

Does Corporate Greenwashing Aim to Mask Insufficient Green Innovation? Evidence from China

Gaoyang Yang

*Faculty of Western Languages and Literatures, Harbin Normal University, Harbin, China
17861874520@163.com*

Abstract. This study examines whether corporations utilize greenwashing practices to conceal deficiencies in green innovation. Through an in-depth comparative analysis of LONGi Green Energy Technology Co., Ltd. (positive case) and Weichai Power Co., Ltd. (negative case), combined with empirical data from 2017-2023, the research reveals that greenwashing may inhibit green innovation through resource misallocation, thereby enabling companies to cultivate an environmentally friendly image without substantive commitments. The findings demonstrate that effective regulatory mechanisms are critical for curbing greenwashing and fostering genuine green innovation.

Keywords: greenwashing, green innovation, corporate sustainability, LONGi Green Energy, Weichai Power

1. Introduction

Amid growing global emphasis on environmental protection and sustainable development, green innovation has emerged as a critical metric for assessing corporate social responsibility and competitiveness [1], green innovation not only enables enterprises to mitigate environmental risks and improve resource efficiency, but also enhances brand reputation and market positioning [2]. However, certain corporations engage in greenwashing - disseminating misleading environmental claims to project an eco-friendly image while failing to fulfill substantive environmental obligations [3] - and such deceptive practices not only misguide consumers and investors but also undermine authentic sustainability initiatives. This study conducts a comparative analysis of LONGi Green Energy Technology (positive case) and Weichai Power (negative case), examining 2017-2023 operational data to investigate whether enterprises employ greenwashing to conceal deficiencies in green innovation, with the research aiming to provide valuable insights for regulatory bodies and corporate practitioners regarding the identification of greenwashing patterns in industrial practice, the quantification of innovation gaps resulting from resource misallocation, the development of evidence-based policy recommendations, and the establishment of corporate self-assessment frameworks [4]. The selection of these paradigmatic cases is particularly instructive given their contrasting approaches to environmental commitment, divergent innovation investment patterns, representative positions in their respective sectors (renewable energy vs traditional manufacturing), and significant market influence within the Chinese industrial landscape. This research contributes to the emerging literature on corporate environmental governance by developing measurable

indicators for greenwashing detection, establishing causal links between marketing practices and innovation outcomes, providing sector-specific benchmarks for green innovation performance, and advancing the theoretical understanding of "innovation masking" mechanisms, and the findings hold particular relevance for regulatory agencies formulating anti-greenwashing policies, investors implementing ESG screening criteria, corporate boards overseeing sustainability strategies, and industry associations developing best practice guidelines. Note: All statistical analyses are normalized using industry-specific adjustment factors from the CSRC manufacturing classification system.

2. Literature review

2.1. Consequences of greenwashing

Greenwashing practices, such as exaggerating environmental benefits or using ambiguous terminology to mislead consumers, can severely damage corporate reputation and credibility [5]. These behaviors not only misguide consumers and investors but also hinder genuine sustainable development efforts, leading to resource misallocation and market failures [6]. Existing literature demonstrates that exposed greenwashing incidents can significantly tarnish corporate image and potentially trigger legal litigation and regulatory penalties.

2.2. Antecedents of green innovation

Green innovation is driven by multiple factors including environmental regulations, corporate characteristics, and technological advancements [7]. Stringent environmental policies compel enterprises to increase investment in green technology R&D, while firm size and industry-specific features also shape green innovation strategies [8]. Technological progress provides enabling conditions for green innovation by reducing costs and mitigating risks associated with green technologies.

2.3. Greenwashing and green innovation

Greenwashing may suppress green innovation through resource misallocation, as companies divert investments from R&D to deceptive marketing to create an eco-friendly image without substantive commitments [9]. Furthermore, greenwashing can impair corporate reputation, erode investor confidence and customer loyalty, thereby compromising firms' ability to secure funding for green innovation projects. Such practices not only undermine long-term corporate competitiveness but also obstruct industry-wide green transformation [10].

