

### THE EFFECT OF ENVIRONMENTAL MANAGEMENT ACCOUNTING ON ENVIRONMENTAL PERFORMANCE WITH GREEN PROCESS INNOVATION AS A MEDIATING

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Article Info	Abstract
Accepted February, 2025	This paper analyzes the Effect of Environmental management accounting on Environmental Performance with Green Process Innovation as a Mediating in manufacturing company of Banten Province. This research adopts quantitative method and survey method. This study relied on self-reported primary data from a self-administered survey by spreading questionnaires to 153 manufacturing companies in Banten Province. Three measurements were analyzed using structural equation modeling (SmartPLS 3.3). Three hypotheses were positively associated. The results of this study show that environmental management accounting have a positive effect on environmental performance, environmental management accounting have a positive effect on green process innovation, green process innovation can mediate the effect of environmental management accounting on environmental performance.
Revised March, 2025	
Published March, 2025	
<b>Keywords:</b>  <i>Environmental Management Accounting, Environment Performance, Green Process Innovation</i>	



### Introduction

Environmental degradation has become a serious concern due to the rapid development of industry and the growth of the global population ((Wang et al., 2019, Bansal and Kistruck, 2006, Zheng et al., 2014, Obeidat et al., 2020). As a result, key stakeholders, including customers, suppliers, investors, non-governmental organizations (NGOs), and government agencies, have become increasingly concerned about environmental issues, including climate change. This has led to a widespread call for businesses to reduce their negative impact on the environment (Kassinis & Vafeas, 2006; Yu et al., 2017; Schmitz et al., 2017). Companies across industries and regions are now required to engage in environmentally friendly processes and product development as this increases pressure from stakeholders to implement environmental management measures.

Over the past few decades, the environment has been heavily impacted by excessive resource consumption and increased industrial activity, as these activities play an active role in cumulative environmental contamination (El-Kassar & Singh, 2019). Many manufacturing companies face inefficiencies in producing goods and services (Huseno, 2018), and waste is generally prevalent. Industrial waste can arise from the use of raw materials, energy, water, or other materials, with significant losses occurring in these processes. In economic systems, environmental impacts are expressed monetarily, such as income from net production or fines for violating environmental regulations (Huseno, 2018). Today, rapid technological changes are occurring, and it is difficult for organizations to recognize and predict them (Singh et al., 2017).

Currently, many organizations are expected to pay attention to their business environment due to the high public awareness of environmental preservation. As public awareness of the environment grows, people are also becoming more conscious of eco-friendly products and environmental sustainability (Ria Nelly Sari, 2020). The Chartered Institute of Management Accountants (CIMA), a leading professional body based in the UK, suggests that Environmental Management Accounting (EMA) is critical for corporate sustainability, as it



acts as an interface between traditional management accounting, which focuses inward, and environmental management strategies (CIMA, 2019).

On this basis, environmental issues should be seen as a critical concern for businesses and other organizations, as they relate to the economic and production processes of a company (Amiruddin & Pagalung, 2015; Khan et al., 2020). In the field of accounting, Environmental Management Accounting (EMA) has been considered. The Chartered Institute of Management Accountants (CIMA) emphasizes that EMA plays a vital role in corporate sustainability by linking traditional internal-focused management accounting with environmental management strategies (CIMA, 2019). In this context, several EMA features, such as material flow costs, sustainability balanced scorecards, and eco-control, have proven useful in identifying a company's impact on ecological conditions (Aliakbari Nouri et al., 2019; Jasch, 2008; Henri & Journeault, 2018; Lu et al., 2018). Previous research focusing on the role of environmental accounting has been limited to identifying costs associated with company processes that can lead to harmful ecological impacts. In this context, most studies examine environmental impacts and cost measurements (Epstein, 1996; Parker, 1997; Yasch, 2003; Gale, 2006; Hye & Jafri, 2011). While past research on the environmental and social implications of accounting practices has transparently revealed the presence of ecological exposure, EMA has progressively been explored and utilized as a management tool to address companies' ecological burdens and traditional practices (Qian et al., 2018). Therefore, EMA has been recognized as playing a crucial role in driving impartiality in operations and facilitating the shift toward reducing the ecological impacts of companies, thus improving their environmental management practices (Schaltegger, 2018; Hossain et al., 2018).

