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The Effect of Environmental Management Accounting and Green Transformational Leadership on Environment, Social, Governance (ESG) Performance: Green Innovation as Mediating Variable

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Abstract

This paper analyzes the effect of environmental management accounting and green transformational leadership on environment, social, and governance (ESG) performance, with green product innovation and green process innovation as mediating variables. This research adopts a quantitative method and survey method. This study relied on self-reported primary data from a self-administered survey by spreading questionnaires to collect primary data from 263 chief executive officers and finance managers of manufacturing companies in Banten Province. One measurement was analyzed using structural equation modeling (SmartPLS 3.3). Twenty-eight (28) hypotheses were proposed: Environmental Management Accounting (EMA) has a positive effect on Green Process Innovation (GPI1); Environmental Management Accounting (EMA) has a positive effect on Green Product Innovation (GPI2); Green Transformational Leadership (GTL) has a positive effect on Green Process Innovation (GPI1); Green Transformational Leadership (GTL) has a positive effect on Green Product Innovation (GPI2); Environmental Management Accounting (EMA) has a positive effect on Environmental Performance (EP); Environmental Management Accounting (EMA) has a positive effect on Social Performance (SP); Environmental Management Accounting (EMA) has a positive effect on Governance Performance (GP); Green Transformational Leadership (GTL) has a positive effect on Environmental Performance (EP); Green Transformational Leadership (GTL) has a positive effect on Social Performance (SP); Green Transformational Leadership (GTL) has a positive effect on Governance Performance (GP); Green Product Innovation (GPI2) has a positive effect on Environmental Performance (EP); Green Product Innovation (GPI2) has a positive effect on Social Performance (SP); Green Product Innovation (GPI2) has a positive effect on Governance Performance; Green Process Innovation (GPI1) positively impacts Environmental Performance (EP); Green Process Innovation (GPI1) has a positive impact on Social Performance (SP); Green Process Innovation (GPI1) has a positive impact on Governance Performance (GP). Green Process Innovation (GPI1) mediates the effect of Environmental Management Accounting (EMA) on Environment, Social, and Governance Performance (ESG); Green Process Innovation (GPI1) mediates the effect of Environmental Management Accounting (EMA) on Environment, Social, and Governance Performance (ESG); Green Process Innovation (GPI1) mediates the effect of Green Transformational Leadership (GTL) on Environment, Social, and Governance Performance (ESG); Green Process Innovation (GPI1) mediates the effect of Green Transformational Leadership (GTL) on Environment, Social, and Governance Performance (ESG).

Keywords: Environmental management accounting, ESG performance, Green process innovation, Green product innovation, Green transformational leadership.

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1. Introduction

Companies play a significant role in achieving Sustainable Development Goals (SDGs). Environmental consideration is a crucial element of sustainable development [1]. Companies are expected to integrate global policies and objectives into their strategies, including taking action in environmental management and production processes that adhere to sustainability principles [2]. Environmental management activities involve developing strategies, using environmental evaluation methods, setting performance goals, and preparing staff for environmental protection [3].

Over the past few decades, the environment has been severely impacted by excessive resource consumption and increased industrial activities, which actively contribute to cumulative environmental contamination [4]. Organizations are under intense pressure from stakeholders to reduce hazardous waste and contribute positively to environmental safety efforts. Many businesses are now focusing on addressing environmental issues to maintain their image in a competitive marketplace [5].

This transformation is increasingly under the spotlight, pushing organizations to strengthen their commitment to environmental responsibility [6, 7]. Ignoring environmental considerations in operational practices poses significant risks to long-term sustainability [7, 8], which affects environmental impact and operational continuity [9]. As a result, there is a strong push to improve Operational Environmental Performance (OEP) through continuous efforts to enhance material efficiency, limit energy and water consumption, and optimize waste and emissions during production and service activities [10, 11].

Through Law No. 24 of 2009, Article 23a, the Indonesian government mandates that industries protect the environment. Violations of this regulation are subject to fines or even business license revocation. However, it is acknowledged that the environmental impact of business processes is difficult to avoid. As reported by Sindonews.com [12], Indonesia is still facing ten major environmental issues, largely caused by industrial processes, as of 2018.

Raising awareness of environmental responsibility is crucial and plays a key role in company sustainability [13], encompassing environmental and social responsibility, as well as its connection to CSR [14, 15]. Therefore, environmental issues must be considered crucial for businesses and other organizations because they relate directly to a company's economic and production processes [16]. To ensure that business activities are environmentally safe, it is necessary to account for the costs involved. If the costs are not aligned with environmental improvement objectives, it will add strain to the company's efforts. Thus, organizations must adopt appropriate management practices to handle environmental protection issues, which is known as Environmental Management Accounting (EMA).

Transformational values have been promoted by businesses with sustainability principles. To address sustainability challenges, leaders focus on management strategies and strengthening corporate governance Porter and Kramer [17]. AlSuwaidi et al. [18] suggest that CSR initiatives can be developed by building relationships between employees and organizations, mediating CSR's influence on employee well-being and eco-friendly behavior in the workplace. Prabhakar et al. [19] found that organizations not only consider profitability but also uphold social responsibility and obligations to the community, balancing local production and environmental conservation.

The lack of green transformational leadership (GTL) in general practitioners within restaurant operations has led to harmful environmental effects, such as pollution and global warming [20]. GTL is not only about environmental issues but also about social responsibility practices. According to Chen and Chang [14], companies must accept environmental protection as their social responsibility. Therefore, it is crucial to identify the elements of standard restaurant services (e.g., from food production to waste management) that ensure environmental and social sustainability. Green innovation refers to environmental innovation focused on waste reduction, pollution prevention, and the implementation of environmental management systems designed to help minimize the operational impact on the environment [21].

Green innovation is a way for companies to achieve strategic goals by using new technologies, systems, practices, and manufacturing processes to minimize environmental damage [22]. Market research shows that organizational innovations related to the environment tend to improve processes, highlighting the need for innovation in production [23]. Environmental innovation refers to the introduction of new methods and management systems that help address environmental issues in production processes, Ozusaglam [24]. Christine et al. [23] reveal that market research on "eco-friendly" products tends to lead to better environmental processes, making innovation in production processes vital.

Innovation in production processes enabled by EMA can improve organizational performance. This is supported by

Saeidi et al. [25], who state that consumers drive company revenue. Through innovation in manufacturing processes, organizations can meet consumer expectations, enhancing customer satisfaction, generating more demand, and ultimately improving business performance. This aligns with research by Tadros and Magnan [26], who found that environmentally conscious companies are more widely accepted by the public. In other words, companies will enjoy long-term survival and profitability if they are supported by innovation [27].

