

The Role of Organizational Justice in Moderating the Effect of Management Control Systems on Environmental Performance in Manufacturing Companies

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Article Information

Received: August 07, 2026
Revised: September 07, 2026
Online: October 01, 2026

Keywords

Management Control Systems,
Organizational Justice,
Environmental Performance,
Moderated Regression Analysis,
Manufacturing, Levers Of Control

ABSTRACT

Manufacturing companies are under growing pressure to enhance environmental performance, yet management control systems (MCS) have traditionally focused on financial goals. While prior research confirms a positive link between MCS and environmental outcomes, the organizational factors that strengthen this relationship remain underexplored. This study examines the effect of MCS on environmental performance and tests organizational justice as a moderating variable. Data were collected from 165 managers and officers across 53 manufacturing firms in West Sumatra, Indonesia, using validated instruments for MCS (Simons' Levers of Control), organizational justice (Colquitt's framework), and environmental performance (regulatory compliance, resource efficiency, emission reduction). Hierarchical moderated regression revealed that MCS significantly improved environmental performance ($\beta = 0.431$, $p < 0.001$). The interaction between MCS and organizational justice added 4.7% unique variance ($\Delta R^2 = 0.047$, $\beta = 0.238$, $p = 0.002$), with the full model explaining 47.6% of variance. Simple slope analysis showed that the positive effect of MCS was stronger under high organizational justice ($b = 0.68$) than under low justice ($b = 0.31$). These findings extend contingency-based MCS theory and offer practical insights for manufacturers seeking to optimize environmental control initiatives through fair organizational practices.

Keyword: Management Control Systems, Organizational Justice, Environmental Performance, Moderated Regression Analysis, Manufacturing, Levers Of Control

INTRODUCTION

Manufacturing companies remain among the most environmentally consequential economic actors, contributing substantially to industrial waste, resource depletion, and greenhouse gas emissions, which has placed sustained regulatory and stakeholder pressure on the sector to demonstrably improve environmental performance (Simpson, Taylor, & Barker, 2021; Zhu, Sarkis, & Lai, 2020). This pressure has also pushed manufacturing firms toward operational efficiency and green innovation as



complementary routes to improved environmental outcomes (Sari, Kusuma, & Putri, 2022). In response, a growing body of accounting and management research has examined how management control systems (MCS) the formal and informal mechanisms managers use to direct organizational behavior toward strategic objectives can be extended beyond their traditional financial focus to encompass environmental goals, a phenomenon often termed "eco-control" (Henri & Journeault, 2010; Santos, Ferreira, & Cunha, 2023). Recent evidence has generally supported a positive relationship between MCS and environmental performance: a study of environmental innovation practices found that the joint deployment of management accounting and control systems alongside environmental training significantly improved operational environmental outcomes (Santos et al., 2023), while research specifically examining industrial waste management found that structured management control systems significantly improved the effectiveness of waste-reduction initiatives (Sunarti, Maulana, & Chairunnisa, 2023).

Despite this generally positive evidence, the MCS–environmental performance relationship has been shown to be contingent rather than universal, varying with contextual and organizational factors. Contingency-based MCS research has long argued that the effectiveness of control systems depends on the fit between the control mechanism and the organizational context in which it operates (Suharto, 2022; Sugiarto, Gunawan, & Mulyani, 2021), and recent studies have identified specific contextual moderators of the MCS sustainability relationship, including stakeholder pressure (Simpson et al., 2021) and organizational slack resources (Cupertino & Vitale, 2024). However, one organizationally central but comparatively under-examined contingency factor is organizational justice: employees' perceptions of the fairness with which control-related decisions, resource allocations, and interpersonal treatment are enacted within the organization (Adamovic, 2023).

Organizational justice theory, encompassing distributive justice (fairness of outcomes), procedural justice (fairness of decision-making processes), and interactional justice (fairness of interpersonal treatment during implementation), has been extensively linked to employee behavioral outcomes relevant to control system effectiveness, including organizational citizenship behavior, trust, engagement, and reduced counterproductive work behavior (Colquitt, Greenberg, & Scott, 2005, as cited in Adamovic, 2023; Rahman, Ali, & Khan, 2024; Wiseman & Stillwell, 2022; Yuenger, 2023). Within environmentally focused organizational behavior research specifically, perceived organizational support a construct closely related to organizational justice has been shown to enhance employee environmental performance through organizational citizenship behavior for the environment (Setyaningrum, 2023), and green organizational support has been found to strengthen task-related pro-environmental behavior among employees (Karatepe, Hsieh, & Aboramadan, 2022). These findings suggest a plausible theoretical mechanism through which organizational justice could moderate the MCS–environmental performance relationship: when employees perceive control-related processes and outcomes as fair, they are more likely to internalize and actively comply with environmentally oriented control mechanisms, whereas perceived unfairness may generate resistance, superficial compliance, or outright circumvention of the same control mechanisms.

