The Role of Environmental Management Accounting in Economic Development through Corporate Product and Process Innovation in Indonesia

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ABSTRACT

Aims: This research aims to examine the influence of environmental management accounting on economic development through innovation

Study design: This research hypothesis testing was carried out using the Partial Least Square (PLS) approach.

Place of Study: The sample data for this research was obtained from 150 respondents. The respondents in this research sample were accounting managers of manufacturing companies in East Java.

Methodology: This research method is quantitative. This research will test the influence of the relationship between variables, namely the independent variable consisting of environmental management accounting as the independent variable (X1). The product innovation variable (Z1) and the process innovation variable (Z2) are mediating variables, and economic development (Y) is the dependent variable.

Results: The result of the test shows that Environmental management accounting (EMA) is proven to have a positive and significant influence on Economic development, with a t value > t table (5.526 > 1.975) and a path coefficient of 0.000. The product innovation is also able to strongly mediate the relationship between environmental management accounting (EMA) and economic development, this finding is supported by the value of t count > t table (2.710 > 1.975) and a path coefficient of 0.000. The latest test results also prove that process innovation is also able to strengthen the relationship between Environmental Management Accounting (EMA) variables and economic development.

Conclusion: Overall, the results of this study support the dimensions of management accountingenvironment (AML) can increase economic development even though companies carry out product innovation and process innovation activities.This research provides a perspective on possible strategiescompanies to achieve more effective environmental management accountingand supports company goals related to product innovation andcompany process innovation.

Keywords: Environmental management accounting; Economic development; Innovation Product; Innovation process

1. INTRODUCTION

In recent years, the balance between environmental sustainability and economic development has become a global concern (Jaya & Padilla, 2024).This is felt by companies because basically companies always have certain goals that they want to achieve to

optimize profits from the goods they produce, but indirectly these activities have a serious impact on environmental damage(JAYA & Narsa, 2022).The company's lack of attention to environmental responsibility results in environmental damage. In 2019, this basic industrial and chemical sub-sector manufacturing company became one of the companies that contributed a lot to various cases of environmental pollution in Indonesia. This happened because it was caused by unsafe waste resulting from the activities of the goods, which had an impact on the area around the company.Therefore, companies are expected to pay attention to their business environment (Mignon & Bankel, 2022).

The underlying reasons why an organization must care about environmental issues include: many company stakeholders, both internal and external, show increased interest in the environmental performance of an organization (Wang et al., 2023). The existence of various policies in the environmental sector is what later became the beginning of the development of a concept that aims to find solutions to fulfill business goals and resolve environmental problems called eco-efficiency (Rahayu et al., 2022). This principle studies how organizations can produce more useful goods and services, while simultaneously reducing negative environmental impacts, resource consumption and costs, through increasing efficiency that comes from improving environmental performance. Environmental Management Accounting is needed by every company to provide information to the company regarding the company's environmental performance (Paul et al., 2014). Environmental Management Accounting aims to increase the amount of relevant information for those who need it, so that it can be used as an indicator for decision making.

The success of Environmental Accounting does not only depend on accuracy in classifying all costs made by the company (Idris, 2012). However, the ability and accuracy of the company's accounting data can reduce the environmental impacts resulting from the company's activities. To support this hope, it is appropriate to encourage a company to carry out business processes by paying attention to the impacts that will occur from the process. With this information relating to relevant environmental impacts, it is hoped that it can encourage a business to innovate, because by innovating the company will gain various benefits, not only focusing on the market (externally), but also profits within the company itself (internal) (Astuti et al., 2022).

