“Implementation of eco-control system by Indonesian manufacturing firms: Understanding the mediating role of organizational culture”

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IMPLEMENTATION OF ECO-CONTROL SYSTEM BY INDONESIAN MANUFACTURING FIRMS: UNDERSTANDING THE MEDIATING ROLE OF ORGANIZATIONAL CULTURE

Abstract

Implementing eco-control is a strategic way for companies to prevent environmental damage. This paper aims to analyze the effect of perceived environmental uncertainty and stakeholder pressure on system implementation through environmentally oriented organizational culture as a mediating variable. This study utilizes the PLS-SEM model using a sample of 104 manufacturing companies in Indonesia; 197 respondents from those companies completed the survey. All variables used in the research model are significant for a formative measurement model, and an internal model applied met all criteria. This study confirms a negative relationship between perceptions of environmental uncertainty and environmentally oriented organizational culture (β = 0.174, $p < 0.01$). The opposite effect is shown by the relationship between stakeholder pressure and organizational culture (β = 0.379, $p < 0.01$), and the positive effect of organizational culture on the implementation of eco-control in companies is significant (β = 0.650, $p < 0.01$). In addition, organizational culture partially mediates the relationship between perceptions of environmental uncertainty and the implementation of the eco-control system (β = 0.317, $p < 0.05$) and between stakeholder pressure and the implementation of this system (β = 0.401, $p < 0.05$). When companies through managers face uncertainty from the ecological environment and stakeholder pressure, they should utilize an eco-control system, which can succeed in profit goals and environmental responsibility.

Keywords eco-control, perception of ecological environment uncertainty, stakeholder pressure, environmentally oriented organizational culture

JEL Classification Q56, D81, M14

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INTRODUCTION

Current industrial development significantly affects the environment and society, such as global warming, ozone depletion, and toxic waste (Abdel-Maksoud et al., 2016). Ecological problems due to the influence of technology have the impact of environmental pollution and excessive use of natural resources (Velasquez, 2002). This impact has triggered society, government, customers, investors, and other parties (stakeholders) to urge companies to be more responsible for the environment (Kawai et al., 2018; Perez-Batres et al., 2012).

To minimize this circumstance, Indonesia has enacted a number of laws and regulations to address these environmental conditions, including Law No. 22 of 2001, Law No. 25 of 2007, Law No. 40 of 2007, and Government Regulation No. 47 of 2012, which emphasize the need for businesses to fulfill their social and environmental obliga-

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tions. Nevertheless, a large number of businesses continue to flout these laws (Gunarathne & Lee, 2015; Moreno-Castilla, 2004). Through the firm performance rating assessment program, the Indonesian Ministry of Environment and Forestry has assigned companies a gold, green, blue, red, or black ranking according to how well they comply with environmental standards. Out of the 2,046 registered firms, just 26 are in the gold rank, while 303 are in the black rank because they have not made any efforts at environmental management. The rest levels cover other firms that have dealt with the issue, although not optimally.

With this fact, environmental strategies are an important step for companies to immediately adopt to minimize their environmental impact (Koehler & Hespeinheide, 2013; Kiron et al., 2012; Unruh & Ettenson, 2010). The example company is General Electric (Yu & Choi, 2016). Environmental management accounting (EMA) was introduced to provide a solution for companies to focus on achieving financial performance without neglecting their environmental responsibilities (Abdel-Maksoud et al., 2016; Schaltegger et al., 2000). EMA refers to concepts used in decision-making, policy planning, communication, evaluation, and implementation of activities related to the environment (Anthony & Govindarajan, 2007). Furthermore, as part of EMA, eco-control provides information in decision-making regarding a company's environment by offering evidence that supports the benefits of environmental actions and ensuring the achievement of environmental goals without compromising company profits (Henri & Journeault, 2010). Another advantage of implementing eco-control is that it creates competitive strength for companies (Primandaru et al., 2023; Hwang et al., 2016; Herman et al., 2024).

