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Green Technology Innovation and Corporate Environmental Performance

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Abstract

Green Technology Innovation (GTI) has emerged as a critical strategy for organizations seeking to achieve environmental sustainability while maintaining competitiveness. This study examines the relationship between GTI and Corporate Environmental Performance (CEP) through a sequential exploratory mixed-method approach combining a systematic literature review and qualitative insights from sustainability experts. The literature review, based on studies published between 2015 and 2025, identifies key dimensions of GTI, including green product innovation, green process innovation, and digital green technologies such as Artificial Intelligence, Internet of Things, and Big Data Analytics. Findings reveal that GTI significantly contributes to improved environmental outcomes through reduced emissions, enhanced resource efficiency, waste minimization, and regulatory compliance. Qualitative findings further indicate that organizational capabilities, sustainability-oriented culture, ESG orientation, and regulatory support play vital roles in translating technological innovation into environmental performance. The study develops a holistic conceptual framework grounded in the Natural Resource-Based View, Dynamic Capability Theory, Stakeholder Theory, and Ecological Modernization Theory. The framework proposes that GTI positively influences CEP, while regulatory pressure, ESG orientation, and green organizational culture strengthen this relationship. The study contributes to sustainability literature by integrating technological, organizational, and institutional perspectives and offers practical implications for managers and policymakers promoting sustainable business transformation.

Keywords: Green Technology Innovation, Corporate Environmental Performance, Environmental Sustainability, ESG Orientation, Green Organizational Culture, Digital Green Technologies, Resource Efficiency.

Introduction

The increasing difficulty of addressing issues such as climate change, natural resource depletion, extinction of species, and environmental degradation has led to increased demand for environmental sustainability across the world. The expectation is that businesses reduce their impact on the environment without sacrificing their competitiveness. Consequently,

environmental sustainability has emerged as an important consideration for businesses that aim to ensure economic growth while being environmentally conscious (United Nations, 2023; Porter & Van der Linde, 1995). The focus on ESG metrics has added more weight to the necessity for organizations to develop innovations that would create environmental benefits (Eccles et al., 2014).

Green Technology Innovation (GTI) has been identified as one of the important ways by which organizations can be able to fulfill their environmental goals in line with the different sustainability strategies available. This involves the use of innovative ideas that are designed in such a way that environmental impact is reduced, there is efficient use of resources, minimum wastage, and sustainable consumption practices (Chen et al., 2006). These innovations can range from technologies such as renewable energy, energy-efficient production techniques, recycling of waste, green technology designs, carbon reduction technology, and digital sustainability among others. Environmental innovation leads to improvement in efficiency, performance, and competitive advantage (Hart, 1995; Rennings, 2000).

Corporate Environmental Performance (CEP) is seen to be an important measure of a company's ability to lower its pollution, conserve resources, be more efficient with energy use, and adhere to environmental policies and regulations (Clarkson et al., 2008). According to previous literature, green innovation has been found to have a positive relationship with the environment because it leads to reduced pollution, improved use of resources, and environmental sustainability of firms (Albort-Morant et al., 2016; Xie et al., 2019). Furthermore, according to the Natural Resource-Based View theory, environmental skills that companies develop through innovation are considered strategic resources that would help the firm perform better environmentally and competitively (Hart, 1995). According to the theory of Dynamic Capability, organizations that have the ability to continually adapt their resources would be better equipped to deal with environmental concerns and sustainability challenges (Teece et al., 1997).

In spite of the emerging research interest, the connection between Green Technology Innovation and Corporate Environmental Performance continues to suffer from a lack of coherence. Most existing academic literature tends to consider individual industrial sectors, geographic regions, or innovative technologies, leading to inconsistent results and little theoretical consolidation. Moreover, empirical research that uses mostly quantitative methods only evaluates the connection between environmental performance and innovation without analyzing organizational processes and management aspects necessary to implement green innovation effectively (Chen et al., 2023; Shahzad et al., 2024). Therefore, there is a need for a more thorough analysis of the contribution of green technology innovation to corporate environmental performance.