Environmental Management Accounting can enhance corporate performance and competitive advantage by providing detailed environmental information to stakeholders (Saeidi et al., 2011). EMA helps managers achieve economic efficiency. Some organizations do not pay attention to EMA and thus face many obstacles in improving their environmental performance (Li et al., 2017; Sari et al., 2020). By implementing EMA, companies are expected to achieve sustainable development. Companies that make more use of Environmental

Management Accounting (EMA) are likely to enhance environmentally friendly process innovations to reduce environmental costs, waste, and other negative impacts on society (Ferreira et al., 2010).

### **Legitimacy Theory**

The Legitimacy Theory ensures that a company's operational activities are conducted in accordance with the norms prevailing in society, thus making them accepted by external parties (legitimized). This theory is based on the idea that a company must operate within the rules or norms present in society (O'Donovan, 2002). A company will face legitimacy pressure if its operational activities are not aligned with the rules in society.

Social legitimacy is a strategic factor for companies in developing the business moving forward. It can be used as a tool to build a company's strategy, especially in efforts to position itself within an increasingly advanced societal environment (Hadi, 2011). Legitimacy is a psychological state of the alignment of individuals or groups who are highly sensitive to environmental phenomena, both physical and non-physical (Hadi, 2011). O'Donovan (2002) argues that organizational legitimacy can be seen as something granted by society to a company, and something that the company seeks or desires from society. Therefore, legitimacy is a benefit or a potential resource for a company to survive (going concern). Deegan and Tobin (2002) state that legitimacy can be achieved if a company's existence does not disturb or is in line with the values present in society and the environment. When a shift toward non-compliance occurs, the company's legitimacy is threatened. Thus, it can be stated that the company's legitimacy in the eyes of stakeholders is a significant factor in supporting the company's image and reputation (Hadi, 2011).

A company is an organization built on public trust in the company (O'Dwyer et al., 2011) and tends to maintain its position within society to ensure the continuity of its business operations (Erin et al., 2022). In the context of environmental, social, and governance (ESG), Maroun et al. (2014) explain that social and environmental responsibility under effective governance is part of the legitimacy process designed to signal the company's reporting capability and governance system in





responding to stakeholder interests. Although the implementation of ESG is made to fulfill regulatory obligations, legitimacy must still be built through social and environmental responsibility and business sustainability to attract the attention of investors and other stakeholders (Maroun et al., 2014). From a legitimacy theory perspective, the ESG aspects aim to legitimize the company's activities based on the expectations of diverse stakeholders. Companies maintain their legitimacy by signaling to stakeholders that their behaviors align with stakeholders' expectations (Suchman, 1995).

### **Environmental management accounting (EMA) on Green Process Innovation (GPI)**

Environmental Management Accounting (EMA) is a combination of cost allocation and financial accounting to reduce environmental impacts and risks, which can minimize environmental protection costs used by top management in decision-making to improve performance (Bresciani et al., 2022). Conventional accounting practices are insufficient to address environmental issues, which is why EMA is crucial for making environmentally friendly decisions and participating in environmental stability. The implementation of EMA signals to the public that the company considers environmental aspects and norms in its operational activities (Saeidi, 2013). EMA is essential for providing details about decisions regarding Green Process Innovation (GPI) required to improve the organization's environmental performance (Somjai, 2020). Environmental management accounting is a combined approach that provides data transition from financial accounting, cost accounting, and material balance accounting to enhance material efficiency, reduce environmental impacts and risks, and lower environmental protection costs (Christine Jasch, 2003). In this context, EMA helps companies identify, measure, and manage costs associated with environmental activities, with a deeper understanding of these costs that can help identify opportunities for driving green process innovation (GPI).

H1 :Environmental management accounting (EMA) has a positive effect on Green Process Innovation (GPI)

### **Green Process Innovation (GPI) on Environmental performance (EP)**

Environmental innovation has become a major concern in the business world and is a multidimensional process, consisting of three main components: materials, energy, and pollution (Dangelico and Pujari, 2010). Company efforts to implement environmentally friendly products can influence consumers to be environmentally conscious and purchase environmentally friendly products (Okada and Mais, 2010). Consumer awareness of the use of green products influences purchase intention and ultimately can improve company performance (Chen et al., 2011); (Chen et al., 2015); (Patel et al., 2015); (Chekima and Wafa, 2015). The implementation of green products can save energy and reduce or eliminate pollution and waste (Pankaj and Vishal, 2014). Green Product Innovation (GPI) implemented by companies can improve product design, quality, and environmental awareness, which can create opportunities for companies to set higher prices and create better profit margins, thereby improving company performance (Chen et al., 2006)."