The innovation needed now may focus on the product itself, and even focus on the processes and costs involved in producing the item. Product innovation in accordance with technological developments is the main focus for companies to compete in the market (Farida & Sutopo, 2023). Almost all companies are now competing to release the newest products in accordance with current developments. Innovation is a change in method or technology—a positive and useful change from the previous way of doing things. The two fundamental types of innovation are product innovation and process innovation (Mcelroy, 2002). Process innovation is a change that affects the way an output is produced. Product innovation is a change in the actual output (products and services) itself(Tang et al., 2018). Process innovation describes a change in the way a company produces a product with modern technology that makes the process less time consuming and expensive. Process innovation describes changes in the way an organization produces a company's final product or service. Innovation refers to the new application of knowledge, ideas, methods and skills that can exploit a company's competitiveness. Process innovation is a new technique and process that is included in the operational process to increase efficiency and effectiveness to reduce production and delivery costs. Process innovation describes changes in how an organization produces products and services. Measuring process innovation to produce a product uses three indicators, namely the speed and efficiency of the production process, the reliability of the production process and technology.However, innovation sometimes does not coincide with the impact produced by the company, so there

is also a need for process innovation in producing a product to avoid environmental risks. One of the possible benefits of implementing Environmental Management Accounting is innovation by companies to reduce environmental impacts. In addition, the application of Environmental Management Accounting can help environmental managers (Agustia, 2020).

The lack of accounting research that discusses the application of Environmental Management Accounting is one of the obstacles in this research. Therefore, this research is still in the initial phase or exploratory research. In Indonesia, there is a lot of research on environmental performance and disclosure of environmental performance, however, research on the application of Environmental Management Accounting (EMA) is still very rare and is still in its initial phase. One of the studies on the application of Environmental Management Accounting is (Agustia, 2020). This research aims to analyze the importance of implementing Environmental Management Accounting to reduce environmental impacts that occur due to the production process. The research results show that the application of Environmental Management Accounting is closely related to the concept of eco-efficiency which is measured through a comparison between environmental performance indicators and financial performance indicators. From this evidence it can be seen that research on the environment is only limited to environmental performance and disclosure of environmental reports themselves, so this can be a reference for researching other problems related to the environment such as the application of Environmental Management Accounting (EMA).

Environmental management accounting for company economic development

Environmental Management Accounting is a sub-system of environmental accounting that explains a number of issues regarding the issue of quantifying a company's business impacts into a number of monetary units(Leonard et al., 2019). Environmental management accounting can be used as a benchmark for environmental performance (Gerged et al., 2023). In an ideal business world, companies tend to describe environmental aspects in the company's accounting process through a number of identifications of costs, products, processes and services. Even though conventional accounting systems have an important role in the development of the business world, existing conventional accounting systems are unable to adapt to environmental costs. Conventional accounting is only able to show accounts for indirect general costs.

Environmental management accounting is useful for management because it can provide physical information regarding inputs (materials, water, energy) and outputs (products, waste, emissions) as well as monetary information regarding all expenditures and savings related to the environment (Elhossade et al., 2022). This information makes it easier for management to carry out environmental management because management has sufficient information to control the use of materials, water and energy, control waste and emissions, as well as control environmental costs. Various decisions related to the environment can also be taken with this information, making it possible to improve environmental performance. One way to protect the environment in the long term is to integrate environmental considerations into the company's accounting system. Therefore, accounting plays a very important role in managing the relationship between the company and the environment (Gunarathne et al., 2021).

Environmentally sound development is a conscious and planned effort to use and manage resources wisely in planned and sustainable development to improve the quality of life. Implementing environmentally sound development and controlling the wise use of natural resources is the main objective of environmental management. It is fully realized that development activities, especially those of a physical nature and related to the use of natural resources, clearly contain the risk of changes in the ecosystem which will subsequently result in impacts, both negative and positive. Therefore, the development activities carried

out should not only have a social and economic perspective but also an environmental perspective. Therefore, the planning and policy-making process by state institutions regarding technological and environmental issues requires a comprehensive understanding from policy-making actors regarding related issues. This understanding originates from academic knowledge and is strengthened by field data so that it can produce a scale of policies based on people in general and ecology in particular. The policy that can be implemented is an environmentally sound development policy which is concerned with efforts to utilize natural resources while maintaining aspects of environmental maintenance and preservation. Appropriate economic development also takes into account the need for conservation for bio-physical survival and the need for peace and equality (justice) in carrying out life together (He et al., 2022).Based on the presentation of the grand theory and differences in the results of previous research, the researcher will test it again by proposing the following hypothesis:

H1:*There is a positive influence between environmental management accounting on the company's economic development*

Environmental management accounting for economic development through product and company process innovation