To fill this gap, the current study employs a mixed methodology of both the literature review and insights from the sustainability and innovation perspectives. In particular, the study aims at exploring the link between Green Technology Innovation and Corporate Environmental Performance, organizational and environmental conditions that enable GTI adoption, managers' views about green innovations' implementation, and a holistic conceptual model describing how GTI influences corporate environmental performance. Thus, by integrating different perspectives into one analysis, this study not only enhances our understanding of the topic but also provides valuable insights for practice and policy.

Literature Review

Green Technology Innovation

Green technology innovation (GTI) has evolved as a critical strategic option for businesses that wish to ensure a balance between economic development and environmental protection. GTI is defined as the process through which innovative products, processes, technologies, and management practices that help minimize negative environmental impacts are developed, adopted, and implemented (Chen et al., 2006; Rennings, 2000). Differing from conventional innovation, GTI includes environmental considerations in its technological innovations and business operations and contributes to sustainable development.

One of the major dimensions of GTI is green product innovation that involves designing environmentally friendly products that will minimize resource use, minimize pollution, and improve recyclability. Green

product innovation helps businesses not only respond to the increasing demand for sustainable products but also improve environmental performance and enhance competitiveness (Dangelico & Pujari, 2010).

Another significant dimension of GTI is green process innovation that involves developing improved production processes that help reduce energy use, emissions, waste generation, and risks to the environment. Cleaner production technologies have been found to contribute significantly to operational efficiency and environmental protection in organizations adopting them (Xie et al., 2019)

Green Energy Innovations refer to innovations concerning renewable energy resources, energy-efficient systems, and carbon reduction processes. From being dependent on fossil fuels, shifting towards renewables has emerged as an approach to cut down greenhouse gas emissions and accomplish the sustainability goals of organizations (Balsalobre-Lorente et al., 2024).

Other sustainable approaches that organizations have increasingly adopted include the application of Circular Economy Technologies. These innovations aid resource recovery and recycling, as well as the reuse of waste products (Geissdoerfer et al., 2017).

In addition to this, the advent of Digital Green Technologies, which include technologies such as Artificial Intelligence (AI), Big Data Analysis, Internet of Things (IoT), blockchain technology, and smart manufacturing solutions, has contributed to innovations in the environment. Such technologies have been found to aid in the process of monitoring the environment, efficient use of resources, managing energy requirements, and making sustainable decisions on the basis of data (Elhassan, 2025; Gupta et al., 2023).

Corporate Environmental Performance

The Corporate Environmental Performance (CEP) relates to how efficiently organizations manage their environmental impacts through sustainable practices, prevention of pollution, conservation of resources, and compliance with environmental laws and regulations (Clarkson et al., 2008). CEP is a highly important sustainability measure that indicates the organization's engagement in environmental stewardship and responsible operations.

The reduction of carbon emissions is one of the best-known metrics to indicate the Corporate Environmental Performance (CEP). Organizations adopting green technology can significantly decrease their carbon intensity levels through the introduction of cleaner manufacturing procedures and utilization of alternative energy sources (Shahbaz et al., 2020).

Efficiency in the use of energy is another important feature that helps evaluate CEP. Advanced energy-saving technologies lead to lower operating costs for organizations and help decrease their environmental footprint due to excessive energy usage. Previous research showed that energy efficiency can also have positive effects on the economic performance of organizations (Porter & Van der Linde, 1995).

Efficient Resource Utilization is an indicator of the company's effectiveness in ensuring optimum utilization of materials, water, and energy. Efficient utilization of resources lowers pressures on the environment and increases productivity and sustainability (Hart, 1995).

