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EFFECTUATING SUSTAINABILITY: EXPLORING THE ROLE OF CORPORATE ENVIRONMENTAL RESPONSIBILITY AND GREEN INNOVATION

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Abstract

The harmful effects of climate change need reassessment based on the tenets of the contemporary business scenario. Amidst the environmental concerns, the concepts of Green Innovation (GI) and Corporate Environmental Responsibility (CER) have become vital for shaping the business arena. The objective is to explore and recognize the role of green innovation, corporate environmental responsibility in effectuating sustainability. The study engages a mixed qualitative approach combining grounded theory with conceptual framework analysis. This conceptual paper relied on systematic data mining from pre-existing literature to explore the links between GI, CER, and Sustainability. This was done by initially dividing the literature into conceptual frames (based on points of homogeneity) and then subjecting the identified frames to grounded theory. Major studies in this direction were empirical and quantitative, which inherited limitations such as superficial and partial depiction of the full spectrum. In contrast, this study is qualitative and uses grounded theory to dive deep into the existing literature, thereby uncovering previously unexplored relationships and offering a more comprehensive perspective. The inductive inferences of the research, reflected in the form of findings, reveal that the GI and CER have a significant influence on sustainability by boosting organizational effectiveness and ensuring remarkable transformations. These findings hold promise for techno-environmental policy makers & strategists inclined towards nurturing sustainable initiatives for building a culture of environmental consciousness.

Keywords: *Corporate Environmental Responsibility, Eco-centric, Green Innovation, Sustainability.*

1. INTRODUCTION

The extensive industrialization by countries has induced carbon emissions, exploitation of natural resources, and ecological deterioration, which jointly cause climate change and its extreme events. Therefore, climate change has become a big challenge worldwide, and there is an urgent need to devise an effective solution to tackle it. The discussion and dialogue have been going on international, national, and academic platforms concerning climate change. The past studies revealed that green innovation and corporate environmental responsibility are among the most effective instruments for the mitigation and adaptation of climate change. Green Innovation uses the latest technological advancements and is designed to enhance resource efficiency and facilitate environmental conservation, thus confronting stakeholders' sustainability concerns. Conversely, Corporate Environmental Responsibility (CER) shows a company's commitment to restricting its operational and commercial environmental footprint and strengthening sustainability through its conduct, products, and services. These concepts are significant in fostering sustainable business practices and achieving balanced development, although stakeholders have been forcing corporations to align activities with the sustainability principle.

Sustainability evolved as a crucial cornerstone of the worldwide economy, receiving great attention and acknowledgement from international organizations, legislation, government, and business. The United Nations defined sustainability as meeting current requirements without hampering the capacity of the next generation to satisfy their need. This concept emphasizes and considers ecological conservation, societal equity, and economic prosperity as its core elements. Similarly, the transition to a climate-resilient world economy releasing minimum emissions requires substantial investment and implementation of a robust legal framework. Past studies have not utilized a qualitative approach, and have not infused grounded theory to study the relationship of GI and CER with sustainability; hence, this research objective is to explore and validate the role of GI and CER in strengthening sustainability, important for accomplishing eco-centric development. This study endeavours to bridge this gap by incorporating the above-mentioned points. The findings provide practical insight, and their integration by stakeholders could bring a seismic shift towards a greener economy and sustainability. This study thoroughly explores the existing literature and endeavours to highlight the crucial role of GI and CER in strengthening and achieving sustainability and a climate-resilient economy.