Many experts or management experts state that innovation is a guarantee for companies or organizations to increase their competitiveness (Farida et al., 2022). Innovation is a necessity and must become a discipline. The concept of innovation has a long history and different meanings, mainly based on competition between companies and the different strategies implemented by the companies themselves (Gochhait et al., 2014). Innovation consists of five elements, namely: (1) Introducing new products or qualitative changes to existing products, (2) Introducing new processes to the industry, (3) Opening new markets, (4) Developing new sources of supply of raw materials or inputs others, (5) Changes in industrial organization (Gunday et al., 2011). The application of Environmental Management Accounting encourages companies to carry out product innovation and process innovation. For example, in the livestock industry, companies must innovate processes in waste management so that it does not pollute the environment. Process innovations that must be carried out by livestock require quite a lot of money. This causes companies in the livestock industry to be required to increase income through product innovation in order to maintain their business.

Basically, the main goal of companies implementing a prospective strategy is the market (Greckhamer et al., 2013). An innovative prospective strategy will develop new products to achieve its goals in finding new markets. Companies that implement prospective strategies will influence company innovation. This can be seen when a company responds quickly to things or issues related to market needs. Therefore, the greater the pressure that occurs in the market, it is hoped that companies can increase product innovation in order to survive in that market.

Innovation can be defined as the implementation of new systems, policies, programs and processes that are generated internally and externally (Yuana et al., 2021). What is interesting is that there is a difference between process innovation and product innovation, where both complement each other to increase company profitability. In addition, both product innovation and process innovation can influence the costs incurred by the company. In other words, the use of Environmental Management Accounting may be related to the creation of product innovations and process innovations that can improve a company's competitiveness and position. Based on the presentation of the grand theory and differences

in the results of previous research, the researcher will test it again by proposing the following hypothesis:

H2:*Product innovation is able to mediate the strong relationship between the role of environmental management accounting on the company's economic development*

H3:*Process innovation is able to mediate the strong relationship between the role of environmental management accounting and the company's economic development*

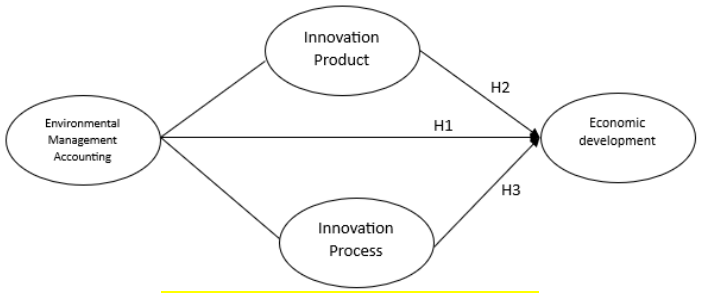


Figure 1. Conceptual framework

Based on previous research, it is evident that the application of Environmental Management Accounting provides many benefits for business people, especially for companies. This research aims to examine the influence of environmental management accounting on economic development through innovation. It is hoped that the theoretical implications of the results of this research will be evidence of the development of environmentally based management accounting science which is currently in the world's spotlight, especially its implementation in various institutions so that it continues to be developed and studied in order to welcome environmentally based economic development. Meanwhile, the practical implications of this research are expected to be useful for companies as industrial players in protecting the surrounding resource environment by implementing environmental management accounting correctly and appropriately. It is also hoped that the findings of this research will be used as material for consideration in developing environmental management accounting learning programs.

2. MATERIAL AND METHODS

This research method is quantitative. Quantitative research is a research method based on the philosophy of positivism, as a scientific or scientific method because it fulfills scientific principles in a concrete or empirical, objective, measurable, rational and systematic manner (Jaya, 2020). Quantitative methods aim to test predetermined hypotheses that will be used to research certain populations and samples, collect data using research instruments, and analyze quantitative or statistical data (Sugiyono, 2018). This research will test the influence of the relationship between variables, namely the independent variable consisting of environmental management accounting as the independent variable (X1). The product innovation variable (Z1) and the process innovation variable (Z2) are mediating variables, and economic development (Y) is the dependent variable. The data used in this research is primary data, which was obtained directly by respondents by means of observation, interviews and distributing questionnaires. The target data for primary data is data found directly by researchers in the field. Some of the respondents in the population in this study were accounting managers of manufacturing companies in East Java. Completed questionnaires can be collected directly to researchers for data tabulation and testing.