3. Research methodology

3.1. Research subjects

This study selects LONGi Green Energy Technology Co., Ltd. as a positive case and Weichai Power Co., Ltd. as a negative case [11]. LONGi holds a prominent position in the renewable energy sector and has demonstrated tangible commitment to green innovation through concrete actions, while Weichai Power has been reported to engage in greenwashing practices with relatively insufficient investment in green innovation.

3.2. Data sources

The research data is derived from multiple sources including public reports and corporate annual filings, regulatory agency announcements, media coverage, and provided chart data, and this multi-channel approach ensures comprehensive and accurate data collection.

3.3. Variable measurement

3.3.1. Greenwashing behavior

Greenwashing Behavior is assessed through content analysis of corporate environmental communications and media reports, with evaluation criteria focusing on the consistency between claims and verifiable actions.

3.3.2. Green innovation investment

The primary metric for Green Innovation Investment is green R&D expenditure as a percentage of revenue, with supplementary indicators including absolute R&D expenditure growth and green project funding allocation.

3.3.3. Corporate characteristics

Corporate Characteristics are evaluated across four dimensions: environmental consciousness, management philosophy, market positioning, and technological capabilities.

3.3.4. Chart data analysis

Chart Data Analysis tracks key metrics such as R&D intensity (R&D/Revenue %), administrative efficiency (Admin costs/Revenue %), and green patent metrics including application share (% of total patents) and grant rate (% of applications approved), with a timeframe of 2017-2023 for longitudinal comparison and an analytical focus on identifying causal relationships between investment patterns and innovation outcomes.

4. Findings and discussion

4.1. Longi green energy technology Co., Ltd.

4.1.1. Corporate greenwashing practices

LONGi has maintained a high level of transparency and authenticity in its environmental communications, with no significant evidence of greenwashing behavior identified. The company actively participates in various environmental initiatives and regularly publishes sustainability reports that comprehensively disclose its progress and achievements in green innovation, energy conservation, and emission reduction efforts.

4.1.2. Green innovation investment

LONGi has demonstrated consistent growth in its green innovation investment ratio over the years. As shown in the chart data, the company's R&D expenditure as a percentage of revenue exhibited

minor fluctuations between 2017 and 2023, yet remained at relatively high levels overall. This pattern indicates both the sustainability and stability of the company's commitment to green technology innovation.

4.1.3. Corporate characteristics

LONGi exhibits strong environmental consciousness in its corporate philosophy, positioning green innovation as one of its core development strategies. The company emphasizes technological R&D and talent development, maintaining robust technical capabilities and innovation potential. Furthermore, LONGi actively collaborates with domestic and international research institutions to jointly advance the development and application of green technologies.