2. REVIEW OF THE LITERATURE

2.1 Green Innovation (GI): Driving Sustainability Through Technological Advancements.

2.1.1 Necessity of adopting Green Innovation (GI) in an emerging economy.

The increase in greenhouse gas (GHG) emissions and their impact cause ecological deterioration and global warming, posing a threat to a sustainable globe (Machiba et al., 2018; Wu et al., 2018). The

strain has escalated on world economic growth as it is accentuated by carbon dioxide, acknowledged as a major contributor to GHG (Lin et al., 2014; Hiatt et al., 2015). As a result, various committed nations have devised and incorporated regulations to restrict pollution and promote green innovation, recognised as a tool to confront these ecological devastations (Rehfield et al., 2007; Li et al., 2013; Qi et al., 2020). In many developing countries, economic growth, alongside industrialization and urbanization, contributes to significantly higher carbon intensity compared to developed nations, thereby intensifying the ecological strain in these regions (Lee, Zhang, & Hou, 2023; Lee et al., 2022). As a result, emerging economies are more susceptible to the adverse effects of ecological deterioration on human well-being, societal productivity, and monetary action. These economies are confronting exacerbating ecological challenges and difficulties in harmonising economic growth with the restriction of environmental externalities (Tolliver et al., 2021).

2.1.2 Green Innovation addressing ecological challenges

Escalating ecological issues, involving resource contraction and significant climate change, have amplified the global relevance of GI and related initiatives, attracting growing attention and interest (Bergman, 2018; Fujii & Managi, 2019; Wei et al., 2023). Green Innovation practices focus on protecting natural resources, restricting pollution, and reducing energy consumption throughout the manufacturing process, thus resulting in the creation of products with eco-friendly features. Moreover, green products are curated to advance resource conservation and enable recycling, reuse, recovery of raw materials, and waste. Consequently, it restricts waste secretion and mitigates environmental harms (Dangelico, 2016). Likewise, green innovation holds profound capability to accomplish sustainability at national level and navigate a way for the ecological transition of business (Yang et al., 2022; Fu et al., 2023; Chen et al., 2021; Wang et al., 2022; Zheng et al., 2022; Zhao et al., 2023; Fujii et al., 2013).

2.1.3 Pollution Intensive Industries and Green Innovation's associated challenges, building hurdles in eco-centric innovation

Some experts contend that green finance does not always extend support for green innovation. They assert that the government-enforced ecological regulations can lead to an increase in costs and present uncertainty, which may adversely impact the innovation potential, profitability, and investment decision of businesses (Kozluk and Zipperer, 2014). This is especially correct for companies operating in the power and pollution-concentrated industries, where green finance limits their financial resources and access to loans. Hence, it impedes finance for technology and innovation research, thus inhibiting green innovation within these sectors (Andersen, 2017). On the other hand, green Innovation research conventionally requires prolonged research and development periods, needs a huge financial outlay, and mostly possesses doubtful consequences (Hall, 2022). These

components represent a significant threat to the business in acquiring external funding, resulting in a lowering of their incentive to follow green innovation undertakings (Andersen, 2017). Additionally, it requires a high upfront investment and entails uncertain returns, which becomes a hurdle for private sector participation. Moreover, it often follows complex regulatory compliance and infrastructure change, making their adoption more difficult than conventional technologies (Rennings, 2000). Similarly, there is a dearth of standardized metrics to evaluate ecological benefits, making investment decisions and policy evaluation more complex. In conclusion, green innovation has inherited the capacity to promote sustainability by aligning economic and social growth without environmental externalities. Future studies must assess its impact on the extensive sustainability framework and strategies.

2.2 Corporate Environmental Responsibility (CER): The Role of Businesses in Advancing Environmental Sustainability

2.2.1 Theoretical underpinnings of CER and its functionality

CER depicts the responsibility of enterprises to emphasize and promote eco-centric products, engage in recycling programs, and effectuate additional sustainable activities that lead to mitigating their environmental footprint (Dummett, 2006; Chen et al., 2021). The factors impacting CER are inspected primarily from three views, including;

a) The focus at the person level largely relates to the attributes of managers and directors (Xu and Ma, 2021; Bhuiyan et al., 2021).

b) At the enterprise level, crucial aspects include;

- Corporate Governance (Li et al., 2020)
- Ownership Structure (Wei and Zhou, 2021)
- Financial Performance (Testa and D'Amato, 2017; Falavigna and Ippoliti, 2022)

c) External variables include;

- Media scrutiny (Aerts and Cormier, 2019)
- Public Consciousness (Liao and Shi, 2008)
- Governmental Financial Aid (Wang and Zhang, 2020)
- Ecological rule and regulation (Huang and Lei, 2021)
- Competitive market forces (Tsendsuren et al., 2021)

