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# Quality Management, Green Innovation and Firm Value: Evidence from Indonesia

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## ABSTRACT

The purpose of this study is to examine the effect of quality management on green innovation, as measured by green process innovation and green product innovation. The study also aims to examine the effect of green innovation as a mediating variable between quality management and firm value. Data were collected from 352 annual reports of manufacturing companies listed on the Indonesia Stock Exchange for the financial year 2014-2017. The study employed simple regression analysis, multiple regression and Sobel Test for hypotheses testing. The results showed that quality management has a positive effect on green process innovation, but not with green product innovation. Quality management decreases firm value, but, when the company conducts a green process innovation together with quality management, firm value increases. Being an ISO 9001 certified company does not guarantee implementing green product innovation because it requires a large investment. Companies can enhance firm value by simultaneously and consistently employing quality management, green process innovation and green product innovation.

**Keywords:** Quality Management, Green Process Innovation, Green Product Innovation, Firm Value

**JEL Classifications:** Q56, G32

## 1. INTRODUCTION

Recent global warming is caused by the use of carbon dioxide (CO<sub>2</sub>), greenhouse gas emissions and excessive pollution; (Depoers et al., 2016; Nikzad and Sedigh, 2017; van der Ploeg and Withageny, 2015). Climate change caused by these substances causes an increase in demand for companies to develop technology and sustainable innovation in an effort to reduce global warming (De Vargas Mores et al., 2018; Leenders and Chandra, 2013; Vinci et al., 2019). Companies are increasingly required to pay more attention to green innovation because it is more environmentally friendly and as a pollution prevention solution (Ang et al., 2017; De Castro et al., 2013).

Green innovation is seen as a reflection of the theory of legitimacy. Legitimacy requires the actions taken by companies

to be consistent with the values and norms in society (Stillman, 1974). Pressure from various parties has urged companies to pay attention to and be responsible for the environmental conditions in which the company operates and leads them to take strategic actions, such as investment in green innovation. Companies realize that consumers are more interested in using and buying products that are environmentally friendly, even though the price is more expensive (Henriques and Sadorsky, 1996).

Green innovation is one of the tools to determine long-term sustainability (Iqbal, 2019), which is useful for business facilities to increase sources of productivity (Chen et al., 2006; Papagiannakis et al., 2019), improve financial performance, profitability and competitive advantage (Abu Seman et al., 2019; Aguilera-Caracuel and Ortiz-de-Mandojana, 2013; Dong et al., 2014; El-Kassar and Singh, 2019; King and Lenox, 2002; Lin et

al., 2014; Xie et al., 2019; Zhang et al., 2019); reduce internal and external pressure both from government and society (El-Kassar and Singh, 2019; Leenders and Chandra, 2013; Li et al., 2018; Sangwan and Choudhary, 2018), and relate to compliance with standards issued by government or authorized institutions (Bossle et al., 2016). Green innovation consists of hardware and software innovations related to processes and green product innovations, including innovations in technology such as energy savings, pollution prevention, waste recycling, green product innovation designs, or environmental management (Chen et al., 2006; King and Lenox, 2002; Lin et al., 2014).

Previous studies have linked green innovation to quality management (QM). According to Li et al., (2018), quality management is negatively related to green innovation because quality management focuses more on the development of existing production and management systems rather than green innovation aimed at the company's sustainable development. In contrast, Hamdoun et al., (2018) and Iqbal (2019) explained that quality management is positively related to innovation. Quality management practices aim at creating an environment that motivates employees to think innovatively and risk takers so that they affect innovation. According to Escrig-Tena et al., (2018), quality management, both hard and soft, influences innovation. Hard QM is directly related to product and process innovation while soft QM is more concerned with infrastructure so that employees can be proactive and participate in the innovation process by providing new ideas. Song and Su (2015) expressed a different view, which stated that two opposite directions will show when quality management practices are divided into core QM practices and infrastructure. Core QM practice was found to negatively influence the process of new technology innovation, because it emphasizes more on control and stability and the existence of confidence, which is the method currently used, is the best innovation solution, which impedes the process of adoption of new technology. Meanwhile, infrastructure was found to positively affect product innovation since good infrastructure accelerates product innovation. However, Camisón and Puig-Denia (2016) does not show a relationship between the practice of QM implementation with the performance of the innovation process because innovation is not required or applied for competitive advantage.