Waste Reduction can be viewed as another measure of Corporate Environmental Performance. There is a trend in adopting strategies aimed at minimizing wastes, developing recycling programs, and applying circular economy models. This approach helps cut back landfill waste and environmental pollution (Geissdoerfer et al., 2017).

Lastly, Environmental Compliance evaluates the degree to which organizations comply with existing environmental standards and regulations. Apart from reducing risks associated with regulatory compliance, such a strategy also indicates a firm's intention to manage environmental activities responsibly (Clarkson et al., 2008).

Theoretical Frameworks

Natural Resource-Based View (NRBV): The Natural Resource-Based View (NRBV) expands the Resource-Based View framework by underscoring the significance of developing environmental capabilities to gain competitive advantage. Hart suggests that companies which are able to establish their own environmental capabilities through pollution prevention, product stewardship, and sustainable development efforts will be able to produce unique, valuable, and imitable resources. Thus, Green Technology Innovation becomes an organization's capability to help them perform environmentally and become more competitive in the process.

Dynamic Capability Theory: Dynamic Capability Theory states that the success of any business lies in its capacity to align and redeploy their internal and external capabilities in light of changes in the environment (Teece et al., 1997). In relation to environmental issues and sustainability, GTI acts as a dynamic capability of businesses, which helps them adapt to changes in the environmental landscape and deliver better performance.

Stakeholder Theory: The Stakeholder Theory holds that decisions made within an organization are affected by the demands and expectations of the stakeholders of the organization, which include customers, stockholders, government, community, and even environmental organizations (Freeman, 1984). The increased demand from stakeholders on issues of sustainability and ESG performance by businesses has made organizations develop green technology innovations. Thus, stakeholder expectations have become an important push factor to the Green Technology Innovation and Corporate Environmental Performance.

Ecological Modernization Theory: Ecological modernization theory asserts that economic development and technological innovation can be done without compromising environmental sustainability (Mol & Sonnenfeld, 2000). Instead of seeing environmental sustainability as an obstacle to development, this theoretical approach sees the development of technology as key in helping the business address environmental degradation while still being competitive economically. Green technology innovation is a perfect example of this theoretical perspective. These are just some of the theoretical approaches used to explain Green Technology Innovation and Corporate Environmental Performance.

Thematic Review of Literature

Green Innovation and Environmental Sustainability

Green innovation has become an essential tool for ensuring sustainability within the environment while simultaneously remaining competitive. The term refers to innovations in products, processes, and technologies that aim at reducing negative effects on the environment and being resource-efficient (Chen et al., 2006). Several research works have proved that firms that engage in green innovation exhibit better results in terms of environmental performance due to reduced emissions, resource use, and improved waste management (Rennings, 2000; Xie et al., 2019). Moreover, green innovation can serve as a tool for achieving sustainable development, balancing economic goals with the protection of the environment. Although some researchers indicate positive environmental performance results of firms that engage in green innovation, others present contradictory findings.

Green Process Innovation and Resource Productivity

Green process innovation is an approach that emphasizes improving processes, systems, and manufacturing technologies in order to have minimum negative effects on the environment. It has been found that more efficient production processes, energy-effective manufacturing systems, and pollution prevention lead to a higher level of resource productivity and operational cost savings (Porter & Van der Linde, 1995). The companies that use green process innovation manage to optimize energy consumption, improve material productivity, and minimize the generation of waste. It is obvious that the use of green process innovation can positively affect environmental performance in a company. Besides, process innovation can help organizations to comply with stricter environmental legislation while remaining productive and profitable.

The Relationship Between Digital Technologies and Green Transformation

The intersection of digital technologies and sustainability practices has led to increased adoption of green transformation by organizations. Technologies like artificial intelligence, big data analytics, internet of things, blockchain, and smart manufacturing support environmental sensing, preventive maintenance, energy efficiency, and resource utilization (Gupta et al., 2023). These technologies help organizations measure environmental parameters, make informed decisions, and enhance their sustainability efforts. Recent research indicates that digital transformation acts as a facilitator of green innovations by strengthening the organization's environmental capability and effectiveness (Elhassan, 2025). Nonetheless, there is inadequate knowledge in existing literature concerning how digital technologies impact organizational capabilities to achieve environmental benefits, which requires additional research efforts.