New transformational values have been promoted by businesses with sustainability principles. To tackle sustainability challenges, leaders focus on management strategies and strengthening corporate governance Porter and Kramer [17]. AlSuwaidi et al. [18] highlight that corporate social responsibility initiatives can be developed by building relationships between employees and organizations, mediating CSR's influence on employee well-being and eco-friendly behavior at work. Prabhakar et al. [19] found that organizations not only consider profitability but also uphold their social responsibility to the community, aiming for a balance between local production and environmental conservation.

Keren and De Bruin [28] emphasize the expected relationship between poor outcomes and suboptimal decisions, while positive outcomes are typically linked to successful decision-making. Regarding decision quality, experts have identified two key dimensions: effectiveness and efficiency [28, 29].

An organization's environmental awareness will not successfully achieve its sustainability goals without management support. In this regard, managerial commitment to ecological improvement is essential for achieving productive organizational growth. In many ecological processes, organizations face a trade-off between monetary benefits and increased costs. In such situations, managerial commitment is necessary to strengthen the organization's financial goals driven by ecology. However, many studies suggest that a company's efficient environmental policy not only limits its ability to improve environmental performance but also boosts the organization's economic performance [30].

Stakeholder integration can be defined as the ability to build positive, collaborative relationships

with stakeholders [31, 32]. Companies often engage with

external stakeholders to achieve benefits that are difficult to obtain internally [33], sometimes involving stakeholders in decisions and company activities [34]. Previous research suggests that stakeholder integration can enable SMEs to achieve competitive advantages, benefiting their performance [35-38].

Stakeholder integration can take various forms depending on the stakeholders. For example, it can include joint arrangements with trade associations [39, 40], strategic alliances with industry peers [41, 42], and engagement with other groups such as customers, suppliers, NGOs, communities, and local authorities [43-45].

Stakeholder integration allows organizations to gain insights into how best to manage and coordinate environmental innovation activities that benefit company performance [46]. This can be viewed as comprising three dimensions: stakeholder knowledge, interaction with stakeholders, and adaptation to stakeholder demands [32].

2. Literature Review

1. Environmental Management Accounting (EMA) on Green Process Innovation (GPI1)
   Companies that make greater use of Environmental Management Accounting (EMA) tend to enhance their environmentally friendly process innovation practices, aiming to reduce environmental costs, waste, and other negative impacts on society [47]. In this context, EMA also considers the environmental impacts of green process innovations in production practices. With the support of accurate information from EMA, companies can make better decisions to adopt effective Green Product Innovation (GPI), thereby minimizing the costs associated with ineffective GPI. According to studies by Hanif et al. [48], [49], Jayanti and Mutmainah [50], Dyananda and Noorlailie [51], Ferreira et al. [47], Sari et al. [52], Yumnah and Nilu [53], Agustia et al. [54], Ferreira et al. [47], Jermsittiparsert et al. [55], Saeidi and Othman [56] and Schaltegger et al. [57] there is a positive relationship between the use of EMA and environmentally friendly process innovation.
   $H_{1:}$ Environmental Management Accounting (EMA) has a positive effect on Green Process Innovation (GPI1)

2. Environmental Management Accounting (EMA) on Green Product Innovation (GPI2)
   Innovation is an effective way to improve product quality, boost company productivity, and ultimately contribute to a company's performance in achieving a competitive advantage [58, 59]. Companies that implement Green Innovation (GI) will increase productivity, reduce environmental costs, and save expenses by using raw materials more efficiently, which in turn contributes to better financial performance and enhances the company's value in the eyes of investors [60]. The adoption of Environmental Management Accounting (EMA) is one of the strategies that provides a competitive advantage, particularly in terms of cost savings for environmental expenses [61]. The use of EMA is often linked to environmentally friendly product innovation because a company's competitive edge and performance cannot be achieved without innovation. High and consistent productivity levels will drive a company to maintain its market value [62]. This innovation is a reflection of the company's commitment to environmental sustainability. GI will also improve company performance by increasing market share and reducing operational costs [63]. Based on the above explanation, the researcher proposes the following hypothesis:
   H2: Environmental Management Accounting (EMA) has a positive effect on Green Product Innovation (GPI2)
3. Green Transformational Leadership (GTL) on Green Process Innovation (GPI1)
   Many studies highlight the importance of transformational leadership due to its significant role in driving innovation and productivity through vision-based motivation processes [64-66]. Green Product Innovation (GPI) is a sub-dimension of Green Technology Innovation (GTI), which experts define as the process of creating new products, technologies, and solutions that reduce negative environmental impacts [67]. To support the organization's

environmental goals, Green Transformational Leadership (GTL) motivates and inspires employees' skills, enhancing their ability to generate innovative and creative ideas [68, 69]. As Jackson et al. [70] pointed out, Green Process Innovation (GPI) is a concept aimed at reducing the harmful impact of production processes on the environment by driving changes across nearly every aspect of the organization. In this context, transformational leaders encourage organizations to prioritize green process innovation as part of a broader business strategy. They promote awareness of the importance of protecting the environment and inspire teams to explore new ways to reduce the environmental impact of their company's processes and products. GPI, in turn, also helps organizations engage in other environmentally friendly practices such as Green Product Innovation to enhance Corporate Environmental Performance (CEP) [5]. To achieve GPI goals and maximize environmental stability, GTL provides the intangible resources necessary to encourage employees' involvement in GPI and foster innovation that supports the organization's environmental sustainability [71].

H_3: Green Transformational Leadership (GTL) has a positive effect on Green Process Innovation (GPI1)

4. Green Transformational Leadership (GTL) on Green Product Innovation (GPI2)

Previous studies have shown that transformational leadership plays a crucial role in driving innovation within organizations, Zuraik and Kelly [72]; García-Morales et al. [73]; Gumusluoglu and İlsev [74], and Elkins and Keller [75]. García-Morales et al. [73] found support for the influence of transformational leadership on innovation through the development of key competencies and capabilities, as well as through collective decision-making processes aimed at achieving shared goals. Transformational leaders are openly committed to continuous learning and use a collective vision to foster greater awareness and recognition of the organization's goals and mission among their people [73].