In addition to influencing innovation, quality management is seen as the key to determining firm value in the future Llach et al., (2016) as a measure of good management practices (Heckman, 2012). Companies that develop quality management can improve competitiveness by applying environmental management practices such as energy and water saving so that they can support the process of continuous improvement, which ultimately affects firm performance (Pereira-Moliner et al., 2012). Pipatprapa et al. (2017) differently explained that quality management does not directly affect innovation, but innovation mediates the relationship between quality management and green performance, and quality management directly affects green performance. The industry can achieve environmentally friendly performance by developing quality management and developing innovation.

This study aims to examine the effect of quality management on green innovation, namely green product innovation and green process innovation and their effect on firm value. We argue that quality management, as measured by international standards, such as ISO 9001, aims at cost efficiency and investing in green innovation is one of the ways to manage this. Firm value is expected to enhance when the company implements quality management accompanied by concrete actions such as the development of green innovation. This research is expected to contribute to the literature relating to green innovation and the limited research that links quality management to green innovation (Li et al., 2018) and company value by classifying green innovation into green product innovation and green process innovation as mediating variables.

The difference between this research and previous studies is in connecting quality management and green innovation with firm value. Firm value is important as it represents the external factor, namely investors. Meanwhile, previous research mostly emphasizes on internal factors such as Return on Assets (ROA) or Return on Equity (ROE). Hypotheses were tested in three stages. Firstly, by analyzing the direct effect between quality management and firm value followed by that between quality management and green process innovation and green product innovation. Lastly, by analyzing the mediation variables of green process innovation and green product innovation on the relationship between quality management and firm value. The study focuses on manufacturing companies on the Indonesia Stock Exchange which were selected due to the high level of innovation associated with diverse products and processes (Chang, 2011; Sanni, 2018). The manufacturing industry implements a better quality management system that significantly influences performance (Lee et al., 2003). In addition, the manufacturing sector is a means of promotion and dissemination of technological change because it is a driver of sustainable economic growth and is environmentally friendly (UNIDO, 2014).

## 2. LITERATURE REVIEW

Quality management is a practice that significantly increases performance, productivity and cost reduction (Iqbal, 2019), driving the development of sustainability and sustainability (Siva et al., 2016). Quality management is a factor that influences a company's innovation strategy (Cuerva et al., 2014; Leenders and Chandra, 2013). Process management, as part of QM practice, is positively related to all types of innovation and plays an important role in supporting process and product innovation (Kim et al., 2012). Quality management is measured using international standards ISO 9000/9001, can be used by multiple industries and consists of eight quality management principles: customer focus, leadership, people involvement, process approach, system approach to management, continuous improvement, factual approach to management, and mutually beneficial supplier relationships (Delmas and Montiel, 2008). Management that has implemented ISO 9000/9001 and has environmental awareness considers the need to adopt green innovation (Cuerva et al., 2014; Manders et al., 2016). Quality management directly affects the speed of the company in introducing new products and product innovations (Zeng et al., 2017). Based on this explanation, the research hypotheses proposed are:

H<sub>1a</sub>: Quality management positively affects green process innovation

H<sub>1b</sub>: Quality management positively affects green product innovation

Quality management associated with performance has recently become a very interesting issue for practitioners, academics and researchers (Guzmán et al., 2019). Quality management is an integrated management philosophy and aims to improve sustainable performance, helping companies to achieve operational activities and financial performance (Ali, 2014; Augustyn et al., 2019; Kumar et al., 2018; Nair, 2006; Pereira-Moliner et al., 2012) and serves as a very important performance indicator in industry (Guzmán et al., 2019). ISO 9000 is a measure of quality management that has been implemented by more than one million organizations in 187 countries (Manders et al., 2016) and is an international standard that aims to prove that the company's quality management system has been implemented correctly (Martínez-Costa and Martínez-Lorente, 2003). Companies that have implemented ISO 9000 directly showed enhancement in operational performance and it has affected market performance and business performance both in the private sector (Jang and Lin, 2008; Siougle et al., 2019) and the public sector (To et al., 2011). ISO 9001-certified companies experienced an increase in sales growth of around 9% compared to companies that were not certified (Levine and Toffel, 2010). Based on this explanation, the research hypothesis proposed is:

H<sub>2</sub>: Quality management positively affects firm value

Green innovation refers to research (Chang, 2011; Chen et al., 2006) which classifies green innovation into green product innovation and green process innovation. Green product innovation is related to product development and design, while green process innovation is related to the company's activity processes, effectively reducing raw materials and energy sources. Green product innovation is a concern for policy makers, companies and the public, causing research on green innovation products to increase (Dangelico, 2016; Melander, 2017). In companies that understand market demand, decision-makers will develop environmentally friendly products with the aim of improving performance (Chen et al., 2006; El-Kassar and Singh, 2019; Huang and Li, 2017; Küçükoğlu and Pinar, 2015; Leenders and Chandra, 2013; Lin et al., 2014). Green product innovation and green process innovation help companies reduce waste, reduce pollution and stimulate the recovery of resources with new processes and in redesigning products so as to minimize adverse environmental impacts, ultimately increasing company performance in the future (Dangelico & Pontrandolfo, 2013; Huang and Li, 2017). Zhang et al. (2019) prove Porter's hypotheses that green innovation enhances company performance in the following year (sales and net income). According to Agustia, Sawarjuwono, and Dianawati (2019), companies that develop innovations by using processes and producing environmentally friendly products, reducing the use of CO<sub>2</sub>, increasing biodiversity and reducing pollution, are more a concern of investors because they believe that the company will continue to grow in the future. Based on this explanation, the research hypotheses proposed are:

H<sub>3a</sub>: Green process innovation positively affects firm value

H<sub>3b</sub>: Green product innovation positively affects firm value

Quality management is directly related to company performance (Ali, 2014; Nair, 2006; Tari et al., 2017). Having an ISO 9000 certificate proves that the company implements an international standard quality management system, showing positive performance (Jang and Lin, 2008; To et al., 2011; Wang, 2014). Quality management (QM) and green innovation are two business practices that can affect company performance (Molina-Azorin et al., 2009), both directly and indirectly, with Companies that implement QM improve process efficiency, which leads to increased revenue. Environmental design is one of the environmental management practices that helps companies create value for shareholders and reduce environmental impact (Lenox et al., 2000). Quality management and innovation generally aim to implement practices and, when companies develop quality management practices, resources are created that can help to implement them, namely by innovation. Implementing innovation practices will be easier when companies have developed quality management practices. Innovation affects company performance directly and innovation as a mechanism for practicing quality management, which ultimately improves company performance (Pereira-Moliner et al., 2012; Pipatprapa et al., 2017). Innovation plays an important role in mediating the relationship between quality management and performance and companies that are committed to protecting the environment will encourage managers to find ways to implement quality management and innovation together and implement them in all aspects of the company. Based on this explanation, the research hypotheses that:

H<sub>4a</sub>: Green process innovation mediates the relationship between quality management and firm value

H<sub>4b</sub>: Green product innovation mediates the relationship between quality management and firm value

### 3. METHODOLOGY

#### 3.1. Data Collection Procedure

Data were collected from 352 annual reports of manufacturing companies listed on the Indonesia Stock Exchange for the financial year 2014-2017. The study selected manufacturing companies because manufacturing requires green innovation to reduce environmental impacts due to the processing of raw materials into finished products (Soewarno et al., 2019).

#### 3.2. Variables and Measurements

The research variables consist of firm value, quality management, green process innovation, green product innovation and three control variables, namely, age, size and leverage. The measurement of each variable is explained in Table 1.

#### 3.3. The Empirical Model

Research model for each hypothesis testing uses the following equation:



**Table 1: Variables and measurements**

| Variables                           | Measurements   | Data Sources  |
|-------------------------------------|--|---|
| Firm Value (FV)                     | Measurement using Tobin's Q (Chung and Pruitt, 1994):<br><br>$\text{Approximate } q = \frac{(MVE + PS + Debt)}{TA}$ MVE = Market Value of Equity; PS = Liquidation value of preferred shares; Debt = Total Debt;<br>TA = Book value of total assets  | Firm's Annual Report                                  |
| Quality Management (QM)             | Measurement using ISO 9001; dummy variable, 1: if the company passes ISO 9001 certification, and 0: for others. (Li et al., 2018).   | Firm's Annual Report                                  |
| Green Process Innovation (GPI)      | Measurement using ISO 14001; dummy variable, 1: if the company passes ISO 14001 certification; 0 for others (Li et al., 2018; Lin et al., 2014)  | Firm's Annual Report                                  |
| Green Product Innovation (GProdInn) | Measurements using content analysis based on research (Chang, 2011; Xie et al., 2019); if in the sustainability report it is stated that in carrying out product development or design, the company (1) chooses the product ingredients that produce the least amount of pollution and energy; (2) using the least amount of product ingredients; and (3) products are easily recycled, reused, and described. | Firm's Annual Report;<br>Firm's Sustainability Report |
| Firm Age (FA)                       | $FA = \text{Research Period} - \text{Registered on the IDX}$<br>(Amores-Salvadó et al., 2014)  | Firm's Annual Report                                  |
| Company Size (Size)                 | $\text{Size} = \text{Log Total Asset}$   | Firm's Annual Report                                  |
| Leverage (Lev)                      | $\text{Lev} = \frac{\text{Total Debt}}{\text{Total Asset}}$  | Firm's Annual Report                                  |

$$GPI_{i,t} = \alpha_0 + \beta_1 QM_{i,t} + e \quad (1)$$

$$GProdInn_{i,t} = \alpha_0 + \beta_1 QM_{i,t} + e \quad (2)$$

$$FV_{i,t} = \alpha_0 + \beta_1 QM_{i,t} + e \quad (3)$$

$$FV_{it} = \alpha_0 + \beta_1 QM_{i,t} + \beta_2 GPI_{i,t} + \alpha_0 + \beta_3 GProdInn_{i,t} + \beta_4 FA_{i,t} + \beta_5 Size_{i,t} + \beta_6 Lev_{i,t} + e \quad (4)$$

QM = quality management, GPI = Green Process Innovation, GProdInn = Green Product Innovation, FA = firm age, Size = firm size and Lev = Leverage. Testing green process innovation and green product innovation as mediating variables uses the Sobel Test.

## 4. RESULT AND DISCUSSIONS

### 4.1. Result of Descriptive Statistics

Table 2 explains the main research variables, namely, quality management, green process innovation and green product innovation.

According to Table 2, 85.5% of companies have received an ISO 9001 certificate as proof of the implementation of quality management. The application of high quality management indicates that 85% of companies have implemented cost efficiencies. Furthermore, 61.4% companies have implemented green process innovation, 29.5% companies have fully produced environmentally friendly products while there are 37.2% that have not yet produced environmentally friendly products. This condition shows that 62.8% of the companies have awareness of protecting the environment by trying to produce environmentally friendly products.

**Table 2: Descriptive statistics**

| Variable<br>Dummy | QM  |      | GPI |      | GProdInn |      |
|-------------------|-----|------|-----|------|----------|------|
|                   | n   | %    | n   | %    | n        | %    |
| 0                 | 51  | 14.5 | 136 | 38.6 | 131      | 37.2 |
| 1                 | 301 | 85.5 | 216 | 61.4 | 45       | 12.8 |
| 2                 |     |      |     |      | 72       | 20.5 |
| 3                 |     |      |     |      | 104      | 29.5 |
| Total             | 352 |      | 352 |      | 352      |      |

QM is measured using ISO 9001; GPI is measured using ISO 14001; (QM and GPI dummy variable; 1 passes ISO, 0 others). GProdInn is measured using content analysis (0=no information; 1=1 condition is fulfilled, 2=2 requirements fulfilled and 3 = all requirements fulfilled based on (Chang, 2011; Xie et al., 2019))

### 4.2. Correlation Analysis

Table 3 explains the Pearson Correlation of each variable and shows that quality of management, green process innovation, and firm size do not correlate with firm value, while green product innovation and firm age have a significant positive correlation with firm value at 5% level. Pearson Correlation is also used to detect multi-collinearity between independent variables. Pearson Correlation > 0.80 indicates a very high correlation so that multi-collinearity occurs (Gujarati and Porter, 2009). Table 3 shows the Pearson Correlation of each independent variable is below 0.80, so that there is no multi-collinearity of each independent variable.