H2 :Green Process Innovation (GPI) has a positive effect on Environmental performance (EP)

### **Green Process Innovation (GPI) mediates the effect of Environmental management accounting (EMA) on Environmental Performance (EP)**

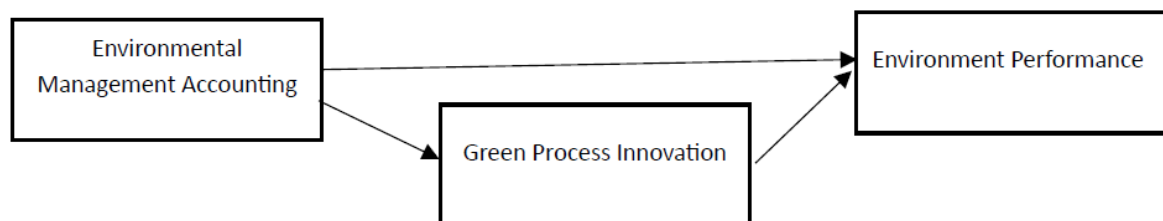
Masanet-Liodra (2006) found a positive relationship between EMA and company product innovation. EMA is considered an information system that can improve the performance and quality of a company's management business. Saeidi et al. (2011) provided empirical evidence that the use of EMA has a positive effect on company performance that focuses on innovation. Environmental innovation, in this case environmental friendly product innovation, is likely to lead to improved environmental performance and company performance. Given that in practice innovation requires high initial investment and is a high-risk activity, good management is needed to plan and organize so that the GI (Green Innovation) process can produce quality innovations. This management includes the management of GI costs, the management of resource and energy use, and the management of processes that do not harm the environment (Ar, 2012). EMA is able to overcome problems that arise during the GI implementation process,

with good coordination companies gain many benefits of GI such as product differentiation which will create competitive advantage for the company, high customer loyalty, and sales with premium prices for innovative products are far more valuable than the costs incurred (Amores-Salvadó et al., 2014). Therefore, with GI companies can improve their internal products and processes and reduce their business operating costs, directly impacting the company's financial performance (Agustia et al., 2019).

H3 :Green Process Innovation (GPI) mediates the effect of Environmental management accounting (EMA) on Environmental Performance (EP)

### Theoretical Framework

This study proposes a theoretical framework. Figure 2 depicts the framework, which is specifically designed to test the role of organizational culture in mediating the effectiveness of information technology and internal audit.



### Data and Methods

The population in this study were 153 manufacturing companies in Banten Province. Sampling was carried out using the partial least square (PLS) method based on variance with convenience sampling and non-probability sampling with purposive sampling technique, as suggested by Wong (2010). The structural equation modeling approach (PLS version 3.3) was



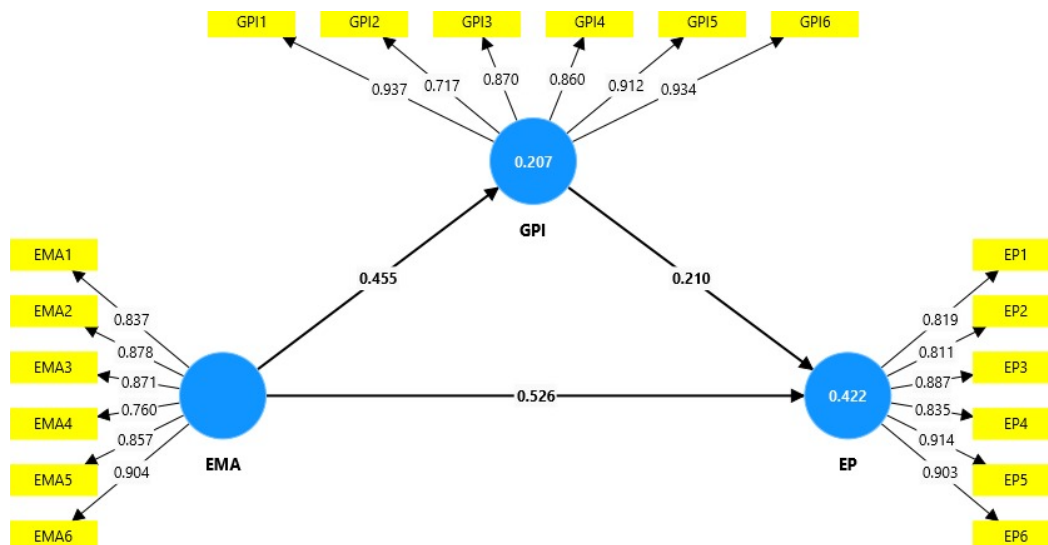
used for data analysis. Wong (2010) explained that once there were no measurement issues, so the external model was evaluated next (unidimensionality test model). The average variance extracted (AVE), composite reliability, and Cronbach Alpha were used to test for unidimensionality. These indicators have a cut-off value of 0.5, indicating that all statement items in the variable are reliable (Hair et al. 2010). Cronbach Alpha and Composite Reliability on greater-than- 0.6 construction values. Therefore, there are no problems in the reliability and unidimensionality test. As shown in Figure 4, subsequent analyzes tested the interior or structural model (Ghozali 2008).

