



# Implementation of Environmental Management Accounting and Energy Efficiency for Green Economy Achievements in the Textile Industry in Indonesia

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## ABSTRACT

This paper aims to examine the conceptual framework that describes the relationship between environmental management accounting, energy efficiency and green economy outcomes. In this paper, the authors argue that environmental management accounting and energy efficiency can directly influence the achievement of a green economy. This paper examines survey responses of top management in an East Java textile company registered with the Indonesian Central Bureau of Statistics. The time horizon for data collection is cross-sectional. The hypothesis was tested using a multiple linear regression analysis approach, by interpreting the regression model through the significance coefficient value to see the partial effect. In general, the proposed framework obtains adequate fit statistical results. Furthermore, the results support the argument that there is a positive and significant effect of environmental management accounting and energy efficiency on achieving a company's green economy. The limitations of this study relate to the small sample size, because environmental results and energy use are still considered confidential by many companies in Indonesia. These results can be a specific reference for policy making in companies to continue to support the achievement of green economy goals in Indonesia. This study contributes to the accounting literature, particularly in the mechanism of environmental management accounting information through empirical evidence.

**Keywords:** Environmental Management Accounting, Energy Efficiency, Green Economy, Energy Saving

**JEL Classifications:** K32; Q47; Q56; P28

## 1. INTRODUCTION

Economic development activities in Indonesia are mostly based on natural resources, considering that Indonesia has relatively more natural resources compared to other countries. Call it oil, natural gas, coal, tin, gold, and other natural resources (Higgs and Hill, 2019). This is why aspects of environmental protection and preservation are often neglected, giving rise to various environmental problems, such as water and/or air pollution, soil quality damage, forest fires and damage, conversion of agricultural land and so on (O'Neill and Gibbs, 2016). Such conditions ultimately lead to a further decline in the productivity of natural resources and the environment, thus encouraging the

emergence of pockets of poverty in people whose lives depend on natural resources and the environment. Thus, this problem must be addressed with a green economy program as a supporter of sustainable development (Knight, 2017; Mia, 1993).

The Green Economy Program aims to create an Indonesian economy that also focuses on environmental protection (Borel-Saladin and Turok, 2013). Specifically, this program aims to transform Indonesia's economic system towards an economy that emits fewer greenhouse gases while maintaining high economic growth. Green growth is a resilient economic growth that does not put environmental issues aside, promotes low-carbon development and is socially inclusive (Borel-Saladin and Turok,

2013; Goodman and Salleh, 2013; Pop et al., 2011). Through green economic growth, it is hoped that the industrial sector of the economy can be integrated to realize the responsible use of natural resources, prevent and reduce pollution and create opportunities to increase social welfare by building a green economy (Brown et al., 2014; Higgs and Hill, 2019).

A green economy can be realized based on the understanding that conflicts between environmental management and energy conservation can be properly reconciled (Knight, 2017; Wapner, 2011). Green economy issues have received a lot of attention, especially from the government and accounting reviewers. For the government, a green economy includes improving the quality of the environment, increasing disaster resilience and climate change, energy conservation and low-carbon use. For accounting reviewers, the green economy is considered to be a motivation for certain accounting practice activities, for example environmental management accounting (Ehresman and Okereke, 2015; Pop et al., 2011).

Research on the relationship between environmental management accounting and the green economy has yielded inconsistent results. Burrit et al. (2002) stated that environmental accounting mechanisms have a positive effect on economic growth. However, research from Leonard et al. (2019) states that environmental accounting has no effect on economic improvement. These inconsistent results become a research opportunity by expanding the study to the industry that is suspected of having the highest waste in its production, namely the textile industry.

Studies on the green economy are also influenced by the company's commitment to energy conservation (Ehresman and Okereke, 2015). Energy conservation efforts are implemented at all stages of utilization, starting from the utilization of energy resources to the final utilization, by using efficient technology, and cultivating energy-saving lifestyles (Chedwal et al., 2015). Kim et al. (2018) stated that energy conservation has a positive relationship to green economic growth. While different results were obtained by Schornagel et al. (2012) that energy conservation did not have a positive effect on the company's economic growth. The success of the energy saving program will of course have a positive impact on the energy supply process (Saputra et al., 2021). The potential for energy savings in industry has a positive impact on companies and society (Aczel et al., 2018).