Transformational leaders encourage innovation within organizations and positively impact market success through product and service innovations [74] achieved through inspirational motivation and intellectual stimulation, Elkins and Keller [75]. In this context, Green Transformational Leadership (GTL) not only promotes change in business or operational processes but also in the products produced by the organization. They initiate and support new research and development focused on environmentally friendly technologies and materials. Transformational leadership can drive innovation while allowing employees the freedom to choose what they want to work on and how to achieve their goals [76]. The support from top management, particularly supervisory support, encourages employees to take environmental actions—designing eco-friendly products by reducing resources and minimizing pollution [77].

H_4: Green Transformational Leadership (GTL) has a positive effect on Green Product Innovation (GPI2)

5. Environmental Management Accounting (EMA) on Environmental Performance (EP)

EMA helps organizations protect the environment and recognize its impact [25]. This can be achieved by switching to machines and materials that do not produce toxic waste. EMA also facilitates organizations in improving efficiency in the use of materials and energy. Additionally, it plays a crucial role in reducing environmental impact by identifying, investigating, collecting, setting, and controlling environmental costs, which make up about 20% of a company's operational costs and are usually invisible [47]. Previous studies by Gale [78] and Ferreira et al. [47] state that clarifying environmental costs through EMA leads organizations to acknowledge the actual annual cost calculations. As a result, managers are motivated and compelled to discover or introduce new systems and methods to reduce environmental costs in the production process or even during new product development. By accurately accounting for these costs, organizations can develop sustainable cost-saving strategies by reducing resource consumption and managing waste.

H_5: Environmental Management Accounting (EMA) has a positive effect on Environmental Performance (EP)

6. Environmental Management Accounting (EMA) on Social Performance (SP)

Environmental Management Accounting (EMA) can enhance a company's performance and competitive advantage by providing detailed environmental information to its stakeholders [25]. The implementation of EMA sends a signal to the public that the company considers environmental norms in its operations [79]. Quantitative environmental reporting and voluntary environmental disclosures have been proven to serve as a complement to improve performance in the economic, social, and environmental areas, contributing to sustainable development [80]. According to Deegan et al. [81], environmental and social disclosures are linked to the legitimacy theory and benefit the company. When stakeholders respond positively to a company's production results, the company's profits tend to increase.

H_6: Environmental Management Accounting (EMA) has a positive effect on Social Performance (SP)

7. Environmental Management Accounting (EMA) on Governance Performance (GP)

Companies will seek capital to run their businesses efficiently in order to generate profits. Environmental cost disclosures in annual financial reports are not detailed or explained comprehensively, but companies are starting to include them in sustainability reports. This is also necessary to develop Environmental Management Accounting (EMA) to make this happen. Nowadays, there is increasing pressure from stakeholders, making companies more aware of the environmental damage caused by their activities. Companies that neglect their social and environmental responsibilities will spend significant resources to restore the conditions, meaning they will have to work harder to achieve high productivity and efficiency in their operations. A study by Sari et al. [52] found that companies implementing EMA will be encouraged to continuously innovate and improve organizational performance. EMA

helps companies reduce their environmental impact and prevent excessive resource consumption.
$H_{7:}$ Environmental Management Accounting (EMA) has a positive effect on Governance Performance (GP)

8. Green Transformational Leadership (GTL) on Environmental Performance (EP)
Organizations can improve their environmental performance simply by transforming employee behavior, as when employees act responsibly toward the environment, the company's performance will indirectly improve [82]. Green Transformational Leadership (GTL) helps organizations achieve their environmental goals by encouraging employees to think creatively and adopt innovative strategies that reduce environmental pollution [83]. Transformational leaders urge employees to work beyond personal interests and act responsibly toward the environment. Organizations use GTL to motivate employees, inspire them to acquire new skills, and bring creative ideas to enhance the environmental stability of the company.
$H_{8:}$ Green Transformational Leadership (GTL) has a positive effect on Environmental Performance (EP)

9. Green Transformational Leadership (GTL) on Social Performance (SP)
Organizations led by Green Transformational Leadership (GTL) tend to have better relationships with various stakeholders, including the community, government, and investors. This can improve the company's reputation in terms of social and environmental responsibility, ultimately bringing long-term benefits to the business. The humanistic perspective of transformational leaders, based on altruism, fairness, and the greater good, effectively creates a collective identity based on attractive values. These values may include fulfilling the more significant needs of stakeholder groups and promoting social good, aligning with corporate social responsibility (CSR) [84, 85]. As a result, followers will associate their organization's identity with a greater social good and be motivated to engage in CSR activities [86, 87].
H9: Green Transformational Leadership (GTL) has a positive effect on Social Performance (SP)

10. Green Transformational Leadership (GTL) on Governance Performance (GP)
Transformational leadership is defined as a leadership structure based on trust and commitment, which positively influences followers' motivation, identity, and achievement of goals by building their self-confidence, self-efficacy, and self-esteem [88]. At the corporate governance level, transformational leaders begin with a shared vision for the organization, considering not only the interests of shareholders but also those of other stakeholders, such as small and medium shareholders, external investors, creditors, employees, and the government [89]. They also enhance the transparency of company information and develop good corporate governance systems [90, 91]. Additionally, transformational leaders have a strong understanding of intrinsic values and conceptual systems. They provide a clear vision for their subordinates, stimulate their higher-level needs by making them aware of the importance of their tasks, build an environment of mutual trust, motivate them to sacrifice personal interests for the good of the organization, and ultimately achieve performance that exceeds expectations [92].
$H_{10:}$ Green Transformational Leadership (GTL) has a positive effect on Governance Performance (GP)

11. Green Product Innovation (GPI2) on Environmental Performance (EP)
Green product innovation is an effort by companies to create new environmentally friendly products based on the 3R principles (Reduce, Reuse, and Recycle) [93]. Green product innovation (GPI) has become increasingly important for companies to create eco-friendly products that add value to the business [94]. Companies must implement environmental management strategies to minimize their impact on the environment and work on reducing energy consumption and waste [95]. Innovation is an effective way to improve product quality, boost company productivity, and ultimately contribute to the company's performance in achieving a competitive edge [58, 59]. Innovation is not only for large companies but can also be applied to small and medium-sized businesses to enhance their performance [96].
H11: Green Product Innovation (GPI2) has a positive effect on Environmental Performance (EP)

12. Green Product Innovation (GPI2) on Social Performance (SP)
Research by Waskito and Harsono [97] found that public awareness of environmental preservation and interest in eco-friendly products is growing. This increased awareness has led companies to be more mindful of their environmental responsibilities as part of their social duty [98]. GPI aims not only to reduce the negative environmental impact but also to minimize the adverse effects of company operations, such as waste or pollution, which can harm local communities. Therefore, GPI can have a direct positive impact on the health and well-being of people in the surrounding areas where the products are produced or used. Green Product Innovation contributes not only to the company's environmental performance but also significantly boosts their social performance by creating added value for the community through more eco-friendly and sustainable product innovations.
H12: Green Product Innovation (GPI2) has a positive effect on Social Performance (SP)

