

# Beyond Costs: How Environmental Investment Enhances Innovation in Indonesian SMEs

Nilam Kemala Odang<sup>1</sup>

Dany Juhandi<sup>2</sup>

Putri Helendgri Simanungkalit<sup>3</sup>

<sup>1,3</sup>Program Studi Akuntansi Perpajakan Politeknik Wilmar Bisnis Indonesia, Indonesia

<sup>2</sup>Program Studi Agribisnis Hortikultura Politeknik Wilmar Bisnis Indonesia, Indonesia

\*Correspondences : [nilam.odang@wbi.ac.id](mailto:nilam.odang@wbi.ac.id)

## ABSTRACT

This study examines the influence of environmental cost (EC) and environmental investment (E-INV) on environmental innovation (E-INN) in medium-scale manufacturing SMEs in Indonesia. Although many SMEs allocate budgets for environmental activities, it remains unclear whether such expenditures drive innovation. The study distinguishes between compliance-based costs and strategic investments—an approach rarely explored in the context of SMEs in developing countries. A survey of 106 SMEs was conducted and analyzed using PLS-SEM. EC has no significant effect on E-INN. In contrast, E-INV significantly and positively affects E-INN, indicating that only proactive, strategic investments enhance innovation capacity. The results confirm the Resource-Based View (RBV) by demonstrating that strategic environmental resources foster innovation. Simultaneously, the findings support institutional theory and the weak version of the Porter Hypothesis by showing that compliance spending alone is ineffective in driving innovation if it is not accompanied by strategy-oriented actions.

**Kata Kunci:** Environmental Innovation; Environmental Investment; Environmental Cost; SMEs.

## Lebih dari Sekadar Biaya: Peran Investasi Lingkungan dalam Mendorong Inovasi UKM di Indonesia

### ABSTRAK

Penelitian ini mengkaji pengaruh biaya lingkungan (EC) dan investasi lingkungan (E-INV) terhadap inovasi lingkungan (E-INN) pada UKM sektor manufaktur skala menengah di Indonesia. Meskipun banyak UKM mengalokasikan anggaran untuk kegiatan lingkungan, tetapi masih belum jelas apakah pengeluaran tersebut mampu mendorong inovasi. Studi ini membedakan antara biaya berbasis kepatuhan dan investasi strategis – pendekatan yang jarang dieksplorasi dalam konteks UKM di negara berkembang. Survei dilakukan terhadap 106 UKM dan dianalisis menggunakan metode PLS-SEM. Hasil penelitian menunjukkan bahwa EC tidak berpengaruh signifikan terhadap E-INN. Sebaliknya, E-INV berpengaruh positif dan signifikan terhadap E-INN. Hasil ini mendukung Resource-Based View (RBV) dengan menunjukkan bahwa sumber daya lingkungan strategis mendorong inovasi. Temuan ini juga memperkuat teori institusional dan versi lemah dari Porter Hypothesis dengan menunjukkan bahwa pengeluaran berbasis kepatuhan saja tidak efektif dalam mendorong inovasi jika tidak disertai dengan tindakan yang berorientasi strategis.

**Keywords:** Biaya Lingkungan; Inovasi Lingkungan; Investasi Lingkungan; UKM.

Artikel dapat diakses : <https://ejournal1.unud.ac.id/index.php/akuntansi/index>



e-ISSN 2302-8556

Vol. 35 No. 9  
Denpasar, 30 September 2025  
Hal. 2456-2470

**DOI:**  
10.24843/EJA.2025.v35.i09.p16

**PENGUTIPAN:**  
Odang, N. K., & Juhandi, D.  
(2025). Beyond Costs: How  
Environmental Investment  
Enhances Innovation in  
Indonesian SMEs.  
*E-Jurnal Akuntansi*,  
35(9), 2456-2470

**RIWAYAT ARTIKEL:**  
Artikel Masuk:  
2 Mei 2025  
Artikel Diterima:  
4 Juli 2025

## INTRODUCTION

In recent years, sustainability issues have become a major concern at both global and national levels, leading to pressure from various stakeholders for more environmentally friendly business practices (Haleem et al., 2022). Indonesia, as a developing country, also faces this pressure, particularly with its commitment to the Sustainability Development Goals (SDGs) (Odang & Sinambela, 2025). Amid this transition, SMEs play a crucial role in the national economic structure, given their significant contribution to Gross Domestic Product (around 60%) and employment (over 97%) (Suhaili & Sugiharsono, 2019). However, SME involvement in driving environmental innovation (E-INN) remains relatively low, creating a gap between global sustainability demands and the actual capacity of businesses in this sector (Gerged et al., 2024).

One strategic issue facing SMEs in the transition to sustainable business is limited resources to develop E-INN. Many SMEs view environmental expenditures as a regulatory compliance burden, rather than a source of competitive advantage. Two main approaches frequently used are environmental cost (EC) and environmental investment (E-INV). EC is more often associated with compliance-based operational activities (Thomas et al., 2022), such as waste management, environmental audits, or permit compliance (Fuji et al., 2022), while E-INV is more strategic and aimed at building long-term capabilities, such as investments in environmentally friendly technologies, employee training, energy efficiency, and the use of sustainable raw materials (Aldieri et al., 2020; Ren et al., 2022).