Regulatory Pressure and Green Innovation

Environmental regulations have emerged as one of the most influential external sources of innovation related to green technologies. Through the use of regulatory systems, environmental standards, policies on carbon tax, and sustainability reports, organizations are incentivized to develop green technologies and engage in environmentally-friendly business activities (Porter & Van der Linde, 1995). The hypothesis proposed by Porter posits that with well-designed environmental regulation, innovation can be triggered as well as efficiency gains made, resulting in competitive advantages for businesses, rather than simply incurring high compliance costs (Porter & Van der Linde, 1995). While studies indicate that regulatory pressure positively correlates with green innovation adoption, there is wide variation in terms of the effectiveness of such regulation in different settings (Horbach et al., 2012).

Organization Capability and Environmental Performance

Organization capability has played an essential part in influencing green technology innovation efforts. In accordance with the NRNBV, environmental capabilities such as technological proficiency, environmental management systems, sustainable leadership and organizational learning are key strategic assets that facilitate outstanding environmental performance (Hart, 1995). Likewise, the theory of dynamic capability highlights the need for organization capability in the ability of organizations to continuously adapt, integrate and transform their resources according to changing environmental situations (Teece et al., 1997). Various studies show that organizations with a high level of environmental capabilities have been more successful in adopting innovations to reduce emissions, pollution and use of resources (Shahzad et al., 2024). Yet, little is known about the link between organization capabilities and environmental performance.

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ESG Orientations and Green Competitive Advantage

The increasing relevance of ESG considerations has changed corporate approaches to sustainability across the globe. ESG-oriented companies incorporate green technology innovations into their organizational

strategy as a means of improving their environmental performance, stakeholder relations, and corporate reputation (Eccles et al., 2014). Recent evidence indicates that organizations with ESG orientations tend to be more proactive regarding sustainable technology innovations and exhibit better environmental performance than those that consider sustainability merely as a regulatory issue (Friede et al., 2015). Moreover, ESG activities have been found to lead to green competitive advantages through improving stakeholder perceptions, investor trust, customer loyalty, and availability of funding for sustainable development. Although ESG performance is receiving considerable attention from scholars today, empirical studies investigating the role of ESG orientation in the association between green technology innovation and corporate environmental performance remain scarce.

Thematic Synthesis

According to the thematic literature review, it appears that there are many ways in which Green Technology Innovation positively impacts Corporate Environmental Performance, including through better resource utilization, cleaner production methods, digitization, and environmental capacity building. Organizational capabilities also play a role in the impact of adoption efforts on environmental performance, alongside the pressure from regulations and ESG considerations that guide organizations toward adopting green technology innovations. It must be noted that previous research on this topic tends to focus on individual factors and provides limited integrated theories.

Research Gap

Notwithstanding the increasing number of researches dealing with Green Technology Innovation (GTI) and Corporate Environmental Performance (CEP), there are several research questions left unanswered by previous studies. Firstly, prior researches lack coherence because they are mostly based on independent pieces of work that do not provide an integrated approach towards innovation theories and environmental performance concepts, thus failing to reveal a complete pattern of how innovation capabilities are transformed into environmental achievements (Hart, 1995; Teece et al., 1997). Secondly, the bulk of prior researches is characterized by a predominance of quantitative techniques and thus lacks information about the difficulties companies face when implementing green technologies. Thirdly, mediation factors, such as organizational learning, environmental capabilities, and sustainability culture, have been studied insufficiently despite the pivotal role they play. Fourthly, prior researches deal with individual cases of industries or nations rather than considering a wider context. Fifthly, digital green technologies (e.g. applications of Artificial Intelligence (AI), Big Data Analytics, and the Internet of Things (IoT)) receive insufficient attention despite their fast-growing impact on sustainability and environmental performance.