In implementing eco-control systems, companies need to pay attention to perceptions of ecological uncertainty (Al-Tuwaijri et al., 2004; Pondeville et al., 2013; Russo & Fouts, 1997) and pressure from stakeholders (Henri & Journeault, 2018; Abdel-Maksoud et al., 2016). However, environmental strategies in companies cannot be implemented well; they are more caused by aspects of organizational culture that focus on the environment (Gunarathne & Lee, 2015; Yu & Choi, 2016). Thus, there is no definite conclusion regarding the relationship between implementing eco-control, manager perceptions, and stakeholder pressure.

1. LITERATURE REVIEW AND HYPOTHESES

The framework of this study draws upon stakeholder theory, positing that individuals or groups exert influence on organizational objectives (Freeman, 1984). Central to this theory is the managerial pursuit of both profit and social and environmental responsibilities (Cho et al., 2022; Rounaghi, 2019; Mitchell et al., 1997). Effective organizational management, as suggested by Utami et al. (2024) and Phillips (2003), demonstrates the compatibility of profit generation with ethical business practices, including social and environmental considerations.

In alignment with organizational objectives, companies may adopt eco-control mechanisms, integrating environmental concerns into management systems. This approach resonates with Elkington's (1994) triple bottom line concept, emphasizing profit, people, and planet. Here, profit entails pursuing maximum profitability while adhering to fair and ethical trade practices, people underscore the support for workforce interests, and the planet pertains to sustainable resource management.

Eco-control offers strategic alignment with environmental goals alongside profit and people objectives (Anthony & Govindarajan, 2007). By fostering transparency and accountability in company operations, eco-control cultivates environmental responsibility (Hauser, 2016; Henri & Journeault, 2018). Consequently, eco-control informs decision-making processes conducive to achieving organizational goals (Henri & Journeault, 2010).

However, challenges persist in implementing eco-control systems, notably environmental uncertainty, stakeholder pressures, and corporate culture. Environmental uncertainty poses significant managerial hurdles (Pondeville et al., 2013),

hindering predictive accuracy and organizational performance (Miller, 1993). Access to pertinent information through modern environmental control systems mitigates uncertainty, potentially prompting eco-control adoption (Chenhall & Morris, 1986).

Environmental uncertainty further influences managerial decision-making and organizational culture (Warrick, 2017; Jogaratnam, 2017), shaping responses to stakeholder pressures (Barney, 1986). Stakeholder demands, including environmental considerations, prompt companies to adopt environmentally oriented cultures (Yu & Choi, 2016). Such cultures motivate employees to meet stakeholder expectations, enhancing organizational effectiveness (Ravasi & Schultz, 1993).

Organizational culture emerges as a key determinant of company success, influencing employee behavior and decision-making (Warrick, 2017). By reinforcing shared beliefs and values, organizational culture aligns with eco-control implementation, facilitating goal attainment (Agyemang et al., 2024; Henri & Journeault, 2010). Notably, a lack of environmental information systems exacerbates ecological uncertainty, underscoring the importance of eco-control integration within supportive organizational cultures (Henri & Journeault, 2010).

Ultimately, organizational culture mediates the relationship between stakeholder pressures and environmental control system adoption (Yu & Choi, 2016). While external pressures advocate for environmental responsibility, a conducive internal culture determines the success of eco-control implementation (Galbreath, 2010; Ittner & Larcker, 2001). Thus, organizational culture serves as a critical link between stakeholder demands and corporate environmental initiatives.

The purpose of this study is to examine the connections between perceived uncertainty of the environment, stakeholder pressure, organizational culture, and eco-control implementation. The hypotheses in this study are as follows:

H1: *A perceived uncertainty of the ecological environment positively affects an environmentally oriented organizational culture.*

H2: *A stakeholder pressure has a positive effect on an environmentally oriented organizational culture.*

H3: *An environmentally oriented organizational culture positively affects an eco-control system's implementation.*

H4: *A perceived uncertainty of the ecological environment directly affects an eco-control system's implementation.*

H5: *Stakeholder pressure has a direct positive effect on an environmentally oriented organizational culture.*