The scale used to measure is a scale with an interval of 1 - 5, from strongly disagree to strongly agree. In measuring respondents' answers, filling out the questionnaire was measured using a Likert scale. The statement is given a score of 1 for the answer strongly disagree, score 2 for the answer disagree, score 3 for the answer unsure, score 4 for the answer agree and score 5 for the answer strongly agree(Likert, 1932).

Table 1. Research variable indicators

No.	Research variable	Indicator	Measurement
1.	Environmental Management Accounting	1. Calculation and recording of employee training costs for environmental issues 2. Calculation and recording of environmental management system development costs 3. Calculation and recording of environmental audit costs 4. Calculation and recording of production process inspection costs 5. Calculation and recording of repair/conservation costs for damaged land	Likert Scale
2.	Economic development	(1) Continuous increase in inventory of goods; (2) advanced technology as the main factor that determines the degree of growth in providing a variety of goods to the population; (3) widespread and efficient use of technology	Likert Scale
3.	Product innovation	(1) Product quality (2) Product variants (3) Product style and design	Likert Scale
4.	Innovation process	(1) Increasing the quantity and quality of products through the production process, (2) Reducing costs, (3) Speed and efficiency of production processes, (4) Reliability of production processes and technology, (5) Strive to keep the production process ahead of competitors	Likert Scale

This research hypothesis testing was carried out using the Partial Least Square (PLS) approach. Partial Least Square (PLS) is an alternative method of Structural Equation Modeling which can be used to solve relationship problems between complex variables, but with a small data sample of between 30 and 100. Meanwhile, SEM has a minimum data sample size of 100 (Hair et al., 2014). The purpose of PLS is also to help researchers to confirm theories and to explain whether or not there is a relationship between latent variables. The PLS method is also able to describe latent variables (not directly measurable) and is measured using indicators. The author uses Partial Least Square because this research is a latent variable that can be measured based on the indicators so that the author can analyze it with clear and detailed calculations.

In statistical analysis of data using the SEM PLS method, it is carried out starting from the first stage, namely testing the validity and reliability of the data. Next, hypothesis testing which can be seen from the t-statistic value and probability value. To test the hypothesis, namely by using statistical values, for alpha 5% the t-statistic value used is 1.96. So, the criteria for accepting or rejecting a hypothesis is that Ha is accepted and H0 is rejected when the t-statistic is > 1.96. To reject or accept a hypothesis using probability, Ha is accepted if the p value <0.05.

3. RESULTS AND DISCUSSION

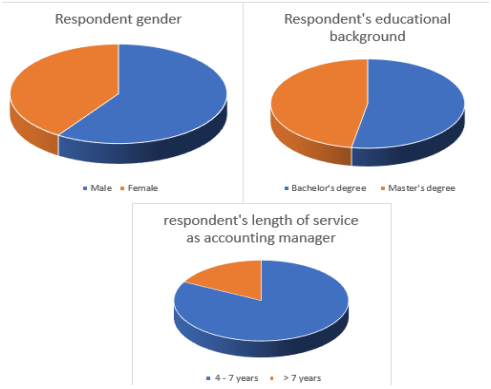
After distributing the questionnaire, sample data of 150 respondents was obtained. This data is based on the response rate and returns of questionnaires that have been distributed

previously, and the filling is complete without any gaps in the survey fields. The data that has been obtained from respondents is then identified as follows.

a) Respondent characteristics

This explanation of the characteristics of respondents is carried out to inform readers about the profile of the respondents used as samples in this test. This respondent's profile includes gender, educational background and length of time working as a company accounting manager.

Diagram 1. Respondent characteristics



The respondents in this research sample consisted of men and women. The number of male respondents dominates compared to women. Then the educational background of the respondents consists of bachelor's degree and master's degree graduates, where bachelor's degree graduates dominate compared to master's degree graduates. Meanwhile, the length of time respondents have worked as accounting managers in companies also varies, ranging from 4 years to more than 7 years, but sample data shows that the average respondent has served as an accounting manager, namely 4-7 years.

b) Validity and Reliability Test

The survey data that has been obtained is carried out first, namely the validity and reliability test to determine the accuracy of the data that has been tabulated. The test results are explained in table 2 below.