Prior research on EC shows mixed results regarding its influence on E-INN. Some studies indicate that EC can support environmental performance and innovation when accompanied by strategic management systems (Gomez-Conde et al., 2019; Henri et al., 2016). Others suggest that EC, when purely compliance-driven, may fail to generate innovation outcomes (Zhao et al., 2024). On the other hand, E-INV has been more consistently linked to positive innovation outcomes. Empirical evidence suggests that E-INV enhances E-INN by facilitating access to green technologies and reducing agency costs, particularly under strong environmental regulatory pressure (Bouchmel et al., 2024; Xie & Yu, 2024).

Despite these insights, research gaps remain. First, most prior studies have focused on large companies or developed country contexts. The context of SMEs in developing countries, which have structural limitations and differing institutional structures, has not been widely studied. Yet, SMEs' strategic approaches and motivations in managing environmental expenditures are likely to differ significantly from those of large companies. Second, few studies have explicitly differentiated EC from E-INV and examined their simultaneous impact on E-INN within a single empirical framework. Given the unique challenges faced by SMEs, it is crucial to understand how different forms of environmental spending contribute to innovation in this context.

This study aims to address these gaps by examining how EC and E-INV affect E-INN in medium-sized manufacturing SMEs in Indonesia. Theoretically, this study draws on two important grand theories. Institutional theory emphasizes how firms adapt their behaviors in response to external pressures – regulatory, normative, and cognitive (DiMaggio & Powell, 1983). EC, often linked with

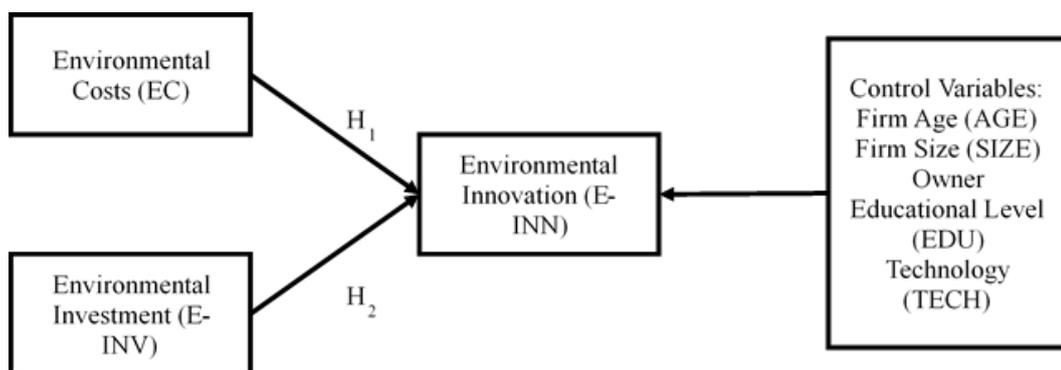
compliance-driven actions like pollution control and waste management (Fuji et al., 2022; Thomas et al., 2022), may be motivated by regulatory compliance. However, when strategically managed, EC can go beyond compliance to support process innovation and efficiency improvements

(Esfahbodi et al., 2016; Henri et al., 2016). Zhao et al. (2024) found that strategically aligned EC correlates with increased E-INN under certain organizational conditions. Furthermore, Porter & Linde (1995) proposed the "weak" version of the Porter Hypothesis, suggesting that well-designed environmental regulations, alongside internal strategic initiatives, can stimulate innovation by encouraging firms to seek efficiency and technology improvements. Building on this view, it is posited that EC—despite its compliance-oriented nature—can positively influence E-INN, especially when firms recognize innovation as a means to meet environmental demands more efficiently.

H<sub>1</sub>: environmental cost has a positive effect on environmental innovation.

In contrast, the Resource-Based View (RBV) emphasizes the role of strategic resources in fostering innovation and competitiveness (Barney, 1991). E-INNV, characterized by long-term commitments to environmentally friendly technologies, employee development, and sustainable inputs, can be seen as such a strategic resource (Burritt et al., 2023; Hart, 1995). Through these investments, firms enhance their capability to develop sustainable innovations that differentiate them in the market (Hossain et al., 2025). Empirical evidences support this view. Aldieri et al. (2020) found that green technology investment significantly boosts eco-innovation in European firms. X. Zhang et al. (2023) revealed a positive link between long-term E-INNV and product/process innovation in Chinese SMEs. Ren et al. (2022) showed that sustainable input investment correlates positively with innovation output. This study hypothesizes that E-INNV contributes significantly to E-INN by providing the necessary capabilities and resources for sustainable innovation.

H<sub>2</sub>: environmental investment has a positive effect on environmental innovation.



**Figure 1. Research Model**

Source: Research Data, 2025

This study offers a theoretical contribution by expanding the scope of RBV and institutional theory in explaining the dynamics of E-INN in the SME sector – a context that has been minimally explored in previous literature. Practically, this research provides input to policymakers and SMEs to review their environmental

expenditure structures. The results are expected to encourage policies that focus not only on compliance but also incentivize long-term E-INV. The basic conceptual framework can be seen in Figure 1.