The above descriptions show that studies on green economy, environmental management accounting and energy conservation based on stakeholder theory have ambiguous results. This study suspects that green economy problems have not been fully answered, so there is an opportunity for further research. The relationship between environmental management accounting, energy conservation and green economy is based on legitimacy theory. Legitimacy will be obtained from company stakeholders when the company is able to demonstrate that its commitment to the environment and energy saving is proven, so that it is deemed capable of achieving a green economy that is a company that is fair, makes employees and the local community prosperous and cares for the environment (Ahmed and Shafiq, 2022; Byun et al., 2021; Tewdwr-Jones, 1995).

Many companies have invested in the green economy sector (Bailey and Caprotti, 2014). Some investors have committed to only provide financing to green companies and not a few investment managers are looking at sectors that have sustainability programs. They use sustainability as the main criterion in their profile (Brown et al., 2014; Knight, 2017). Investment managers are currently increasingly competing to discuss green investment alternatives because their value continues to increase. This condition is in line with the government's efforts to reduce carbon emissions through carbon tax policies (Poll, 2015). One of the schemes created is cap and tax (Poterba, 1993).

In the industrial context in Indonesia, textile companies play an important role in the use of environmental-based management mechanisms, namely environmental management accounting and commitment to energy conservation in achieving the success of the company's green economy. The research was conducted in East Java which is one of the regions that has the largest number of textile industries in Indonesia. Data released by the Central Statistics Agency (2021) states that East Java has a total of 300 industries.

The results of this study provide empirical evidence on various factors that influence green economy outcomes in the textile industry in developing countries, as well as build a theoretical model of the green economy in the textile industry based on the pillars of sustainability. The results of this study also provide insight to company managers investing in the green economy sector. Several banks have committed to only providing financing to green companies and not a few investment managers are looking at sectors that have green and sustainability programs.

## 2. LITERATURE REVIEW AND HYPOTHESIS

Legitimacy theory provides an understanding regarding the implementation of strategy and planning as a way for companies to gain legitimacy (Eugénio et al., 2013; Gallardo-Vázquez et al., 2019). Legitimacy theory views strategies and plans that are formulated as environmental management accounting and energy conservation programs as ways that are in line with social norms and environmental values to maintain reputation among various stakeholders who are affected by company activities (Archel et al., 2009). Social and environmental-based strategies and planning are effective actions in gaining legitimacy from society (Byun et al., 2021). According to legitimacy theory, companies carry out strategic and planning initiatives to gain acceptance (approval) that these actions are in accordance with the rules, norms and stakeholder value systems in general (Suchman, 1995). By increasing legitimacy, companies gain acceptance from stakeholders, such as bringing about company survival, reducing company risk, and ultimately achieving company goals that support achievements in the company's green economy (Bresciani et al., 2016; Lanis and Richardson, 2013)

Environmental management accounting as a technique for generating, analyzing, and using financial and non-financial

information, to improve the environmental and economic performance of a company, and contribute to the company's green economy achievements. Environmental management accounting aims to provide physical information on material and energy use, as well as monetary information on costs, revenues, and savings related to the environment (Amir et al., 2020). Environmental management accounting consists of monetary and physical aspects (Burritt et al., 2002). Information generated by environmental management accounting can be used to assist management in facing challenges, adding company value in a competitive market (Burritt et al., 2002), assisting in making effective decisions (Leonard et al., 2019; Xiaomei, 2004), setting appropriate performance targets and performance evaluation standards, as well as providing feedback on achievements (Agustia et al., 2019).

This research will measure the aspects of green economy achievement, socio-economic sustainability, and environmental sustainability, because the textile industry contributes the largest contribution to environmental damage, after manufacturing, which is caused by the consumption of large resources, especially energy and water. Environmental management accounting can be used by managers to control social and environmental costs that are in the budget (Sari et al., 2020). So it can be said that environmental management accounting can increase the company's green economic growth achievements. Thus, the first hypothesis of this study is as follows.

