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The Impact of Supply Chain Finance on Green Innovation in Listed Firms: A Supply-Demand Mismatch Perspective

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Abstract

Under China's carbon peaking and carbon neutrality goals, supply chain finance (SCF) is widely regarded as a practical way to ease the financing constraints on green innovation in listed firms. Its enabling effect, however, remains limited. Drawing on the literature on SCF and green innovation, this paper argues that the constraint is not simply a shortage of credit but a structural mismatch between the supply of and demand for funds. First, the short maturity of most SCF products does not fit the multi-year horizon of green R&D. Second, credit assessment centered on tangible trade assets struggles to recognize the value of green patents, process know-how, and other intangible outputs. Third, weak incentive alignment and fragmented coordination across organizational units reduce the likelihood that additional liquidity reaches green R&D. Accordingly, the paper proposes longer-dated and milestone-based SCF products, a revised credit assessment framework that incorporates green intangible assets, and stronger incentive and coordination mechanisms. The central implication is that SCF can support green innovation only when product design, organizational routines, and external institutions are aligned with the distinctive funding needs of green projects.

Keywords

Supply Chain Finance; Green Innovation; Maturity Mismatch; Financing Constraints; Listed Firms

1. Introduction

The carbon peaking and carbon neutrality goals have made a comprehensive green transition a national strategic priority in China. Policy documents repeatedly call for financial resources to be directed toward green activities, making the financing of low-carbon development a shared concern in research and practice. Listed firms are

central participants in capital markets. Their green innovation shapes not only their environmental performance and long-run competitiveness but also the low-carbon upgrading of entire industrial chains. In this paper, green innovation covers the development and patenting of green technologies, low-carbon redesign of production processes, and coordinated emission reduction across supply chains.

Green innovation differs from general technological innovation in ways that raise its financing threshold. R&D often spans several accounting years and requires patient capital. Its main outputs, such as green patents and process solutions, are intangible and cannot be pledged like inventories or machinery. The work also depends on sustained coordination among R&D, production, and finance departments. Traditional bank credit, which relies on collateral and reported financial data, therefore provides limited support to firms with genuine research needs but few pledgeable assets.

SCF partly addresses this gap. By using receivables, inventory, orders, and other real trade assets as financing bases, and by drawing on the credit of core firms, SCF incorporates supply-chain transactions into credit assessment. This can lower information-collection costs and broaden access to finance for firms within the chain. Several policy initiatives now encourage the standardized development of SCF and the channeling of funds toward the green transition. Some listed firms have used SCF to finance cleaner processes and technology development.

The green innovation effect of SCF is nevertheless conditional. Evidence from Chinese A-share listed firms shows that ownership, supply-chain concentration, and local environmental regulation influence the observed effect (Hao & Zhang, 2025). Some firms adopt SCF only nominally. In the absence of supporting internal routines and external institutions, additional funds do not necessarily flow into green R&D. Existing studies focus mainly on average effects and transmission channels; they pay less attention to the conditions under which finance is converted into green innovation. This paper therefore examines whether the funding logic of SCF matches the funding needs of green innovation. It identifies three mismatches related to maturity, collateral and credit assessment, and participant incentives, and then derives implications for product design and policy.

2. Literature Review

2.1. Research Perspectives on Supply Chain Finance

Chinese scholarship generally treats SCF as both a financial arrangement and a supply-chain arrangement (Ling et al., 2021). As a financial arrangement, its core value lies in relaxing financing constraints. Traditional lending involves severe information asymmetry between banks and firms and often requires qualified collateral, which keeps financing costs high. SCF uses real transaction assets, including receivables, inventory, and orders, and leverages the credit of core firms to enhance the creditworthiness of other chain members (Yao et al., 2017). Its effect

need not be uniform: Yao et al. (2017) show that technology-based small and medium-sized enterprises (SMEs) benefit more when information asymmetry is greater, indicating that SCF has structural rather than universal effects. The Hadlock-Pierce index has also provided a widely used way to measure the severity of financing constraints (Hadlock & Pierce, 2010).

International research emphasizes the efficiency of financial and information flows across the chain. Pfohl and Gomm (2009) describe SCF as coordinated management of these flows to reduce financing and tied-up-capital costs. Wuttke et al. (2016) find that adoption depends on the trade-off among implementation costs, financial gains, and upstream and downstream willingness to cooperate, not merely on credit availability. The field has increasingly moved from designing individual instruments toward chain coordination and risk sharing (Xu et al., 2018). Kouvelis and Xu (2021) further show that the value of factoring and reverse factoring varies with buyer credit quality and supplier liquidity. These findings imply that SCF can relieve selected constraints without covering every financing need.