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. This table shows the results of testing the validity of six different variables, namely decentralization, electronic participatory budgeting, management accounting system, organizational culture, management accounting system, and managerial performance. 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 for four variables, namely decentralization, electronic participatory budgeting, management accounting



systems, and management performance. 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.



Construction	Items	Loading	AVE	Composite Reliability	Cronbach's Alpha	Description
EMA	EMA1	0.837	0.727	0.932	0.924	Valid and Reliable
	EMA2	0.878				
	EMA3	0.871				
	EMA4	0.760				
	EMA5	0.857				
	EMA6	0.904				
EP	EP1	0.819	0.744	0.933	0.931	Valid and Reliable
	EP2	0.811				
	EP3	0.887				

	EP4	0.835				
	EP5	0.914				
	EP6	0.903				
GPI	GPI1	0.937	0.765	0.958	0.938	Valid and Reliable
	GPI2	0.717				
	GPI3	0.870				
	GPI4	0.860				
	GPI5	0.912				
	GPI6	0.934				

Description	T-Statistics	P Values	Results
EMA -> EP	6,805	0,000	Accepted
EMA -> GPI	5,690	0,000	Accepted
GPI -> EP	2,844	0.004	Accepted

Estimated path coefficient for the effect of EMA on EP is 0.526, with a t-statistic of 6.805 and a p-value of 0.000. This indicates that the effect of EMA on EP is highly significant, as the t-statistic is much larger than the t-table value (1.96) at an alpha of 0.05. Therefore, it can be concluded that EMA has a strong positive influence on environmental performance.

The path coefficient for the effect of EMA on GPI is 0.455, with a t-statistic of 5.690 and a p-value of 0.000. This also shows that the effect of EMA on GPI is significant, as the t-statistic is greater

than the t-table value. This indicates that GPI plays a role in improving environmental performance, although its effect is not as strong as the effect of EMA on EP. This suggests that green process innovation remains important in achieving sustainability goals.

The estimated path coefficient for the effect of GPI on EP is 0.210, with a t-statistic of 2.844 and a p-value of 0.004. This effect is also significant, as the t-statistic exceeds the t-table value. This shows that GPI plays a role in improving environmental performance, although its influence is not as big as the influence of EMA on EP. This indicates that the green innovation process remains important in achieving desired goals.

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics ( O/STDEV )	P values
EMA -> GPI -> EP	0.096	0.096	0.040	2,412	0.016

The estimated path coefficient for the indirect effect of EMA on EP through GPI is 0.096, with a t-statistic of 2.412 and a p-value of 0.016. This result indicates that the indirect effect of EMA on EP through GPI is significant, as the t-statistic is greater than the t-table value (1.96) at an alpha of 0.05. This means that EMA not only has a direct effect on EP but also makes a positive contribution through the enhancement of green process innovation. Therefore, GPI serves as an important mediator in the relationship between EMA and environmental performance, emphasizing the importance of innovation in achieving sustainability goals.

### 1. The Effect of Environmental management accounting (EMA) on Environmental Performance (EP)

Environmental management accounting (EMA) has a positive effect on Environmental Performance (EP) because it can enable organizations to track, analyze, and manage their environmental impacts in a more systematic and efficient way. By integrating environmental factors into the accounting process, EMA provides companies with critical data regarding resource usage, waste production, emissions, and other environmental factors. This data helps decision-makers identify areas where they can reduce waste, improve efficiency, and adopt more sustainable practices.