## RESEARCH METHODS

This study used a survey method on manufacturing SMEs in Indonesia, which have significant environmental impacts and significant potential for adopting sustainable practices. Stratified sampling was used to ensure better representation by considering business scale based on annual turnover, number of employees, and level of adoption of sustainable practices (Tipton, 2013). The population in this study focused on manufacturing SMEs registered with the Indonesian Ministry of Cooperatives and SMEs and the Central Statistics Agency, amounted as 4.52 million businesses.

The criteria for identifying the sampling frame were adopted from Gerged et al. (2024): (a) independently owned firms, not affiliated with larger corporate groups; (b) employing no more than 250 permanent staff; and (c) operating in the manufacturing sector. Questions were sent to business owners, who were the most appropriate individuals to provide the required responses. Various questions were asked, including those related to E-INV and E-INN practices. However, to avoid common method bias (Podsakoff et al., 2003) in the EC variable, business owners were not given a questionnaire regarding EC management in their businesses. Instead, questionnaires were sent to their financial managers.

Of the 300 questionnaires distributed, 192 (64%) received responses. However, only 182 business owners completed the questionnaires completely, representing a response rate of 94.8%. Of the 182 questionnaires sent to financial managers, 106 were completed completely, representing a response rate of 58.2%. The 76 completed questionnaires received from business owners did not receive a response from the financial managers and were discarded due to incomplete information. Therefore, the overall effective response rate based on the initial sample of 300 SMEs was 35.3%.

Multi-item constructs to measure the variables used in this study. The EC and E-INN constructs utilize constructs from previous research, while E-INV is a construct whose indicators were developed based on discussions with experts in management accounting and sustainability. This questionnaire will undergo a pilot test to ensure its validity and reliability before being used in a full-scale survey.

The EC construct uses five items (Mohd Fuzi et al., 2019). These five items are related to assessing whether EC management has been implemented. These include (1) a dedicated budget allocation for hazardous waste management; (2) expenditures to comply with environmental regulations; (3) dedicated costs for periodic external environmental audits; (4) a budget for handling pollution from production processes; and (5) regular recording and monitoring of all environmental costs in internal reports.

The measurement of the E-INV construct was developed through discussions with experts in management accounting and sustainability. Eight indicators are used to measure the E-INV construct: (1) technologies that support energy efficiency; (2) resource allocation for waste and water treatment system

installation; (3) investment to support the efficient use of raw materials and energy; (4) allocation of funds for employee training and environmental certification; (5) allocation of Corporate Social Responsibility (CSR) funds; (6) updating environmentally friendly technologies; (7) purchasing environmentally friendly raw materials; and (8) strengthening organizational capacity in managing environmental issues.

The E-INN construct is measured using indicators used by Gerged et al. (2024) in their research. These indicators include (1) product design that considers environmental impacts; (2) recyclable product design; (3) gradually changing production processes to reduce the use of hazardous materials; (4) updating production systems to meet or exceed applicable environmental standards; (5) using technological innovation to reduce energy consumption and produce less waste; and (6) management actively encouraging the implementation of new ideas related to efficiency and sustainability.

Several control variables include company age (AGE), company size (SIZE), owner education level (EDU), and the type of technology used (TECH). SIZE and AGE measured as the natural logarithm of the number of permanent employees and company's operating years. EDU was measured using categorical data ('0' = < high school, '1' = high school, '2' = diploma, '3' = bachelor's degree, '4' = master's degree, and '5' = doctoral degree). TECH was measured using the categories '1' = low technology, '2' = medium technology, and '3' = high technology.

Each construct in this study used a seven-point scale, ranging from 1 to 7 (very low to very high). This was determined based on the fact that a seven-point scale can produce reliable, more precise, and more significant results than a Likert scale (Habidin et al., 2018; Weijters et al., 2010). Data were analyzed using the Structural Equation Modeling-Partial Least Squares (SEM-PLS) method. The choice of SEM-PLS was based on the non-normal characteristics of the data and the exploratory nature of the study (Sholihin & Ratmono, 2021). Hypothesis testing is performed using the following model estimates:

$$E-INN = \alpha + \beta_1 AGE + \beta_2 SIZE + \beta_3 EDU + \beta_4 TECH + \varepsilon \quad (1)$$

$$E-INN = \alpha + \beta_1 EC + \beta_2 E-INV + \beta_3 AGE + \beta_4 SIZE + \beta_5 EDU + \beta_6 TECH + \varepsilon \quad (2)$$

Where:

- $\alpha$  = Constant
- $\beta$  = Coefficient
- EC = Environmental cost
- E-INV = Environmental investment
- AGE = Firm age
- SIZE = Firm size
- EDU = Owner educational level
- TECH = technology used
- $\varepsilon$  = error

## RESULTS AND DISCUSSION

The characteristics of the sample are summarized in Table 1. Panel A outlines the profiles of 106 medium-sized manufacturing SMEs in Indonesia. The majority of

firms are between 6 and 10 years old (55.7%) and employ 20 to 69 workers (89.6%). Most business owners possess relatively high formal education, with 45.3% holding a bachelor's degree and 18.9% a master's degree. In terms of technological adoption, 42.5% of firms still rely on low-level technology, while only 16.0% have adopted advanced technology.

