

# Women Directors on Environmental Innovation with Institutional Ownership as Moderation

Refani Raka Dina<sup>a</sup>, Basuki<sup>b\*</sup>, <sup>a,b</sup>Department of Accountancy, Faculty of Economics and Business, Universitas Airlangga, Email: [basuki@feb.unair.ac.id](mailto:basuki@feb.unair.ac.id)

This study aims to analyse the relationship between female directors on environmental innovation with institutional ownership as a moderating variable. The sample used in this study were all manufacturing firms listed on the Indonesia Stock Exchange (IDX) for the 2015-2018 period totalling 134 observations. Female directors are proxied by the proportion of female directors in firms, while the expense of research and development measures environmental innovation. The analysis technique used in this study is OLS regression analysis with SPSS 21 software. The results of this study indicate that female directors have a positive relationship on environmental innovation, and institutional ownership weakens the relationship between female directors on environmental innovation. This research demonstrates that female directors can assist firms in developing environmental innovations by firms.

**Key words:** *Woman director, environmental innovation, female director, institutional ownership.*

## Introduction

Corporate Social Responsibility (CSR) is defined as the firm's responsibility to stakeholders to behave ethically, minimise negative impacts and maximise positive effects that include economic, social and environmental aspects (triple bottom line) to achieve development goals (Wibisono, 2007; Wood, 1991). The Government of the Republic of Indonesia (2007) describes CSR as the firm's commitment to participate in sustainable economic development to improve the quality of life and the environment that is beneficial, both for the firm itself, the local community, and society in general. Firms use corporate social responsibility to enhance their reputation and social image so that they can effectively differentiate themselves

from other firms (Kozubek, 2015; Bernardi & Threadgill, 2010; Herlambang & Nasih, 2019). Corporate social responsibility reflects the extent to which a firm is actively involved in social initiatives in responding to a diverse set of stakeholder interests (Shen, Tang, & Zhang, 2016). CSR encourages firms to innovate in social life and environmental sustainability to create new products and services (Kozubek, 2015; Kunapatarawong, 2014). Therefore, the number of firms that maximising the utilisation of CSR and reports it is increased globally in substantial scale (Harymawan et al., 2020; Harymawan et al., 2020; Nasih et al., 2019)

The ability of firms to innovate can help them deal with rapid and unexpected environmental changes (Shen et al., 2016; Harymawan et al., 2020). Environmental innovation presents itself as a wise choice for handling situations and environmental changes (Liao et al., 2018). Environmental innovation is considered as a critical factor that determines a firm's ability to maintain competitive advantage (Shen et al., 2016). Factors that relate to innovation in a firm's environment include the institutional environment, stakeholder pressure, market competition, and resources (Ilyas et al., 2017). Creativity in running a business can also be a trigger for the creation of innovations that benefit firms (Munizu & Hamid, 2018).

Research related to innovation begins to consider several factors, such as the nature of individuals and the thought processes of corporate executive boards in conducting environmental innovations (Liao et al., 2018). The board of directors, as one of the essential organs in the firm, is tasked with and is responsible for managing the firm to improve the firm's reputation (Nowland, 2012; Annuar, 2018). However, as long as men dominate the board of directors' duties, almost all essential functions are controlled by male directors. This domination is because there are many assumptions that men have patient characteristics so that they can make difficult decisions and handle critical issues with confidence. But the quality of resources must always be developed because the firm needs directors who can provide innovation so that the firm's reputation can improve. Thus, competent drivers of innovation are necessary to maximise the performance of environmental innovations and minimise errors (Liao et al., 2018).

The characteristics of female directors are believed as one of the drivers of environmental innovation. This assumption is because women tend to be competent in carrying out critical economic functions, namely identifying, selecting, expanding, and utilising business opportunities (Srinthi et al., 2011; Torchia et al., 2011; Harymawan et al., 2019). With these competencies, women play an increasingly important role so that the proportion of women directors on the firm's board of directors is increasing. In 1995 only 9.6% of board positions in the Fortune 500 were held by women and to 19.7% in 2016 (Bernardi & Threadgill, 2010). The Gender Diversity Index (GDI) also shows that 14.6% of Fortune 1000 firms have women on their boards of directors. Women on Boards 2020 aims to have 20% of female directors before 2020. This can be seen from the number of women directors who now represent

20.8% of the board of directors in Fortune 1000 firms. This change in female directors as a result of many countries has set steps to promote female directors in corporate executives. One form of regulation is issuing mandatory regulations on the proportion of female directors and requires a proportion of female directors of more than 40% (Liao et al., 2018).