Conceptual Framework Development

Conceptual Framework

According to NRBV, Dynamic Capability Theory, Stakeholder Theory, and Ecological Modernization Theory, this study develops an easy to understand framework explaining the contribution of GTI towards Corporate Environmental Performance (CEP).

Green Technology Innovation is defined as the use and development of technologies that are eco-friendly and sustainable in nature while increasing organizational efficiency. The proposed framework conceptualizes GTI as a multi-dimensional construct including three dimensions, which are Green Product Innovation, Green Process Innovation, and Digital Green Innovation. With these innovations, organizations have the capacity to enhance the utilization of resources, minimize emissions, decrease waste generation, and promote environmental sustainability.

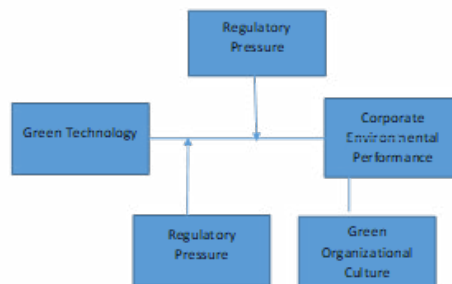
Corporate Environmental Performance entails the performance of organizations in achieving their environmental goals through decreased carbon emissions, increased energy efficiency, proper utilization of resources, minimal waste generation, and environmental compliance. Previous research indicates that by

adopting green technologies, organizations are able to achieve better results environmentally and attain a sustainable advantage (Hart, 1995; Xie et al., 2019).

The postulated model starts from the assumption that there is a direct positive correlation between Green Technology Innovation and Corporate Environmental Performance. Yet, the efficiency of such a correlation depends on organizational and institutional variables. For this reason, three context-based variables are added to this model as supportive ones: Regulatory Pressure, ESG Orientation, and Green Organizational Culture. The regulatory pressure forces organizations to use environmentally-friendly technologies, ESG Orientation motivates companies to achieve sustainability-related objectives, and green organizational culture helps organizations implement environmental activities.

Thus, according to the model, Green Technology Innovation plays the role of a catalyst for Corporate Environmental Performance, whereas organizational and institutional sustainability aspects enhance its efficiency.

Figure 1 Proposed Conceptual Framework



Hypotheses

- P_1 : There is a positive impact of Green Technology Innovation on Corporate Environmental Performance.
- P_2 : The effect of Green Technology Innovation on Corporate Environmental Performance is moderated by Regulatory Pressure, ESG Orientation, and Green Organizational Culture.

Methodology

Research Methodology

The current study uses sequential exploratory mixed methodology in order to gain an extensive insight into the association between GTI and CEP. Specifically, the research is carried out in two interconnected stages. First of all, a thorough literature analysis is performed in order to detect important theoretical frameworks, trends, drivers, and consequences related to the phenomenon of green technology innovation. Secondly, qualitative interviews with sustainability practitioners and experts in the field are conducted for the purpose of confirming, refining, and extending the results derived from the literature review.

Systematic Literature Review

The initial step was based on a systematic literature review (SLR), conducted according to the PRISMA protocol (Page et al., 2021). The purpose of the systematic literature review was to analyze scientific studies related to green technology innovation, environmental sustainability, organizational capacities, and corporate environmental performance.

In total, peer-reviewed publications were found in three leading academic databases, namely Scopus, Web of Science, and ScienceDirect. In order to obtain the most up-to-date data on the topic of sustainability, green innovation, and environmental management, only publications issued between 2015 and 2025 were considered. The keywords used in the database search were “green technology innovation,” “green

innovation,” “environmental sustainability,” “corporate environmental performance,” “ESG,” “resource efficiency,” and “digital green technologies.”