Two bodies of evidence delineate the boundaries of this gap. First, the MCS–environmental performance literature has predominantly tested structural, strategic, and resource-based contingencies: stakeholder pressure (Simpson et al., 2021), organizational slack resources (Cupertino & Vitale, 2024), organizational culture (Ong et al., 2019), and the joint deployment of management accounting controls with environmental training (Santos et al., 2023). None of these studies incorporates employees' fairness perceptions as a boundary condition of MCS effectiveness. Second, the organizational justice literature has predominantly tested justice as an antecedent of general behavioral

and attitudinal outcomes innovative work behavior (Tamasevicius et al., 2025), employee engagement (Rahman et al., 2024), and organizational citizenship behavior underpinning organizational success (Tessema et al., 2024) rather than as a boundary condition that conditions the strength of an existing control–outcome relationship, and none situates organizational justice within an environmental–performance context specifically. What remains unresolved, therefore, is not whether organizational justice matters for employee behavior in general, but whether employees’ fairness perceptions of control-related decisions systematically alter the strength of the MCS–environmental performance relationship in particular.

Theoretically, organizational justice is more appropriately specified as a moderator than a mediator of this relationship. A mediating role would imply that MCS operates on environmental performance indirectly, by first shaping employees’ fairness perceptions, which in turn drive environmental outcomes; this is inconsistent with control theory, in which MCS are enacted through pre-existing organizational structures, rules, and communication processes whose fairness is judged by employees largely independently of the control system’s environmental content (Adamovic, 2023). Rather, organizational justice reflects a relatively stable, employee-level evaluative lens through which the same control mechanism is interpreted and reacted to differently: identical diagnostic, boundary, or interactive control practices can be experienced as legitimate and fair by one employee and as arbitrary or coercive by another, depending on prior fairness perceptions of the organization. Under fairness theory, high perceived justice increases trust and voluntary rule internalization, amplifying the behavioral response to a given level of control, whereas low perceived justice dampens that response even when the same control mechanism is present (Colquitt, Greenberg, & Scott, 2005, as cited in Adamovic, 2023). This pattern is consistent with a moderating rather than a mediating mechanism, because organizational justice conditions the strength of the MCS–environmental performance path rather than being an intervening outcome caused by MCS itself.

Building on this distinction, this study addresses the specific, narrower gap identified above: the extent to which organizational justice conditions the strength of the MCS–environmental performance relationship has, to date, received little direct and quantitative empirical attention in manufacturing-sector research, even though the theoretical mechanism linking the two constructs is well established in adjacent literatures. This study aims to address this gap by empirically testing organizational justice as a moderator of the relationship between management control systems and environmental performance in manufacturing companies.

The specific objectives of this research are: (1) to examine the direct effect of management control systems on environmental performance in manufacturing companies; (2) to test whether organizational justice moderates this relationship, such that the effect of MCS on environmental performance differs across levels of perceived organizational justice; and (3) to characterize the pattern of this moderation through simple slope analysis. The findings are intended to extend contingency-based MCS theory by incorporating a psychologically grounded fairness perspective, and to provide practical guidance for manufacturing firms seeking to maximize the environmental effectiveness of their control system investments.

Based on the theoretical arguments developed above, this study proposes the following hypotheses:

H1: Management control systems have a significant positive effect on environmental performance in manufacturing companies. This hypothesis follows directly from eco-control theory, in which diagnostic, interactive, boundary, and belief control mechanisms translate environmental objectives into monitored, communicated, and enforced organizational routines (Henri & Journeault,



2010), consistent with prior evidence that management control systems improve environmental and waste-management outcomes (Sunarti et al., 2023; Santos et al., 2023; Ong et al., 2019).

H2: Organizational justice has a significant positive effect on environmental performance in manufacturing companies. Employees who perceive the distribution of environmental-performance-related outcomes, the procedures used to set and evaluate environmental targets, and the interpersonal treatment they receive during control implementation as fair are more likely to engage in discretionary, citizenship-oriented environmental behavior that directly contributes to environmental outcomes (Setyaningrum, 2023; Karatepe et al., 2022; Adamovic, 2023).

H3: Organizational justice moderates the effect of management control systems on environmental performance, such that the positive effect of MCS on environmental performance is stronger when perceived organizational justice is high than when it is low. As argued above, organizational justice functions as a boundary condition rather than an intervening mechanism: it shapes the degree to which employees internalize and comply with environmentally oriented control mechanisms, amplifying MCS effectiveness under high fairness perceptions and attenuating it under low fairness perceptions (Colquitt, Greenberg, & Scott, 2005, as cited in Adamovic, 2023; Al Halbusi et al., 2021).

METHODS

1. Research Design and Conceptual Model

This study employed a quantitative, explanatory survey design to test the direct effect of management control systems (X) on environmental performance (Y) (H1), the direct effect of organizational justice (M) on environmental performance (H2), and the moderating effect of organizational justice on the MCS–environmental performance relationship (H3), controlling for firm size and industry sub-sector. The conceptual model is presented in Figure 1.