**Table 1. Description of the Respondents**

Panel A: Respondents' Profile	N	Percentage
<i>Firm Age</i>		
0 - 5 years	8	7.5%
6 - 10 years	59	55.7%
11 - 15 years	33	31.1%
>15 years	6	5.7%
Total	106	100%
<i>Firm Size</i>		
20 - 39 employees	51	48.1%
40 - 69 employees	44	41.5%
70 - 99 employees	11	10.4%
>99 employees	0	0.0%
Total	106	100%
<i>Owner Educational Level</i>		
<High school	1	0.9%
High school	24	22.6%
Associate degree	4	3.8%
Bachelor's degree	48	45.3%
Master's degree	20	18.9%
Doctoral degree	9	8.5%
Total	106	100%
<i>Technology used</i>		
Low	45	42.5%
Middle	44	41.5%
High	17	16.0%
Total	106	100%
<b>Panel B: Type of Industry</b>		
Food and beverages	30	28.3%
Clothing and textiles	15	14.2%
Furniture and crafts	10	9.4%
Metals, machinery, and electronics	9	8.5%
Chemicals, pharmaceuticals, and herbal products	8	7.5%
Plastics, rubber, and recycling	7	6.6%
Paper, printing, and derivatives	6	5.7%
Agroindustry	8	7.5%
Building materials and construction materials	6	5.7%
Others	7	6.6%
Total	106	100%

Source: Research Data, 2025

Panel B presents the distribution of industry sectors represented in the sample. The food and beverage sector comprises the largest share (28.3%), followed by clothing and textiles (14.2%) and furniture and crafts (9.4%). Other sectors include metals and machinery, chemicals and pharmaceuticals, recycling,

printing, agroindustry, and building materials, reflecting the diversity of the SME manufacturing sector in this study.

Table 2 presents descriptive statistics for the main variables in this study. The mean EC of 4.408 with a standard deviation of 0.909 indicates that SMEs generally have a moderate tendency to incur operational expenditures related to environmental management, such as regulatory compliance and waste management. The mean E-INV was slightly higher, at 4.468 (SD = 0.900), reflecting that respondents are beginning to demonstrate a commitment to strategic investments. Meanwhile, the mean E-INN showed the highest value, at 4.544 (SD = 0.974), indicating that most of the sample is quite active in implementing innovations that support environmental sustainability.

For control variables, mean of AGE was 2.220 (SD = 0.347) and SIZE had a mean of 3.712 (SD = 0.381). The mean of EDU was 2.840 (SD = 1.237), which falls between the Diploma and Bachelor's levels, with considerable variation among respondents. Meanwhile, the mean score for TECH is 1.736 (SD = 0.718) which indicates that most SMEs are still in the low to medium technology category, with fairly moderate variations.

**Table 2. Descriptive Statistics**

Variables	N	Mean	Standard deviation
EC	106	4.408	0.909
E-INV	106	4.468	0.900
E-INN	106	4.544	0.974
AGE	106	2.220	0.347
SIZE	106	3.712	0.381
EDU	106	2.840	1.237
TECH	106	1.736	0.718

Source: Research Data, 2025

Table 3 describes the evaluation of the measurement model to ensure that the constructs used in this study meet validity and reliability criteria. Three main constructs were analyzed: EC, E-INV, and E-INN, each measured through several reflective indicators. EC construct was measured using five indicators (EC-1 to EC-5) and had outer loadings ranging from 0.742 to 0.79, with an Average Variance Extracted (AVE) of 0.589 (convergent validity met). The Composite Reliability (CR) value of 0.878 and Cronbach's Alpha (CA) of 0.826 also indicate that the EC construct has excellent internal reliability.

E-INV construct initially consisted of eight indicators. However, preliminary analysis showed that one indicator, E-INV3 (investment to support efficient use of raw materials and energy), had an outer loading value below 0.708, causing the AVE value to fall below the minimum threshold. Therefore, E-INV3 was removed from the model to improve measurement quality (J. F. Hair et al., 2021). The remaining seven indicators showed outer loading values between 0.654 and 0.778, with an AVE value of 0.516, meeting convergent validity criteria. Furthermore, this construct demonstrated good internal reliability with a CR value of 0.882 and a CA value of 0.843.

E-INN construct is measured using six indicators (E-INN1 to E-INN6) and has an outer loading value ranging from 0.659 to 0.791. Although E-INN2 has a

loading slightly below 0.70, the construct's AVE value is above the minimum threshold, which is 0.557. The CR value of 0.883 and CA of 0.840 indicate that the E-INN construct also has excellent internal consistency.