The existing literature on CER primarily emphasized its financial outcomes, but the theoretical reasoning and empirical results remain inconclusive (Jo et al., 2015). Neoclassical economists argue that CER investments involve substantial costs, while the financial benefits of environmental responsibility are insufficient to offset these expenses (Walley & Whitehead, 1994). Conversely, other scholars, drawing on the resource-based (Wernerfelt, 1984) and stakeholder theory (Freeman, 1984)

view, observe CER initiatives as a strategic approach to gaining stakeholder support and achieving competitive advantages, which ultimately contribute to higher profitability.

2.2.2 CER: Rise, Recognition, and Action

CER is gaining recognition as a significant component of CSR, as confirmed by various researchers (Mitchen et al., 1997; Gibson, 2000; Crone & Matten, 2004; Kaler, 2002). The importance of CER continues to increase, as an expanding collection of research explores the factors pushing corporations to adopt CER and its impact on financial results (Jo et al., 2014; Cai & He, 2014; Ambec & Lanoie, 2008; Etzion, 2008; Berchicci & King, 2007). Past studies by researchers assert that CER is often considered a subset of CSR, or CS is expanding its validation and gaining attention. Similarly, Montiel (2008) showed that modern studies consider joint social and environmental awareness concerning strategies to strengthen environmental stewardship. In recent years, the ecological dimension of CSR has attracted considerable attention, particularly from a market perspective (Wahba, 2008; Bird et al., 2007). Klassen and McLaughlin (1996) argue that superior environmental performance directly contributes to improved financial outcomes. Additionally, Welford et al. (2007) and Kassinis & Vafeas (2006) highlight the ecology as a pivotal element for stakeholders in assessing a firm's CSR initiatives. Similarly, Wahba (2008) investigates the role of economic productivity as a moderating factor in the association between CER and institutional investors, demonstrating that CER positively and significantly impacts institutional ownership. Moreover, Oikonomou et al. (2020) identify ecological integrity as a prominent aspect of CSR, but researchers do not largely explore and address the specific aspects of CER or the related ecological benefits and challenges.

In conclusion, corporate environmental responsibility serves as a critical driver for sustainability, urging businesses to include ecological considerations within their activities and discretion while contributing to broader social, economic, and eco-centric goals.

2.3 Sustainability: A Mechanism for Balancing Growth and Conservation

2.3.1 Demonstrating the essence of sustainability

Sustainable development entails fulfilling current needs and not limiting the capacity of upcoming species to satisfy their requirement (Portney, 2015). It involves enhancing living standards while preserving the environment and fostering progress without depleting resources necessary for future generations (Thiele, 2016; Hameed et al., 2019). Elkington (1999) highlights that sustainability is a complex goal, requiring adherence to fundamental principles such as human rights, equity, justice, diversity, democracy, citizen engagement, prosperity, and consideration for the rights of future generations. Achieving sustainability necessitates substantial transformations in public awareness, behaviors, production, and consumption patterns. Moreover, scientific expertise alone cannot ensure the development and implementation of effective solutions; intellectual capital, encompassing

knowledge, skills, and experience, is equally critical (Faraji et al., 2022). Tackling climate change presents a significant chance to enhance environmental quality while advancing pathways for low-carbon development (IPCC, 2021). Environmental sustainability presents a major challenge for the corporate sector, as social, economic, and environmental issues caused by ecological degradation have compelled both developing and industrialized nations to confront criticism for their contribution (Amankwah-Amoah, 2020). Therefore, Brown et al. (1987) support the idea that current development and environmental management recognise the growing need for sustainability as a core goal.