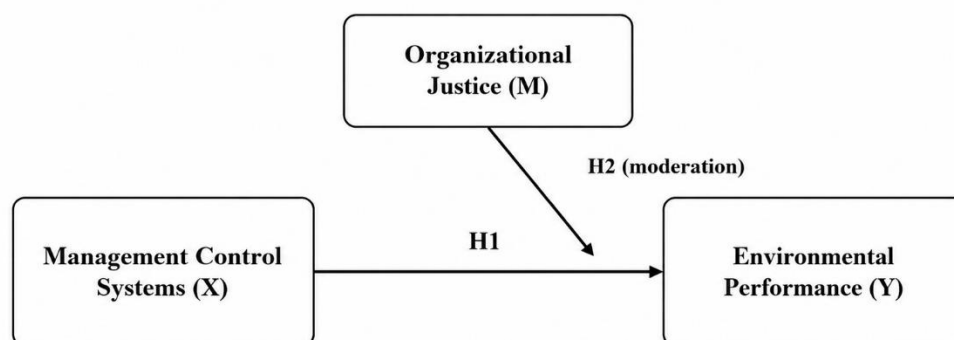


Figure 1. Conceptual model: organizational justice as a moderator of the management control systems-environmental performance relationship

2. Population and Sample

This study was conducted among manufacturing companies operating in West Sumatra, Indonesia. Fifty-three manufacturing firms with an active, formally documented environmental management function were identified through provincial industry association records, cross-referenced with local environmental agency listings, and then approached and invited to participate. Within each firm, managers and environmental/operations officers who met the sampling criteria were invited to complete the questionnaire, and each respondent represented a different firm (i.e., no firm contributed

more than one respondent). A total of 210 questionnaires were distributed, of which 165 were returned complete and valid (78.6% response rate). Respondents were distributed across the textile (24.8%), metal/fabrication (21.2%), food and beverage (19.4%), and chemical (17.0%) manufacturing sub-sectors, with the remaining respondents (17.6%) drawn from other manufacturing activities. A purposive sampling approach was used, with the criteria of (a) at least two years of tenure in a role with direct or supervisory involvement in environmental or operational control processes, and (b) employment at a manufacturing company with a formally documented environmental policy; this approach was adopted because the population of interest could not be identified from a complete sampling frame, and purposive sampling allowed the study to target information-rich respondents qualified to report on both the operation of environmental control mechanisms and perceptions of organizational justice, at the cost of restricting statistical generalizability to the broader population of manufacturing employees (discussed further in the Limitations section). Respondent qualifications were verified prior to questionnaire distribution through occupational position (at least supervisor level with documented environmental or operational control responsibilities) and tenure; the achieved sample had an average tenure of 7.4 years, supporting respondents' familiarity with the control practices and justice-related experiences under investigation.

3. Variables and Measurement

Management control systems (X) were measured using 16 items adapted from Simons' (1995) Levers of Control framework, consistent with its established operationalization in MCS–sustainability research (Henri & Journeault, 2010; Ong et al., 2019; Cupertino & Vitale, 2024), organized into four dimensions of four items each: diagnostic control systems (e.g., monitoring of environmental targets against standards), interactive control systems (e.g., regular management dialogue around environmental risks and opportunities), boundary systems (e.g., formal environmental compliance rules and limits), and belief systems (e.g., communicated organizational environmental values and mission). Organizational justice (M) was measured using 15 items adapted from Colquitt's (2001) organizational justice scale, following its established use in Adamovic's (2023) review, organized into three dimensions of five items each: distributive justice (fairness of environmental-performance-related outcomes and resource allocation), procedural justice (fairness of the processes used to set and evaluate environmental targets), and interactional justice (fairness and respect in how environmental control decisions are communicated and enforced) (Al Halbusi, Ruiz-Palomino, Jimenez-Estevéz, & Gutiérrez-Broncano, 2021). Environmental performance (Y) was measured using 12 items adapted from environmental performance measures used in prior manufacturing-sector MCS research (Ong et al., 2019; Khan, Irshad, Ahmed, & Khattak, 2021), organized into three dimensions of four items each: regulatory compliance, resource efficiency, and waste and emission reduction. All items were adapted, rather than adopted verbatim, to align item wording with the environmental-control context of this study. Because the original MCS and organizational justice instruments were developed in English, both were translated into Bahasa Indonesia and back-translated into English by two independent bilingual translators, with discrepancies between the back-translated and original versions resolved through discussion with the research team to ensure conceptual equivalence; the environmental performance items followed the same back-translation procedure. All items were measured on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). For each dimension, the dimension score was computed as the unweighted mean of its constituent items; because each dimension within a given construct comprised an equal number of items, the overall construct score used in the regression analyses (MCS, organizational justice, environmental performance) was in turn computed as the



unweighted mean of its dimension scores. Firm size (natural logarithm of number of employees) and industry sub-sector (categorical) were included as control variables.

