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The Nexus Between ESG Performance and Green Technology Innovation: A Conceptual Study

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Abstract

A long-standing issue that impedes organizational innovation and development is a lack of sufficient financial security. Businesses suffer from constrained development as a result, and their edge over competitors in the market is lost. This study investigates the connections between green technology innovation (GTI), environment, social and governance (ESG) performance, and financial access. According to the study's findings, businesses with strong ESG practices may foster the growth of their GTI, preserving their competitive advantages and advancing the long-term sustainable development of their businesses. The findings of the investigation indicate that a favorable relationship between improved corporate value and GTI and strong ESG performance may exist through a funding mechanism. It is further established that companies that value ESG performance have better GTI potential, gain rare core competitiveness, and further enhance corporate value while maintaining competitive advantages. Based on these results, the study recommends that commercial enterprises pay attention to the needs of corporate stakeholders and formulate detailed ESG action plans. The company's development strategy should consider ESG performance, and management should consider tightly tying ESG initiatives to GTI. The government ought to make an effort to give businesses the necessary financial backing, policy direction, and incentives.

Keywords: ESG, Green Technology Innovation, Access to Finance, Financing

Introduction

It is already common knowledge among modern businesses that to survive in the highly competitive business world, they must improve their core competencies and work towards sustainable, green development. Therefore, environment, social, and governance (ESG) performance and green technology innovation (GTI) metrics, which assess an organization's capacity for sustainable development, have drawn a lot of interest from researchers and

industry professionals. However, the relationship between corporate ESG and GTI and the mediating effect of finance between them deserves further exploration.

Green innovation is defined as an innovation that benefits businesses and customers while also having a less detrimental effect on the environment (Dangelico et al., 2017). Green technology innovation, a key element of green innovation, has drawn more attention recently, particularly given the elevated level of concern regarding the state of the environment (Abdullah et al., 2016).

The importance of green technology is becoming increasingly prominent globally, and green innovation is seen as a necessary and sufficient condition for firms to achieve the goal of sustainable development successfully(Kuo & Smith, 2018). It is widely recognized that far-reaching innovations are needed to address climate change and other environmental challenges.

Nevertheless, studies by academics suggest that one factor contributing to the low level of green innovation in businesses may be a lack of awareness of how innovation may increase an organization's sustainability, profitability, and productivity. It's a financial issue, which is another crucial factor(Onileowo et al., 2021). Thus, one of the most crucial prerequisites for innovation can be said to be the availability of funding. Financing is the backbone of every business and the key to its success (Alharbi et al., 2018).

Simultaneously, several findings have found that companies that excel in environmental, social, and corporate governance have superior financial performance(Zhai et al., 2022). ESG is a corporate assessment criterion that comes from the socially responsible investing (SRI) space and focuses on the environmental, social, and governance performance of businesses (Richardson, 2009).

Moreover, the impact of ESG on assets should not be underestimated, especially in terms of financing. According to the research of the Global Sustainable Investment Alliance, the global ESG asset management scale reached 28.6 trillion US dollars in 2017, accounting for 30% of the total global asset management scale. Therefore, the impact of corporate ESG performance on financing should not be underestimated. Kim and Li(2021) assert that a company's credit rating is typically positively impacted by ESG performance. Better ESG performance enables businesses to access third-party funding resources on more favorable terms and with reduced debt financing costs(Raimo et al., 2021). This increases corporate financing efficiency (Chang et al., 2023).

Despite the importance of this issue, especially in recent times, most emphasize the link between innovation rather than green innovation and corporate ESG and do not track the moderating effect of financing on the relationship between ESG performance and GTI (Sun et al., 2019). Therefore, this study selects ESG ratings and patent data that can represent corporate GTI levels to explore the moderating effect of financing on the relationship between ESG performance and GTI. The study found that there may be a positive relationship between increased corporate value, GTI, and strong ESG performance through financing mechanisms. As financing channels increase, the intensity of interaction between these variables will also increase(Alharbi et al., 2018). It is further confirmed that companies that

value ESG performance have better GTI potential and will gain rare core competitiveness, further enhancing corporate value while maintaining competitive advantages.