2.3.2 Demystifying sustainability and its coverages

Sustainability is generally recognised as a concept incorporating three dimensions: environmental, social, and economic. These dimensions constitute the "triple bottom line," which seeks to embed ecological safety, economic feasibility, and social equity in major decision-making (Elkington,1997). The economic facet centres around financial performance and long-term economic resilience. Furthermore, the social aspect focuses on community development, human rights, and equity, while the environmental aspect emphasizes conserving natural resources and decreasing ecological deterioration (Purvis et al., 2019). On the other hand, the notion of "sustainability" differs across circumstances, incorporating social, economic, and environmental dimensions. Recently, various interpretations of sustainability and regenerative development have evolved, mostly defined by their complexity, contention, and contradiction (Baker, 2006; Lozano, 2008; Hussey et al., 2001). Over a period, it has expanded its reach and incorporated numerous spectrums, encouraging organisations to pursue operations and reporting focusing on holistic performance, unlike only on the financial aspect (Delai and Takahashi, 2011; Choi and Ng, 2011). Consequently, the triple bottom line serves as a foundation for sustainability and sustainable development, as it is constituted from the convergence of social, ecological, and economic facets (Vos, 2007; Choi and Ng, 2011). These aspects are essential in regional development planning for analysts and policymakers (Galdeano-Gomez et al., 2013). In summary, the literature hinted that a holistic approach is required that balances economic progress, social inclusivity, and ecological conservation for realizing sustainable development. It further stresses the importance of promoting responsible practices, encouraging innovation, and securing efficient resource management to fulfill the requirements of present and upcoming generations.

2.4 Relating Green Innovation and Corporate Environmental Responsibility with Sustainability

2.4.1 Revealing the impact of green innovation on sustainability

The demand for green products has been escalating; thus, sustainability has become a significant component for various industries and businesses (Dangelico and Pujari, 2010; Dangelico and Pontrandolfo, 2015). Likewise, the past research has revealed that corporate competitiveness

extensively influenced by green innovation (Wang, 2012). Similarly, Xie et al. (2019) assert that incorporating the green process and innovative product leads to improved corporation's financial success. Their outcomes were generated through the association of green process innovation and financial performance mediated by green product innovation (Dangelico, 2016).

Technological innovations deliver positive results, such as mitigating pollution and creating social welfare. Similarly, eco-innovation integration helped businesses to enhance their contributions in advancing sustainable development (Roy, 1994). Moreover, environmental performance encompasses activities like reducing waste generation, encouraging energy and resource efficiency, and emissions management as its core aspects. Furthermore, it helps in the recycling of the products, starting from the collection of waste and ending with the creation of new products and reusable materials (Roy, 1994; Smith, Roy, and Porter, 1996). This is essential for advancing sustainable development by preserving natural resources via the transformation of trash into raw materials (Luttropp & Lagerstedt, 2006; Rennings, 2000). Xie et al. highlighted that green advancement strategies substantially impact both an enterprise's ecological productivity and its competitive edge (Xie, Huo, & Zou, 2019). Notably, green innovation has been shown to influence changes in eco-centric efficiency. Eco-conscious practices, such as sustainable design and green industrial planning, are gaining traction (Pujari, 2006). "Green products" refer to goods engineered to reduce their ecological footprint over their complete life cycle. The manufacturing of such eco-friendly items often involves eliminating harmful substances and reducing waste generation (Luttropp & Lagerstedt, 2006).

2.4.2 Corporate Environmental Responsibility as a mechanism to foster holistic development

Enhancing CER is vital for tackling contaminants at their origin. As a distinctive and indispensable component of CSR (Rahman and Post, 2012), CER involves implementing diverse environmental management strategies to reduce environmental pollution and mitigate ecological harm (Bansal and Roth, 2000). Embracing CER has multiple advantages; it not only increases the company's long-term value (Xu et al., 2020; Qian et al., 2021; Ren et al., 2020), but also magnifies eco-efficiency (Chuang and Hang, 2018), enables companies to get a green competitive advantage (Hadj, 2000), and create sustainable corporate reputation (Qian et al., 2021).