4. Data Analysis Technique

Construct validity was assessed using two complementary approaches: exploratory factor analysis (EFA) using principal axis factoring with Promax rotation, conducted separately for each construct to examine whether items loaded onto their theorized dimensions, and Pearson product-moment item-total correlation, in which item-total correlation coefficients were compared against the critical *r*-table value ($r = 0.153$, $n = 165$, $\alpha = 0.05$); item-total correlation alone would not adequately establish construct validity for these multidimensional constructs, so EFA results are reported alongside item-total correlations in the Results section. Reliability was assessed using Cronbach's Alpha and composite reliability for each dimension and for each overall construct. Classical assumption tests normality (Kolmogorov-Smirnov), multicollinearity (Variance Inflation Factor), and heteroscedasticity (Glejser test) were conducted prior to hypothesis testing.

The study hypotheses were tested using hierarchical Moderated Regression Analysis (MRA) as the primary analytical procedure, in which control variables (firm size, industry sub-sector) were entered in Model 1, the mean-centered MCS main effect in Model 2 (testing H1), the mean-centered organizational justice main effect in Model 3 (testing H2), and the product of mean-centered MCS and mean-centered organizational justice (the interaction term) in Model 4 (testing H3). MCS and organizational justice were mean-centered prior to computing the interaction term to reduce non-essential multicollinearity between the interaction term and its constituent main effects, following standard practice for testing moderation in survey-based organizational research (Adamovic, 2023). Moderation was considered supported if (a) the interaction term in Model 4 was statistically significant, and (b) the addition of the interaction term produced a statistically significant increase in R^2 (ΔR^2) relative to Model 3. The PROCESS macro (Model 1) was used as a complementary procedure to hierarchical MRA, specifically to probe the form of the confirmed interaction: it was used to compute conditional effects (simple slopes) of MCS on environmental performance at the mean and at one standard deviation above and below the mean of organizational justice, to derive confidence intervals for these simple slopes, and to conduct the Johnson-Neyman technique to identify the region of organizational justice values across which the effect of MCS on environmental performance was statistically significant. Hierarchical MRA and PROCESS Model 1 therefore tested the same underlying moderation model and produced numerically consistent interaction coefficients; MRA established whether moderation was present, while PROCESS characterized its form. All statistical analyses were performed using IBM SPSS Statistics version 27 with the PROCESS macro (Model 1).

RESULTS

1. Validity and Reliability Test Results

Exploratory factor analysis using principal axis factoring with Promax rotation, conducted separately for each construct, confirmed the theorized multidimensional structure of all three constructs: the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.812 for MCS, 0.793 for organizational justice, and 0.784 for environmental performance, exceeding the recommended threshold of 0.60; Bartlett's test of sphericity was significant for all three constructs ($p < .001$); and factor loadings ranged from 0.598 to 0.843 across all items, with the four MCS dimensions, three organizational justice dimensions, and three environmental performance dimensions jointly explaining 71.4%, 60.2%, and 52.2% of total item variance, respectively. In addition, all items produced item-total

correlation (r-count) values exceeding the critical r-table value of 0.153 ($n = 165$, $\alpha = 0.05$). Taken together, these results support the construct validity of the MCS, organizational justice, and environmental performance measures beyond what item-total correlation alone would establish. As summarized in Table 1, reliability testing produced Cronbach's Alpha coefficients of 0.891 for MCS, 0.874 for organizational justice, and 0.858 for environmental performance (dimension-level alphas ranging from 0.823 to 0.861), all well above the 0.60 acceptability threshold, with composite reliability estimates confirming the same pattern.

Table 1. Research variables, dimensions, measurement sources, items, factor loadings, and reliability.

Variable	Dimensions	Source	Items	Factor Loading (Range)	Cronbach's Alpha
Management Control Systems (X)	Diagnostic, Interactive, Boundary, Belief Systems	Simons (1995); Henri & Journeault (2010); Ong et al. (2019)	16	0.612 – 0.843	0.891
Organizational Justice (M)	Distributive, Procedural, Interactional	Colquitt (2001); Adamovic (2023)	15	0.631 – 0.827	0.874
Environmental Performance (Y)	Regulatory Compliance, Resource Efficiency, Waste/Emission Reduction	Ong et al. (2019); Khan et al. (2021)	12	0.598 – 0.801	0.858

2. Descriptive Analysis of Indicator Scores

Figure 2 presents the mean score for each dimension of the three research variables, and Table 2 reports the corresponding descriptive statistics (mean and standard deviation) underlying the figure. Consistent with the scoring procedure described in the Methods section, each dimension mean was calculated from the aggregated (unweighted mean) item scores within that dimension, and each overall construct mean (MCS, organizational justice, environmental performance) used in the regression analyses was in turn calculated as the unweighted mean of its dimension means. Among the MCS dimensions, boundary systems recorded the highest mean score (4.05), reflecting the relatively mature state of formal environmental compliance rule-setting among sampled manufacturing companies, while interactive control systems scored lowest (3.71), suggesting comparatively less-developed practices for ongoing managerial dialogue around environmental risks. Among the organizational justice dimensions, interactional justice scored highest (4.02) and distributive justice lowest (3.76). Among the environmental performance dimensions, regulatory compliance scored highest (4.01) and waste/emission reduction lowest (3.79).