### 4.3. Regression Test Results And Discussion

According to Table 4, the result shows that quality management has a positive impact on green process innovation, which supports hypothesis 1a. In accordance with the goal of quality management, which is cost efficiency, the company conducts a green process innovation because this is a way of making cost efficiencies, such as the cost of raw materials and reducing energy costs, such as water use and electricity. This result was supported by the research data in which 61.4% of sample companies have conducted a green

**Table 3: Pearson correlation**

|          | TQ      | QM      | GPI     | GProdInn | FA    | Size    | Lev |
|----------|---------|---------|---------|----------|-------|---------|-----|
| TQ       | 1       |         |         |          |       |         |     |
| QM       | -0.045  | 1       |         |          |       |         |     |
| GPI      | 0.090   | 0.403** | 1       |          |       |         |     |
| GProdInn | 0.121*  | 0.042   | 0.332** | 1        |       |         |     |
| FA       | 0.126*  | -0.001  | 0.183** | -0.078   | 1     |         |     |
| Size     | 0.057   | 0.089   | 0.382** | 0.353**  | 0.098 | 1       |     |
| Lev      | 0.222** | 0.060   | -0.039  | -0.072   | 0.025 | -0.131* | 1   |

\*\*and \*indicate that correlation is significant at the 0.01 and 0.05 levels (two-tailed), respectively; this table reports the Pearson Correlation matrix

**Table 4: Result of hypotheses testing (direct effect)**

| Hypotheses  | Predicted Sign | $\beta$  | Decision      |
|---|----------------|----------|---------------|
| 1a. Quality management → green process innovation | +              | 0.557*** | Supported     |
| 1b. Quality management → green product innovation | +              | 0.050    | Not supported |
| 2. Quality management → Firm Value                | +              | -2.098** | Not supported |
| 3a. Green process innovation → Firm Value         | +              | 1.324*   | Supported     |
| 3b. Green product innovation → Firm Value         | +              | 1.203    | Not supported |

\*, \*\*, \*\*\*Indicate significance at the 10; 5 and 1 per cent levels

process innovation. ISO 9001 as a measure of quality management emphasizes the process, so that quality management increases green process innovation. This result supports the theory of legitimacy that companies carry out operational activities in line with the norms that exist in society.

In contrast, the result shows that quality management has no impact on green product innovation, albeit showing a positive direction. Thus, it rejects hypothesis 1b. ISO 9001-certified management does not guarantee that companies produce environmentally friendly products, such as products that can be recycled or reused, even though they undertake environmental-based innovations in the product manufacturing process. Positive direction means the company will produce environmentally friendly products as a concrete action of management using ISO 9001. This condition is supported by data that 29.5% of companies are producing fully environmentally friendly products while 33.3% are in the process of so doing. The main goal of quality management is cost efficiency, while green product innovation requires large investments since it requires a long production time and expensive certification costs, which makes it difficult for companies to produce environmentally friendly products. The results of the study do not support research (Li et al., 2018; Song and Su, 2015) which shows a negative direction between quality management and green innovation as well as core QM practice. However, it supports research (Escrig-Tena et al., 2018; Hamdoun et al., 2018; Iqbal, 2019; Kim et al., 2012) stating that quality management encourages companies to innovate, namely green process innovation. Furthermore, the result supports research by Camisón and Puig-Denia, (2016) and Pipatprapa et al. (2017) that QM practices do not affect green product innovation.

The direct relationship between quality management and corporate value shows a negative direction, meaning that quality management decreases firm value. This result rejects hypothesis 2 even though it has a significant effect since the direction is in contrast with the proposed hypothesis. Investors have viewed that ISO 9001 is a quality management system that must be carried out by companies as a condition for competing with other companies. In addition, ISO 9001 requires substantial investment, so that most resources are absorbed for ISO even though the company needs funds for operational activities. Large amount of funds spending causes inconsistencies in implementing ISO companies. In addition, ISO is also considered a corporate image and investors react negatively for these reasons. Investors assume that companies implement ISO 9001 only for positive imaging instead of an earnest act. This result does not support the research by Nair (2006), Jang and Lin (2008), Pereira-Moliner et al. (2012), Ali (2014), Kumar et al., (2018), Augustyn et al., (2019) and Siougle et al., (2019).