H6: *An environmentally oriented organizational culture mediates the relationship between the perceived uncertainty of the ecological environment and the eco-control system's implementation.*

H7: *An environmentally oriented organizational culture mediates the relationship between stakeholder pressure and the eco-control system's implementation.*

2. METHOD

This study uses the PLS-SEM model to look for exploratory relationships in situations where theories have not been developed or existing theories have not been expanded (Sholihin & Ratmono, 2013). The PLS-SEM method includes two tests: the outer/measurement model and the inner/structural model (Hair et al., 2022). The outer/measurement model is applied to test the perceived uncertainty of the ecological environment and stakeholder pressure. When the indicator coefficient of a constructed variable is significant, and no multicollinearity is found, the variable is relevant (Hair et al., 2022; Hartono & Abdillah, 2014).

This study uses a survey method to collect the data. All research variables were measured on a 5-point scale used in the PROPER test (1 = strongly disagree, 5 = strongly agree). The analysis focuses on the manufacturing companies in Indonesia. Those companies were chosen because their production activities have a direct impact on the environment

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(Ratmono et al., 2024), and the manufacturing industry in Indonesia is one of the largest contributors to mercury emissions into the environment and water pollution in Indonesia which reaches 35. In determining the sample size, the purposive sampling method was used with the following criteria:

1) Manufacturing companies registered by the Ministry of Industry of the Republic of Indonesia.

2) Manufacturing companies that are limited liability companies (Ltd.).

Table 1. Respondents' information

Description	Respondents, *n*	Total respondents, %
Gender		
Male	142	72%
Female	55	28%
Age, years		
19-25	32	17%
26-35	53	27%
36-45	28	15%
46-55	63	31%
>55	21	10%
Education level, degree		
Diploma	21	11%
Bachelor	107	54%
Master	53	27%
Doctor	3	1%
Others	13	7%
Occupation		
General manager	21	10%
Deputy general manager	15	8%
Junior deputy	10	6%
Environmental advisor	77	39%
Others	74	37%

Table 1 shows that 104 companies met the criteria, with 197 respondents from those companies. In total, 72 percent of the respondents were male, and 28 percent were female. Most respondents (54 percent) held a bachelor's level, 27 percent held a master's level, 11 percent held a diploma, 1 percent held a doctoral degree, and the rest had other educational levels. Approximately 39 percent of the respondents had been working as a company environmental advisor; 10 percent as general managers; 8 percent as deputy general managers; 6 percent as junior deputies; 39 percent as environmental advisors; and 37 percent had been working in other positions. The average age was 39.4 years.

3. RESULTS AND DISCUSSION

Table 2 displays descriptive statistics. The average perceived uncertainty of the ecological environment (PU) is around 3.75, with a standard deviation of 0.66. Likewise, stakeholder pressure (SP) has an average value of 3.42 with a standard deviation value of 0.78, which is the largest value among the other variables. Significant data variations are also shown by environmentally oriented organizational culture (OC), with an average value of 3.85. The eco-control (EC) system implementation shows an average of 3.91, with significant variations between respondents from selected companies as indicated by the minimum, maximum, and standard deviation values. The cumulative average of respondents' answers tends to be neutral regarding the questions asked.

Table 2. Descriptive statistics

Variables	Maximum	Minimum	Mean	St. Deviation
PU	1.00	5.00	3.75	0.66
SP	1.00	5.00	3.42	0.78
OC	1.00	5.00	3.85	0.77
EC	2.00	5.00	3.91	0.62

Note: PU = Perceived Uncertainty of Ecological Environment; *SP* = Stakeholder Pressure; *OC* = Environmentally Oriented Organizational Culture; *EC* = Eco-control System's Implementation.

Table 3 proves that all variables (perceived uncertainty of ecological environment, stakeholder pressure, environmental-oriented organizational culture, and eco-control system's implementation) from the measurement model testing meet the criteria for a formative measurement model. In addition, fulfilling these criteria indicates no symptoms of multicollinearity in each of the specified variables.