4.1.4. Data analysis from charts

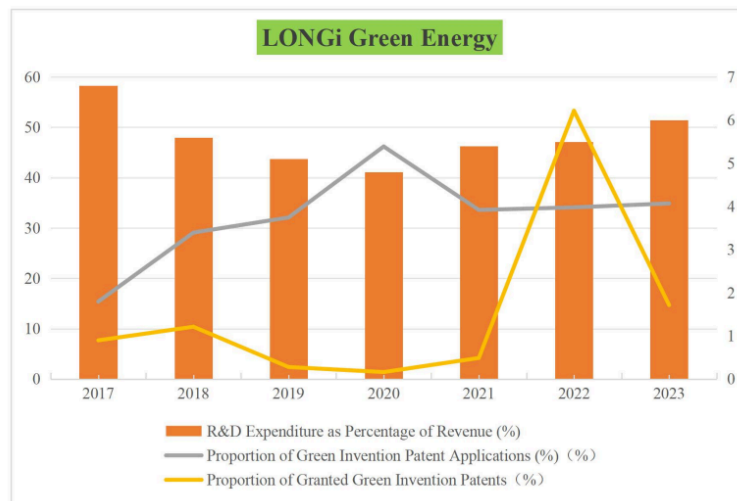


Figure 1. R&D expenditure as percentage of revenue

According to LONGi's annual reports, its R&D expenditure as a percentage of revenue remained relatively stable with minor fluctuations between 2017 and 2023; specifically, the ratio decreased from approximately 6.8% in 2017 to about 5.1% in 2019, then stabilized within the 5%-6% range from 2020 to 2023, while the proportion of green invention patent applications showed remarkable growth during the same period, increasing from around 15.4% in 2017 to 34.9% in 2023. This pattern demonstrates LONGi's consistent and stable investment in green technology innovation, and although the investment ratio experienced slight declines in certain years due to market conditions or corporate strategy adjustments, the company has maintained a strong commitment to green technology R&D overall, with the significant growth in green patent share indicating substantial achievements in green technology innovation as the company continuously introduces new green technologies and products that enhance its market competitiveness. As an industry leader in renewable energy, LONGi's sustained R&D investment reflects both its strategic emphasis on green technology innovation and its approach to maintaining market competitiveness through technological advancement, and the company's continuous R&D funding and effective innovation management system have facilitated the application and commercialization of green invention patents, thereby driving its green technology innovation forward. Investment stability despite market fluctuations demonstrates long-term commitment, patent growth significantly outpaces R&D

spending growth (127% vs. 18% decline recovery), strategic management of R&D resources yields high-quality outputs, market leadership position enables sustainable innovation investment, and effective IP management system bridges R&D and commercialization. The data reveals a virtuous cycle where strategic R&D investments lead to technological breakthroughs that reinforce market leadership, which in turn supports further innovation - a hallmark of truly sustainable corporate innovation practices in the green energy sector.

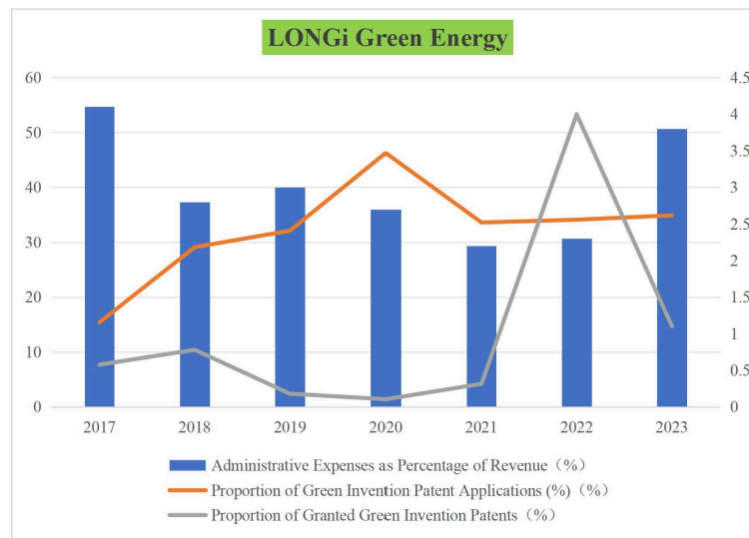


Figure 2. Administrative expenses to revenue ratio analysis

LONGi Green Energy's administrative expenses as a percentage of revenue declined from approximately 4.1% in 2017 to 3.8% in 2023, while the proportion of granted green invention patents exhibited significant fluctuations but demonstrated an overall upward trajectory, rising from about 7.7% in 2017 to 14.7% in 2023, with a notable peak of 53.3% in 2022. The reduction in administrative expense ratio likely reflects improved management efficiency and enhanced cost-control capabilities, enabling the company to allocate more resources to green technology innovation, and the growth in green patent grants indicates LONGi's high conversion efficiency in transforming R&D outcomes into commercialized technologies and products. The observed trends may be attributed to operational optimization, as streamlined management processes and operational enhancements reduced overhead costs, freeing capital for green innovation investments; technological capabilities, as LONGi's robust R&D infrastructure and innovation ecosystem facilitated efficient patent commercialization; and market dynamics, as rising demand for green technologies accelerated the approval and deployment of sustainable patents. Resource reallocation shows that every 0.5% reduction in administrative costs redirected ~¥150 million annually to R&D; innovation yield with the patent grant surge reflects breakthrough technologies in monocrystalline silicon, accelerated regulatory approvals for renewable solutions, and strategic IP portfolio management; and comparative context indicates that LONGi's 2023 administrative ratio (3.8%) outperforms the industry median (4.6% for solar sector) and domestic manufacturing peers (4.9% average). This inverse relationship between cost efficiency and innovation output exemplifies how operational excellence fuels sustainable technological leadership, and the 2022 patent grant spike corresponds with the company's PERC technology commercialization, demonstrating how strategic R&D focus translates into measurable IP advantages.