Table 2. Validity and reliability test results

Variable	Items	Correlation (r)		Coefficient	
		r	Status	Alpha	Status
Environmental Management Accounting	EMA01	0.425	Valid	0.815	Reliable
	EMA02	0.963	Valid		
	EMA03	0.963	Valid		
	EMA04	0.959	Valid		
	EMA05	0.951	Valid		
Economic development	ED01	0.582	Valid	0.795	Reliable
	ED02	0.925	Valid		
	ED03	0.925	Valid		
	ED04	0.425	Valid		
	ED05	0.925	Valid		
Product innovation	PRD01	0.568	Valid	0.779	Reliable
	PRD02	0.634	Valid		
	PRD03	0.788	Valid		
	PRD04	0.741	Valid		
	PRD05	0.793	Valid		
Innovation process	PRC01	0.915	Valid	0.785	Reliable
	PRC02	0.417	Valid		
	PRC03	0.915	Valid		
	PRC04	0.915	Valid		
	PRC05	0.474	Valid		

Based on table 2, it shows that all question items from the variables studied are in accordance with the provisions that have been determined, namely the calculated r value > r table, so that with 150 questionnaire data, using the degree of freedom equation (DF = N-2) or DF = 150-2 = 148, then the r table value of 148 is 0.161. This result means that all statement items are completely valid and can be used in research. Meanwhile, based on the results of the reliability test, it is known that the Cronbach's alpha value for all variables is greater than the standard reliability test, namely 0.70.High or low reliability is expressed by a value called the reliability coefficient, ranging between 0-1. The reliability coefficient is denoted r_x where x is the index of the case being searched for. Reliability testing uses Cronbach's Alpha formula, as follows.

$$r_x = \left(\frac{n}{n-1}\right)\left(1 - \frac{\sum \sigma_t^2}{\sigma_t^2}\right)$$

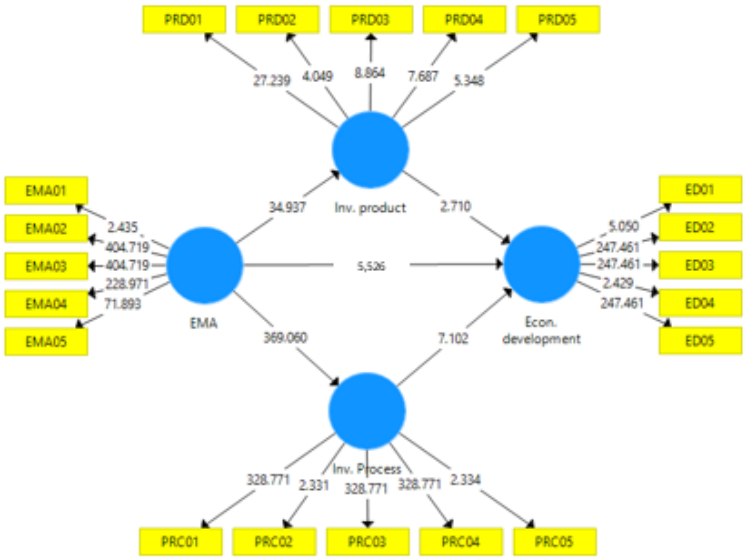
r_x =the reliability sought
n =number of question items
$\sum \sigma_t^2$ =the amount of variance in the scores for each item
σ_t^2 =total variance

The smaller the alpha value indicates the more items are unreliable. The standard used is alpha > 0.70 (sufficient reliability). Based on test data results shows that all statement items from all variables are valid and reliable and can be used in research.

c) SEM (Structural Equation Modeling) Test

Figure 2 shows the output results of the data test model that has been carried out with the help of PLS, and table 3 provides information about the statistical values of the hypothesis results that have been carried out, the display is as follows.