As a supply-chain arrangement, SCF also changes inter-firm relationships. Closer transactional ties increase information exchange and can generate knowledge spillovers within the chain (Wang et al., 2025). Pan et al. (2020) show that SCF affects cash holdings and working-capital management, with indirect consequences for later investment. Domestic studies usually measure SCF through disclosure keywords or dummy variables indicating whether a firm acts as a core enterprise. Such studies find that SCF can improve firm resilience through collaborative innovation and risk bearing, although the effect differs by ownership, life-cycle stage, and bank-firm relationships (Pan & Luo, 2024).

A further body of work stresses network position and firm capability. Song and Lu (2017) find that not all SMEs benefit equally from SCF: firms near the center of a supply network, closely connected with core enterprises, and equipped with stronger information capabilities obtain more financing convenience. This conclusion reinforces the view that SCF effects are structurally differentiated and that resource allocation within a chain can be highly uneven.

2.2. Research Perspectives on Green Innovation

Green innovation carries both economic and environmental value. Following Qi et al. (2018), many studies use green patent applications as an indicator of corporate green innovation. Its determinants can be divided into external conditions and internal capabilities. Environmental regulation is the most extensively studied external factor. The Porter hypothesis suggests that appropriately designed regulation can induce green innovation, while regulation that is too weak or too stringent may produce divergent effects. In China, higher pollution charges have been found to suppress green innovation, whereas environmental subsidies tend to stimulate it (Li & Xiao, 2020). Low-carbon city pilot policies have also raised green

technological innovation, especially in high-carbon industries and state-owned enterprises (Xu & Cui, 2020).

Internally, financing constraints, governance, and capital structure shape the continuity of green R&D. Green projects are long-term, uncertain, and slow to yield returns, so they are often among the first expenditures to be cut when liquidity tightens (Gong et al., 2026). Chinese evidence shows that constrained firms rely more on internal funds and working-capital management to sustain innovation; when financing conditions deteriorate, innovation is hit harder than fixed investment (Ju et al., 2013). Better corporate governance is also associated with more green patents, and green innovation appears more sensitive to governance quality than general innovation (Amore & Bennedsen, 2016). These findings point to a need for stable long-term finance and internal organizational capacity, not merely a larger volume of credit.

2.3. Literature Synthesis and Research Gap

Prior work has established three important results. First, large-sample evidence from A-share firms generally supports a positive average effect of SCF on green innovation. Second, studies identify financing-constraint relief, reputation, and collaborative innovation as channels, together with environmental regulation and digitalization as moderating conditions. Third, heterogeneity analyses cover ownership, region, and supply-chain characteristics.

Most studies nevertheless assume that additional SCF funding can be converted smoothly into green R&D. They give limited attention to compatibility in maturity, collateral basis, and participant incentives. Empirical work also tends to test one moderator at a time, making it difficult to connect business models, organizational structures, and institutional conditions. This paper therefore moves from the question of whether SCF promotes green innovation to the question of why that effect is difficult to realize in practice. Table 1 summarizes the main strands of the literature.

Table 1. Main Literature on Supply Chain Finance and Green Innovation

Literature stream	Representative studies	Main finding	Remaining gap
Financing function	Ling et al. (2021); Yao et al. (2017)	Real trade assets relax financing constraints; effects vary with information asymmetry.	Access to finance is emphasized more than how funds are used.
Chain collaboration	Song and Lu (2017); Pan et al. (2020); Wang et al. (2025)	Improves working capital and information exchange, generating spillovers within the chain.	Conditions for cooperation and its boundary effects remain underexplored.
Composite performance	Pan and Luo (2024)	Improves resilience through collaborative innovation and risk bearing.	The link between SCF-generated liquidity and green R&D is not traced.
Green innovation drivers	Qi et al. (2018); Li and Xiao (2020); Xu and Cui (2020); Ju et al. (2013)	Regulation, public support, financing constraints, and governance affect green R&D.	External policy and SCF product design are rarely analyzed together.
SCF-green innovation nexus	Hao and Zhang (2025); Liu and Wang (2026); Gong et al. (2026)	SCF has positive average effects through several channels and under several conditions.	The conversion conditions from finance to green projects are insufficiently specified.

3. Barriers to SCF-Supported Green Innovation

3.1. Maturity Mismatch in Green R&D Finance

SCF primarily optimizes working capital and relieves short-term liquidity pressure. Its funding is therefore oriented toward short maturities and rapid turnover. This feature is useful for managing receivables and inventory, but it contrasts sharply with the financing profile of green innovation. Green R&D extends from technical development to patenting and commercialization, frequently across several accounting years. It is a long-term, high-risk investment that is often subordinated to production and debt service.