**Table 3. Constructs, Measurement Items, and Reliability and Validity Test**

Construct	Indicators	Convergent validity		Internal consistent reliability		Discriminant validity
		Loadings	AVE	CR	CA	HTMT confidence interval does not include 1
Environmental cost			0.589	0.878	0.826	yes
	EC-1	0.786				
	EC-2	0.770				
	EC-3	0.745				
	EC-4	0.794				
	EC-5	0.742				
Environmental investment			0.516	0.882	0.843	yes
	E-INV1	0.720				
	E-INV2	0.778				
	E-INV3	0.703				
	E-INV4	0.707				
	E-INV5	0.722				
	E-INV6	0.742				
	E-INV7	0.654				
Environmental innovation			0.557	0.883	0.840	yes
	E-INN1	0.722				
	E-INN2	0.659				
	E-INN3	0.751				
	E-INN4	0.767				
	E-INN5	0.781				
	E-INN6	0.791				

Notes: CA = Cronbach's Alpha; CR = Composite Reliability; AVE = Average Variance Extracted; HTMT = Heterotrait-monotrait ratio

Source: Research Data, 2025

All constructs in the model were tested for discriminant validity using the Heterotrait-Monotrait Ratio (HTMT) approach. The test results showed that all HTMT values had confidence intervals that met the discriminant validity criteria. This means that each construct can be empirically distinguished and measures different dimensions. Overall, the results of the measurement model evaluation indicate that the EC, E-INV, and E-INN constructs in this study have met the criteria for convergent validity, internal reliability, and discriminant validity. Thus, these constructs are suitable for use in the structural model analysis at the next stage.

Table 4 presents the relationships between the main research variables and the control variables. The diagonal of the table shows the square root of the AVE,

namely EC = 0.768; E-INV = 0.719; and E-INN = 0.746. Higher AVE values compared to the correlations between other constructs indicate that each construct has good discriminant validity (Fornell-Larcker criterion). This is because each construct contains more variance in its own indicators than in the other constructs.

**Table 4. Correlations Matrix and AVE**

	EC	E-INV	E-INN	AGE	SIZE	EDU	TECH
EC	0.768						
E-INV	0.829***	0.719					
E-INN	0.785***	0.746***	0.746				
AGE	0.080	0.030	0.085	1			
SIZE	0.258***	0.184*	0.221**	0.532***	1		
EDU	0.469***	0.533***	0.497***	0.092	0.055	1	
TECH	0.285***	0.356***	0.381***	-0.028	0.285***	0.335***	1

Notes: Values on the diagonal represent the square root of AVE.

\*,\*\* and \*\*\* represent significant correlations at 10 %, 5% and 1% respectively.

Source: Research Data, 2025

The relationships between the constructs show significant and consistent correlations. EC and E-INV ( $r = 0.829$ ,  $p < 0.001$ ), EC and E-INN ( $r = 0.785$ ,  $p < 0.001$ ), and E-INV and E-INN ( $r = 0.746$ ,  $p < 0.001$ ) have strong correlations. Furthermore, the control variables also show several significant correlations. SIZE correlates significantly with all three constructs, albeit at a more moderate level. EDU shows a fairly strong positive correlation with all three constructs, particularly with E-INV ( $r = 0.533$ \*\*\*) and E-INN ( $r = 0.497$ \*\*\*). This indicates that EDU plays a significant role in driving E-INV and E-INN. On the other hand, TECH has a significant positive correlation with E-INN ( $r = 0.381$ \*\*\*), indicating that technology adoption supports a company's ability to innovate from an environmental perspective. Conversely, AGE does not show a significant correlation with the main constructs but has a moderate correlation with SIZE ( $r = 0.532$ \*\*\*). This reflects the general tendency that older companies tend to have more employees. These correlation results support the initial assumption in the theoretical model that there is a positive relationship between the constructs and demonstrate the important contribution of internal factors such as SIZE, EDU, and TECH in supporting a company's sustainability agenda.

Table 5 describes the structural model analysis conducted to test the effect of EC and E-INV on E-INN, considering the control variables AGE, SIZE, EDU, and TECH. The test was conducted in two models: Model 1 (control variables only) and Model 2 (control variables and main variables). Furthermore, no symptoms of multicollinearity were found in the models (all VIFs  $< 3.3$ ) (J. Hair & Alamer, 2022). Thus, the regression estimation results can be interpreted reliably.

Model 1 shows that only EDU ( $\beta = 0.454$ ;  $p < 0.001$ ) and TECH ( $\beta = 0.199$ ;  $p = 0.040$ ) have a significant effect on E-INN. However, AGE and SIZE do not show significance. The  $R^2$  of Model 1 is 0.358, meaning that 35.8% of the variation in E-INN can be explained by the control variables. After the EC and E-INV constructs are entered into Model 2, only E-INV has a positive and significant effect on E-INN ( $\beta = 0.701$ ;  $p < 0.001$ ). In contrast, EC does not show a significant effect ( $\beta = 0.173$ ;  $p = 0.302$ ). The addition of these main constructs increases the  $R^2$  value to 0.792, indicating that 79.2% of the variation in E-INN can be explained by the

combination of the main and control variables, with very strong model predictive power.