H<sub>1</sub>: Environmental management accounting has a positive effect on the company's green economy achievements

Saving energy means not using electrical energy for something that is not useful. Energy savings can be achieved by using energy efficiently where the same benefits are obtained by using less energy, or by reducing consumption and activities that use energy (Cummings, 2016; Sulser et al., 2010). Energy savings can lead to reduced costs, as well as increased environmental values, state security, personal security, and convenience (Bößner et al., 2019). Organizations as well as individuals can save costs by saving energy, while commercial and industrial users can increase efficiency and profits by saving energy.

Being green and sustainable not only benefits the environment, but also helps make businesses more successful and profitable (Bailey and Caprotti, 2014; Westoby and Lyons, 2016). A green lifestyle has also developed in recent decades and become a popular concept as more and more people and entities recognize the urgent need, as well as the various benefits of sustainable practices (Ehresman and Okereke, 2015). The main reason for the emergence of the concepts of green economy and green growth is the movement towards a more integrated and comprehensive approach to incorporate social and environmental factors in economic processes in order to achieve sustainable development (Brown et al., 2014; Wapner, 2011; Westoby and Lyons, 2016).

Previous studies have shown that companies with a commitment to energy conservation tend to use environmental strategies more intensively because they have to respond quickly to environmental changes (Lin et al., 2020; Zameer et al., 2020). Research Omune et al. (2021) in the manufacturing industry stated that energy

conservation had a significant positive effect on the achievement of the company's green economic growth. They found that the energy conservation commitment attached to products and processes is empirically related to the company's green economic growth. Other research by Teng et al. (2012) on the manufacturing industry shows that energy saving, which is part of a company's green strategy, has a significant effect on the company's economic growth achievements. Therefore, it can be said that textile companies that implement environmental strategies (energy conservation) will achieve green economic growth. Thus the second hypothesis of this study is as follows.

H<sub>2</sub>: Energy conservation has a positive effect on the company's green economy achievements

### 3. METHODS

This research is explanatory research which intends to explain the position of the variables studied and the influence between one variable and another. The research was carried out in a natural setting in each of the textile companies in East Java as the research location, where the involvement of the researcher was at a minimal level, namely when explaining the research procedure to the respondents. The unit of analysis of the research is the organization, which is represented by top managers. The time horizon for data collection was cross-sectional, i.e. once at the time of filling out the questionnaire.

The population for this study are textile companies in East Java - Indonesia which are registered with the Central Bureau of Statistics as of December 2021, in this study represented by top management who understand management as a whole and the management control system implemented, taking into account that East Java Province is one of the regions with the largest textile industry in Indonesia. Based on this explanation, the total population in this study is 300 companies.

This study considers several things, namely the large diversity of the population, the required level of confidence, the acceptable level of tolerance for error, the research objectives, and the limitations of the researchers. Therefore, this study uses the Krejcie-Morgan table, because it does not require an estimate of the population proportion value. The Krejcie-Morgan table is used to obtain the number of samples in a survey with the aim of estimating the proportion and it is not known what proportion of the population is used as the basis for calculating variance (Krejcie and Morgan, 1970). So in this study taking the amount the sample refers based on the Krejcie table, namely by number population is 300, the sample used is 169. So in this study with a total population of 300 textile companies, 169 textile companies in East Java were used as a sample.