13. Green Product Innovation (GPI2) on Governance Performance (GP)
Innovation is an effective way to improve product quality, enhance company productivity, and ultimately contribute to achieving a competitive edge [59, 99]. It is not only superior in terms of economic value but also in terms of environmental friendliness, energy efficiency, raw material usage, pollution reduction, and waste minimization

[100].
Green product innovation often involves identifying and mitigating environmental risks associated with the product lifecycle. Organizations that manage these risks effectively can improve their governance aspects, including overall risk management. Additionally, GPI2 can strengthen relationships with stakeholders, such as customers who are increasingly concerned about environmental issues. This can open up opportunities for closer collaboration with external stakeholders, supporting better governance practices.
H13: Green Product Innovation (GPI2) has a positive effect on Governance Performance.

14. Green Process Innovation (GPI1) on Environmental Performance (EP)
Environmental performance relates to an organization's efforts to meet and exceed public expectations regarding the natural environment [101] in a manner that goes beyond mere compliance with rules and regulations [102]. It encompasses the environmental impacts of organizational processes, products, and resource consumption in ways that best align with environmental legal requirements [103]. Green innovation is linked to the company's environmental management agenda, and green innovations stimulate improved environmental performance [104-106]. Previous research has shown that environmentally friendly innovations should not be seen as reactive actions to stakeholder pressures but as proactive organizational practices aimed at enhancing environmental performance to gain a competitive advantage [107-109].
H14: Green Process Innovation (GPI1) has a positive effect on Environmental Performance (EP)

15. Green Process Innovation (GPI1) on Social Performance (SP)
Green innovation is closely linked to the company's environmental management agenda and plays a role in stimulating improved environmental performance [104-106]. Additionally, eco-friendly product and process innovations not only reduce the negative impact of business activities on the environment but also enhance the company's financial and social performance by reducing waste and costs [110]. Green Process Innovation (GPI) refers to innovations in production or operational processes that can help reduce air, water, or soil pollution resulting from manufacturing processes. This can have a direct impact on the health of the local community surrounding the production site by minimizing exposure to harmful chemicals or pollutants. Implementing GPI often requires investments in new, more eco-friendly technology or equipment, which can lead to the creation of new jobs in the green technology or environmental sectors and improve workers' skills in related fields. As a result, GPI can contribute positively to the economic well-being of the local community, environmental preservation, and an improved quality of life in the areas where the operations are based.
H15: Green Process Innovation (GPI1) has a positive effect on Social Performance (SP)

16. Green Process Innovation (GPI1) on Governance Performance
Green process innovation refers to operational activities within a company that take into account various factors, such as energy savings, waste treatment, resource management, and the ecological impact of the process [14]. Green Process Innovation (GPI) has a significant influence on the company's Governance Performance. GPI often involves the implementation of technologies and practices that comply with stricter environmental standards. By improving production or operational processes to reduce emissions or waste, companies can more easily comply with existing or newly introduced environmental regulations. This supports the company's governance performance by ensuring compliance with applicable laws and regulations. Regarding environmental risk management, GPI also helps companies identify, assess, and manage environmental risks related to their operations. By minimizing the negative environmental impact through green process innovations, companies can reduce reputational, legal, and operational risks that might affect overall governance performance.
H16: Green Process Innovation (GPI1) has a positive impact on Governance Performance (GP)

17. Green Process Innovation (GPI1) Mediates the Effect of Environmental Management Accounting (EMA) on Environment, Social, and Governance (ESG) Performance
This hypothesis proposes that Green Process Innovation (GPI1) mediates the impact of Environmental Management Accounting (EMA) on a company's Environmental, Social, and Governance (ESG) performance. Previous research indicates that GPI1 contributes to reducing operational burdens through energy efficiency, manufacturing cost savings, and more efficient resource usage, which in turn enhances company profits and drives better social performance [110]. Additionally, EMA supports companies by disclosing environmental-related cost flows, which leads to better decision-making and operational efficiency [111]. As EMA integrates environmental information with management accounting, it fosters green innovation, enhancing a company's commitment to sustainability and improving its reputation for social responsibility [54, 112].
Green process innovation can mediate the relationship between EMA and social performance by increasing social recognition and supporting sales growth [111]. In a similar vein, EMA helps companies track and manage environmental costs, which strengthens green innovation efforts. Previous studies also highlight how GPI1 positively impacts cost savings, resource efficiency, and the company's competitiveness while contributing to improved environmental performance [93, 113]. Therefore, the implementation of GPI1 can enhance EMA's influence on ESG performance by improving environmental and social outcomes and supporting stronger governance practices throughout the product lifecycle.

H17: Green Process Innovation (GPI1) Mediates the Effect of Environmental Management Accounting (EMA) on Environmental Performance (EP)
H18: Green Process Innovation (GPI1) Mediates the Effect of Environmental Management Accounting (EMA) on Social Performance (SP)
H19: Green Process Innovation (GPI1) Mediates the Effect of Environmental Management Accounting (EMA) on Governance Performance (GP)

18. Green Product Innovation (GPI2) Mediates the Effect of Environmental Management Accounting (EMA) on Environment, Social, and Governance (ESG) Performance

This hypothesis suggests that Green Product Innovation (GPI2) mediates the effect of Environmental Management Accounting (EMA) on a company's Environmental, Social, and Governance (ESG) performance. Based on legitimacy theory, companies must align with the prevailing social norms and values to gain recognition from society, which, in turn, enhances the company's resources and profitability [114, 115].

Previous studies have shown that Green Product Innovation positively impacts company performance. Green product innovations, which are based on sustainability and environmental principles, can attract consumers, ultimately boosting company sales [93, 116]. Furthermore, the development of green products that efficiently use energy and raw materials, while reducing pollution and waste, can provide greater benefits than conventional products, both environmentally and economically [117, 118].

The implementation of EMA, which integrates environmental information with management accounting, strengthens green product innovation efforts by providing more accurate and measurable data on environmental costs. This helps companies manage the environmental impacts of their products and supports sustainability efforts, which ultimately leads to improved ESG performance. Therefore, GPI2 can mediate the relationship between EMA and ESG performance by enhancing environmental cost management, increasing social recognition, and supporting sales growth, as well as improving the company's reputation in terms of social and environmental responsibility [116].