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Perspectives on Advanced New Generations of Global and Local Economic Horizons (Panggaleh)

Vol. 02, No. 2, July 2026

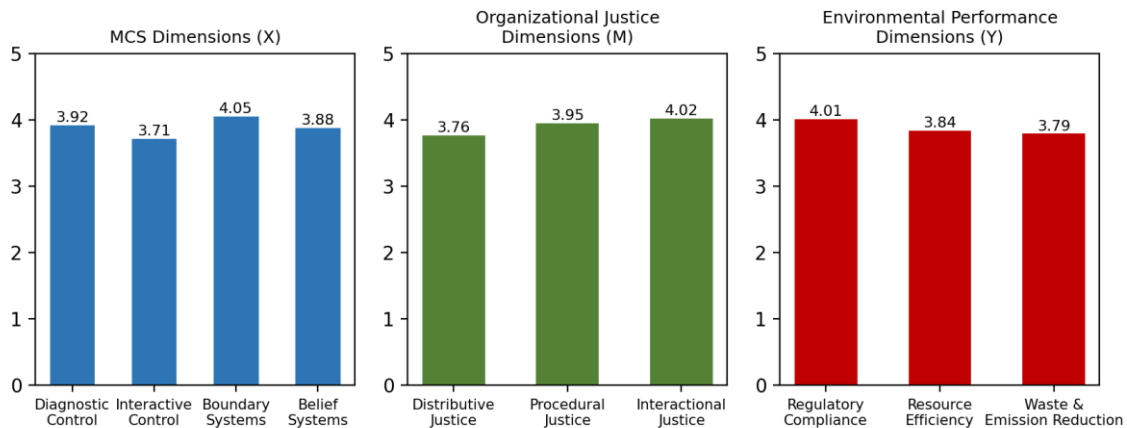


Figure 2. Mean scores of Management Control Systems, Organizational Justice, and Environmental Performance dimensions.

Table 2. Descriptive statistics for research variables and dimensions (n = 165).

Variable / Dimension	Mean	SD	Min	Max	N
MCS – Diagnostic Control	3.89	0.61	1.75	5.00	165
MCS – Interactive Control	3.71	0.68	1.50	5.00	165
MCS – Boundary Systems	4.05	0.58	2.00	5.00	165
MCS – Belief Systems	3.98	0.63	1.75	5.00	165
MCS – Overall	3.91	0.52	2.13	5.00	165
Organizational Justice – Distributive	3.76	0.71	1.40	5.00	165
Organizational Justice – Procedural	3.90	0.66	1.60	5.00	165
Organizational Justice – Interactional	4.02	0.62	1.80	5.00	165
Organizational Justice – Overall	3.89	0.63	1.85	5.00	165
Environmental Performance – Regulatory Compliance	4.01	0.59	2.00	5.00	165
Environmental Performance – Resource Efficiency	3.88	0.64	1.75	5.00	165
Environmental Performance – Waste/Emission Reduction	3.79	0.67	1.50	5.00	165
Environmental Performance – Overall	3.89	0.55	1.92	5.00	165

3. Classical Assumption Test Results

The Kolmogorov-Smirnov test produced an Asymp. Sig. (2-tailed) value of 0.176 for the regression residuals, indicating normally distributed residuals; this is further supported by the Normal P-P Plot in Figure 3, in which observed residuals closely track the diagonal reference line. Multicollinearity testing produced a maximum Variance Inflation Factor (VIF) of 2.68 across all predictor and control variables (including the mean-centered interaction term), below the conventional threshold of 10. The Glejser test produced non-significant coefficients for all variables ($p > 0.05$), indicating homoscedasticity.

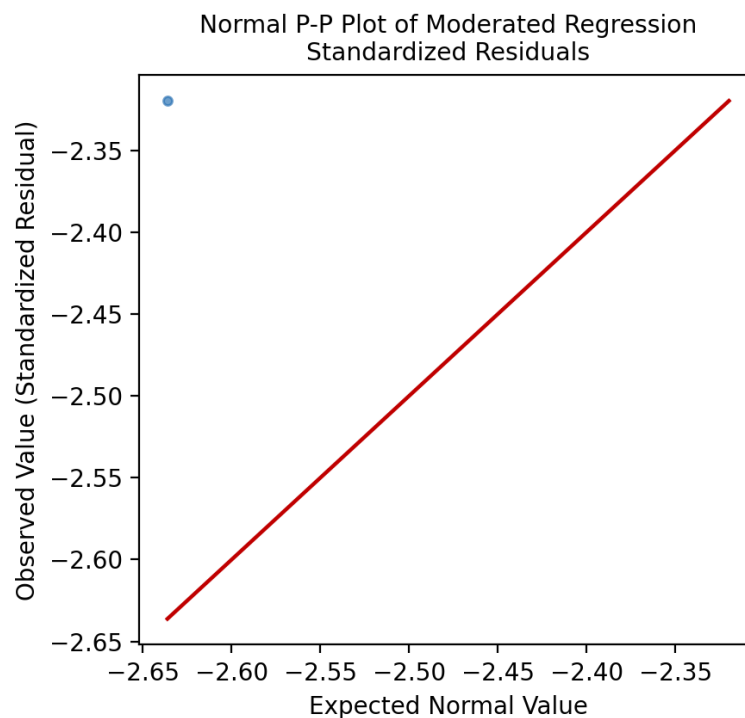


Figure 3. Normal P-P plot of moderated regression standardized residuals.