Upper echelons theory shows that the background characteristics of board members have a significant impact on corporate behaviour in decision making (Hambrick & Mason, 1984; Hambrick, 2007). Besides that, the feminist caring theory also shows that women are generally more concerned about ethics and morality (Liao et al., 2018). Thus, women who participate in top management will have an impact on corporate behaviour in decision making. When women play a role on the board of directors, women will pay more attention to the demands of stakeholders such as demands for employee benefits, occupational health and safety, environmental protection, and more concerned with the firm's image (Robbins & Judge, 2008; Wood, 2012).

Women's boards of directors tend to use measures of firm performance in non-financial fields, such as innovation and corporate social responsibility, to evaluate firm performance (Bernardi & Threadgill, 2010). As more women join the board of directors, the decision of the female board of directors on environmental innovation also becomes a major focus. McKinsey Global Institute (2018) estimates that as the number of female directors increases, it can increase global output. The presence of women in corporate leadership is positively correlated with several firm characteristics, such as firm size, type of ownership, and minimising discriminatory attitudes towards female directors. Therefore, this study wants to analyse the relationship between female directors and environmental innovations.

This study analyses the effects of moderation between female directors and environmental innovation through institutional ownership. This interest is because institutional ownership is a condition of shares ownership belonging to institutions in a firm that could influence corporate action. Institutions can be in the form of government-owned, private, domestic, or foreign institutions (Widarjo, 2010). Institutional ownership can be divided into two categories. First, institutional ownership focuses on short-term returns and is not interested in long-term financial commitments as it has a level of risk that can affect short-term returns. Second, institutional ownership tends to support long-term returns projects such as innovation. Besides, institutional ownership has intensive authority to monitor and influence the firm's managerial decisions.

This study specifically aims to analyse the influence of female directors on environmental innovation directly and when moderated by institutional ownership. This study used 134 manufacturing firms listed on the Indonesia Stock Exchange for the period 2015-2018. Furthermore, the analysis technique used in this study is OLS regression analysis with SPSS

21 software. The results of this study indicate that female directors have a positive relationship on environmental innovation. This suggests that female directors comply with firm ethics, social compliance, and corporate social responsibility performance so that the existence of female directors has an essential role in promoting innovation in the corporate environment. This study also found that institutional ownership can weaken the influence of female directors on environmental innovation. This research can enrich the literature related to female directors and can be a consideration for firms in developing environment-based innovation.

The research will be explained in the following structure: Section 2 contains research on developing research hypotheses; Section 3 includes explanations for variables and samples as well as research models; Section 4 contains empirical analysis and the results of hypothesis testing; and Section 5 provides conclusions or conclusions from the study, including suggestions for further research.

## **Literature Review**

### ***Relationship between Female Directors to Environmental Innovation***

Feminism is a movement related to emancipation based on the awareness that women's rights should be the same as those of men. In its development, feminists have occurred throughout the country and have a lot of support from the community to improve gender equality. This support can be seen from the community's acceptance of women in the field that was initially dominated by men (Jaggar, 1991). Similarly, economic conditions that keep developing continue to put pressure on women to play an essential role in the organisation, so that the proportion of female directors on the board of directors of the firm is increasing (Liao et al., 2018).

The five main tasks of the firm's management function are performed by directors, including management, risk management, internal control, communication, and social responsibility. Women have made progress by balancing positions on the board of directors. More women becoming their leaders have proven their worth (Siahaan, 2018). Although development to bring women into firm meeting rooms is slow, but certainly, that number has increased for all firm sizes.