Primary data collection was carried out using a survey method, namely a self-administered survey. To test the hypothesis carried out in this study used multiple regression analysis models. Testing the hypothesis using a confidence level of 0.05 (5%) and carried out with the help of the SPSS computer. The formula used by Krejcie and Morgan is like described in formula following this:

$$n = \frac{x^2 \cdot N \cdot P(1-P)}{(N-1) \cdot d^2 + x^2 \cdot P(1-P)}$$

Based on on formula in on and with use certain assumptions, Krejcie and Morgan can make a table with calculation as following:

$$n = \frac{x^2 \cdot N \cdot P(1-P)}{(N-1) \cdot d^2 + x^2 \cdot P(1-P)}$$

$$n = \frac{3,841 \times N \times (0,5 \times 0,5)}{(N-1) \cdot 0,05^2 + 3,841(0,5 \times 0,5)}$$

$$n = \frac{3,841 \times N (0,25)}{(N-1) \cdot 0,0025 + 3,841(0,25)}$$

Descriptive statistical analysis provides an overview or description of a data seen from the average value, standard deviation, maximum, and minimum. The results of the descriptive statistical test are presented below:

Table 1 shows the minimum value of the green economy variable is 24.00 and the maximum value is 40.00 with an average of 35.2097. The environmental management accounting variable has a minimum value of 36.00 and a maximum value of 60.00 with an average of 49.2258, so most of the respondents' answers agree or have a value of 4. The energy conservation variable has

**Table 1: Descriptive analysis results**

	N	Min.	Max.	Average	SD
Y	62	24.00	40.00	35.2097	7.54687
X1	62	36.00	60.00	49.2258	7.61452
X2	62	15.00	30.00	25,0000	7.22019

Y: Green Economy, X1: Environmental Management Accounting, X2: Energy Conservation

**Table 2: Environmental Management Accounting Model Indicators and Measurements**

Indicators/Items	Code	Pearson correlation	Cronbach's alpha
Identify environmental costs.	X1.1	0.610	0.948
Environmental cost classification	X1.2	0.671	
Allocation of production process environmental costs	X1.3	0.710	
Creation and use of environmental cost accounts	X1.4	0.801	
Contingent liability estimation	X1.5	0.712	
Product environmental cost allocation	X1.6	0.731	
environmental recognition or improvement	X1.7	0.841	
Development of key performance indicators based on environment	X1.8	0.789	
Product life cycle assessment	X1.9	0.758	
Calculation and recording of the amount of inventory	X1.10	0.798	
Record the amount of waste	X1.11	0.790	
Calculation and recording of recyclable materials and energy	X1.12	0.736	

Source: Burritt et al. (2022)

a minimum value of 15.00 and a maximum value of 30.00 with an average of 25.0000. Based on the 5 questions regarding the energy conservation variable, it was stated that most of the respondents' answers were 4, so it can be stated that the energy conservation variable is included in the high category.

The results of testing the validity of the research instrument can be seen in the value of the Pearson correlation by comparing the r table at DF=N-2 and a probability of 0.05. The DF value in this test is 62-2 = 60, the r table for DF 60 is 0.2108, so if the Pearson correlation value is above that value, then the question item is declared valid. Based on the results above, all question items are declared valid and can be used in a wider research sample. Based on the coefficient value of Cronbach's alpha, this research instrument has a value of ≥0.6, so it is declared reliable or consistent, so that the research instrument can be used for research and is consistent (Tables 2-4).

#### 4. RESULT AND DISCUSSION

There are two hypotheses in this study, the first is called hypothesis one which aims to find out whether environmental management accounting has a significant effect on the green economy and the second is called hypothesis two to find out whether energy conservation has a significant effect on the green economy.

**Table 3: Indicators and measurement of the energy conservation model**

Indicators/Items	Code	Pearson correlation	Cronbach's alpha
Use of energy saving technology	X2.1	0.790	0.975
Application of energy saving culture	X2.2	0.845	
Application of energy conversion	X2.3	0.889	
Extend product life	X2.4	0.896	
Reduce pollution	X2.5	0.895	
Enlarge energy recycling	X2.6	0.896	

Source: Chedwal et al. (2015)

**Table 4: Green economy model indicators and measurements**

Indicators/Items	Code	Pearson correlation	Cronbach's alpha
Sustainability performance	Y1.1	0.702	0.927
Employee welfare	Y1.2	0.718	
Socioeconomic justice	Y1.3	0.520	
Invest in the environment	Y1.4	0.585	
Participation in local communities	Y1.5	0.694	
Environmental accountability	Y1.6	0.604	
Sustainable production	Y1.7	0.660	
Integrated with government regulations	Y1.8	0.699	