The identification process comprised four phases: identification, screening, eligibility testing, and final inclusion. Duplicate entries, non-English studies, conference proceedings, editorial reviews, and studies that failed to relate directly to the research objectives were filtered out. Finally, descriptive analysis was performed on the collection of studies.

Moreover, bibliometric analysis was undertaken to examine publication patterns, notable authors, prominent journals, and emerging topics in research. After that, thematic analysis was used to formulate the conceptual framework of the study.

Qualitative Study

The second stage was the completion of a qualitative study aimed at gaining insight into experts’ opinions on the use and success of green innovation initiatives. Purposeful sampling was used to select those participants who had extensive professional background and knowledge in sustainability and environmental management issues.

The participants selected comprised sustainability managers, ESG (Environment, Social & Governance) officers, environmental consultants, green innovation specialists, and researchers in sustainability. Twenty to thirty participants would be interviewed, which is the required number for qualitative studies.

Results and Discussion

Results from the Systematic Literature Review

It emerged from the systematic literature review that there has been an increase in academic interests in GTI and CEP during the past ten years. In most cases, authors focused on the importance of green innovation for efficient resource management, minimizing environmental impacts, and ensuring sustainability within corporate operations. As anticipated by the NRBV framework, green technologies were deemed important factors that could generate competitive advantage and improve environmental conditions (Hart, 1995; Xie et al., 2019).

Bibliometric analysis showed that the key areas covered by literature on the topic include green product innovation, green process innovation, circular economic practices, sustainability, ESG performance, and digitalization. Recently, more attention has been given to the use of digital technologies such as artificial intelligence, the Internet of Things, big data analytics, and smart production systems to ensure sustainability (Gupta et al., 2023).

The thematic review identified five major research clusters:

Cluster	Research Cluster	Key Focus
1	Green Innovation and Sustainability	Environmental performance and competitive advantage
2	Resource Efficiency and Cleaner Production	Waste reduction and energy optimization
3	Digital Green Transformation	AI, IoT, and data-driven sustainability
4	Regulatory and Institutional Drivers	Environmental regulations and compliance
5	ESG and Sustainable Value Creation	Long-term sustainability and stakeholder value

Although there is an abundance of research supporting the existence of a relationship between GTI and CEP, the literature review found few studies providing qualitative insights on the process involved and the organizational factors influencing it. In addition, many studies were industry-specific, thus the need for wider perspectives on translating green innovation to environmental performance.

Qualitative Findings

The themes that emerged from the thematic analysis of interview data of sustainability managers, ESG officers, environmental consultants, and green innovation experts include five major themes giving further insights into the dynamics of GTI's impact on environmental performance.

Theme 1: Strategic Nature of Green Technology Innovation

There was a consensus among participants that Green Technology Innovation is an area of strategic investments rather than something related to regulations and compliance. Experts stressed the fact that green innovations help companies increase their efficiency, lower environmental risks, and enhance competitiveness in the long run.

As one sustainability manager observed, "Green innovation is not anymore optional. This has become a strategic imperative for companies." This supports the results of earlier research which indicates that environmental innovations contribute both to sustainability and competitiveness (Porter & Van der Linde, 1995; Chen et al., 2006).

Theme 2: Developing Environmental Capabilities

Developing organizational environmental capabilities was another topic that emerged during interviews. Experts pointed out that the success of adopting any innovation depended on employee skills, management engagement, environmental awareness, and organizational learning. Several participants mentioned that green innovations could lead to environmental changes only when companies have the necessary capabilities to implement them.

The current finding confirms the theory of Dynamic Capability, according to which organizations need to constantly develop and reconfigure their capabilities in response to environmental threats (Teece et al., 1997; Albort-Morant et al., 2016).

Theme 3: Role of Regulations

The most common answer from most respondents was that regulations are one of the key triggers for innovation adoption, as regulation drives businesses to adopt cleaner technologies, monitor the environment, and minimize negative environmental effects. Nevertheless, according to the experts' opinions, the effectiveness of regulatory frameworks lies not only in the use of punishment but also in providing incentives and sustainability policies.