H20: Green Process Innovation (GPI1) Mediates the Effect of Environmental Management Accounting (EMA) on Environmental Performance (EP)
H21: Green Process Innovation (GPI1) Mediates the Effect of Environmental Management Accounting (EMA) on Social Performance (SP)
H22: Green Process Innovation (GPI1) Mediates the Effect of Environmental Management Accounting (EMA) on Governance Performance (GP)

19. Green Process Innovation (GPI1) Mediates the Effect of Green Transformational Leadership (GTL) on Environment, Social, and Governance (ESG) Performance

This hypothesis proposes that Green Process Innovation (GPI1) mediates the effect of Green Transformational Leadership (GTL) on a company's Environmental, Social, and Governance (ESG) performance. Green process innovation is considered an important addition to the production system, enabling companies to develop green products and services that generate positive externalities for the environment [119]. According to Carrion-Flores and Innes [120], the adoption of green innovation can lead to a reduction in toxic gas emissions, helping companies meet government pollution reduction targets. As such, green innovation becomes a strategy for enhancing company performance while staying competitive in the global marketplace [121, 122].

Green products produced by companies through the implementation of green process innovation can be defined as products that are reusable, recyclable, and energy-efficient, reducing the use of materials that harm the environment. By adopting environmental attributes, green process innovation benefits both consumers and companies with cost-effective solutions [123]. In this context, GPI1 serves as concrete proof that the organization is genuinely applying these values through eco-friendly products. This, in turn, enhances the trust of the public and stakeholders in the company's implementation of GTL, creating the company's image as a socially and environmentally responsible workplace. As a result, this increases consumer attraction to the products produced by the company. Thus, GPI1 can mediate the relationship between GTL and ESG performance by reinforcing the company's environmental commitment and improving its social and governance outcomes.

$H_{23:}$ Green Process Innovation (GPI1) Mediates the Green Transformational Leadership (GTL) on Environment Performance (EP)

$H_{24:}$ Green Process Innovation (GPI1) Mediates the Effect of Green Transformational Leadership (GTL) on Social Performance (SP)

$H_{25:}$ Green Process Innovation (GPI1) Mediates the Effect of Green Transformational Leadership (GTL) on Governance Performance (GP)

20. Green Product Innovation (GPI2) Mediates the Effect of Green Transformational Leadership (GTL) on Environment, Social, and Governance (ESG) Performance

This hypothesis proposes that Green Product Innovation (GPI2) mediates the effect of Green Transformational Leadership (GTL) on a company's Environmental, Social, and Governance (ESG) performance. Green process innovation has been identified as an important step in the production system, helping companies develop green products and services that generate positive externalities for the environment [119]. According to Carrion-Flores and Innes [120], the adoption of green innovation can drive reductions in toxic gas emissions, helping companies meet government pollution reduction

targets. As a result, green innovation becomes a strategy for enhancing company performance and staying competitive in the global market [121, 122].

In this context, Green Transformational Leadership (GTL), with its focus on transformational leadership, has the ability to influence an organization's culture and values, encouraging a greater focus on sustainability and social responsibility. When GTL promotes GPI2, it not only drives more sustainable product innovation but also strengthens the company's commitment to social performance. Therefore, GPI2 can mediate the relationship between GTL and ESG performance by fostering environmentally friendly innovations, enhancing social responsibility, and improving governance practices across the company.

H26: Green Process Innovation (GPI1) Mediates the Effect of Green Transformational Leadership (GTL) on Environmental Performance (EP)

H27: Green Process Innovation (GPI1) Mediates the Effect of Green Transformational Leadership (GTL) on Social Performance (SP)

H28: Green Process Innovation (GPI1) Mediates the Effect of Green Transformational Leadership (GTL) on Governance Performance (GP)

2.1. Framework of Study

This study proposes a theoretical framework. Figure 1 depicts the framework, which is specifically designed to test the role of product creativity and organizational citizenship behavior in mediating risk-taking tendency and transformational leadership on the management accounting system and the impact on performance.

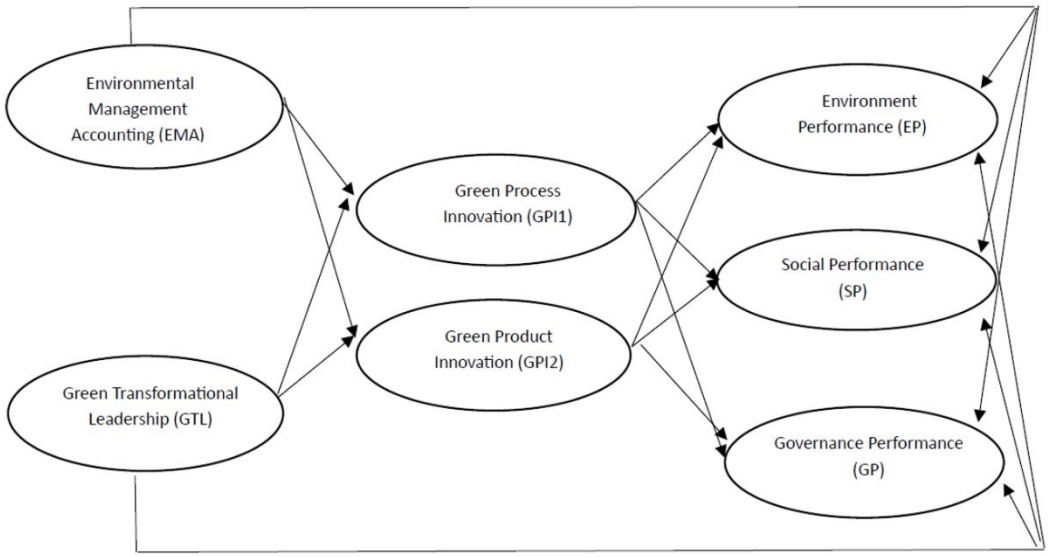

Figure 1.
Research Framework.

3. Research Methodology

The population in this study consisted of 263 chief executive officers and finance managers of manufacturing companies in Banten Province. Sampling was carried out using the partial least squares (PLS) method based on variance, with convenience sampling and non-probability sampling using a purposive sampling technique, as suggested by Wong [124]. The structural equation modeling approach (PLS version 3.3) was used for data analysis. Wong [124] explained that once there were no measurement issues, the external model was evaluated next (unidimensionality test model). The average variance extracted (AVE), composite reliability, and Cronbach's Alpha were used to test for unidimensionality. These indicators have a cut-off value of 0.5, indicating that all statement items in the variable are reliable [125]. Cronbach's Alpha and Composite Reliability were greater than 0.6. Table 1 presents the subsequent analyses that tested the interior or structural model [126].