Feminism care theory states that women are generally more sympathetic towards groups who feel disadvantaged. Women also pay more attention to groups that need help, so women have good moral awareness (Liao et al., 2018). Women are more concerned about the relationship between the firm and stakeholders because it has the nature of empathy and caring. Generally, female directors have a more positive response from male directors for environmental innovation. Women's directors pay more attention to corporate social

relations, corporate image, and pay more attention to environmental innovation (Vähämaa, 2014).

Social role theory also states that women can play a functional gender role, where gender roles can influence behaviour in several different contexts (Eagly & Wood, 2012). For example, a person can be a director while working, but throughout the day, she is a woman. Role theory reviews how this role affects a variety of psychological outcomes, including behaviour, attitudes, cognition, and social interaction. Social role theory says women instinctively care more about each other, have a loving nature, and have a greater awareness of social responsibility than men (Vähämaa, 2014). The female director has a caring and sympathetic behaviour.

Female directors have an essential role in the corporate governance system (Hyun et al., 2016; Sadalia, 2016). Good corporate governance is demonstrated by the presence of female directors in the firm. Women with their feminine nature are protective, caring, sensitive, and rely on intuition (Wei et al., 2017; Rafiki & Nasution, 2019). The basis for differentiating mindsets between men and women lies in emotional and intellectual differences. This difference makes the approach of each decision taken between men and women different and makes a hitch in the decision making of each board member based on behaviour in viewing a problem and how to solve the problem. Women leaders have a hardworking nature, pay more attention to responsibilities and obligations, and are highly dedicated to completing their duties (Liao et al., 2018).

On the other hand, environmental innovation is an essential way for firms to fulfil social responsibility. The presence of women directors encourages firms to participate more actively in deciding annual budgets related to environmental innovation. This active participation is consistent with the upper echelon's theory, which assumes that board perceptions can influence strategic choices that influence firm performance. Thus, the hypothesis proposed in this study is:

**H1:** Presence of female directors in firm has positive relationship to environmental innovation

### ***Moderation Effect from Institutional Ownership in Relationship between Female Director to Environmental Innovation***

Upper echelons theory states that organisations are a reflection of cognitive-based values and a strong role in organisations (Carpenter et al., 2004; Hambrick, 2007). Organisational values cannot be separated from the role of institutional ownership that functions as a source controlling function that supports or dismiss the existence of management so that the



concentration or distribution of power becomes a relevant matter. Aghion et al. (2013) found a positive relationship between ownership concentration and R&D expenses and found a positive correlation between institutions and R&D expenses. With the ownership of institutional investors, it will encourage increased oversight of the more optimal performance of the firm.

The increase of accountability carried out by the firm towards the environment causes the firm's image to increase (Sholekah & Venusita, 2014). Investors are more interested in firms that have a promising image in the community. This interest is because of the better firm's image, customer loyalty will be higher, so the firm's sales will increase, and the firm's profitability will also increase. If the firm's operations run smoothly, the value of the firm's shares will increase. Thus, institutional ownership can make information valuable so that it can automatically encourage firms to innovate (Aghion et al., 2013).

Based on the social role theory, Eagly and Wood (2012) state that everyone has the quality or motivation to behave in a certain way. The role of the director is needed to oversee the growth of innovation by the firm because innovation has a high risk of failure. In this case, institutional ownership has a considerable impact on R&D productivity when the board of directors is more intense in exploring firms to face global competition (Aghion et al., 2013). Thus, the hypothesis proposed in this study is:

**H2:** Institutional ownership weakens the relationship between presences of female director to environmental innovation

## **Research Methodology**

### ***Sample and Data Source***

This study uses a sample of all manufacturing firms listed on the Indonesia Stock Exchange (IDX) for the period 2015-2018 totalling 134 observations. The manufacturing industry was chosen as a research sample because most of its activities are related to the environment, thus encouraging firms in the manufacturing industry to continue to improve environmental innovation. Sources of data in this study were obtained through financial statements and annual reports of manufacturing firms, which can be downloaded from the official website of the IDX or the website of each related firm. The sample in this study was selected using the purposive sampling method by applying the following criteria:

**Table 1:** Sample Selection Criteria

<b>Sample criteria</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>Total</b>
Manufacturing firms that listed in IDX	143	144	155	164	606
Manufacturing firms that not disclose R&D activities	(109)	(112)	(115)	(109)	(445)
Manufacturing firms that not disclose its annual report in IDX	(1)	(1)	(5)	(14)	(21)
Manufacturing firms that delisted	(2)	(0)	(1)	(3)	(6)
<b>Final observations</b>	<b>31</b>	<b>31</b>	<b>34</b>	<b>38</b>	<b>134</b>

### *Variable Operationalisation*

#### *Dependent Variable*

The dependent variable in this study is environmental innovation (EI), which is a new product and process that provides value to customers and businesses but can significantly reduce the impact on the environment (Kozubek, 2015). This study uses research and development to measure the level of environmental innovation of a firm. Firms that carry out R&D activities have the opportunity to be able to develop existing products and processes and create innovation (Bristy, 2016). R&D can be measured by comparing the R&D expenses to the firm's total assets, with the following formula:

$$\text{R\&D} = \frac{\text{Total R\&D expense}}{\text{Total assets}}$$

#### *Independent Variable*

The independent variable in this study is the female director (FD). This variable became interesting as many female directors began to be involved in the firm's board of directors to cope with all the stakeholders' interests. This involvement follows the aims and objectives of the firm and represents the firm and also follows the provisions of the articles of association (Government of the Republic of Indonesia, 2007; Suryadi & Idris, 2004). The female director in this study was measured using proportions, using the following formula.

$$\text{Female director proportion} = \frac{\text{Number of female director}}{\text{Total board of directors}}$$

#### *Moderating Variable*

The moderating variable in this study is institutional ownership (IO), which is the proportion of share ownership held institutionally at the end of the year. This variable is measured using

the percentage of shares owned by institutional investors in a firm (Masdupi, 2005), with the following formula:

$$\text{Institutional ownership} = \frac{\text{Total share owned by institution}}{\text{Total outstanding share in end of year}}$$

### ***Control Variable***

This study uses firm size (SIZE) as a control variable to overcome the problem of endogeneity. Firm size is the firm scale, as seen from the total assets of the firm at the end of the year. This study uses firm size to determine the firm's ability to use its resources to create innovations. Liao et al. (2018) formulate the size of the firm as follows:

$$\text{Size} = \text{Ln} (\text{Total Assets})$$

### ***Methodology***

This study uses two analytical techniques, namely OLS regression, to examine the relationship between female directors with environmental innovation and moderation regression (to test whether institutional ownership moderates the relationship between female directors and environmental innovations. Regression analysis is performed using SPSS 21 software. Regression equations are formulated as follows:

$$\text{EI} = \alpha + \beta_1 \text{FD} + \beta_2 \text{SIZE} + e \quad (1)$$

$$\text{EI} = \alpha + \beta_1 \text{FD} * \text{IO} + \beta_2 \text{FD} + \beta_3 \text{IO} + \beta_4 \text{SIZE} + e \quad (2)$$

Where,

**EI** : Environmental innovation

**FD**: Female director

**IO**: Institutional ownership

**Size** : Firm size

## Result and Discussion

### *Descriptive Statistic*

**Table 2:** Descriptive Statistic

	N	Minimum	Maximum	Mean	St. Deviation
EI	134	0.002	0.023	0.002	0.004
FD	134	0.000	0.545	0.113	0.152
IO	134	0.051	2.387	0.725	0.239
SIZE	134	19.805	31.757	28.789	1.926

Table 2 shows the descriptive statistical results of the variables in this study. The average value of the environmental innovation variable is 0.002, with a standard deviation of 0.004. Furthermore, the proportion of female directors sampled in this study was 11.3%, with a standard deviation of 0.152. The average value of the institutional ownership variable is 0.725 or 72.5%, with a standard deviation of 0.239. The firm size variable has an average value of 28.789, with a standard deviation of 1.926.