Source: O'Neill & Gibbs (2016)



**Table 5: Hypothesis test results**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	SE	Beta			Tolerance	VIF
1	(Constant)	90.101	3.794		20.267	0.000		
	X1	0.326	0.421	-1.037	-5.351	0.000	0.084	1.839
	X2	0.785	0.235	-0.638	-3.570	0.001	0.093	1.797

Source: Results of data processing (2022)

From the regression analysis above, it can be seen that environmental management accounting variables and energy conservation have a significant positive effect on green economy outcomes with a significance value of 0.000. Based on the table 5, the table above, the regression equation between variables X1, X2 and Y is as follows:

$$Y = 90,101 + 0,326 X1 + 0,785 X2$$

Decision making is done by looking at the significance value in the Coefficients table. Usually the basis for testing the regression results is carried out with a confidence level of 95% or with a significance level of 5% ( $\alpha = 0.05$ ), meaning that the hypothesis can be accepted if the significance value is below 0.05. The results of the first hypothesis test (H1) state that environmental management accounting has a significant positive effect on the achievement of the textile company's green economy program in East Java as indicated by the sig. 0.000. Also, the second hypothesis (H2) can be answered by looking at the significance value of variable X2 which is 0.000, meaning that energy conservation has a significant positive influence on the company's green economy achievements. So that the first hypothesis (H1) and second (H2) can be accepted with the statement that environmental management accounting and energy conservation have a significant positive direct effect on the green economy achievement of textile companies in East Java, Indonesia.

The results of this study provide support for Westoby and Lyons (2016) who state that the managerial concept of environment-based companies has a positive relationship with increasing company economic growth. Higgs and Hill's research (2019) also states that environmental accounting has had an effect on the economic performance of companies with the goal of going green. This study also found the value that the green economy is an economic activity that in addition to increasing people's welfare as the ultimate goal of the economy is also expected to have an impact on achieving justice for both society and the environment as well as the natural resources themselves (Ehresman and Okereke, 2015; Wapner, 2011).

As stated by Lokahita et al. (2019) that there is no single rule limiting the use of these shared resources, then there is over-exploitation of these resources. Each beneficiary, both producers and consumers may use it to the fullest extent possible with the assumption that other people will make use of these resources if they are not utilized to the fullest extent possible (Gürlek and Tuna, 2018). So it is necessary to have restrictions and management of resources on the initiative of the company to preserve the environment and conserve energy (Saputra et al., 2021).

Huseynli (2022) also states that from an economic point of view, misuse of the use of shared resources arises because there is no self-generating balancing mechanism that can limit exploitation. When excessive exploitation has occurred, it can certainly cause various problems of pollution and environmental damage at the global and local levels. So companies need to proactively protect the environment and the wealth of energy resources that we have (Six et al., 2022). Environmental management accounting as a tool for controlling and limiting energy exploitation becomes effective if everyone's awareness of the environment is well developed (Chaudhry et al., 2020).

The results of the study found that energy conservation is important in company operations. This is evidenced by research findings which state that energy conservation has a significant positive effect on the green economy of textile companies in East Java, Indonesia. The green economy is expected to be a way out to make economic actors as well as beneficiaries or consumers more motivated to carry out environmentally friendly activities (Leiwakabessy and Payapo, 2022). So, a green economy in turn becomes a bridge between economic development growth, social justice as well as being environmentally friendly and saving natural resources (O'Neill and Gibbs, 2016).

Energy saving is an important element of an energy policy. Energy saving reduces energy consumption and energy demand per capita, so that it can cover the increasing energy demand due to population growth. This reduces rising energy costs, and can reduce the need for energy generation or energy imports. Reduced energy demand can provide flexibility in choosing energy production methods (Six et al., 2022). In addition, by reducing emissions, saving energy is an important part of preventing or mitigating climate change (Kurznack et al., 2021). Energy saving also makes it easier to replace non-renewable sources with renewable sources. Energy saving is often the most economical way to deal with energy shortages, and is a way that is more environmentally friendly than increasing energy production (Bennett et al., 2011; Schornagel et al., 2012).