Testing for the structural model is utilized after the previous test, namely the measurement model, is fulfilled. Structural or inner models must be tested using several criterion indices. Table 4 shows that the applied inner model fits all indices well.

Table 3. Measurement model results

Indicators	Parameter	Result	Rule of thumb	Interpretation
PU	Significant Weight	*p*-values < 0.0001	*p*-values < 0.01 (level = 1%)	Accepted
	VIF	0.784	VIF < 5	Accepted
SP	Significant Weight	*p*-values < 0.0001	*p*-values < 0.01 (level = 1%)	Accepted
	VIF	0.738	VIF < 5	Accepted
OC	Significant Weight	*p*-values < 0.0001	*p*-values < 0.01 (level = 1%)	Accepted
	VIF	0.620	VIF < 5	Accepted
EC	Significant Weight	*p*-values < 0.0001	*p*-values < 0.01 (level = 1%)	Accepted
	VIF	0.650	VIF < 5	Accepted

Note: PU = Perceived Uncertainty of Ecological Environment; *SP* = Stakeholder Pressure; *OC* = Environmentally Oriented Organizational Culture; *EC* = Eco-control System's Implementation.

Table 4. Model fit indices

Criteria	Result	*p*-values	Rule of thumb
Average Path Coefficient (APC)	0.289	0.002	p < 0.05
Average R-squared (ARS)	0.337	0.040	p < 0.05
Average Block VIF (AVIF)	1.134	–	≤ 3.3
Average Full Collinearity VIF (AFVIF)	1.627	–	≤ 3.3
Tenenhaus GoF (GoF)	0.437	–	≥ 0.25
Sympson's Paradox Ratio (SPR)	0.800	–	≥ 0.70
R-squared Contribution Ratio (SPR)	0.944	–	≥ 0.90
Statistical Suppression Ratio (SSR)	1.000	–	≥ 0.70
Nonlinear Bivariate Causality Direction Ratio (NLBCDR)	0.900	–	≥ 0.70

Figure 1 displays the results of the structural model in the PLS-SEM analysis. If the criteria are met, hypothesis testing is applied by estimating each variable relationship's expected direction, path coefficient, and significance.

More specifically, the results of the PLS-SEM analysis shown in Figure 1 show that with a value of β = 0.174 and $p < 0.01$, perceived uncertainty of the ecological environment has a significant negative effect on environmentally oriented organizational culture. On the other hand, with a value of β = 0.379 and $p < 0.01$, there is a significant positive relationship between stakeholder pressure and environmentally oriented organizational culture. Thus, environmentally oriented organizational culture significantly impacts the eco-control system's implementation (β = 0.650, *p*-value < 0.01).

Furthermore, perceived uncertainty of the ecological environment has a weak positive effect on the eco-control system's implementation, with a very low significance (β = 0.142, *p*-value = 0.06). This result is similar to the direct effect of stakeholder pressure on the eco-control system's implementation (β = 0.103, *p*-value = 0.07). These results conclude that environmentally oriented organizational culture mediates the relationship between the perceived uncertainty of the ecological environment and the eco-control system's implementation and stakeholder pressure and the eco-control system's implementation.

Three main points are highlighted in the next stage, which shows the conclusions from the results of hypothesis testing based on the PLS-SEM estimation results (see Table 5). First, perceived uncertainty of the ecological environment is negatively related to environmentally oriented organizational culture, with a path coefficient value of 0.174 at the 1% significance level. These results do not support *H1*. This study implies that perceived uncertainty hinders the formation of culture within the organization. The most plausible reason is that managers are unwilling to invest in future-oriented environmental information systems (Pondeville et al., 2013). They do not believe that organizational culture could help them resolve problems related to environmental uncertainty (Yu & Choi, 2016), and high environmental uncertainty creates complicated situations, making it difficult to integrate into the company's strategy formulation (Lewis & Harvey, 2001).