CER is widely considered a cornerstone for achieving an edge over others and meeting sustainable development (Xu et al., 2020; Chuang and Huang, 2018; Qian et al., 2021). Similarly, Hu et al. (2018) assert that companies use ecological engagement as a planned approach to improve corporate governance, curb agency expenditures, and enhance operational efficiency & market value. Additionally, companies can improve stock liquidity, reduce transaction costs, mitigate financial limitations, and bolster long-term value by incorporating a transparent ecological reporting &

proactive CER and its endeavour (Zhao et al., 2021). CER adoption includes numerous advantages beyond financial, such as enhancing the corporation's reputation through showing seriousness about environmental responsibility (Chuang and Huang, 2018), providing societal benefits, and boosting visibility & public approval (Zhang and Ouyang, 2021). Consequently, the integrated process of the triple bottom line is supported by the corporation's commitment to environmental conservation and addressing negative ecological externalities (Qian et al., 2021).

3. RESEARCH METHODOLOGY

Embarking on a mixed approach of grounded theory and conceptual framework analysis, the qualitative treatment of the collected extensive literature was carried out on the topic. Grounded theory is primarily used to develop new theories from data through systematic procedures such as open coding, axial coding, and constant comparison (Glaser & Strauss, 1967). It is especially effective in exploring understudied or complex phenomena, like the point-in-case, engaging nexus of three different dimensions (GI, CER, and Sustainability). Conceptual framework analysis is a structured approach for interpreting qualitative data by identifying key concepts and their relationships within a theoretical or conceptual structure. This method is particularly useful in theory development, policy analysis, and the synthesis of diverse data sources (Jabareen, 2009).

This conceptual paper relied on 'systematic' data mining of pre-existing literature with inclusion criteria as filtering of identified literature using keywords like 'green innovation', 'corporate environmental responsibility', 'eco-centric innovation', and 'sustainability' to extract relevant literature. This was done by initially dividing the literature into conceptual frames (based on points of homogeneity/commonality). For imparting structuredness to the identified frames, they were further fragmented into sub-frames with a unique identity in terms of concept. These sub-frames were then subjected to grounded theory. This exploratory research utilized the inductive technique for drawing inferences to facilitate an in-depth theoretical understanding of the topic.

Construction of the theoretical framework was done by mining the literature from secondary sources, including government reports, academic journals, and industry-intensive documents on GI, CER, and eco-centric sustainability. Relevant articles were identified using databases such as Scopus, Web of Science, and Google Scholar. However, like similar studies, this research has limitations, including its qualitative nature, lack of hypothesis testing, and exclusion of other relevant factors such as green finance and climate finance concerning sustainability. Future research should address these gaps by incorporating these additional elements into its analyses.

4. FINDINGS

The reviewed literature highlighted probable findings and provided valuable insights for future research.

• **Climate Change and emerging economies:** Ecological deterioration and challenges are more severe for developing nations, for the following reasons;

o They need to strike a balance between economic growth and limiting ecological externalities.

o They have limited resources such as finance, technology & innovation, expertise, and a standardized legal framework to address this contemporary problem.

o Most emerging nations are focused on other issues like unemployment, food security, infrastructure, and economic growth; hence, sustainability is often ignored.

• **Recognition of green innovation and its associated benefits:** Rising environmental challenges, depletion of resources, and global warming have raised the global importance of GI, and its adoption results in the following benefits;

o Promote resource conservation and reduce energy usage.

o Limits pollution emissions and facilitates the transition of business.

o Enable the use of recycling, reuse, and recovery of raw materials and waste

• **Obstacles in the pathways of eco-centric innovation;** Past studies have highlighted multiple hurdles including;

o It requires a prolonged R&D period and is associated with a doubtful outcome; hence, stakeholders become sceptical about pursuing it.

o Start with a heavy upfront cost, volatility in return, and seek personnel expertise; therefore, it's beyond the ambit of often investors and major emerging economies to achieve this trio.

Assessing the functions, standing, and impact of CER: Previous literature has established its current position and portrays its impact in enabling eco-centric commerce by following;

o Its functional focus is on advancing green products, following recycling programs, and overhauling the entire operation to make it energy and resource-efficient.

o CER has expanded its recognition as a subset of CSR by gaining sufficient validation and attention, similarly, it has become a pivotal element for stakeholders in evaluating enterprises' CSR initiatives.

o The Neoclassical school of thought believes CER adoption incurs a significant outlay, and its benefits are inadequate to justify it.