**Table 5. PLS Analysis of the Structural Model**

Independent Construct	Standardized $\beta$				VIF
	Model 1	P Value	Model 2	P Value	
EC			0.173	0.302	2.364
E-INV			0.701	0.000	2.623
AGE	-0.048	0.732	0.055	0.050	1.524
SIZE	0.181	0.213	-0.006	0.010	1.731
EDU	0.454	0.000	0.010	0.000	1.527
TECH	0.199	0.040	0.082	0.001	1.356
R <sup>2</sup>	0.358	0.000	0.792	0.000	

Source: Research Data, 2025

Table 5 also shows that H<sub>1</sub> is not supported. This finding suggests that operational environmental expenditures—such as compliance costs, waste management, and environmental audits—have not been able to actively encourage innovation at the firm level. These types of costs tend to be reactive and are aimed more at fulfilling regulatory obligations than at driving innovative transformation (Z. Wang et al., 2022). This finding is also supported by Zhao et al. (2024), who showed that while EC can affect the quantity, the quality of E-INNs does not significantly improve.

The unsupported hypothesis (H<sub>1</sub>), which posited a positive effect of EC on E-INN, suggests that operational environmental spending—such as compliance, audits, and waste management—does not actively stimulate innovation. These expenditures appear reactive, aimed at meeting regulations rather than creating transformation (Z. Wang et al., 2022). Zhao et al. (2024) similarly argue that while EC may influence innovation quantity, it fails to enhance innovation quality meaningfully.

Studies conducted by Zhang et al. (2022) dan Zheng et al. (2023) found that companies that focus solely on environmental regulations and compliance expenditures are insufficient to drive strategic innovation. Based on RBV (Barney, 1991), operational EC cannot be categorized as a strategic resource because it does not meet the criteria of valuable, rare, inimitable, and non-substitutable (VRIN). These expenditures are more related to external legitimacy pressures as explained in institutional theory (DiMaggio & Powell, 1983) being driven by legitimacy and external pressures. This finding also aligns with the weak version of the Porter Hypothesis. Not all forms of environmental regulation or expenditures are capable of driving innovation, especially if they are not accompanied by incentives, policy flexibility, or market incentives (M. Wang et al., 2022; W. Zhang et al., 2024). Therefore, promoting E-INN practices in the SME sector requires an approach that goes beyond compliance-based expenditure and focuses on long-term strategies that develop innovative capabilities (Mady et al., 2024; Odang et al., 2025).

The second hypothesis (H<sub>2</sub>), which states that E-INV has a positive effect on E-INN, is supported. This finding confirms that strategic resource allocation plays a crucial role in strengthening companies' innovative capacity. Proactive and transformative investments provide opportunities for companies to create

innovative and sustainable solutions. This finding is consistent with the study by Y. Zhang et al. (2024) and S. Zhang & Cheung (2025).

E-INV significantly encourages E-INN practices, especially in competitive industry contexts. Another study by Zheng et al. (2023) also found that R&D incentives and E-INV were more effective in encouraging E-INN than regulatory expenditures. Furthermore, X. Zhang et al. (2023) found that E-INV improves access to financing and reduces internal organizational barriers to E-INN practices. These results are also consistent with the RBV (Barney, 1991). E-INV will provide a sustainable competitive advantage through increased innovative capacity. This finding is also supported by Dynamic Capabilities Theory (Teece et al., 1997), which explains that E-INV is a crucial instrument in building, integrating, and reconfiguring internal resources in response to external dynamics. E-INV is not only a static resource but also a crucial catalyst in realizing sustainability-oriented innovation.

## CONCLUSIONS

This study aims to examine the influence of Environmental Cost (EC) and Environmental Investment (E-INV) on Environmental Innovation (E-INN) in SMEs in the medium-scale manufacturing sector in Indonesia. The analysis shows that EC has no significant effect on E-INN, while E-INV has a positive and significant effect on E-INN. This finding indicates that operational and compliance-based expenditures have not been able to drive innovation that impacts sustainability. Conversely, E-INV plays a role in driving E-INN at the firm level. This means that when SMEs actively allocate resources to technological updates, environmental training, and the use of environmentally friendly raw materials, the company's innovative capacity to manage environmental issues significantly increases. The practical implications of these findings are important for both businesses and policymakers. For SME managers, these results encourage a re-evaluation of the structure of environmental spending, so that it is not solely focused on compliance aspects, but also directed towards activities that have strategic value in driving innovation. Meanwhile, the government and SME development institutions are expected to create policies and support schemes that expand access to green technology and sustainable E-INV financing.

While providing meaningful empirical and theoretical contributions, this study has limitations, particularly its cross-sectional design, which fails to capture the dynamics of the relationships between variables over time. Furthermore, the sample size is limited to medium-sized manufacturing SMEs. Future research could be developed with a longitudinal approach to observe long-term changes between EC, E-INV, and E-INN. The research model could also be enriched by including mediating variables such as green organizational culture, as well as moderating variables such as environmental management control systems and stakeholder pressure. Expanding to other industrial sectors and different geographic regions could also provide a more holistic understanding of the dynamics of green innovation in the Indonesian SME sector.