Such conclusions coincide with those made by previous studies on the effect of environmental regulations on innovation (Rennings, 2000; Horbach et al., 2012).

Theme 4: Digital Sustainability Transformation

The fourth emerging theme revolved around the importance of leveraging digital technology to accelerate environmentally sustainable practices within organizations. Technologies including Artificial Intelligence, IoT, cloud computing, and data analytics were mentioned multiple times by the experts as key enablers in monitoring environmental performance, managing resource utilization, and making optimal decisions. It was found out that digital technologies can help companies gather real-time environmental data, forecast resource needs, and reduce waste through optimization. This result aligns with the current academic literature on the role of digital transformation in fostering sustainable practices (Gupta et al., 2023; Balsalobre-Lorente et al., 2024).

Theme 5: Barriers to Green Innovation

While there are many benefits associated with the application of green technologies in businesses, there are several barriers preventing their adoption. The most common barriers include high implementation costs, lack of financial resources, technological uncertainties, lack of expertise, organizational resistance to change, and regulatory barriers. However, it was found that SMEs were facing more challenges than others because of resource shortages and lack of access to sustainability knowledge. The results support previous research which shows that financial restrictions, skills deficiencies, and organizational opposition are the main barriers for environmental innovations (Dangelico & Pujari, 2010; Xie et al., 2019).

Integrated Discussion

The synthesis of both literature review and qualitative study findings offers compelling evidence supporting the proposed conceptual framework. Both phases reveal that Green Technology Innovation plays a vital role in influencing the Corporate Environmental Performance by allowing companies to achieve resource efficiency, low emission production processes, and better sustainability initiatives.

Additionally, the study findings confirm that the success of green innovations requires more than technological advancements. Other factors such as organization capabilities, government regulations, and environmental culture are essential. Environmental capabilities were established as an important mediator that allows firms to convert technological innovations into concrete environmental performance. Moreover, there are indications that digital technology acts as a catalyst for green transformation in organizations.

Finally, the findings show that environmental pressures from stakeholders and regulations are key determinants of green innovation. As suggested by Stakeholder Theory and Ecological Modernization Theory, firms are increasingly embracing environmental expectations by adopting technological and sustainability measures (Freeman, 1984; Mol & Sonnenfeld, 2000).

In general, the findings indicate that companies that have outstanding Corporate Environmental Performance are those that exhibit technological innovation together with strong organizational capacity, an enabling institutional context, and sustainability considerations. The results of this study have practical implications for the developed conceptual framework on the relationship between Green Technology Innovation and Corporate Environmental Performance.

Table 1 Summary of Qualitative Themes

Theme	Key Findings	Supporting Literature
Strategic Importance of GTI	GTI viewed as a source of sustainability and competitiveness	Porter & Van der Linde (1995); Chen et al. (2006)
Environmental Capability Development	Organizational learning and competencies facilitate implementation	Hart (1995); Teece et al. (1997)
Role of Regulation	Regulatory pressure encourages green innovation adoption	Rennings (2000); Horbach et al. (2012)
Digital Sustainability Transformation	AI, IoT, and analytics support environmental management	Gupta et al. (2023); Balsalobre-Lorente et al. (2024)
Barriers to Green Innovation	Cost, expertise, and resistance hinder adoption	Dangelico & Pujari (2010); Xie et al. (2019)

Theoretical Implications

The current research has added to existing knowledge regarding GTI and CEP by incorporating several theories into one model which seeks to understand how organizations attain environmental sustainability through innovations.

To begin with, the current study expands the NRBV by showing that green technology innovation is an important resource for organizations since it leads to the development of superior environmental performance among firms. As indicated by Hart (1995), it is evident that investing in green products, green processes, and digital sustainability innovations can help organizations develop environmental capabilities that help attain sustainability.