Literature Review

Green Technology Innovation

Green technology innovation includes technological innovations in energy conservation, pollution prevention, waste recycling, green product design, and environmental management (Huang et al., 2019). It is considered to bring win-win results in terms of limiting environmental burdens and promoting economic and technological modernization (Rennings et al., 2006). This view is supported by Sun et al.(2019), who suggest that green technologies can help balance environmental protection and economic development and contribute to the creation of a sustainable society. The "World Intellectual Property Report 2022" by the World Intellectual Property Organization (WIPO) also stated that "global green technology needs to be restarted." Therefore, to pursue high-quality economic development, green innovation is an important leading force.

In terms of specific indicators to measure green technological innovation in firms, patent data are often used as a measure of technological innovation, as they focus on the output of the invention process (Griliches, 1981; Haščič & Migotto, 2015). Patent data provide a wealth of information about the nature of the invention, the inventor, and the applicant. These data are readily available and discrete. Therefore, this study selected the number of green patents, the number of green invention patents, and the number of green utility model patents to observe the impact of green innovation on corporate ESG performance.

Environment, Social, and Governance (ESG)

ESG is developed from CSR, which is essentially a refined corporate social responsibility. It has also been discussed in the academic literature for more than 30 years (Tarmuji et al., 2016). It is a comprehensive evaluation index based on the concept of sustainable development for the performance of enterprises in terms of environmental responsibility, social responsibility, and corporate governance. Not only investors but also more and more companies realize the importance of ESG performance to the sustainable development of companies in the future.

As a comprehensive indicator for evaluating corporate long-term development capabilities, ESG has received widespread attention from academics and stakeholders(Zhang et al., 2020a). The ability of an enterprise to achieve sustainable development depends not only on its internal business performance but also on the social and environmental performance derived from its business activities. In order to meet the needs of value creation and maintain the resources of value advantages, enterprises need to undertake more social responsibilities to gain more attention and support from stakeholders. Therefore, ESG is not only a civic duty but also a means to maintain a competitive advantage (Liu, 2022).

For a long time, although companies that disclose ESG information are highly favored by investors and government organizations advocate companies to disclose ESG information, most developing countries do not mandate how companies fulfill their responsibilities related to ESG activities, let alone mandatory disclosure of ESG information. So far, there is still no unified approach to the measurement of corporate ESG performance in academia or practice. Several international professional organizations have developed ESG evaluation methods.

Among them, Moody's ESG, S&P Global, Sustainalytics, and MSCI are widely known ESG ratings (Cohen, 2023).

Finance- Green Technology Innovation Nexus

Many academics think that achieving synchronized development of economic growth and environmental protection can be accomplished through green innovation. However, businesses frequently require enough cash to finance ongoing investment in green innovation because of the lengthy return cycle, significant risks, and extreme market uncertainty associated with it (Huang & Li, 2017; Xiang et al., 2022) Capital is one of the most crucial instruments for advancing economic activity in many nations (Kelley et al., 2012).

For businesses, financing is seen as one of the key elements that impact a company's ability to grow, succeed, and endure. The development of green innovation in enterprises requires the growth of internal capital as well as outside funding. An organization's funding structure and innovation initiatives are strongly related(Xiang et al., 2022). Academics are divided on which financing source best encourages GTI(Bostan & Spatareanu, 2018). This is due to many factors that drive up the cost of external financing, including the high risk associated with green innovation activities, knowledge asymmetry between internal management and external investors, and moral hazard issues(Onileowo et al., 2021). Conversely, internal financing is less expensive and has the built-in benefit of preventing moral hazard and adverse selection because it doesn't require collateralization procedures(Beladi et al., 2021).