The authors gratefully acknowledge the Directorate of Research and Community Service, Directorate General of Research and Development, Ministry of Higher Education, Science, and Technology, for funding support provided

under the Novice Lecturer Research scheme, contract number 122/C3/DT.05.00/PL/2025, dated May 28, 2025.

## REFERENCES

- Aldieri, L., Kotsemir, M., & Vinci, C. P. (2020). The role of environmental innovation through the technological proximity in the implementation of the sustainable development. *Business Strategy and the Environment*, 29(2), 493–502. <https://doi.org/10.1002/bse.2382>
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120. <https://doi.org/10.1177/014920639101700108>
- Bouchmel, I., Ftiti, Z., Louhich, W., & Omri, A. (2024). Financing sources, green investment, and environmental performance: Cross-country evidence. *Journal of Environmental Management*, 353, 120230. <https://doi.org/10.1016/j.jenvman.2024.120230>
- Burritt, R. L., Schaltegger, S., & Christ, K. L. (2023). Environmental management accounting - developments over the last 20 years from a framework perspective. *Australian Accounting Review*, 33(4), 336–351. <https://doi.org/10.1111/auar.12407>
- DiMaggio, P. J., & Powell, W. W. (1983). The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields. *American Sociological Review*, 48(2), 147. <https://doi.org/10.2307/2095101>
- Esfahbodi, A., Zhang, Y., & Watson, G. (2016). Sustainable supply chain management in emerging economies: Trade-offs between environmental and cost performance. *International Journal of Production Economics*, 181, 350–366. <https://doi.org/10.1016/j.ijpe.2016.02.013>
- Fuzi, N. M., Habidin, N. F., Adam, S., & Ong, S. Y. Y. (2022). The relationship between environmental cost on organisational performance and environmental management system: a structural equation modelling approach. *Measuring Business Excellence*, 26(4), 496–507. <https://doi.org/10.1108/MBE-03-2021-0039>
- Gerged, A. M., Zahoor, N., & Cowton, C. J. (2024). Understanding the relationship between environmental management accounting and firm performance: The role of environmental innovation and stakeholder integration - Evidence from a developing country. *Management Accounting Research*, 62, 100865. <https://doi.org/10.1016/j.mar.2023.100865>
- Gomez-Conde, J., Lunkes, R. J., & Rosa, F. S. (2019). Environmental innovation practices and operational performance. *Accounting, Auditing & Accountability Journal*, 32(5), 1325–1357. <https://doi.org/10.1108/AAAJ-01-2018-3327>
- Habidin, N. F., Hashim, S., Fuzi, N. M., & Salleh, M. I. (2018). Total productive maintenance, kaizen event, and performance. *International Journal of Quality & Reliability Management*, 35(9), 1853–1867. <https://doi.org/10.1108/IJQRM-11-2017-0234>
- Hair, J., & Alamer, A. (2022). Partial Least Squares Structural Equation Modeling (PLS-SEM) in second language and education research: Guidelines using an applied example. *Research Methods in Applied Linguistics*, 1(3), 100027. <https://doi.org/10.1016/j.rmal.2022.100027>
- Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021).

- Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R*. Springer International Publishing. <https://doi.org/10.1007/978-3-030-80519-7>
- Haleem, F., Farooq, S., Cheng, Y., & Waehrens, B. V. (2022). Sustainable management practices and stakeholder pressure: A systematic literature review. *Sustainability*, 14(4), 1967. <https://doi.org/10.3390/su14041967>
- Hart, S. L. (1995). A natural-resource-based view of the firm. *The Academy of Management Review*, 20(4), 986. <https://doi.org/10.2307/258963>
- Henri, J.-F., Boiral, O., & Roy, M.-J. (2016). Strategic cost management and performance: The case of environmental costs. *The British Accounting Review*, 48(2), 269–282. <https://doi.org/10.1016/j.bar.2015.01.001>
- Hossain, M. I., Jamadar, Y., Islam, M. F., Rashed, M., & Akter, T. (2025). Environmental sustainability practices in SMEs: Insights from integrated PLS-SEM and fsQCA approaches. *Journal of Cleaner Production*, 503, 145185. <https://doi.org/10.1016/j.jclepro.2025.145185>
- Mady, K., Abdul Halim, M. A. S., Omar, K., Battour, M., & Abdelkareem, R. S. (2024). Environmental pressures and eco-innovation in manufacturing SMEs: the mediating effect of environmental capabilities. *International Journal of Innovation Science*, 16(3), 501–526. <https://doi.org/10.1108/IJIS-08-2022-0163>
- Mohd Fuzi, N., Habidin, N. F., Janudin, S. E., & Ong, S. Y. Y. (2019). Critical success factors of environmental management accounting practices: findings from Malaysian manufacturing industry. *Measuring Business Excellence*, 23(1), 1–14. <https://doi.org/10.1108/MBE-03-2018-0015>
- Odang, N. K., Murni, I., Zharaura, K. A., & Setiaji, Y. T. (2025). When control backfires: The double-edged role of management control systems in environmental capabilities and environmental management accounting practices. *Jurnal Dinamika Akuntansi Dan Bisnis*, 12(1), 153–174. <https://doi.org/10.24815/jdab.v12i1.43670>
- Odang, N. K., & Sinambela, J. S. (2025). Does environmental management accounting associated with sustainability report disclosure? *Jurnal Akuntansi Integratif*, 11(1), 1–11. <https://doi.org/10.29080/jai.v11i01.2026>
- Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879–903. <https://doi.org/10.1037/0021-9010.88.5.879>
- Porter, M. E., & Linde, C. van der. (1995). Toward a new conception of the environment-competitiveness relationship. *Journal of Economic Perspectives*, 9(4), 97–118. <https://doi.org/10.1257/jep.9.4.97>
- Ren, S., Hao, Y., & Wu, H. (2022). How Does Green Investment Affect Environmental Pollution? Evidence from China. *Environmental and Resource Economics*, 81(1), 25–51. <https://doi.org/10.1007/s10640-021-00615-4>
- Sholihin, M., & Ratmono, D. (2021). *Analisis SEM-PLS dengan WarpPLS 7.0 untuk hubungan nonlinier dalam penelitian sosial dan bisnis*. Penerbit Andi.
- Suhaili, M., & Sugiharsono, S. (2019). Role of MSME in absorbing labor and contribution to GDP. *Economics Development Analysis Journal*, 8(3), 301–315. <https://doi.org/10.15294/edaj.v8i3.35229>
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic

- management. *Strategic Management Journal*, 18(7), 509–533. [https://doi.org/10.1002/\(SICI\)1097-0266\(199708\)18:7<509::AID-SMJ882>3.0.CO;2-Z](https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z)
- Thomas, J., Yao, W., Zhang, F., & Zhu, W. (2022). Meet, beat, and pollute. *Review of Accounting Studies*, 27(3), 1038–1078. <https://doi.org/10.1007/s11142-022-09694-0>
- Tipton, E. (2013). Stratified Sampling Using Cluster Analysis: A Sample Selection Strategy for Improved Generalizations From Experiments. *Evaluation Review*, 37(2), 109–139. <https://doi.org/10.1177/0193841X13516324>
- Wang, M., Zhou, J., Xia, X., & Wang, Z. (2022). The mixed impact of environmental regulations and external financing constraints on green technological innovation of enterprise. *International Journal of Environmental Research and Public Health*, 19(19), 11972. <https://doi.org/10.3390/ijerph191911972>
- Wang, Z., Zhu, N., Wang, J., Hu, Y., & Nkana, M. (2022). The impact of environmental taxes on economic benefits and technology innovation input of heavily polluting industries in China. *Frontiers in Environmental Science*, 10. <https://doi.org/10.3389/fenvs.2022.959939>
- Weijters, B., Cabooter, E., & Schillewaert, N. (2010). The effect of rating scale format on response styles: The number of response categories and response category labels. *International Journal of Research in Marketing*, 27(3), 236–247. <https://doi.org/10.1016/j.ijresmar.2010.02.004>
- Xie, T., & Yu, G. (2024). The impact of intelligent investment on corporate green innovation: Moderating effects of executive green perception and environmental regulation. *Finance Research Letters*, 69, 106089. <https://doi.org/10.1016/j.frl.2024.106089>
- Zhang, C., Zou, C. F., Luo, W., & Liao, L. (2022). Effect of environmental tax reform on corporate green technology innovation. *Frontiers in Environmental Science*, 10. <https://doi.org/10.3389/fenvs.2022.1036810>
- Zhang, S., & Cheung, A. (Waikong). (2025). Are green finance and inclusive finance complements or substitutes for MSMEs? – Evidence from China’s green finance reform and innovation pilot zone. *Energy Economics*, 141, 108125. <https://doi.org/10.1016/j.eneco.2024.108125>
- Zhang, W., Zhu, B., Li, Y., & Yan, D. (2024). Revisiting the Porter hypothesis: a multi-country meta-analysis of the relationship between environmental regulation and green innovation. *Humanities and Social Sciences Communications*, 11(1), 232. <https://doi.org/10.1057/s41599-024-02671-9>
- Zhang, X., Song, Y., & Zhang, M. (2023). Exploring the relationship of green investment and green innovation: Evidence from Chinese corporate performance. *Journal of Cleaner Production*, 412, 137444. <https://doi.org/10.1016/j.jclepro.2023.137444>
- Zhang, Y., Shou, S., & Li, Y. (2024). Do green investments impact corporate green innovation? empirical evidence from Chinese-listed companies. *Frontiers in Environmental Science*, 12. <https://doi.org/10.3389/fenvs.2024.1468843>
- Zhao, A., Zhang, H., Liu, Y., & Guan, H. (2024). Environmental taxes, technological innovation and firm performance: Evidence from China’s manufacturing firms. *Heliyon*, 10(10), e31386. <https://doi.org/10.1016/j.heliyon.2024.e31386>
- Zheng, Q., Li, J., & Duan, X. (2023). The Impact of Environmental Tax and

R&D Tax Incentives on Green Innovation. *Sustainability*, 15(9), 7303.  
<https://doi.org/10.3390/su15097303>