Green Process Innovation was found to have positive impact on firm value, which supports hypothesis 3a. Green process innovation is related to the process of using raw materials, resources aimed at reducing pollution and in accordance with the wishes of the stakeholders. This condition shows that the company has paid attention to sustainability so that investors react positively to the increasing value of the company. This result support research carried out by Chen et al. (2006), Leenders and Chandra (2013), Lin et al. (2014), Küçükoğlu and Pınar, (2015), Huang and Li (2017), Agustia et al. (2019) and El-Kassar and Singh (2019). Meanwhile, green product innovation was found to insignificantly affect firm value. This result rejects hypothesis 3b. Green product innovation is related to goods produced that are environmentally friendly, but since more companies included in the study samples are producing and not producing environmentally friendly products, firm value is not significant. This result contradicts research by Dangelico and Pontrandolfo (2013), and Huang and Li (2017).

Firm age has a positive, but not significant, effect on firm value. The longer the company is established will provide opportunities to increase firm value by developing new products. The size of the company has a negative impact on firm value. Large companies do not guarantee that they will innovate in the environment through process and product innovation, so that it does not affect firm value since investing in environment-based innovation requires a large amount of money. Leverage enhances firm value, which may be due to effective debt management by investing in tangible and intangible assets with the aim of increasing firm value.

We employed Sobel Test to examine the effects of Green Process Innovation and Green Product Innovation as mediation variables and the results are shown in Table 5.

According to Table 5, the Green Process Innovation variable mediates the relationship between quality management and firm value at the significance value of 10%. The concrete action of quality management is followed by cost efficiency in the environment through green process innovation such as reducing the use of raw materials, water resources and electricity, will

**Table 5: Result of hypotheses testing (mediating effect)**

| Mediating                    | t-statistic | Std. error | p-value  | Decision      |
|------------------------------|-------------|------------|----------|---------------|
| 4a. Green Process Innovation | 1.71478     | 0.43006    | 0.08638* | Supported     |
| 4b. Green Product Innovation | 0.69547     | 0.08649    | 0.48675  | Not Supported |

\*Indicate significance at the 10 percent levels

increase investor confidence as reflected by the increased of firm value. In contrast, the Green Product Innovation variable does not mediate the relationship between quality management and corporate value. A company that implements quality management does not guarantee that it will produce environmentally friendly products because it requires a large investment, which ultimately does not increase firm value. In other words, investors will react positively if quality management and green innovation are carried out together. Green innovation is a form of concrete action on the implementation of quality management. These results support hypothesis 4a and reject hypothesis 4b. The results of this study support research by Pereira-Moliner et al. (2012) and Pipatprapa et al. (2017) for green process innovation while contradicting the research for green product innovation.

## 5. CONCLUSION

The separation of green innovation into green process innovation and green product innovation shows inconsistent results when related to quality management and firm value. Quality management has a significant positive impact on green process innovation, but does not affect green product innovation. Quality management is related to the process so that, in order to implement quality management consistently, the company needs to carry out green process innovation. Even though a company has obtained ISO 9001 certificate as proof that the company has carried out quality management, it does not guarantee that the company produces environmentally friendly products. Green product innovation requires considerable investment, so that the company finds it difficult to produce environmentally friendly products.

Green process innovation has a positive impact on firm value, but green product innovation has no impact on firm value. Making cost efficiency by choosing the fewest raw materials and reducing resources are considered as a way for companies to protect the environment, which is positively responded to by investors. The company is part of a social society wherein carrying out their activities does not violate the norms existing in society in relation to environmental innovation for the purpose of sustainability, which, in turn, increases the company's legitimacy in the eyes of investors. Green product innovation does not affect firm value because environmentally friendly products require a large investment, while, on the other hand, the company requires a large cost for operations so the company prefers operational activities that ultimately do not affect firm value. Quality management decreases firm value, but increases firm value when the company does green innovation. To increase firm value, the company must carry out quality management and green innovation simultaneously and consistently.

The study was limited to manufacturing companies listed on the Indonesia Stock Exchange and the measurement of green product innovation, which is based on content analysis, is highly dependent on the perception of researchers. Measurement of green product innovation based on content analysis causes different perceptions between researchers depending on the researcher's perspective. Measurement of green product innovation in addition to using content analysis needs to be further tested, for example, eco-friendly labels in companies other than manufacturing and other countries, because, in Indonesia, there are still limited companies that obtain eco-friendly label certification, especially for manufacturing companies.

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