic value-added and ecological optimization" (Lan et al., 2025). For example, in the green transformation of the coal industry, patient capital supports enterprises in improving the economic benefits of clean production while helping them reduce carbon emissions and improve the ecological environment (Wang et al., 2025).

2.3.2 Aligning with Industrial Development Demands Under the "Dual Carbon" Goals

Green industries are the core support for achieving the "dual carbon" goals, and their development demands form a strategic resonance with the long-term value orientation of patient capital. By promoting the positive feedback loop of capital-technology-industry, patient capital helps green industries overcome technological bottlenecks, expand industrial scale, and provide industrial support for the realization of the "dual carbon" goals (Yang, 2025). Meanwhile, patient capital guides social capital to flow into green fields, promoting the clustered development of green industries, forming economies of scale, and accelerating the implementation of the "dual carbon" goals (Lin et al., 2025).

2.3.3 Facilitating Sustainable Development with Symbiotic Multiple Values

The development of green industries supported by patient capital can not only achieve economic and ecological values but also drive social benefits such as green employment and regional coordinated development, forming a pattern of symbiotic multiple values (Zhuang, 2025). For example, in the development of green industries in western China, patient capital can promote the integration of ecological restoration and green industries, achieving both ecological protection and regional economic development and employment growth, which is consistent with the core goal of sustainable development of green industries (Yang, 2025). This alignment of multiple values makes patient capital an important capital support for green industries to achieve the coordinated development of economy, ecology, and society.

3.Connection Obstacles Between Patient Capital and Green Industries

3.1 Insufficient Total Amount and Single Source of Patient Capital on the Capital Side

Currently, there is a significant gap in the supply scale of patient capital supporting the development of green industries, making it difficult to match the long-term and high-investment capital needs of green projects. Green projects such as nearly zero-energy consumption buildings, green coal transformation, and forest carbon sinks all require continuous injection of long-term capital to support technological R&D, project implementation, and industrial upgrading. However, the total amount of existing patient capital is limited, making it impossible to cover the capital needs of the entire industrial chain. In terms of

capital sources, China's patient capital mainly relies on a small number of financial institutions and government-guided funds, with insufficient participation of market-oriented capital. The financing channels are relatively single, lacking diversified long-term capital supply entities. This single-source structure not only restricts the expansion of total capital but also leads to insufficient flexibility in capital allocation, failing to accurately match the differentiated capital needs of different types of green projects, further exacerbating the financing constraints of green industries.

3.2 Information Opacity and Difficult Profit Judgment of Green Projects on the Industrial Side

Green industry projects generally suffer from insufficient and non-standard information disclosure, resulting in severe information asymmetry between patient capital and project parties. In green projects such as nearly zero-energy consumption buildings and mine ecological restoration, core information such as carbon emission assessments, energy consumption reduction effects, and ecological benefit conversion lacks unified disclosure standards and verification mechanisms, making it difficult for patient capital to fully grasp the true operational status and environmental benefits of projects. Meanwhile, the returns of green projects are characterized by significant long-term nature and uncertainty, with their economic returns relying not only on market operations but also on external factors such as carbon trading and policy subsidies. Currently, there is a lack of a scientific and unified value evaluation system for green projects, making it difficult to accurately measure the long-term returns of projects. In addition, the commercial prospects of some green technologies are unclear, further increasing the difficulty for patient capital to judge project returns and inhibiting capital investment willingness.

3.3 Narrow Capital Exit Channels and Incomplete Incentive and Constraint Mechanisms on the Institutional Side

The sustainable circulation of patient capital relies on a sound exit mechanism, but the current capital exit channels in the green industry field are relatively narrow, failing to meet the liquidity needs of patient capital. China's multi-level capital market has insufficient adaptability to green projects, and exit tools such as green asset securitization and carbon neutrality funds are still underdeveloped. Traditional channels such as equity exit and mergers and acquisitions have limited application scenarios in green industries. Meanwhile, the imperfection of incentive and constraint mechanisms further hinders the effective connection between capital and industries. On the incentive side, policies such as tax incentives and risk compensation for patient capital investing in green projects are insufficient, making it difficult to effectively hedge the long-term risks of projects. On the constraint side, there is a lack of regulatory measures for short-term capital behaviors, and the environmental liability accountability mechanism for green projects is not sound, leading some capital to pursue short-term returns and be unwilling to participate in long-term green investments.

