"GREENER PORTFOLIOS, GREATER ORGANIZATIONAL VALUE? PATENT GREENNESS, SUSTAINABILITY PRACTICES, AND THE ROLE OF SCOPE 3 EMISSIONS"

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Overview

The global transition toward sustainability is driving organizations to reshape their strategies, routines, and external relationships fundamentally. In high-emission industries, firms are increasingly expected to demonstrate not only technological innovation but also credible, organization-wide behavioral change in response to environmental challenges (Hall et al., 2005; Kogan et al., 2017; Martínez-Falcó et al., 2024). While green innovation—manifested in the development of environmentally oriented patents—has become a central pillar of corporate sustainability, the macro-organizational mechanisms through which such innovations generate economic value remain underexplored (Chirico et al., 2025; Li et al., 2018).

This study examines how the collective behaviors and systemic practices of organizations—spanning internal routines, external collaborations, and value chain management—determine the financial returns to green innovation. Specifically, we investigate how the greenness of a firm's patent portfolio influences its market-based patent value, and how this relationship is shaped by internal and external sustainability practices, the strategic intensity of green patenting, and the complexity of value chain emissions (Scope 3). By focusing on the macro-organizational level, we examine how organizations, as holistic actors, structure, align, and leverage their innovation and sustainability strategies to create value under heightened environmental scrutiny.

Research Questions

1. To what extent does patent greenness enhance the value of a firm's patent portfolio?
2. How do internal and external sustainability efforts, green patent intensity, and Scope 3 emissions moderate this relationship?

Theoretical Background

Stakeholder theory posits that organizations are embedded in networks of stakeholders whose expectations for environmental responsibility shape collective strategy and resource allocation (Eccles et al., 2014; Freeman, 2004). The resource-based view highlights how internal routines and external partnerships enable firms to develop and deploy organization-wide capabilities, such as green innovation and credible sustainability practices (Barney, 1991; Hart, 1995). Patent greenness, defined as the technical breadth and environmental focus of a firm's patent portfolio, is theorized to enhance patent value by aligning innovation with stakeholder demands and regulatory trends.

However, the realization of this value depends on the organizational environment: robust internal sustainability efforts embed environmental priorities in routines and culture, while external efforts facilitate supply chain alignment and stakeholder legitimacy. Green patent intensity signals strategic commitment at the organizational level. In contrast, Scope 3 emissions intensity reflects the complexity of managing environmental impact across the value chain, potentially undermining the credibility and effectiveness of green innovation if not properly managed.

Methods

We analyze an unbalanced panel of 177 US-listed manufacturing firms (2013–2020) that report to the CDP, integrating data from Compustat, the USPTO, and LSEG. Patent value is measured using abnormal stock returns following patent grants, with a forward two-year adjustment to account for patent pendency. Key predictors include patent greenness (e.g., Y02 classification), internal and external sustainability efforts (as reflected in ESG/CDP disclosures and initiatives), green patent intensity, and Scope 3 emissions intensity. To address potential selection bias in green patenting, where the decision to pursue green patents may be non-random and related to unobserved firm characteristics influencing patent value, we employ a random-effects Heckman selection model. This approach jointly estimates the likelihood of a firm engaging in green patenting (selection equation) and the determinants of patent value (outcome equation), while accounting for unobserved heterogeneity at the firm level and providing robust inference for our moderation hypotheses.

Results

Our analysis provides new insights into how macro-organizational behaviors shape the value of green innovation:

- **Patent greenness alone does not increase patent value:** Contrary to expectations, simply increasing the environmental orientation of a firm's patent portfolio does not, in itself, lead to higher market-based patent value. This suggests that patent greenness, absent a supportive organizational context, is insufficient for value creation.

- **Internal sustainability efforts amplify value:** The positive effect of patent greenness on patent value is realized only when firms exhibit robust internal sustainability practices, such as environmental management, training, and governance. These collective organizational routines enable firms to translate green innovation into recognized market value.

- **External sustainability efforts show no significant moderating effect:** Collaboration with suppliers and external ESG initiatives, while important for broader sustainability, do not significantly moderate the relationship between patent greenness and patent value in this sample.

- **Strategic orientation matters:** High green patent intensity within the portfolio strengthens the positive impact of patent greenness on value. This suggests that a systemic, organization-wide commitment to green innovation is recognized and rewarded by the market.

- **Scope 3 emissions as a constraint:** High Scope 3 emissions intensity weakens the value of green patenting. When value chain emissions remain unmanaged, stakeholders appear to discount or penalize green innovation, highlighting the importance of credible, organization-wide environmental performance.

Together, these findings reveal that the financial benefits of green innovation depend critically on the broader organizational environment and value chain context, underscoring the macro-organizational behavior perspective at the heart of this study.

Conclusions

This study demonstrates that the economic value of green patents is not solely determined by patent greenness but instead emerges when embedded within robust organizational sustainability practices and a strategically consistent portfolio of green innovation.

Using a panel of US-listed manufacturing firms and a random-effects Heckman selection model, we find that organizational sustainability efforts and green patent intensity significantly amplify the market value of green patents. In contrast, high Scope 3 emissions intensity can negate or even reverse these gains. In contrast, external sustainability efforts show no significant moderating effect. These results underscore that market rewards for green innovation depend on credible, organization-wide behavioral change, where internal alignment and value chain decarbonization are crucial for translating patent greenness into financial value.

For managers and policymakers, this highlights the need to integrate sustainability deeply within organizational routines and strategies, and to address value chain emissions, in order to realize the full economic and reputational benefits of green innovation.

References

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, *17*(1), 99–120. https://doi.org/10.1177/014920639101700108

Chirico, F., Eddleston, K. A., & Patel, P. C. (2025). Does it Pay to Patent Green Innovations? Stock Market Reactions to Family and Nonfamily Firms' Green Patents. *Journal of Business Ethics*. https://doi.org/10.1007/s10551-025-05942-w

Eccles, R. G., Ioannou, I., & Serafeim, G. (2014). The Impact of Corporate Sustainability on Organizational Processes and Performance. *Management Science*, *60*(11), 2835–2857.

Freeman, R. E. (2004). The Stakeholder Approach Revisited. *zfwu Zeitschrift für Wirtschafts- und Unternehmensethik*, *5*(3), 228–241. https://doi.org/10.5771/1439-880X-2004-3-228

Hall, B. H., Jaffe, A., & Trajtenberg, M. (2005). Market Value and Patent Citations. *The RAND Journal of Economics*, *36*(1), 16–38.

Hart, S. L. (1995). A Natural-Resource-Based View of the Firm. *Academy of Management Review*, *20*(4), 986–1014. https://doi.org/10.5465/amr.1995.9512280033

Kogan, L., Papanikolaou, D., Seru, A., & Stoffman, N. (2017). Technological Innovation, Resource Allocation, and Growth. *The Quarterly Journal of Economics*, *132*(2), 665–712. https://doi.org/10.1093/qje/qjw040

Li, D., Huang, M., Ren, S., Chen, X., & Ning, L. (2018). Environmental Legitimacy, Green Innovation, and Corporate Carbon Disclosure: Evidence from CDP China 100. *Journal of Business Ethics*, *150*(4), 1089–1104. https://doi.org/10.1007/s10551-016-3187-6

Martínez-Falcó, J., Sánchez García, E., Marco-Lajara, B., & Millán-Tudela, L. (2024). Green Innovation: Integrating Economic Growth With Environmental Stewardship. In *Green Supply Chain Management Practice and Principles* (pp. 150–167). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3693-3486-7.ch008