Figure 2. Hypothesis Test Results



Hypothesis testing is carried out by comparing the calculated t value with the t table value. If the calculated t value is greater than the t table, then there is a significant relationship between the variables and vice versa when the calculated t is smaller than the t table, then there is no significant relationship between the variables. The number of data tested is 150, so the t table value (α =5%) obtained is 1.975. The presentation is as follows.

Table 3. Test the research hypothesis

	Hypothesis				t count	Coef.path	Information
H1	Environmental management accounting (EMA)	→	Economic development		5,526*	0,000	Sig.
H2	Environmental management accounting (EMA)	→	Product Innovation →	Economic development	2,710*	0,000	Sig.
H3	Environmental management accounting (EMA)	→	Innovation Process →	Economic development	7,102*	0.001	Sig.

The test results shown in table 3 will then be presented and reviewed and discussed with several previous literature, the explanation is as follows.

Environmental management accounting (EMA) is provenhas a positive and significant influence on economic development, this finding is supported by the calculated t value > t table (5.526 > 1.975) and a path coefficient of 0.000. This coefficient shows that there is a significant positive relationship between Environmental management accounting (EMA) and Economic development. The more precise the implementation of Environmental management accounting (EMA) carried out by accounting managers in manufacturing companies, this will also increase the economic development of the area. These findings support previous literature such as(Agustia, 2020),This finding also indicates that the first hypothesis is accepted.

Product innovation is able to strongly mediate the relationship between Environmental management accounting (EMA) and Economic developmentt, this finding is supported by the calculated t value > t table (2.710 >1.975)and the path coefficient is 0.000. The results of these findings mean that the ability of the product innovation variable used in this research test as mediation is correct, besides that the product innovation variable shows that the product innovation activities carried out by the company have been recorded correctly based on Environmental Management Accounting (EMA) and are capable of contributed to the economic development process in East Java so far.

The latest test results prove that process innovation is also able to strengthen the relationship between the Environmental Management Accounting (EMA) variable and economic development. Innovation is indeed a word that is no longer foreign to our ears, which is a key word for the business world. In this new millennium era, where the sales market has begun to move towards the buyers' market, the role of innovation seems increasingly important and very determining in being able to win the competition (Farida et al., 2022). The findings of this research also prove that implementationSo far, environmental management accounting (EMA) carried out by the accounting managers of the respondent manufacturing companies has correctly recorded all innovation processes, so that the sustainability of economic development in East Java has also increased.These findings support previous literature such as (Héraud, 2021).

4. CONCLUSION

This research concludes that environmental management accounting has an influence on economic development. Apart from that, the role of product and process innovation as a mediator has been able to influence environmental management accounting variables on economic development. The use of environmental management accounting can help organizationsto recognize the environmental impact of their innovation and operational activities. Overall, the results of this study support the dimensions of management accountingenvironment (AML) can increase economic development even though companies

carry out product innovation and process innovation activities.This research provides a perspective on possible strategiescompanies to achieve more effective environmental management accountingand supports company goals related to product innovation andcompany process innovation.

This conclusion contributes not only to manufacturing companies but also to all companies in Indonesia to immediately implement environmental management accounting as a form of management accounting system and management control system in translating and implementing their business strategies, so as to gain an increasingly competitive innovation advantage in this era. globalization. This activity of implementing environmental management accounting is also a form of corporate sustainability practice towards its environment.

The limitation of this study, namely the small sample of research causes the amount of data bias caused, so that these findings cannot be generalized. In addition, there are still many questionnaires that have not been filled back, so researchers cannot find out further whether manufacturing companies in East Java have really paid attention to environmental management accounting and whether environmental management accounting has been implemented. For future research, it is expected to take a wider population, so that the findings can be generalized. It is also recognized that this research instrument may contain measurement error. The inclusion of items to provide a long-term dimension of environmental management accounting (e.g. invested capital) may be considered in future research. In addition, there are opportunities for future research to examine other factors of EMA use such as legal requirements, stakeholder pressure and organizational attitudes towards environmental issues.

AUTHORS' CONTRIBUTIONS

"Author 1" : Designed the study, performed the statistical analysis, wrote the protocol, andwrote the first draft of the manuscript.
"Author 2" : Managed the analyses ofthe study.
"Author 3" : Managed the literature searches

All authors read and approved the final manuscript.

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