4. Data Analysis and Interpretation

Validity testing is the process of demonstrating the accuracy and relevance of data or research findings. This is an important step to ensure that the research is reliable and the results are trustworthy. Each variable has several indicators that measure various aspects of the variable. The R value represents the correlation coefficient, which shows the strength and direction of the relationship between indicators and variables. In this case, all indicators have a high R value, indicating that there is a strong and positive relationship with these variables. Therefore, the confirmation column shows that all indicators are valid, meaning that the indicators accurately measure the variable to be measured. Validity testing results give researchers confidence in their findings and allow them to draw reasonable conclusions based on the data.

Reliability testing is a process of evaluating the consistency and stability of measurements, instruments, or procedures used in research. This aims to ensure that the results obtained from these measurements or procedures are reliable and replicable. In this context, Cronbach's alpha is a statistical measure used to assess the internal consistency and reliability of

a set of test items or questions. A score above 0.70 usually indicates an acceptable level of reliability. This table shows the Cronbach's alpha results based on standard items. This data displays Cronbach's alpha data for each research variable, all of which are greater than 0.70. Because these six variables have an alpha score above 0.70, it can be concluded that the question items representing the variables in this study have met the reliability criteria. Therefore, there are no problems in the reliability and unidimensionality test.

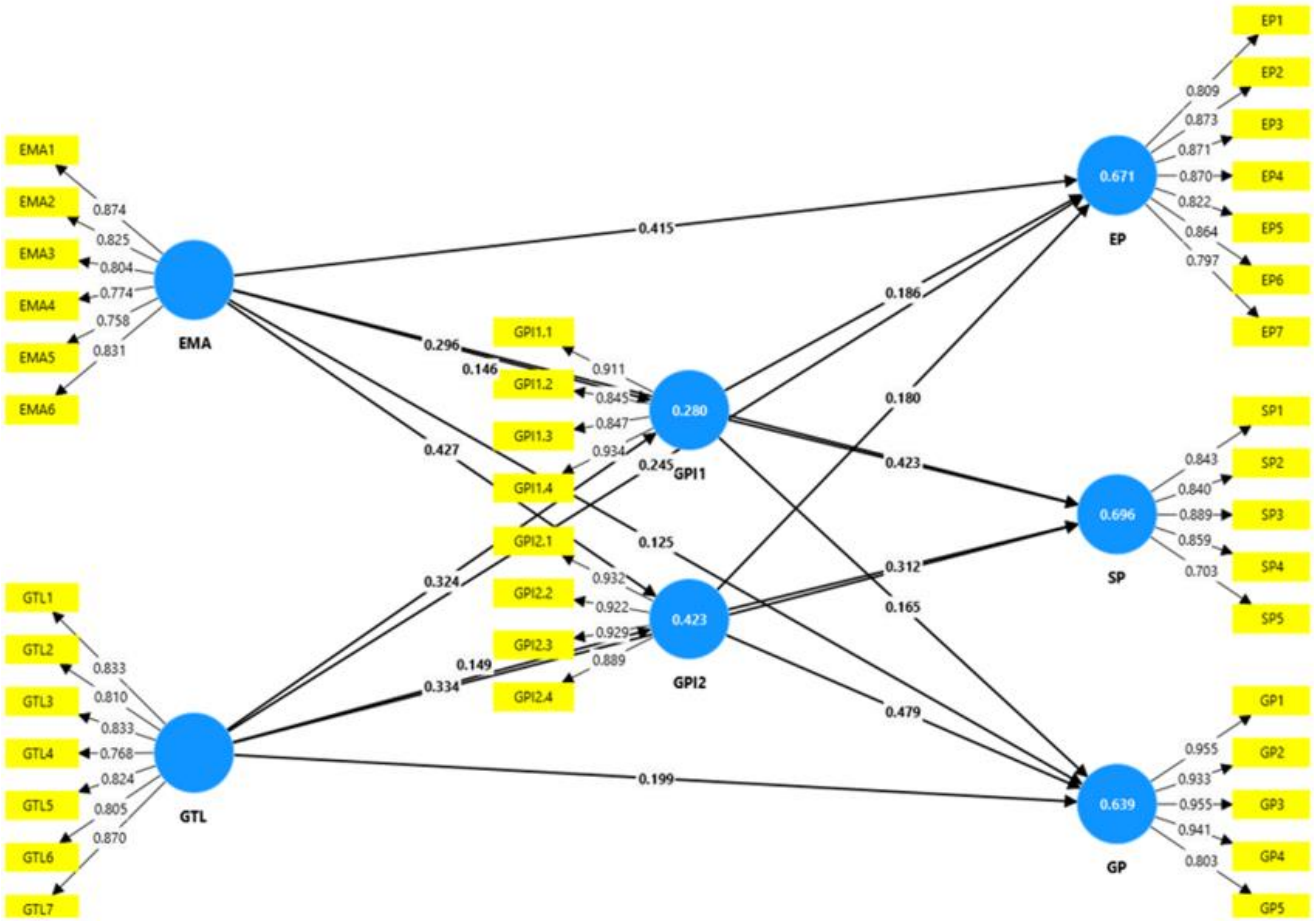

Figure 2.
Hypothesis Testing.

Table 1.
Loading, AVE, Composite Reliability, Cronbach's Alpha, Description.

Construct	Items	Loading	AVE	Composite Reliability	Cronbach's Alpha	Description
Environmental Management Accounting (EMA)	EMA1	0.874	0.659	0.910	0.897	Valid and Reliable
	EMA2	0.825				
	EMA3	0.804				
	EMA4	0.774				
	EMA5	0.758				
	EMA6	0.831				
Environmental Performance (EP)	EP1	0.809	0.713	0.937	0.933	Valid and Reliable
	EP2	0.873				
	EP3	0.871				
	EP4	0.870				
	EP5	0.822				
	EP6	0.864				
	EP7	0.797				
Governance Performance (GP)	GP1	0.955	0.845	0.955	0.953	Valid and Reliable
	GP2	0.933				
	GP3	0.955				
	GP4	0.941				
	GP5	0.803				
Green Process Innovation (GPI1)	GPI1	0.911	0.784	0.909	0.907	Valid and Reliable
	GPI2	0.845				
	GPI3	0.847				
	GPI4	0.934				
Green Transformational Leadership (GTL)	GTL1	0.833	0.674	0.927	0.920	Valid and Reliable
	GTL2	0.810				
	GTL3	0.833				
	GTL4	0.768				
	GTL5	0.824				
	GTL6	0.805				
	GTL7	0.870				
Green Product Innovation (GPI.2)	TL1	0.932	0.843	0.939	0.938	Valid and Reliable
	TL2	0.922				
	TL3	0.929				
	TL4	0.889				
Sustainable Performance (SP)	SP1	0.843	0.688	0.883	0.884	Valid and Reliable
	SP2	0.840				
	SP3	0.889				
	SP4	0.859				
	SP5	0.703				

Table 2.
Direct Model - Original Sample, Sample Mean, Standard Deviation, T Statistics, P Values.