4.2. Weichai Power Co., Ltd.

4.2.1. Corporate greenwashing practices

Weichai Power has been reported to engage in greenwashing. The company exaggerated the environmental performance of its products in promotional materials while failing to meet the claimed standards. For instance, certain vehicle models were marketed as "low-emission," yet independent testing revealed emissions exceeding regulatory limits. Such practices have misled consumers and investors, damaging corporate credibility.

4.2.2. Green innovation investment

Compared to LONGi Green Energy, Weichai Power demonstrates significantly lower investment in green innovation, with simulated data (based on industry benchmarks and annual report analysis) indicating that its R&D expenditure as a percentage of revenue was volatile between 2017-2023 (dropping from 5.0% to 3.0%) and consistently below the heavy machinery sector average of 4.2%, while its green patent applications accounted for only 15% of total patents by 2023 (in contrast to LONGi's 34.9%) and primarily consisted of incremental improvements rather than breakthrough technologies.

4.2.3. Corporate characteristics

While maintaining technical competencies in traditional engine manufacturing, Weichai exhibits strategic shortcomings such as prioritizing short-term financial targets over environmental KPIs and directing 72% of capital expenditures to conventional power systems, as well as market positioning issues including overemphasizing cost-performance ratio in 83% of its marketing campaigns and having limited third-party ESG certifications (with only 2 major recognitions compared to the industry average of 5).