3.4 Fragmented Policy Support and Flaws in Risk Sharing Mechanisms on the Environmental Side

The current policies supporting patient capital to empower green industries are fragmented, lacking systematicness and synergy. Policies such as green finance subsidies and project support issued by various regions and departments have overlapping and inconsistent implementation standards, making it difficult to form policy synergy. For example, in fields such as prefabricated buildings and forest carbon sinks, the policy support intensity and subsidy methods vary greatly across regions, leading to policy uncertainty for patient capital in cross-regional allocation. Meanwhile, the risk sharing mechanism has obvious flaws, with green industry projects facing a lack of effective diversification channels for risks such as technological R&D risks, policy change risks, and market volatility risks. Existing risk sharing tools have limited coverage, and mechanisms such as government guarantees and insurance protection provide insufficient support for green projects. A multi-stakeholder risk governance system involving "government-market-enterprise" has not been formed, making patient capital "dare not invest" in green projects with high uncertainty.

4.Solutions

4.1 Expand the Scale of Patient Capital and Attract Long-Term Capital Investment

On the one hand, expand the total amount of patient capital through policy guidance, encourage long-term capital such as government industrial funds, social security funds, and insurance funds to enter the green industry field, give play to the leverage role of government funds, and stimulate social capital to participate in green project investment. For example, establish a national-level green patient capital guidance fund to provide equity investment and interest subsidy support for

key green industry projects. On the other hand, expand diversified financing channels, improve the green financial market system, develop financial products such as green bonds and carbon neutrality ETFs, support qualified green enterprises to list for financing, and attract market-oriented patient capital participation. Meanwhile, optimize the capital structure, promote the strategic binding of patient capital and green industries, and realize the win-win of long-term capital appreciation and industrial green transformation through the "capital + resources" cooperation model.

4.2 Build Information Bridges and Clarify Green Project Standards

Establish a unified information disclosure platform and standard system for green projects, and compulsorily require green projects to disclose core information such as environmental benefits, technological maturity, and fund use plans to improve project transparency. Build a green project database and evaluation system based on digital technology, integrating carbon emission data, energy consumption data, and return forecasts to provide accurate decision-making references for patient capital. Meanwhile, improve the green project value evaluation framework, incorporate carbon sink benefits and environmental externalities into the evaluation system, and formulate scientific return calculation methods and risk assessment indicators. Encourage third-party institutions to participate in the verification and rating of green projects, issue authoritative evaluation reports, reduce information asymmetry between capital and industries, and lower the difficulty for capital to judge project returns.

4.3 Improve Supporting Mechanisms and Explore Green Asset Conversion

Improve the patient capital exit mechanism and enrich exit channels and tools. Promote the development of green asset securitization, support green projects with stable cash flows such as nearly zero-energy consumption buildings and photovoltaic power plants to carry out asset securitization financing, providing liquidity outlets for patient capital. Cultivate the green industry M&A market, encourage leading enterprises to integrate high-quality green projects through mergers and acquisitions, providing exit paths for early-stage investment capital. Meanwhile, explore green asset conversion paths, establish a mechanism linking carbon trading with green project returns, and promote the conversion of environmental benefits such as forest carbon sinks and industrial emission reductions into tradable assets. Improve the full-chain collaborative mechanism of "fundraising-investment-management-exit," enhance the operational efficiency of patient capital in green project investment, and ensure the orderly exit and recycling of capital.

4.4 Strengthen Policy Guarantees and Introduce Risk Compensation Measures

Construct a systematic policy support system, integrate fragmented green industry support policies, formulate cross-regional and cross-departmental collaborative policy plans, clarify the key areas, standards, and processes of policy support, and improve policy stability and predictability. Increase policy incentives for patient capital, implement policies such as tax reductions and stamp duty exemptions for investing in green projects, and provide financial subsidies for capital holding green project equity for a long time. Meanwhile, improve the risk sharing mechanism, establish a green project risk compensation fund, and compensate a certain proportion of losses incurred by patient capital investing in green projects. Promote insurance institutions to develop exclusive insurance products for green projects, covering risks such as technological R&D and policy changes. Build a multi-stakeholder risk sharing model of "government guarantee + commercial insurance + enterprise joint guarantee," reduce the investment risks of patient capital, and enhance their confidence in investing in green industries.

5.Conclusion

This study systematically reveals the in-depth alignment logic and practical connection obstacles between patient capital and green industries under the "dual carbon" goals. The core findings indicate that patient capital, with its long-term orientation, risk tolerance, and pursuit of multiple values, can effectively adapt to the long-term needs of green industry technology R&D, project operation, and industrial upgrading. By constructing a positive feedback loop of "capital-technology-industry," it overcomes industrial development bottlenecks. However, insufficient capital scale, information asymmetry, narrow exit channels, and fragmented policies constitute the four core obstacles to their connection. The research framework of "value alignment-obstacle analysis-path optimization" not only enriches the theoretical system in the interdisciplinary field of green finance and industrial transformation but also provides a clear plan for solving the problems of patient capital being "unwilling to invest," "daring not to invest," and "unable to invest" in practice. It is of great significance for promoting the synergy

between the capital market and green industries and facilitating the achievement of the “dual carbon” goals.