When SCF supplies additional liquidity, managers may allocate it to activities that improve reported performance sooner, while remaining cautious about distant green patent and low-carbon process projects. The resulting imbalance is not merely managerial myopia. It is a direct business-level manifestation of a maturity mismatch between short-dated SCF products and long-dated green investment needs.

3.2. Collateral Mismatch in Green Innovation

SCF relies heavily on verifiable trade backgrounds and tangible assets. Receivable, inventory, and order financing all use trade assets that can be verified and valued as the credit basis. To control risk, core firms and financial institutions tend to confine SCF to short-cycle transactions with predictable cash flows. Green innovation, by contrast, produces patents, process know-how, and other intangible assets. These outputs lack standard trade documents, and their future returns are difficult to quantify.

The mismatch leaves green projects without collateral that satisfies existing risk controls. Even when a project has strong technical prospects, it may fail to obtain adequate support within a product framework designed for tangible current assets. Green innovation is thus disadvantaged not because it lacks value, but because its value is difficult to verify and pledge through conventional SCF procedures.

3.3. Incentive and Organizational Gaps

Core firms usually lead SCF programs. Some participate mainly to collect fees or optimize their own working capital and do not treat green chain transformation as a business objective. Yet SCF can promote green innovation only when core firms actively build channels for environmental information exchange and knowledge spillovers. If SCF is treated solely as a financing tool, these collaborative effects are unlikely to materialize.

Listed firms also face internal organizational barriers. SCF and green innovation commonly sit in different departments: the former focuses on trade-financing default risk, while the latter is managed by R&D units. Without a formal linkage, there is no routine through which SCF-generated liquidity can be allocated to research. Agency costs can reinforce the problem. Managers may avoid high-risk innovation even after

liquidity pressure eases, so additional funds do not necessarily enter green R&D.

4. Policy and Managerial Implications

4.1. Innovate Product Maturity Structures

The response to maturity mismatch should begin with product design. Within the SCF framework, core-firm credit can support longer-dated products for upstream and downstream green R&D. Repayment schedules can be tied to project milestones, reducing short-term debt service pressure. Revolving credit and committed facilities can extend funding across the full R&D cycle while preserving periodic review. Such arrangements would align cash inflows with the staged nature of green projects rather than forcing them into short-cycle trade finance.

4.2. Rebuild Credit Assessment Standards

Credit assessment should recognize green intangible assets. Financial institutions can use green patents, process quality, and project verification as supplementary signals instead of relying exclusively on inventory and receivables. For collaborative projects led by core firms, dedicated green SCF products can share part of the R&D risk. Enhanced monitoring of fund use is also necessary to prevent resources from being diverted to high-pollution capacity expansion. The objective is not to relax risk control indiscriminately, but to make green value legible within the credit system.

4.3. Strengthen Incentives and Organizational Coordination

Core firms should include green chain transformation in SCF performance evaluation and use business cooperation to promote environmental technology exchange. External regulation can reinforce these incentives: the positive effect of SCF becomes more likely when environmental regulation is sufficiently stringent and credible (Hao & Zhang, 2025). Within listed firms, SCF and R&D units need a formal communication and budgeting mechanism. A share of incremental liquidity can be designated for green process improvement and patent development, and green innovation indicators can be incorporated into managerial performance assessment. Non-state firms should use improved SCF access not only to ease operating pressure but also to plan long-term green R&D investment.

5. Conclusion

Against the background of China's green transition, this paper argues that the green innovation effect of SCF is constrained by a mismatch between the supply of and demand for funds. Three constraints stand out: short product maturities do not support long-cycle R&D; tangible-asset credit logic does not accommodate green intangibles; and weak incentives and organizational coordination prevent liquidity from being systematically directed to green projects. These are not isolated implementation problems. They arise from the interaction of business models,

organizational structures, and institutions.

Releasing the green innovation potential of SCF therefore requires coordinated action at three levels. At the business level, products should combine longer maturities with milestone-based repayment and green intangible assets should enter credit assessment. At the organizational level, SCF and R&D units should be linked through budgeting and performance evaluation. At the institutional level, environmental regulation, interest subsidies, risk compensation, and green information disclosure should reduce information asymmetry and support firm-level investment. This paper is a literature-based theoretical analysis. Future research can develop indicators for each type of mismatch and test their effects empirically.

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