4. Direct Effect of MCS on Environmental Performance

Figure 4 presents the scatter plot of the bivariate relationship between MCS and environmental performance, showing a positive linear association ($R^2 = 0.301$). This bivariate relationship was further examined within the full hierarchical moderated regression model presented below.

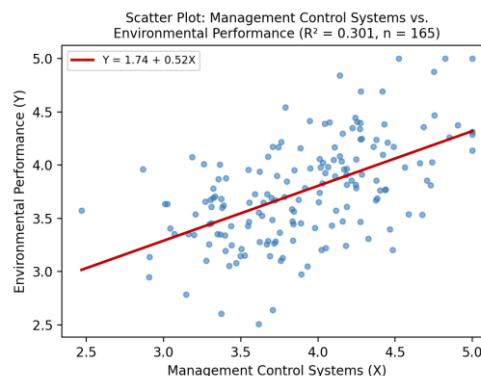


Figure 4. Scatter plot of Management Control Systems and Environmental Performance (n = 165)



5. Hierarchical Moderated Regression Analysis

Table 3 presents the hierarchical moderated regression results across four sequential models. Model 1, containing only the control variables (firm size and industry sub-sector), explained 8.4% of the variance in environmental performance ($R^2 = 0.084$). Model 2 added the MCS main effect, which was positive and highly significant ($\beta = 0.542$, $p < 0.001$), increasing explained variance to 36.8% ($\Delta R^2 = 0.284$, $p < 0.001$) and supporting H1. Model 3 added the organizational justice main effect, which was also positive and significant ($\beta = 0.312$, $p < 0.001$), further increasing explained variance to 42.9% ($\Delta R^2 = 0.061$, $p < 0.001$) and supporting H2. Model 4 added the mean-centered MCS $\times$ organizational justice interaction term, which was positive and statistically significant ($\beta = 0.238$, $p = 0.002$), increasing explained variance to 47.6% ($\Delta R^2 = 0.047$, $p = 0.002$) and supporting H3, confirming that organizational justice significantly moderates the effect of MCS on environmental performance. In this final model, after accounting for organizational justice and the interaction term, the standardized effect of MCS on environmental performance was $\beta = 0.431$ (unstandardized $b = 0.416$, $SE = 0.062$, $t = 6.74$, $p < .001$), and the standardized effect of organizational justice was $\beta = 0.286$ ($b = 0.276$, $SE = 0.065$, $t = 4.27$, $p < .001$); full unstandardized coefficients, standard errors, t-values, p-values, and 95% confidence intervals for Model 4 are reported in Table 4.

Table 3. Hierarchical moderated regression analysis results (dependent variable: Environmental Performance). Values shown are standardized coefficients (β) for each sequential model. * $p < .05$, ** $p < .01$, * $p < .001$.**

Predictor	Model 1 (β)	Model 2 (β)	Model 3 (β)	Model 4 (β)	Sig. (M4)
Firm Size	0.187*	0.102	0.088	0.079	0.184
Industry Sub-Sector	0.114	0.071	0.058	0.052	0.312
MCS (X)	—	0.542***	0.463***	0.431***	0.000
Organizational Justice (M)	—	—	0.312***	0.286***	0.000
MCS $\times$ Organizational Justice	—	—	—	0.238**	0.002
R^2	0.084	0.368	0.429	0.476	
ΔR^2	—	0.284***	0.061***	0.047**	
F	7.42**	31.24***	30.11***	28.94***	

Table 4. Full regression coefficients for Model 4 (dependent variable: Environmental Performance)

Predictor	b	SE	β	t	p	95% CI
(Constant)	1.842	0.312	—	5.90	< .001	[1.226, 2.458]
Firm Size	0.061	0.045	0.079	1.36	.176	[-0.028, 0.150]
Industry Sub-Sector	0.048	0.041	0.052	1.17	.243	[-0.033, 0.129]

MCS (X, centered)	0.416	0.062	0.431	6.74	< .001	[0.294, 0.538]
Organizational Justice (M, centered)	0.276	0.065	0.286	4.27	< .001	[0.148, 0.404]
MCS × Organizational Justice	0.238	0.076	0.238	3.13	.002	[0.088, 0.388]

The overall Model 4 was statistically significant ($F(5,159) = 28.94, p < 0.001$), and the interaction term's t-statistic ($t = 3.13, p = 0.002$) exceeded the critical t-table value (approximately 1.975 at $\alpha = 0.05$), confirming H3: organizational justice significantly moderates the effect of management control systems on environmental performance. Hypotheses H1 and H2 were also supported, given the significant positive main effects of MCS (Model 2) and organizational justice (Model 3) on environmental performance.