Effectuating sustainability to balance the world: It can be possible in these ways; It can be possible in these ways;

o A blend of scientific expertise with intellectual capital, knowledge, skill, and experience is equally important to devise an effective strategy, strengthening sustainability.

o Substantial transformation in public awareness, behaviours, production & consumption

patterns is regarded as a prerequisite for sustainable development.

- o Sustainability adopts a holistic approach and aims to balance economic development, ecological conservation, and social equity for achieving sustainable development.

Nexus of GI and CER with sustainability: The convergence of GI and CER with sustainability leads to various advantages, including;

- o It supports sustainable development by reducing pollution, promoting energy and resource efficiency, minimizing waste generation, and transforming trash into raw materials.
- o Adoption of CER not only advances sustainability through reducing environmental pollution and mitigating ecological harm but also enables companies to improve long-term value and gain a green competitive advantage.

5. DISCUSSION

The study showed that incorporating green innovation strategies has various advantages, such as reducing energy consumption, conserving natural resources, curbing contamination throughout operations, and consolidating efforts to produce eco-friendly, sustainably feature-enriched products. This aligns with the research of Pujari (2006), Dangelico & Pontrandolfo (2010), Roy (1994), Leal-Rodriguez et al. (2008), and Olson (2014). Similarly, this research highlighted that green innovation is pivotal for strengthening sustainable development and facilitating the ecological transformation of businesses, a view also supported by Wang et al. (2021).

However, studies disclosed that GI conventionally comes with huge financial investment and prolonged research and development (R&D) period, majorly associated with uncertain results. This act as hindrance for securing external funding and hurt the aspiration to follow green innovation initiatives, echoing the findings of Hall (2012) and Andersen (2017). Similarly, other researchers have also highlighted green innovation implementation challenges, including high upfront cost, technological uncertainty, complex regulation, and organizational stagnation (Horbach, 2008; Chen et al., 2020; Dangelico and Pujari, 2010).

Lastly, the study denotes that CER could elevate an organization's value, enhance ecological performance, and support a green image through minimizing the company's footprint and tackling eco-challenges. These findings resonate with those of Maletic et al. (2015), Vincenza-Ciasulla & Troisi (2013), Abdul-Rashid et al. (2017), and Golini et al. (2014).

6. CONCLUSION

This conceptual paper has signified GI and CER's vitality in propelling businesses toward eco-centric sustainability. Interjection of GI into the fabric of corporate strategies not only facilitates improved environmental performance but also provides a competitive advantage and proliferates the long-term monetary gains, as evidenced by prior studies (Xie, Huo, & Zou, 2019; Wong, 2012). Business

organizations exhibiting a sense of CER become ambassadors of green brand reputation by depicting a strong commitment to sustainability. It also builds stakeholders' confidence and inculcates customer loyalty in alignment with the findings of previous studies (Qian et al., 2021; Hadj, 2000; Xu et al., 2020; Chuang & Huang, 2018).

Also, the dual impact of GI and CER is critical for taking cognizance of the incumbent ecological trepidations. Organizations can mitigate their carbon footprints and facilitate the alleviation of climate change by engaging in innovative green technologies and adopting sustainable practices. By synchronizing the regulatory policies and government initiatives, the motivational orchestration of business organizations can be done for:

a) Investing in GI and

b) Prioritizing environmental accountability

Future research should focus on assessing factors that drive the incorporation of GI and CER in the business landscape. On the other hand, it should analyze the causes that deter GI and CER adoption on a large scale. Subsequent analysis of such confluence offers valuable guidance to bureaucrats and policymakers on issues concerning market competitiveness and financial outcomes. Collective efforts from all the stakeholders, including consumers, business firms, and the government, constitute the fulcrum on which GI and CER revolve to orchestrate sustainability. By such a synergy between GI and CER, a harmonious economic growth is attainable that maintains sustainable equilibrium with the ecological environment.

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