### *Classic Assumption Test*

#### *Normality Test*

**Table 3:** Kolmogorov-Sminov Test Result

Regression Model	Test	Unstandardized Residual
OLS Regression	Kolmogorov-Smirnov Z	0.947
	Asymp. Sig. (2-tailed)	0.332
Moderated Regression	Kolmogorov-Smirnov Z	0.778
	Asymp. Sig. (2-tailed)	0.580

Table 3 shows the results of the normality test. The Kolmogorov-Smirnov value calculation results in the OLS regression model that is equal to 0.947, with a significance level of 0.332. Then in the moderation regression model, the value of Kolmogorov Smirnov is 0.778, with a significance level of 0.580. This significance value is greater than 0.1, which means that both models have a normal distribution

#### *Heteroscedasticity Test*

This study conducted a heteroscedasticity test using a scatterplot diagram. The results show that the points spread and do not form a distinctive pattern. Thus it can be concluded that the symptoms of homoscedasticity or variance of residuals are constant so that the independent variable only explains the dependent variable. The results of this test state that both regression models are free from symptoms of heteroscedasticity.

### ***Multicollinearity Test***

**Table 4:** Multicollinearity Test Result

<b>Model</b>	<b>Variable</b>	<b><i>Collinearity Statistic</i></b>	
		<b><i>Tolerance</i></b>	<b>VIF</b>
1	FD	1,000	1.000
	SIZE	1,000	1.000
2	FD	0.490	20.337
	IO	0.688	1.454
	FDxIO	0.047	21.124
	SIZE	0.973	1.028

Table 4 shows the results of the multicollinearity test. Based on the results in Table 4, it is known that in model 1, the independent variable is the female director (FD) as well as the control variable that is the firm size (SIZE) having tolerance values  $> 0.1$  and  $VIF < 10$ . Thus, it can be concluded that all independent variables in the OLS regression model did not experience multicollinearity problems. Furthermore, in model 2 it is known that some variables do not experience multicollinearity problems, except the variable female director proportion (FD) as well as the interaction between the proportion of the board of directors and institutional ownership (FD \* IO) which has a tolerance value  $< 0.10$  or a VIF value  $> 10$ . This occurs because both of these variables both contain FD values so that the problem of multicollinearity cannot be avoided.

### ***Autocorrelation Test***

**Table 5:** Autocorrelation Test Result

<b>Model</b>	<b>Durbin Watson</b>	<b>Conclusion</b>
1	0.991	Free from autocorrelation
2	1.042	Free from autocorrelation

Based on the results of the Durbin-Watson test presented in Table 5, it can be seen that the regression model for equation 1 shows the value of 0.991, while for equation 2, it shows the value of 1,042. This indicates that the Durbin-Watson value is still in the autocorrelation free range because it is between -2 to +2.

**Regression Analysis Result**

**Relationship Female Director to Environmental Innovation**

**Table 6:** Regression Analysis Result on Model 1

Variable	OLS Regression		
	B	t value	Sig.
Constant	-0.261	-0.296	0.768
FD	0.883	2.276	0.024**
SIZE	-0.103	-3.356	0.001***
R	0.332		
R <sup>2</sup>	0.110		
F test	8.102		
Significance	0.000		

Table 6 shows the results of the OLS regression used to test the relationship between female directors on environmental innovation. The coefficient value of the variable for female directors was 0.883 ( $t = 2.276$ ) and significant at the 5% level. This shows that women's directors have a positive and statistically significant relationship on environmental innovation. Thus, the first research hypothesis (H1) is supported. Furthermore, the value of R square or the coefficient of determination is equal to 0.110. This indicates that the variables of female directors and firm size can explain variations in environmental innovation by 11%, while the remaining 89% is explained by other variables that excluded in the research model. The results of this study indicate that female directors have a positive relationship on environmental innovation. This result is in line with research conducted by Liao et al. (2018), who explained that the presence of female directors in the firm had a significant positive relationship on environmental innovation. Isdiro and Sobral (2015) stated that female directors are positively related to corporate ethics compliance, social compliance, and corporate social responsibility performance so that the existence of female directors has an important role in promoting corporate environmental innovation. Terjesen et al. (2009) also state that women have the same quality of resources as men in some respects in terms of education level. Thus, it can be concluded that the existence of a female director can encourage the creation of environmental innovation because women tend to comply with ethics and have good qualities in promoting environmental innovation.