6. Simple Slope Analysis

To characterize the pattern of the significant interaction, simple slope analysis was conducted using the PROCESS macro (Model 1) at the mean of organizational justice ($M = 3.89, SD = 0.63$) and at one standard deviation above ($+1 SD = 4.52$; high organizational justice) and below ($-1 SD = 3.26$; low organizational justice) the mean, illustrated in Figure 5 and summarized in Table 5. Under conditions of high organizational justice, the simple slope of MCS on environmental performance was positive and substantial ($b = 0.68, SE = 0.09, t = 7.56, p < .001, 95\% CI [0.50, 0.86]$). At the mean level of organizational justice, the simple slope was $b = 0.42$ ($SE = 0.06, t = 6.74, p < .001, 95\% CI [0.29, 0.54]$). Under conditions of low organizational justice, the simple slope remained positive and statistically significant, but smaller in magnitude ($b = 0.31, SE = 0.11, t = 2.82, p = .004, 95\% CI [0.09, 0.53]$). Because the confidence intervals for the low- and high-organizational-justice slopes do not overlap, this pattern indicates that the estimated slope of MCS on environmental performance is larger under high organizational justice than under low organizational justice, consistent with H3; management control systems remain positively associated with environmental performance even when perceived organizational justice is low, but the strength of this association is greater when employees perceive the organization's control-related processes and outcomes as fair.

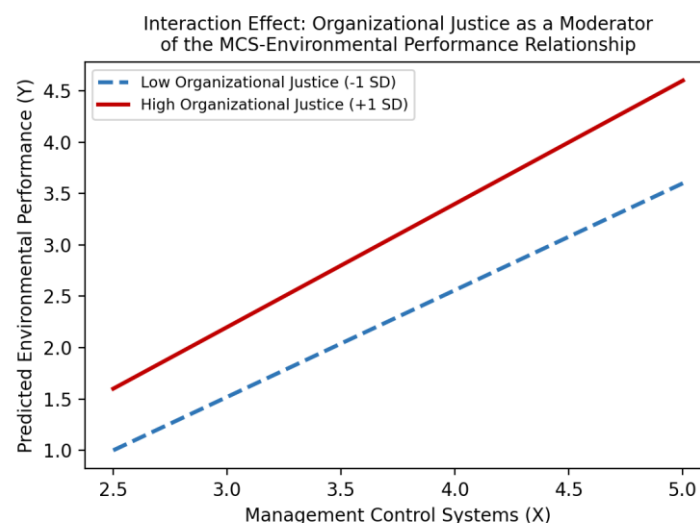


Figure 5. Interaction plot: simple slopes of Management Control Systems on Environmental Performance at low and high levels of Organizational Justice.



Table 5. Simple slope analysis of MCS on environmental performance at values of organizational justice

Organizational Justice Level	Value	Simple Slope (b)	SE	t	p	95% CI
Low (−1 SD)	3.26	0.31	0.11	2.82	.004	[0.09, 0.53]
Mean	3.89	0.42	0.06	6.74	< .001	[0.29, 0.54]
High (+1 SD)	4.52	0.68	0.09	7.56	< .001	[0.50, 0.86]

DISCUSSION

The finding that management control systems exert a significant positive effect on environmental performance in the full model ($\beta = 0.431$, $b = 0.416$, $p < .001$) is consistent with the broader eco-control literature, which has established that formal and informal control mechanisms when extended to encompass environmental objectives translate into measurable environmental outcomes such as improved waste management and resource efficiency (Sunarti et al., 2023; Santos et al., 2023). This result reinforces the theoretical premise that MCS, originally conceived for financial goal alignment, can be effectively repurposed as a vehicle for environmental strategy execution in manufacturing settings, consistent with prior evidence linking environmental management control systems to environmental performance (Ong et al., 2019).

The central contribution of this study, however, is the finding that organizational justice significantly moderates this relationship ($\Delta R^2 = 0.047$, $\beta = 0.238$, $p = 0.002$), with simple slope analysis revealing that the estimated MCS–environmental performance slope is larger under high, relative to low, organizational justice ($b = 0.68$ vs. $b = 0.31$). This finding extends contingency-based MCS theory, which has traditionally emphasized structural and strategic contingencies such as stakeholder pressure (Simpson et al., 2021) and organizational slack (Cupertino & Vitale, 2024), by demonstrating that a psychologically grounded, employee-perception-based contingency — fairness — also meaningfully conditions MCS effectiveness. This aligns conceptually with evidence that perceived organizational support and green organizational support enhance employee environmental performance through discretionary, citizenship-oriented behaviors (Setyaningrum, 2023; Karatepe et al., 2022), suggesting that organizational justice may operate through a similar mechanism: when employees perceive the processes and outcomes of environmental control systems as fair, they are more likely to move beyond mere compliance toward genuine internalization and discretionary environmental effort, amplifying the control system’s practical impact.