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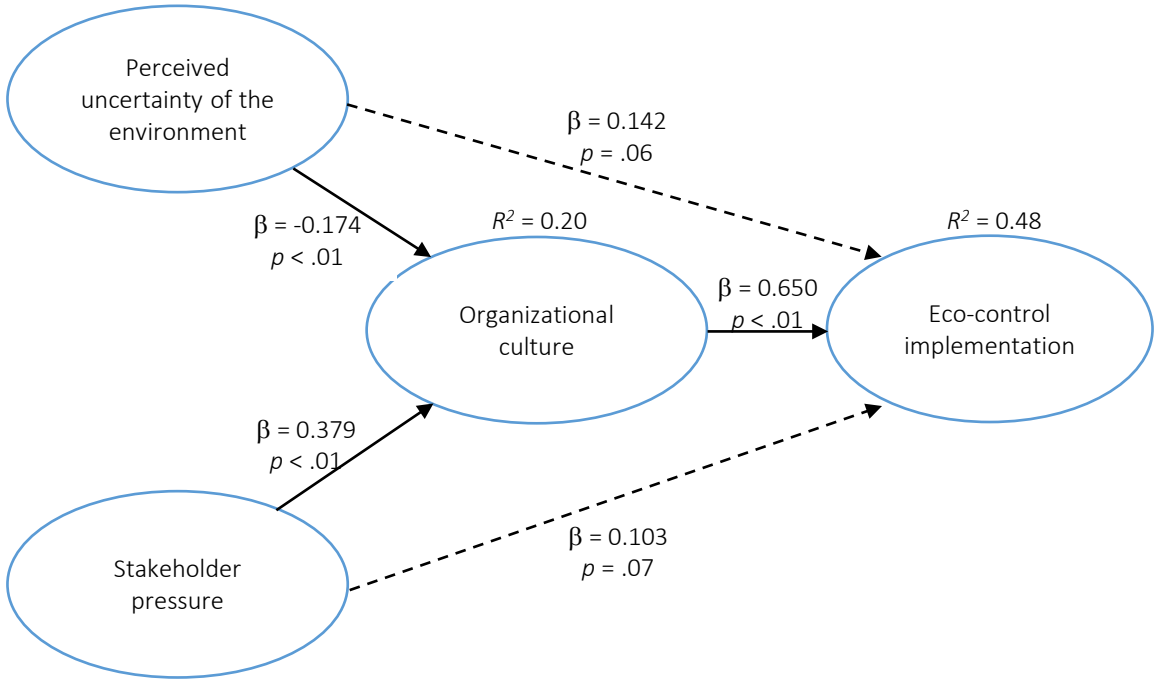

Figure 1. PLS-SEM analysis

Second, stakeholder pressure positively correlated with environmentally oriented organizational culture with a path coefficient of 0.379 and significant at alpha 1%. This result supports *H2*. These results imply that stakeholder pressure affects the implementation of culture within the company because stakeholder pressure can influence management decision-making (Ravasi & Schultz, 1993; Yu & Choi, 2016).

Finally, *H3* is supported, meaning that environmentally oriented organizational culture has a positive relationship with the eco-control system's implementation, with a path coefficient of 0.650 at the 1% significance level. It is believed that organizational culture is a key factor in implementing company strategy, which aims to improve company performance. This culture can influence managers' and employees' decisions and support the implementation of control systems within the company (Warrick, 2017; Yu & Choi, 2016).

Then, this study includes a mediating variable by adopting the procedure developed by Hair et al. (2022) in the relationship between perceived uncertainty of the ecological environment, stakeholder pressure, and the eco-control system's implementation. Three main points are emphasized in the results of testing this mediating variable, testing the significance of standardized path coefficients (direct and indirect effects) using the PLS-SEM bootstrapping procedure (see Table 6) (Ratmono et al., 2024; Nitzl et al., 2016; Hair et al., 2022).