Description	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
EMA -> EP	0.415	0.418	0.068	6.123	0.000
EMA -> GP	0.125	0.125	0.052	2.392	0.017
EMA -> GPI1	0.296	0.295	0.067	4.438	0.000
EMA -> GPI2	0.427	0.426	0.058	7.376	0.000
EMA -> SP	0.146	0.145	0.050	2.919	0.004
GPI1 -> EP	0.186	0.186	0.045	4.145	0.000
GPI1 -> GP	0.165	0.162	0.048	3.455	0.001
GPI1 -> SP	0.423	0.422	0.057	7.465	0.000
GTL -> EP	0.245	0.242	0.056	4.387	0.000
GTL -> GP	0.199	0.202	0.052	3.830	0.000
GTL -> GPI1	0.324	0.324	0.064	5.084	0.000
GTL -> GPI2	0.334	0.331	0.053	6.253	0.000
GTL -> SP	0.149	0.150	0.048	3.093	0.002
GPI2 -> EP	0.180	0.179	0.054	3.351	0.001
GPI2 -> GP	0.479	0.478	0.072	6.695	0.000
GPI2 -> SP	0.312	0.311	0.050	6.236	0.000

5. Findings and Discussion

The estimated path coefficient of 0.415 indicates a significant positive effect of Environmental Management Accounting (EMA) on Environmental Performance. With a t-statistic of 6.123 and a p-value of 0.000, this result shows that this hypothesis is supported, meaning that EMA contributes significantly to improving environmental performance.

The path coefficient of 0.125 suggests a significant positive effect of EMA on Green Product. With a t-statistic of 2.392 and a p-value of 0.017, this hypothesis is accepted, indicating that EMA plays a role in enhancing green products.

The coefficient of 0.296 shows a significant positive effect of EMA on Green Process Innovation. The t-statistic of 4.438 and p-value of 0.000 suggest this hypothesis is supported, indicating EMA contributes to green process innovation.

The path coefficient of 0.427 indicates a significant positive effect of EMA on Organizational Commitment. With a t-statistic of 7.376 and a p-value of 0.000, this hypothesis is accepted, showing that EMA enhances organizational commitment.

The coefficient of 0.146 shows a significant positive effect of EMA on Social Performance. With a t-statistic of 2.919 and a p-value of 0.004, this hypothesis is supported, indicating that EMA contributes to social performance.

The path coefficient of 0.186 indicates a significant positive effect of Green Process Innovation (GPI1) on Environmental Performance. With a t-statistic of 4.145 and a p-value of 0.000, this hypothesis is accepted, meaning that green process innovation improves environmental performance.

The coefficient of 0.165 shows a significant positive effect of GPI1 on Green Product. With a t-statistic of 3.455 and a p-value of 0.001, this hypothesis is accepted, indicating that green process innovation contributes to green products.

The path coefficient of 0.423 indicates a significant positive effect of GPI1 on Social Performance. With a t-statistic of 7.465 and a p-value of 0.000, this hypothesis is accepted, showing that green process innovation improves social performance.

The coefficient of 0.245 indicates a significant positive effect of Green Transformational Leadership (GTL) on Environmental Performance. With a t-statistic of 4.387 and a p-value of 0.000, this hypothesis is supported, meaning that green transformational leadership contributes to environmental performance.

The coefficient of 0.199 indicates a significant positive effect of GTL on Green Product. With a t-statistic of 3.830 and a p-value of 0.000, this hypothesis is accepted, suggesting that green transformational leadership enhances green products.

The path coefficient of 0.324 indicates a significant positive effect of GTL on GPI1. With a t-statistic of 5.084 and a p-value of 0.000, this hypothesis is accepted, showing that green transformational leadership contributes to green process innovation.

The coefficient of 0.334 shows a significant positive effect of GTL on GPI2. With a t-statistic of 6.253 and a p-value of 0.000, this hypothesis is supported, indicating that green transformational leadership enhances organizational commitment.

The coefficient of 0.149 indicates a significant positive effect of GTL on Social Performance. With a t-statistic of 3.093 and a p-value of 0.002, this hypothesis is accepted, showing that green transformational leadership contributes to social performance.

The path coefficient of 0.180 suggests a significant positive effect of Organizational Commitment on Environmental Performance. With a t-statistic of 3.351 and a p-value of 0.001, this hypothesis is supported, indicating that organizational commitment improves environmental performance.

The coefficient of 0.479 shows a significant positive effect of GPI2 on Green Product. With a t-statistic of 6.695 and a p-value of 0.000, this hypothesis is accepted, suggesting that organizational commitment contributes to green products.

The path coefficient of 0.312 indicates a significant positive effect of GPI2 on social performance. With a t-statistic of 6.236 and a p-value of 0.000, this hypothesis is supported, meaning that organizational commitment improves social performance.

Table 3.
Indirect Model - Results of testing indirect effects (X → Y through Z).

Description	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
EMA -> GPI2 -> SP	0.133	0.133	0.029	4.663	0.000
GTL -> GPI2 -> GP	0.160	0.159	0.036	4.391	0.000
GTL -> GPI1 -> EP	0.060	0.060	0.020	3.006	0.003
EMA -> GPI1 -> SP	0.125	0.125	0.034	3.703	0.000
GTL -> GPI1 -> GP	0.053	0.053	0.020	2.727	0.006
GTL -> GPI2 -> SP	0.104	0.103	0.024	4.430	0.000
GTL -> GPI1 -> SP	0.137	0.136	0.032	4.294	0.000
EMA -> GPI2 -> EP	0.077	0.076	0.025	3.097	0.002
EMA -> GPI2 -> GP	0.204	0.204	0.041	4.979	0.000
EMA -> GPI1 -> EP	0.055	0.054	0.017	3.161	0.002
EMA -> GPI1 -> GP	0.049	0.048	0.019	2.555	0.011
GTL -> GPI2 -> EP	0.060	0.060	0.022	2.796	0.005

Here are the results of the indirect hypothesis testing:

The estimated path coefficient of 0.133 indicates a significant positive effect of Environmental Management Accounting (EMA) through Organizational Commitment on Social Performance. With a t-statistic of 4.663 and a p-value of 0.000, this hypothesis is supported, meaning that EMA contributes to social performance through enhanced organizational commitment.