Secondly, this study has contributed to dynamic capability theory by emphasizing the significance of organizational learning, environmental capability development, and adaptability in the process of implementing green innovation initiatives. From the results, it is clear that continuous acquisition, integration, and reconfiguration of knowledge about sustainability and sustainability innovations can help organizations respond to environmental challenges effectively (Teece et al., 1997).

Moreover, the study helps in furthering the research on stakeholder theory since the results of this study show that stakeholders' expectations, regulatory requirements, and social pressure are essential factors that compel companies to implement green technology and better their environmental performance.

Lastly, this study is helpful to the sustainability innovation field since it provides a comprehensive approach that covers technological, organizational, and institutional factors in its analysis. This is because previous studies tended to look at the two concepts separately. The current study, however, provides a comprehensive approach regarding how green technology can help to enhance environmental sustainability. Additionally, the importance of digital green technologies such as Artificial Intelligence, Internet of Things, and data-based environmental management systems is emphasized.

Management Implications

The results have many important implications for managers, sustainability practitioners, and policy makers who wish to improve environmental performance through innovation.

Implications for Managers

Businesses need to think about Green Technology Innovation as a strategic endeavor and not just an environmental compliance activity. According to the results presented here, organizations can obtain better environmental performance when they systematically incorporate their green technologies in the process of conducting business.

First, companies must develop environmental capabilities by building sustainability knowledge, developing skills among employees, designing green technology training programs, and encouraging leaders to promote innovation. Effective environmental capabilities help companies implement innovations successfully. Second, GTI initiatives need to be incorporated in the company's overall ESG strategy, where environmental management and innovation activities are aligned with ESG objectives. Third, managers must create a sustainability culture which is based on environmental responsibility and innovation. Fourth, companies need to use digital technologies like artificial intelligence, internet of things, and big data analytics to monitor their environmental performance.

Implications for Policy Makers

The study underscores the significant influence of government policies on hastening the adoption of green innovations. Governments should use monetary inducements, tax allowances, innovation subsidies, and grants to incentivize organizations in adopting sustainable innovations. Moreover, policymakers should promote technology transfer mechanisms among others that can be beneficial especially for SMEs that lack resources and capabilities. Lastly, governments can spur green innovations through the establishment of environmental regulations that not only motivate green innovation but provide the necessary assurance for investments in sustainability.

Conclusion

This research paper has analyzed the effect of Green Technology Innovation on Corporate Environmental Performance using a sequential exploratory method, where the study has involved conducting a systematic literature review followed by qualitative expert interviews. The results confirm that Green Technology Innovation plays an essential role in ensuring sustainable development, allowing organizations to achieve greater efficiency, decrease their emissions and waste, and ensure greater compliance with environmental requirements.

In particular, the systematic review showed that there is a rising academic interest in the areas of green innovation, digital sustainability transformation, ESG integration, and corporate environmental performance. At the same time, based on expert interviews, it was discovered that building environmental capabilities, favorable regulations, organizational commitment, and modern technologies were key for achieving green innovations to have any impact on corporate environmental performance.

The study adds to the existing body of knowledge through developing a holistic conceptual framework that identifies Green Technology Innovation as a strategic capability affecting Corporate Environmental Performance under the influence of other factors such as regulatory pressure, ESG orientation, and green organization culture.

The results from a policy standpoint suggest that creating a supportive regulatory environment, innovation encouragement, and technology transfer will lead to the adoption of sustainable business practices. Practitioners can use the results to integrate green innovation into their strategies and sustainability programs. Future research could involve the validation of the framework through empirical analysis across various sectors and geographical locations. Studies comparing the impact of green innovation between developed and emerging nations, longitudinal research on the results of green innovation, and analyses of the effects of emerging technologies like Artificial Intelligence, Big Data Analytics, and Industry 5.0 could further our knowledge in this area.

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