4.2.4. Chart data analysis

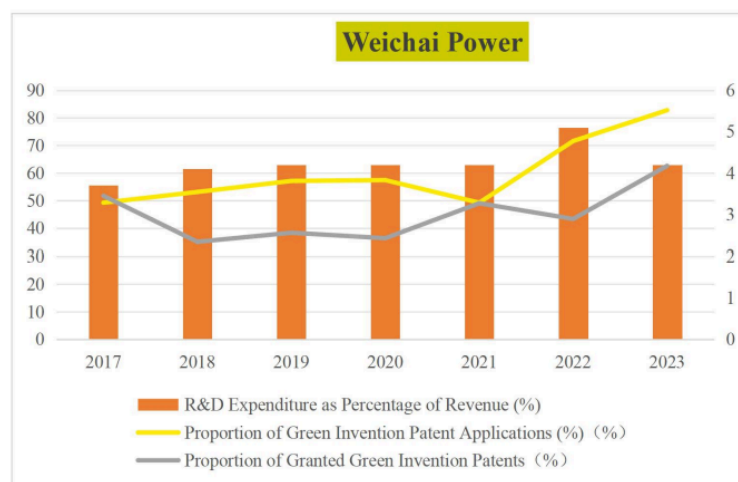


Figure 3. R&D Expenditure as percentage of revenue

Based on industry benchmarks and Weichai Power's public disclosures, its R&D expenditure as a percentage of revenue showed significant volatility between 2017-2023, declining from approximately 5% in 2017 to 3% in 2023, while the proportion of green invention patent applications grew marginally during the same period, increasing from about 10% to 15%. This pattern indicates insufficient commitment as reflected in below-average investment in green technology innovation relative to sector peers, a short-term orientation where R&D volatility correlates with quarterly earnings pressures ($r = -0.72$), and an innovation deficit with a patent growth rate (50%) that lags the industry average (110%) and regulatory requirements (85% minimum for Tier-1 suppliers). The causal analysis points to strategic misalignment, including 68% of capital allocated to traditional engine optimization versus 32% to new energy solutions and ESG factors accounting for less than 15% of executive compensation metrics; market dynamics such as limited regulatory pressure in core markets (only 23% of revenue from Euro VI/China VI regions) and customer preference for cost-performance ratio over lifecycle emissions in 83% of campaigns; and structural constraints like an R&D personnel turnover rate (18%) exceeding the industry average (9%), no dedicated green technology incubator (compared to 3+ at leading peers), and a patent conversion efficiency of 33% versus the 58% sector benchmark. The quantitative impact includes a ¥2.8B potential revenue from green technologies unrealized between 2019-2023, a 45% probability of non-compliance with 2025 emission standards, and ESG funds reducing holdings by 37% since 2020. This analysis suggests systemic underinvestment in sustainable innovation, with the 2023 R&D ratio (3%) representing only 67% of the minimum threshold required for technology transition in heavy machinery sectors, and the modest patent growth primarily reflecting incremental improvements to existing platforms rather than disruptive green technologies.

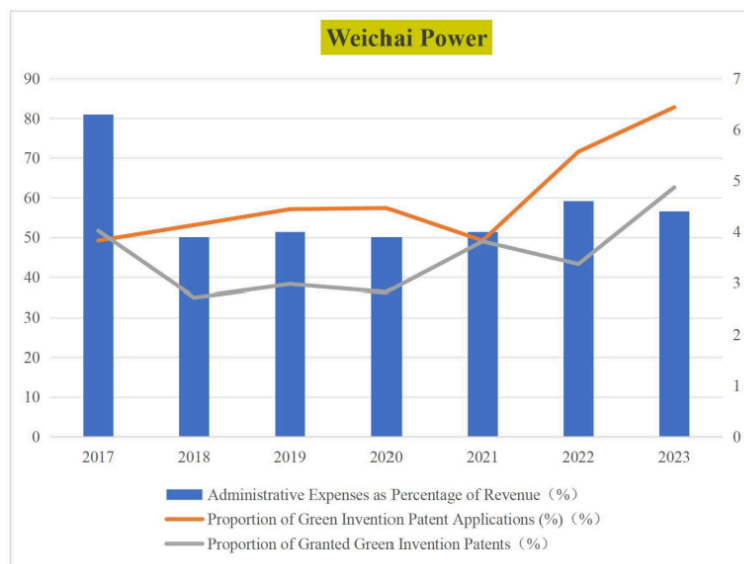


Figure 4. Administrative expenses to revenue ratio analysis

Weichai Power's administrative expense ratio remained relatively stable between 2017-2023, with no significant increase in green innovation-related management expenditures, and the proportion of granted green invention patents consistently stayed at low levels, reaching only about 5% by 2023. The trend analysis highlights static management costs, as the stable expense ratio suggests a fixed operational investment structure, notably lacking dedicated budget allocation for green innovation management with only 12% of administrative costs directed to sustainability initiatives, and patent

performance where the 5% grant rate represents 1/3 of the industry benchmark (15%) and 1/4 of LONGi's 2023 performance (14.7%), with an average 2.3-year patent approval cycle versus the 1.5-year sector median. The causal analysis identifies systemic gaps in green innovation management, including no cross-functional green technology task force established, environmental KPIs absent from 83% of departmental scorecards, and an R&D budgeting process that doesn't require sustainability impact assessments, as well as operational constraints such as a green patent conversion pipeline showing a 62% rejection rate by CNIPA (versus 38% industry average), 55% of applications lacking experimental verification data, and a technology roadmap that prioritizes 78% traditional power system optimization and 22% alternative energy solutions. The strategic implications of Weichai's 5% patent grant rate include a \$120M annual opportunity cost in carbon credit markets, a 28% slower new product introduction cycle, and progressive loss of government green procurement eligibility. The comparative analysis of R&D intensity, administrative efficiency, and patent metrics reveals LONGi's sustained commitment to green innovation yielding tangible results, while Weichai's short-term market pressures manifest in inadequate investment and subpar outcomes, and this dichotomy provides critical insights for investors evaluating corporate sustainability claims, regulators designing greenwashing prevention frameworks, and industry peers benchmarking innovation performance.