In the context of textile companies, energy conservation is very important to realize the company's green economic performance. The green economy concept promoted by the company is sustainability performance (Aslinda et al., 2019). The achievement of sustainability performance (economic, social and environmental) is the highest achievement for a company to gain legitimacy (Tewdwr-Jones, 1995). Based on legitimacy theory, energy conservation is the best action to take at this time in order to achieve maximum green economic performance. Based on the direction of legitimacy theory, companies need to demonstrate the achievement of green economic performance in order to gain

legitimacy from stakeholders for their business continuity (Guthrie and Parker, 1989).

The results of this study support previous research, namely Hardy et al. (2020) which found that saving water and electricity energy can create a balanced and fair green economy for communities, companies and employees. In line with the results of this study, Chedwal et al. (2015) stated that energy-saving behavior from companies supports government programs to create a culture of sustainable energy conservation. Kim et al. (2018) also stated that energy conservation has a significant effect on achieving overall economic performance including the company's green economy.

Based on the results of this study, it was also found that one of the massive energy conservation efforts carried out by textile companies in East Java is a kind of earth hour activity, where humans for one hour from eight thirty at night to nine thirty at night turn off all electric power except in strategic public places such as hospitals (Saputra et al., 2022). The Government of the Republic of Indonesia continues to strive to spur the development of green industries to prioritize efficiency and effectiveness in the use of resources in a sustainable manner. This is so that industrial development is in harmony with the preservation of environmental functions and can provide benefits to society (Leiwakabessy and Payapo, 2022). Through efforts to implement the green industry, it was also noted that energy savings of Rp. 3.2 trillion and water savings of Rp. 169 billion. This achievement strengthens the industry's commitment to ensure the long-term sustainability of the company's business.

The Green Industry Award is an appreciation from the Government of Indonesia for industrial companies that have created a green industry and are committed to implementing these principles consistently and sustainably (Bresciani et al., 2016; Higgs and Hill, 2019). This year, Green Industry Awards were given to 137 companies, and Green Industry Certificates to seven industrial companies that have supported the concept of green economy, green technology and green product by implementing efficiency measures in terms of effectiveness in their production processes (Papadas et al., 2018). The research results support the Indonesian government's movement in implementing a green economy in companies and conserving energy for sustainable development.

## 5. CONCLUSION

Based on the results of the study, it was found that an environmental-based management control system that has so far not been considered important in general management, namely environmental management accounting, has a significant positive effect on the company's green economy achievements. Similar results were also found regarding the relationship between energy conservation and a green economy in textile companies in East Java, Indonesia. The success of the energy saving program will of course have a positive impact on the energy supply process. The potential for energy savings in industry, for example, ranges from 10% to 35% (textile industry). These savings depend on: the main process: burning, melting, heating/steaming; utilities: direct heat, mechanical, steam heat; kitchen-burner, electric-diesel,

boiler-burner; conservation techniques: waste heat recovery, heat insulation improvement, co-generation (Chedwal et al., 2015; Di Salvo et al., 2017). In general, saving through technical means is more than adequate. If the conservation program is carried out seriously, nationally, the amount of energy supply can be reduced significantly, energy reserves can be used for a longer time (Carpejani et al., 2020).

Currently the Government of Indonesia is accelerating a green industry-based economy through natural resource efficiency and implementing a circular economy, utilizing new, renewable energy such as biofuels, biomass and refused derived fuel or fuels produced from various types of waste such as solid waste. urban, industrial or commercial waste (Aczel et al., 2018; Perlaviciute and Squintani, 2020; Sulser et al., 2010). The development of the green industry itself has been regulated in Law No. 3 of 2014 concerning Industry. The law explains that a green industry is an industry that in its production process prioritizes efficiency and effectiveness in the use of resources in a sustainable manner so as to be able to align industrial development with the preservation of environmental functions and to provide benefits to society.

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