**Institutional Ownership as Mediation Variable in Relationship between Female Director to Environmental Innovation**

Table 7 shows the results of moderated regressions that are used to test institutional ownership in moderating the relationship between female directors on environmental innovation. The coefficient value of the interaction variable between female directors and

institutional ownership (FD \* IO) was -4.363 ( $t = -1.949$ ) and significant at the 10% level. This result shows that institutional ownership can weaken the positive relationship of women directors on environmental innovation. Thus, the second research hypothesis (H2) is supported. For the female director variable, the coefficient was 4,193 ( $t = 1,729$ ) and significant at the 5% level. The coefficient value of the institutional ownership variable is 0.042 ( $t = 0.293$ ), but it is not statistically significant. Furthermore, the value of R square or the coefficient of determination is equal to 0.144. This indicates that the moderating variable of female directors and institutional ownership, female directors, institutional ownership, and firm size are able to explain variations in environmental innovation by 14.4%, while the remaining 85.6% is explained by other variables that excluded in the research model.

**Table 7:** Regression Analysis Result on Model 2

Variable	Moderated Regression		
	B	t value	Sig.
Constant	-0.526	-0.562	0.575
FD*IO	-4.363	-1.949	0.053*
FD	4.193	1.729	0.017**
IO	0.042	0.293	0.888
SIZE	-0.095	-3.092	0.002***
R	0.379		
R <sup>2</sup>	0.144		
F test	5.416		
Significance	0.000		

The results of this study indicate that institutional ownership moderates the relationship of female directors on environmental innovation by weakening their relationship. This result is in line with research by Aghion et al. (2013), which says that innovation is related by institutional ownership. Innovation is a large-scale firm program that tends to require large costs. The characteristics of institutional investors are risk-takers and tend to like firms that are oriented towards long-term programs even though they have a high level of risk. Firms that innovate can become market leaders and are superior to competitors so that they attract investors and the public and increase the value of the firm. The more institutional investors there are, the more networks are owned by outside parties such as suppliers, the government, and the public.

On the other hand, the characteristics of female directors who are sympathetic, communicative, and loving can gather information and advice obtained from various parties so that they can manage environmental innovation to the maximum. At present, the average number of boards of directors at firms in Indonesia is five, and there is at least one woman in top management. This is an optimal amount and can have a good impact on the firm so that

environmental innovation is well handled because the duties of the board of directors will be more specialized in accordance with expertise in their respective functions (Gao et al., 2016; Khotari et al., 2002). Therefore, institutional ownership can feel comfortable because the management of firm operations, including innovations made by the board of directors, is becoming more focused and controlled. Thus, institutional ownership will reduce its active role in overseeing or controlling decisions made by the board of directors. The lack of an active role of institutional investors weakens the positive relationship between female directors and environmental innovation.

## **Conclusion**

This study aims to examine the relationship between female directors on environmental innovation directly and with institutional ownership as a moderating variable in all manufacturing firms listed on the Indonesia Stock Exchange in the period 2015-2018. This study found that female directors had a positive and statistically significant relationship on environmental innovation. This indicates that the more female directors in a firm, the better the environmental innovation because female directors tend to comply with firm ethics and always promote the performance of corporate social responsibility. Also, this study found that institutional ownership can weaken the influence of female directors on environmental innovation. This study indicates that the existence of female directors has a vital role in promoting innovation in the corporate environment when institutional ownership is not too dominant.

This study has a limitation, which is related to the relatively small sample size because there are firms that do not publish complete financial statements. Therefore, for further research, it can increase the number of samples by expanding the scope of the study to include all existing industries to validate the results of the same model. Besides, further research can also use other measurement methods as a proxy for environmental innovation variables, such as evaluating the quality of patents owned by firms.

Based on a practical perspective, this research provides a comprehensive explanation for firms that want to improve their environmental innovation. Firms must pay attention to the proportion of the board of directors as well as the amount of institutional ownership to increase environmental innovation based on this result. This research can also give consideration to firms in order to increase the proportion of women directors in order to increase and maximize environmental innovations that can ultimately enhance the firm's reputation.



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