However, it is worth noting that internal financing is limited for organizations involved in green innovation. Government subsidies, debt financing, and equity financing are examples of outside financial sources that businesses might access(Brown et al., 2009). Among them, firms prefer equity financing to debt financing to obtain funding for their green innovation projects(Brown et al., 2012)The reason is that equity investors are not picky about intangible assets such as intellectual capital generated by green innovation investments, but rather value high-risk, high-return investment projects and the long-term value appreciation of the enterprise(Hsu et al., 2014). As a result, equity investors are more willing to finance innovation projects than risk-averse creditors represented by banks. In addition, studies by Wolff and Reinthaler(2008)and Cin et al.(2017) confirm that timely government subsidies facilitate the sustainability of firms' R&D activities.

Finance- ESG Performance Nexus

According to the capital market information asymmetry theory, companies participating in ESG ratings can alleviate market concerns caused by information asymmetry by improving the quality of their information disclosure, thereby attracting more external capital(Kim & Li, 2021). In the end, being able to successfully secure resource support from stakeholders sets one apart from rivals(Ross, 1977). Therefore, ESG rating is an important means to solve the information asymmetry between stakeholders and enterprises. This is so that financial institutions can better understand financial and non-financial corporate information and provide green funding to businesses during credit assessment. It does this by taking into account corporate social responsibility and long-term sustainable development in addition to corporate governance, management capacity, and financial status(Ahmed et al., 2018).

Moreover, good ESG performance has been linked to increased capital-raising capacity for businesses(Chang et al., 2023; Cornell, 2020; Raimo et al., 2021). Businesses that disseminate ESG information more transparently gain preferential access to third-party financing resources on more favorable conditions(Raimo et al., 2021). Additionally, Chang et al(2023) demonstrate that a company's financial efficiency is much enhanced by greater ESG performance. This is because companies' ESG performance can lower the cost of debt financing. A study by Kim and Li (2021) confirmed that ESG as a whole as well as all three dimensions have a significant impact on corporate credit ratings. Among them, the overall social, governance and ESG scores have a positive impact on credit ratings, but environmental scores have a surprisingly negative impact on credit ratings. Furthermore, institutional investors have demonstrated a definite preference for ESG investments over financial institutions to reduce the risk of adverse selection(Cornell, 2020).

Nexus between ESG Performance and GTI

It is necessary to track adequate financing and its capacity to encourage the growth of their own GTI within ESG-conscious businesses. Firstly, GTI has the potential to accelerate the green economy and society transition, strengthen businesses' competitive edge, and serve as a practical means of realising the international economy's high-quality development strategy (Li & Lin, 2016). Enterprises can achieve sustainable development by concurrently improving economic and environmental benefits through various means such as boosting production efficiency, improving product design, and implementing other appropriate actions. However, GTI is a capital-intensive business with high startup costs, a protracted profit cycle, and unpredictability in its risk factors(Jiao et al., 2020). As a result, businesses need a lot of resources, skills, and motivation to implement green innovation. Among them, financing constraints are one of the key challenges that hinder the improvement of green innovation performance. Therefore, having large, stable, and long-term financial support is crucial to ensure the development of corporate GTI.

Information asymmetry and agency conflicts between investors and enterprises are the primary drivers of capital limitations. The idea of information asymmetry in the capital market states that businesses should actively send out positive signals to reduce information asymmetry and gain a competitive advantage (Kim & Li, 2021). The principal-agent theory states that because of information asymmetry and agency issues, businesses should aggressively look for incentive and regulatory frameworks to lower the risk premium that external financiers are seeking(Zhang & Liu, 2023). Studies reveal that strong corporate ESG performance gives investors access to both non-financial and financial data that facilitates their understanding and oversight of businesses. As a result, businesses that perform well in terms of environmental, social, and governance (ESG) can leverage signaling and governance effects to gain the respect of different stakeholders, particularly external investors, and secure cheaper debt and equity financing(Gigante & Manglaviti, 2022), thereby relieving financial constraints (Bai et al., 2022).