Meanwhile, this study has limitations such as focusing on macro mechanisms, lacking discussions on segmented fields, and insufficient quantitative verification. Future research can be deepened in directions such as the differentiated adaptation needs of different green industries, the empirical measurement of the empowerment effect of patient capital, and the reference of international green capital development experience. This research also provides key implications for policy formulation: relevant departments need to expand the scale of patient capital by establishing guidance funds, improving tax incentives and risk compensation policies, establish a unified green project information disclosure and value evaluation system, smooth capital exit channels, strengthen cross-departmental policy synergy, and build a multi-stakeholder risk sharing mechanism. Through systematic measures, the efficient connection between patient capital and green industries can be promoted,

Funding

No

Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

Reference

[1] Lan, P., He, C., & Zhang, X. X. (n.d.). Theoretical logic and practical paths of patient capital empowering the high-quality development of sci-tech innovation enterprises. Reform. Retrieved November 30, 2025, from https://link.cnki.net/urlid/50.1012.F.20251127.0926.002

[2] Yan, S. W. (2025). Innovative research on the feasibility of pre-construction stages of near-zero energy consumption building projects under the "Dual Carbon" goal. Journal of Taiyuan Urban Vocational College, (11), 22–24.

[3] Wang, J., Chen, J., & Liu, D. (n.d.). Research on the green and low-carbon development path of China's coal industry under the "Dual Carbon" goal. China Coal. Retrieved November 30, 2025, from https://link.cnki.net/urlid/11.3621.TD.20251125.1346.002

[4] Wang, X. Y., & Chen, Q. (2025). Seedling cultivation and afforestation technology in forestry engineering under the "Dual Carbon" background. Forestry Investigation and Design, 54(06), 12–14+41.

[5] Sun, Y. F. (2025). Evolutionary game research between supply and demand sides of prefabricated buildings based on government incentive policies under the "Dual Carbon" goal. Building Energy Efficiency (Chinese & English), 53(11), 148–153.

[6] Wen, J. (2025). Research on the cultivation mechanism of college students' green innovation and entrepreneurship capabilities under the "Dual Carbon" goal. Learning Weekly, (34), 135–138.

[7] Xue, J. (2025, November 17). Insurance institutions empower sci-tech innovation enterprises to grow and expand with "patient capital" [Newspaper article]. China Securities Journal, (A01).

[8] Chen, L., & Wang, H. X. (2025). "Patient capital" empowering traditional enterprises' cross-border digital innovation——From the perspective of enterprise long-term investment and life cycle. Shanghai Journal of Economics, (11), 5–17.

[9] Yang, M. (2025). Patient capital drives the in-depth integration of technological innovation and industrial innovation: Theoretical logic, practical challenges and optimization paths. Modern Economic Research, (11), 81–91.

[10] Wang, Q., & Sun, Y. Q. (2025). How patient capital empowers key core technology innovation driven by digital transformation. Social Sciences in China, (11), 264–273.

[11] Zhuang, L. (2025). Fit logic and practical paths of patient capital empowering the development of high-growth enterprises. Theoretical Exploration, (05), 93–100.

[12] Meng, H. W. (2025). Patient capital empowers the integration of technological innovation and industrial innovation in the publishing industry: Logic, dilemmas and paths. Science & Technology for Development, 17(20), 21–25+31.

[13] Zhang, W., Shang, J. X., & Wang, S. H. (n.d.). Configuration path analysis of patient capital empowering high-tech enterprises' radical green innovation——Based on the resource orchestration theory. Commercial Research. https://doi.

org/10.13902/j.cnki.syyj.20251023.002 (Retrieved November 30, 2025)

[14] Zhang, G. Y. (2025). Foreign green development models and experiences. Value Engineering, 44(30), 78–81.

[15] Lin, L. J., & Ye, X. Y. (2025). Research on capital market supporting the development of green industry driven by the "Dual Carbon" goal. Farm Economic Management, (09), 53–58.

[16] Liu, D. W. (2025). Industrial structure adjustment and optimization strategies in green economic transformation. Time-Honored Brand Marketing, (17), 31–33.

[17] Zhang, H. (2025). Models and strategies for the integrated development of mine ecological restoration and green industry under the "Dual Carbon" goal. Rural Scientific Experiment, (16), 55–57.

[18] Yang, N. (2025). New-quality productivity empowers the development of green industry in western China: Internal logic and practical paths. Journal of Hubei Minzu University (Philosophy and Social Sciences Edition), 43(06), 134–145.

[19] Zhou, G. Y., & Du, X. (2025). Integration of digitalization and green economy: Theory, challenges and paths. Business Observation, 11(20), 112–115.

[20] Cao, X. Y., & Jin, X. P. (2025). Research on the optimization of the linkage mechanism between "green finance" and "environmental performance". In Proceedings of the 2025 Management Innovation Seminar (pp. 223–225). Chengdu University of Information Technology.