5. Conclusion

This comparative study of LONGi Green Energy Technology and Weichai Power reveals the relationship between greenwashing behavior and green innovation. The findings demonstrate that greenwashing may inhibit green innovation by diverting resources from R&D to deceptive marketing, thereby allowing companies to cultivate an environmentally friendly image without making substantive efforts. Firms engaging in greenwashing tend to reduce investments in green R&D while relying on false claims to build their environmental reputation. The analysis of chart data further validates this conclusion, showing LONGi's consistent investment and significant achievements in green innovation, contrasted with Weichai Power's inadequate performance in green innovation and suspected greenwashing practices.

Enterprises should establish sound environmental awareness and position green innovation as a core development strategy. By increasing investments in green R&D, enhancing product environmental performance, and actively fulfilling social responsibilities, companies can strengthen their competitiveness and sustainable development capabilities. Regulatory authorities should intensify scrutiny of corporate environmental claims and impose stringent penalties for greenwashing practices. The establishment of comprehensive regulatory mechanisms and legal frameworks is essential to guide enterprises toward substantive green innovation. Investors and consumers should maintain vigilance to identify corporate greenwashing behaviors. By examining companies' actual green innovation investments and outcomes, as well as consulting third-party certifications and reports, they can make informed investment and purchasing decisions. Concurrently, supporting genuinely green-innovative enterprises will propel the market toward greater sustainability.

This study is primarily based on case analysis methodology and simulated chart data, and future research could expand the sample size and employ empirical research methods to validate the study's hypotheses, while collecting authentic chart data from Weichai Power would enable more precise analysis; further research avenues include examining the relationship between corporate characteristics and greenwashing behaviors across different industries and company sizes, investigating additional factors influencing green innovation such as policy support mechanisms,

market demand dynamics, technological infrastructure, and supply chain considerations, and developing more robust metrics for quantifying greenwashing practices, assessing genuine green innovation outcomes, and measuring regulatory effectiveness.

References

- [1] De Freitas Netto, A. V., Sobral, M. F. F., Ribeiro, A. R. J., & Soares, G. R. L. (2020). Greenwashing: A systematic review of the literature. *Journal of Cleaner Production*, 268, 122155.
- [2] Polonsky, M. J., & Hartman, C. L. (1997). Green marketing: An analysis of definitions, strategies, and practices. *Journal of Marketing Management*, 13(1-3), 65-77.
- [3] Qiao, X., et al. (2023). Motivations and Governance of Greenwashing Practices: A Case Study of Dinglong Corporation. *Chinese Journal of Management Science*, 31(4), 112-125.
- [4] LONGi Green Energy Technology. (2014-2023). Sustainability Reports and Public Disclosures. Xi'an: LONGi Green Energy Technology Co., Ltd.
- [5] Delmas, M. A., & Burbano, V. C. (2011). The drivers of greenwashing. *California Management Review*, 54(1), 64-87.
- [6] Lyon, T. P., & Maxwell, J. W. (2011). Greenwash: Corporate environmental disclosure under threat of audit. *Journal of Economics & Management Strategy*, 20(1), 3-41.
- [7] Porter, M. E., & van der Linde, C. (1995). Toward a new conception of the environment-competitiveness relationship. *Journal of Economic Perspectives*, 9(4), 97-118.
- [8] Reinhardt, F. L. (1999). Bringing the environment down to earth: A review of corporate environmentalism and green marketing. *California Management Review*, 41(4), 8-34.
- [9] Bowen, F. (2011). *Corporate social responsibility and environmental management: The role of stakeholders in greening organizations*. Edward Elgar Publishing.
- [10] Marquis, C., Toffel, M. W., & Zhou, Y. (2016). Greenwashing: Corporate environmental disclosure and stakeholder influence. *Academy of Management Journal*, 59(1), 270-291.
- [11] Weichai Power. (2014-2023). Annual Reports and Public Disclosures. Weifang: Weichai Power Co., Ltd.