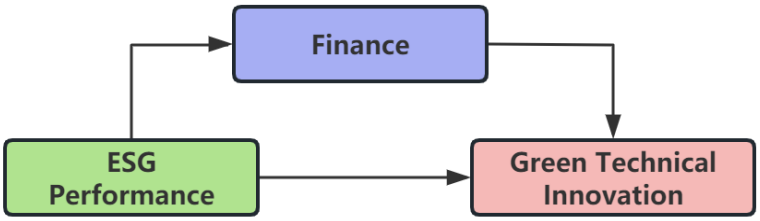

Figure 1. The Interrelationship between Finance, ESG Performance, and Green Technology Innovation
Source: Prepared by the Authors

The relationships between ESG, GTI, and financial access are depicted in Figure 1. As was covered in the earlier parts, a thorough grasp of the entire study served as the foundation for the development of the framework. The research framework demonstrates that one way to improve the impact of corporate ESG performance on green innovation is through funding accessibility. Companies' financial limitations may be lessened by ESG ratings. The loosening of finance restrictions has given businesses enough money to implement energy-saving and emission-reduction strategies, technical advancement, and other environmental protection measures, as well as to create a positive development cycle. Major stakeholders in businesses, or external investors, frequently have clear preferences for ESG investments and control and monitor whether corporate actions adhere to legal and societal norms(Dyck et al., 2019).

A strong ESG performance will boost investors' trust and appetite for capital. Investors decide to fund the company as a result. Companies will therefore continue to invest more in R&D and green innovation initiatives in order to reap the long-term rewards (Tang, 2022). Consequently, ESG performance is crucial for advancing GTI capabilities(Zhou et al., 2024). Furthermore, the current association between company ESG performance and GTI may be influenced by finance availability. Any corporate organization's ability to obtain financing determines both its growth and sustainability. Business managers will find this study to be of great value as it will help them understand the significance of the many funding sources at their disposal.

Conclusion and Recommendations

This study investigates the link between green technology innovation (GTI), ESG performance and financial access. Most literature studies that discuss the impact of corporate ESG ratings or scores on corporate GTI behavior do not track the interrelationship between corporate financing structure, ESG performance, and GTI. Research has found that companies that value ESG practices have better GTI potential, thereby further enhancing the company's competitive advantage, enhancing corporate value, and promoting the long-term sustainable development of its business.

The study believes that financing can be regarded as a mechanism through which corporate ESG performance and GTI are positively related to the company's core competitive advantages and the improvement of corporate value. With appropriate financing, businesses will have incentives to invest in innovation, conduct research, and implement appropriate

technologies to develop projects that improve their competitive position in the market. Furthermore, the strength of the relationship between these variables increases with access to financing. Therefore, it becomes one of the important contributions of this study as it explains how access to financing affects firm value.

The study also suggests that corporate ESG behavior is a crucial corporate strategy, which can help companies improve their image and reputation among a wide range of stakeholder groups, thereby attracting more investors and maintaining corporate competitive advantages. In addition, companies with higher ESG ratings generally have lower idiosyncratic risk levels(Balachandran & Faff, 2015), favorable loan contracts (Goss & Roberts, 2011), and lower equity costs (El Ghoul et al., 2011), these will help reduce corporate financing costs, thereby providing long-term and stable financial support for corporate GTI. However, it is important to note that the fact that most businesses have problems accessing GTI financing means government support may play a role.

This research will be useful because it will encourage commercial enterprises to pay attention to the needs of corporate stakeholders and pay attention to their own ESG actions and related information disclosure. At the same time, corporate management is encouraged to incorporate ESG performance into development strategies and consider closely integrating ESG initiatives with their own GTI, as this will help companies alleviate financing difficulties, enhance market competitiveness, and achieve long-term sustainable development. At the same time, it will help policymakers take companies into consideration when conducting strategic deliberations on high-quality economic development and improve existing financial support, policy guidance and incentives for ESG and GTI, as this will increase their understanding of existing Understanding the challenges of sustainable, high-quality development and factors that encourage green innovation to improve national economic prosperity. Given that this study does not include an empirical investigation, we encourage future research to empirically investigate the interrelationships between financing channels, ESG, and green innovation.

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