EMA also plays an important role in ensuring compliance with environmental regulations. By tracking environmental impacts and maintaining accurate records, companies can ensure they meet legal requirements, avoid fines, and stay updated with evolving environmental regulations. This compliance contributes to better environmental performance by ensuring that companies operate within the boundaries set by regulatory authorities and avoid activities that could harm the environment. Organizations can play a crucial role in improving the environment and generating financial, economic, and environmental benefits by implementing EMA (Burritt and Christ, 2016). When organizations disclose environmental issues in their financial reports to address environmental concerns, it helps companies generate more financial and economic benefits (Gunarathne and Lee, 2015; Ogunode, 2022; Sands and Lee, 2015).

## **2. The Effect of Environmental management accounting (EMA) on Green Process Innovation (GPI)**

EMA contributes positively to green process innovation, which can enhance sustainability in business practices. Environmental Management Accounting (EMA) has a positive effect on Green Process Innovation (GPI) because it provides companies with detailed, accurate data on the environmental impact of their operations, which in turn drives innovation toward more sustainable practices. By incorporating environmental factors into the accounting and decision-making process, EMA enables companies to better understand where their operations are consuming excessive resources, generating waste, or producing harmful emissions. This information helps organizations identify areas for improvement, which can lead to the development of green processes.

EMA encourages companies to optimize resource use, reduce waste, and minimize environmental harm, which are all essential elements in driving green innovation. For example, through the use of EMA, a company can identify energy-



intensive processes and work on redesigning these processes to use less energy or transition to renewable energy sources. EMA provides the financial insights to determine the cost-benefit of such innovations, making it easier for companies to justify investments in green technologies. Companies gain a competitive advantage by innovating processes that focus on environmental issues, which ultimately improve organizational performance (Zhai et al., 2018). An organization's EMA will focus on developing organizational sustainability when the organization's performance is also positive. According to previous research, organizations implement environmentally-based accounting systems that enhance both financial performance and the environmental friendliness of the organization (Klassen and McLaughlin, 1996; Nawaz et al., 2019).

### **3. The Effect of Green Process Innovation (GPI) on Environmental Performance (EP)**

This shows that GPI plays a role in improving environmental performance, although its effect is not as strong as the effect of EMA on EP. This indicates that green process innovation remains important in achieving sustainability goals. Furthermore, GPI can help companies improve their overall efficiency, leading to reduced environmental impact. For example, a company may innovate by optimizing its production processes, reducing the energy required for manufacturing, or increasing the efficiency of logistics and supply chain management. These innovations can lower carbon emissions, reduce the use of non-renewable resources, and minimize other environmental impacts associated with business operations. Some organizations do not pay attention to EMA and as a result, they face many obstacles in improving their environmental performance (Li et al., 2017; Sari et al., 2020). Conventional accounting practices are not sufficient to address environmental issues, which is why EMA is essential for making environmentally friendly decisions and participating in environmental stability. EMA is also crucial for providing details on costly decisions

regarding GPI needed to improve the environmental performance of the organization (Somjai, 2020).

### Conclusion and Implication

The results of this study suggest that policy makers should invest in environment friendly management practices, as this is one of the key ways for companies to enhance their reputation in the eyes of stakeholders. This is due to stakeholders' increasing awareness of the importance of environmental protection and the expectation that companies actively engage in efforts that support sustainability and environmental friendly processes. The findings of this study are highly relevant and beneficial for managers, providing encouragement to focus more on strengthening leadership behaviors that support the environment within the company. This aims to ensure the effective and sustainable implementation of GPI practices, which can ultimately improve environmental performance and strengthen the company's position in addressing global environmental challenges.

The implications of these findings are highly significant for companies and policymakers. First, companies need to adopt better environmental management practices, which not only improve their reputation but also provide long-term benefits through cost savings and enhanced operational efficiency. Second, stakeholders, including investors, consumers, and society, are increasingly demanding transparency and commitment to sustainability, so companies that neglect environmental issues may risk losing trust and business opportunities. Additionally, companies need to strengthen leadership in sustainability to ensure that these changes are fully integrated into their operations and corporate culture. Finally, the implication for managers is the importance of developing the capacity to understand and implement GPI, as well as creating synergy between environment and business goals in addressing global challenges related to climate change and sustainability.



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