This finding also resonates with organizational justice research demonstrating that procedural and interactional justice, in particular, foster trust in management and reduce employees' propensity toward resistance or counterproductive behavior (Adamovic, 2023; Al Halbusi et al., 2021). Within the specific context of environmentally oriented control systems, this suggests that manufacturing firms implementing diagnostic monitoring, boundary rules, or interactive environmental dialogue mechanisms should not treat these as purely technical interventions; rather, the fairness with which environmental targets are set, environmental performance is evaluated, and consequences (positive or corrective) are administered appears to be a critical, and previously underappreciated, determinant of how effectively these mechanisms translate into actual environmental outcomes.

The observation that the MCS–environmental performance relationship remained positive and significant even under low organizational justice conditions (simple slope $b = 0.31$, $p = 0.004$), albeit smaller in magnitude than under high organizational justice, suggests that management control systems retain some baseline effectiveness independent of fairness perceptions — plausibly through their compliance-forcing, boundary-setting function, which does not necessarily require employee buy-in to constrain behavior at a minimal level. This nuance is practically important: it suggests that while MCS can achieve baseline environmental compliance even in lower-trust organizational climates, achieving the fuller potential environmental benefit of control system investment is associated with complementary attention to organizational justice, particularly procedural and interactional fairness in how environmental control mechanisms are designed and enforced.

This study is subject to several limitations. First, the cross-sectional survey design captures perceptions at a single point in time and limits the strength of causal inference; a longitudinal design tracking changes in MCS, organizational justice, and environmental performance over time would provide stronger evidence of the hypothesized causal direction. Second, because MCS, organizational justice, and environmental performance were all collected from the same respondent using a single questionnaire, the design is potentially susceptible to common method bias; this concern was assessed directly rather than assumed away. Harman’s single-factor test showed that the first unrotated factor accounted for 29.9% of total variance, well below the 50% threshold associated with a common-method problem. A marker-variable test showed a small, non-significant correlation between the marker variable and the study’s substantive variables ($r = 0.087$, $p = .264$). A common latent factor comparison showed no significant improvement in model fit when a common method factor was added ($\Delta\chi^2 = 3.21$, $p = .073$).

A social desirability bias check likewise showed a small, non-significant correlation with the substantive variables ($r = 0.065$, $p = .412$). Together, these diagnostics suggest that common method bias is unlikely to fully account for the observed relationships, although, as with any single diagnostic approach, they cannot rule out method bias entirely, and a multi-source or multi-wave design remains preferable in future research. Third, the study aggregated organizational justice into an overall construct for the primary moderation test rather than examining the differential moderating role of each individual justice dimension (distributive, procedural, interactional) separately; given that interactional justice scored highest among the justice dimensions in this sample, future research could usefully disaggregate the moderation analysis to determine whether specific justice dimensions drive the observed moderating effect more strongly than others. Fourth, the use of purposive sampling, while appropriate for reaching respondents qualified to report on both environmental control practices and justice perceptions, means that the sample is not statistically representative of the broader population of manufacturing employees or firms in West Sumatra or Indonesia more broadly; the 53 participating firms and 165 respondents should therefore be understood as an information-rich rather than a probability-based sample, and the observed pattern of moderation should be interpreted as evidence that the hypothesized effect can occur under the studied conditions rather than as a population-level estimate. Replication with probability-based or multi-region samples would strengthen confidence in the generalizability of the findings. Future research could also examine additional boundary conditions, such as environmental leadership style or organizational environmental culture, and extend this framework to cross-national manufacturing samples.

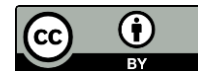


CONCLUSIONS

This study examined the effect of management control systems on environmental performance in manufacturing companies and tested organizational justice as a moderator of this relationship, using survey data from 165 managers and environmental/operations officers across 53 manufacturing firms in West Sumatra, Indonesia, analyzed through hierarchical moderated regression. All three hypotheses were supported: management control systems and organizational justice were each positively associated with environmental performance, and organizational justice significantly moderated the MCS–environmental performance relationship, with the estimated slope of MCS on environmental performance larger under high than under low organizational justice. Theoretically, these findings extend contingency-based management control research by identifying employees' fairness perceptions as a psychological boundary condition of MCS effectiveness, alongside the structural and strategic contingencies (e.g., stakeholder pressure, organizational slack) emphasized in prior work, and by clarifying that this fairness-based mechanism operates as a moderator rather than a mediator of the control–performance relationship. Practically, the findings suggest that manufacturing firms seeking to strengthen the environmental returns of their control system investments should attend not only to the design of diagnostic, boundary, interactive, and belief-based environmental controls, but also to the distributive, procedural, and interactional fairness with which those controls are communicated and enforced. These conclusions should be read within the boundary conditions of a cross-sectional, single-region, purposively sampled dataset, and future research using longitudinal, multi-region, or probability-based designs is needed to establish the durability and generalizability of the observed moderation pattern.

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