First, there is a weak direct effect between the perceived uncertainty of the ecological environment and the eco-control system's implementation, with a coefficient of 0.142 at the 10% significance level. These results support *H4*. Thus, when managers encounter situations of environmental uncertainty, they tend to require a

Table 5. Path coefficients and p-values

Path	Expected Sign	Path coefficients	Interpretation
Perceived uncertainty of the environment → Organizational culture	(–)	0.174***	*H1* is not supported
Stakeholder pressure → Organizational culture	(+)	0.379***	*H2* is supported
Organizational culture → Eco-control implementation	(+)	0.650***	*H3* is supported

Note: significant level = * (α = 10%), ** (α = 5%), *** (α = 1%).

range of relevant information, which is available in the eco-control system for making decisions (Bouwens & Abernethy, 2000). This manager's perception encourages managers to implement an integrated system that is believed to resolve the problem of uncertainty (Warrick, 2017). A weak direct effect was also found in the relationship between stakeholder pressure and the eco-control system's implementation, with a coefficient of 0.103 and significant at the 10% level. This finding seems to support *H5*. The existence, input, and pressure from stakeholders to pay attention to the environment can encourage company managers to implement eco-control systems (Abdel-Maksoud et al., 2016; Wheeler et al., 2002; Yu & Choi, 2016).

Second, the results of the weak direct effect testing confirm that environmentally oriented organizational culture partially mediates the relationship between perceived uncertainty of the ecological environment and the eco-control system's implementation, and stakeholder pressure and eco-control system's implementation so that *H6* and *H7* are supported (Dubey et al., 2017; Warrick, 2017; Yu & Choi, 2016). Implementing eco-control systems in companies can be encouraged if managers' perceptions of environmental uncertainty and the pressure of stakeholders who care about the environment are also increased.

Finally, there is an indirect effect between the perceived uncertainty of the ecological environment and the eco-control system's implementation through the mediating variable of environmentally oriented organizational culture, with an indirect path coefficient of 0.317 and significant at the 5% level. The indirect effect between stakeholder pressure and the eco-control system's implementation is significant at the 5% level, with an indirect path coefficient of 0.401. It means that every environmental uncertainty manager face requires an integrated system concerning the environment, with the condition that managers create an environmentally oriented organizational culture. In contrast, the pressure from stakeholders who expect environmental concern can encourage companies to immediately implement an integrated environmental system by applying a culture that cares about the environment (Dubey et al., 2017; Warrick, 2017; Yu & Choi, 2016).

CONCLUSION

The goal of this study was to analyze the effect of perceived uncertainty of the environment and stakeholder pressure on organizational culture and the impact of organizational culture on the eco-control system. This study's results are quite varied. While perceived uncertainty of the environment negatively impacts organizational culture, stakeholder pressure is positively related to this culture, which in turn improves eco-control implementation. This paper cannot provide sufficient evidence that the perception of ecological and environmental uncertainty can provide impetus to implementing an environmentally oriented organizational culture. These findings imply that companies implementing eco-control should consider managers' perceptions of uncertainty in the ecological environment and stakeholder pressure. Eco-control has the advantage of helping companies consider decisions by combining financial decisions and corporate environmental responsibility. This study also has implications for companies that consider environmentally oriented organizational culture in encouraging the implementation of eco-control systems.

This study has several limitations. The difficulty of targeting managers in companies to become respondents means that this analysis cannot specifically explain different and more detailed industry classifications. Therefore, further research can consider other industrial sectors included in the sensitive category conducting activities that directly impact the environment, such as the mining and agricultural industries. In addition, future research can explore the conditions under which high environmental uncertainty can encourage the implementation of organizational culture within a company.

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AUTHOR CONTRIBUTIONS

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Data curation: Muhammad Try Dharsana, Fakhrul Indra Hermansyah.
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Project administration: Andi Iqra Pradipta Natsir.
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Validation: Muhammad Try Dharsana, Andi Iqra Pradipta Natsir, Khaerunnisa Nur Fatimah Syahnur.
Visualization: Muhammad Try Dharsana, Fakhrul Indra Hermansyah, Khaerunnisa Nur Fatimah Syahnur.
Writing – original draft: Muhammad Try Dharsana, Khaerunnisa Nur Fatimah Syahnur.
Writing – review & editing: Andi Iqra Pradipta Natsir, Khaerunnisa Nur Fatimah Syahnur.

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