The path coefficient of 0.160 suggests a significant positive effect of Green Transformational Leadership (GTL) through Organizational Commitment on Green Products. With a t-statistic of 4.391 and a p-value of 0.000, this hypothesis is accepted, indicating that green transformational leadership enhances green products through organizational commitment.

3. GTL -> GPI1 -> EP (Green Transformational Leadership -> Green Process Innovation -> Environmental Performance): The coefficient of 0.060 shows a significant positive effect of GTL through Green Process Innovation on Environmental Performance. With a t-statistic of 3.006 and a p-value of 0.003, this hypothesis is accepted, meaning that green transformational leadership contributes to environmental performance through green process innovation.

The coefficient of 0.125 indicates a significant positive effect of EMA through Green Process Innovation on Social Performance. With a t-statistic of 3.703 and a p-value of 0.000, this hypothesis is accepted, meaning that EMA improves social performance through green process innovation.

The path coefficient of 0.053 shows a significant positive effect of GTL through Green Process Innovation on Green Product. With a t-statistic of 2.727 and a p-value of 0.006, this hypothesis is accepted, indicating that green transformational leadership contributes to green products through green process innovation.

The coefficient of 0.104 suggests a significant positive effect of GTL through Organizational Commitment on Social Performance. With a t-statistic of 4.430 and a p-value of 0.000, this hypothesis is accepted, meaning that green transformational leadership enhances social performance through organizational commitment.

The estimated coefficient of 0.137 shows a significant positive effect of GTL through Green Process Innovation on Social Performance. With a t-statistic of 4.294 and a p-value of 0.000, this hypothesis is accepted, indicating that green transformational leadership contributes to social performance through green process innovation.

The path coefficient of 0.077 indicates a significant positive effect of EMA through Organizational Commitment on Environmental Performance. With a t-statistic of 3.097 and a p-value of 0.002, this hypothesis is accepted, meaning that EMA improves environmental performance through organizational commitment.

The coefficient of 0.204 shows a significant positive effect of EMA through Organizational Commitment on Green Product. With a t-statistic of 4.979 and a p-value of 0.000, this hypothesis is accepted, indicating that EMA contributes to green products through organizational commitment.

The path coefficient of 0.055 shows a significant positive effect of EMA through Green Process Innovation on Environmental Performance. With a t-statistic of 3.161 and a p-value of 0.002, this hypothesis is accepted, indicating that EMA improves environmental performance through green process innovation.

The coefficient of 0.049 indicates a significant positive effect of EMA through Green Process Innovation on Green Product. With a t-statistic of 2.555 and a p-value of 0.011, this hypothesis is accepted, meaning that EMA contributes to green products through green process innovation.

The coefficient of 0.060 shows a significant positive effect of GTL through Organizational Commitment on Environmental Performance. With a t-statistic of 2.796 and a p-value of 0.005, this hypothesis is accepted, indicating that

green transformational leadership enhances environmental performance through organizational commitment.

6. Conclusion

This research highlights the significant impact of Environmental Management Accounting (EMA) and Green Transformational Leadership (GTL) on Environmental, Social, and Governance (ESG) performance. The findings indicate that EMA plays a crucial role in improving environmental performance, promoting green products, driving green process innovations, and enhancing organizational commitment. These outcomes, in turn, positively contribute to social performance. Moreover, green product innovation and green process innovation were found to act as mediating variables in the relationship between EMA and ESG performance, further amplifying the positive impact of EMA on both environmental and social outcomes.

On the other hand, GTL also demonstrates its ability to foster a positive shift towards better ESG performance. Through its influence on organizational commitment and green process innovation, GTL enhances both environmental and social outcomes, further strengthening the connection between leadership and sustainable practices. Green process innovation was similarly identified as a mediating variable, helping to translate GTL's leadership strategies into tangible improvements in ESG performance.

The study underscores the importance of integrating EMA and GTL into business strategies to achieve better ESG results. By adopting these practices, organizations can not only improve their operational efficiency but also make a significant contribution to sustainability, addressing both environmental challenges and social responsibilities. This research provides valuable insights for businesses seeking to align their operations with global sustainability goals while reinforcing the role of leadership and management practices in shaping a more responsible and sustainable future.

5.1. Implications of the Study

From a practical standpoint, this study provides valuable insights for organizations looking to improve their Environmental, Social, and Governance (ESG) performance. By integrating Environmental Management Accounting (EMA) into their operations, companies can better manage their environmental impacts and drive sustainability initiatives. EMA's role in promoting green product and process innovations proves to be a key factor in achieving better environmental and social outcomes. Organizations can leverage EMA not only to track and improve their environmental performance but also to enhance their commitment to sustainability through the development of green products and processes.

Furthermore, Green Transformational Leadership (GTL) offers an essential framework for leaders who aim to foster a culture of sustainability within their organizations. GTL's emphasis on commitment, innovation, and transformation encourages leaders to inspire their teams to embrace green innovations that positively affect ESG performance. Companies can adopt GTL principles to motivate employees to focus on long-term environmental and social goals while also achieving practical business results. The findings highlight that both EMA and GTL, with green product and process innovations as mediating factors, play an essential role in creating a sustainable competitive advantage.

Theoretically, this study contributes to the existing literature on ESG performance by shedding light on the interplay between Environmental Management Accounting (EMA) and Green Transformational Leadership (GTL). While previous research has explored these concepts separately, this study offers a comprehensive understanding of how they work together to influence ESG outcomes. By incorporating green product and process innovations as mediating variables, the research expands theoretical perspectives on how sustainability practices can be operationalized and measured within organizations.

Additionally, this study enriches our understanding of the role of leadership in driving sustainability initiatives. GTL, as a transformative approach to leadership, emphasizes the need for leaders to not only adopt environmentally conscious strategies but also to encourage innovation within their teams. By focusing on innovation in both products and processes, the study introduces a more nuanced perspective on how leadership and management practices can drive long-term sustainable development. The findings suggest that future research should further explore the role of leadership and accounting practices in fostering sustainability, particularly in industries where environmental and social responsibilities are increasingly critical.

Overall, this research provides a theoretical framework for understanding the synergies between EMA, GTL, and green innovations in driving superior ESG performance, paving the way for further exploration of these connections in diverse organizational contexts.

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