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Leadership Communication and Effectiveness of Environmental Management Systems Implementation among Certified Manufacturing Firms in Kenya

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Abstract

This study examined the influence of leadership communication - as one dimension of leadership commitment- and perceived EMS effectiveness among ISO 14001:2015-certified manufacturing firms in Kenya. ISO 14001:2015 certification does not necessarily indicate equivalent environmental management system (EMS) implementation effectiveness across firms. A cross-sectional explanatory survey invited all 60 eligible firms registered with the Kenya Association of Manufacturers. Seventy-seven completed questionnaires were received from 40 firms. Paired responses from 37 firms (74 respondents) formed the primary firm-level analytical sample. Partial least squares structural equation modelling (PLS-SEM), with 10,000 bootstrap subsamples, estimated the association while accounting for resource allocation, leadership involvement and implementation maturity. In the full-sample model, leadership communication had a positive association with perceived EMS effectiveness ($\beta = .375$, $t = 1.873$, $p = .031$, one-tailed; $f^2 = .114$), although the two-tailed p-value was .061. Excluding Firm 21 reduced the coefficient to $\beta = .252$ and rendered it non-significant ($p = .104$, one-tailed). Implementation maturity was positively associated with effectiveness ($\beta = .554$, $p = .001$; $f^2 = .436$), while resource allocation and leadership involvement showed negligible associations in the estimated model. The findings provide preliminary, sensitivity-dependent evidence of a positive association, not a robust or causal effect. Manufacturing firms may review how environmental policies, objectives, responsibilities and EMS-related changes are communicated alongside resources and implementation processes. The study distinguishes leadership communication and perceived EMS effectiveness from certification status. Its contribution is qualified by the small firm-level sample, overlap between communication and leadership involvement, and sensitivity of the focal estimate.

Key terms: Environmental management systems, implementation effectiveness, ISO 14001, leadership communication, manufacturing firms.

INTRODUCTION

ISO 14001:2015 (International Organisation for Standardisation [ISO], 2015) certification does not guarantee equivalent environmental management system (EMS) implementation effectiveness. Firms may differ in how fully they integrate environmental objectives, responsibilities and monitoring into routine operations. This study examines top leadership communication as one factor that may help explain such variation among certified manufacturing firms in Kenya.

EMS implementation effectiveness refers to the extent to which an EMS achieves intended outcomes, including compliance, fewer incidents and non-conformities, resource efficiency, waste reduction and continual improvement. Certification indicates conformity with a standard; it does not by itself establish that these outcomes are achieved to the same degree across firms.

ISO 14001:2015 Clause 5.1 assigns top management responsibility for EMS effectiveness, alignment of environmental objectives with strategic direction, integration of EMS requirements into business processes and communication of the importance of effective environmental management. Leadership commitment may therefore help explain differences in implementation, although it is not the only relevant organisational condition.

This study focuses on top leadership communication as a distinct manifestation of commitment. Clause 5.1(e) requires top management to communicate the importance of effective environmental management and conformity with EMS requirements. Communication may clarify priorities, responsibilities and expected practices, but its association with effectiveness should be examined separately from resource allocation and leadership involvement.

The study examines the association between top leadership communication and perceived EMS implementation effectiveness in ISO 14001:2015-certified manufacturing firms in Kenya. It contributes evidence from this setting and treats communication as a distinct leadership behaviour, while interpreting the results in light of construct overlap and sensitivity analyses.

The article contributes by examining communication separately rather than treating leadership commitment as an undifferentiated construct. Given the modest firm-level sample and sensitivity of the estimate, the findings are interpreted as preliminary evidence of association, not causation.

LITERATURE REVIEW

EMS Implementation Effectiveness

Environmental management systems provide a structured approach to managing environmental responsibilities, compliance obligations and performance. ISO 14001:2015 requires organisations to establish, implement, maintain and continually improve an EMS, but implementation depth can vary among certified organisations.

Effectiveness concerns whether an EMS achieves intended outcomes rather than merely maintaining documents or meeting certification requirements. Relevant outcomes include compliance, fewer non-conformities, improved resource efficiency, waste reduction, meeting environmental objectives and continual improvement.

Research distinguishes formal adoption from substantive implementation. Boiral et al. (2018) reviewed evidence on ISO 14001 adoption and outcomes, while Johnstone (2022) examined environmental management control systems in certified SMEs. Chowdhury et al. (2018) compared symbolic and substantive implementation of international standards. Together, these studies indicate that certification alone is an incomplete proxy for implementation outcomes; however, their settings and measures differ, limiting direct transfer to Kenyan manufacturing firms.

Three concepts are distinguished. Leadership Communication concerns messages about environmental policy, objectives, responsibilities, performance and EMS changes. EMS Implementation Maturity concerns the depth of integration of EMS requirements into strategy, monitoring and routine decisions. EMS Implementation Effectiveness concerns perceived achievement of intended EMS outcomes.

Leadership Commitment in ISO 14001:2015

ISO 14001:2015 places leadership commitment at the centre of the EMS. Clause 5.1 makes top management accountable for EMS effectiveness, strategic alignment, integration into business processes and support for personnel. These responsibilities imply several related behaviours rather than one interchangeable practice. The standard distinguishes leadership responsibilities: resource provision is addressed in Clauses 5.1(d), 7.1 and 7.2; leadership involvement in Clauses 5.1, 5.2 and 9.3; while communication is addressed in Clauses 5.1(e), 7.3 and 7.4. The research study considered three dimensions of leadership commitment, namely: leadership communication, resource allocation and leadership involvement. The study treats communication as distinct from resource allocation and involvement, while recognising that these behaviours may overlap in practice.

Chowdhury et al. (2018), Weerasinghe and Jayasooriya (2020) and Chiarini (2019) examine leadership commitment or implementation factors in different organisational and national settings. Their findings support the relevance of management involvement but do not isolate the specific association between leadership communication and perceived EMS implementation effectiveness in Kenyan manufacturing firms.

Top Leadership Communication and EMS Implementation Effectiveness

International studies provide relevant but not fully comparable evidence. Sammalisto and Brorson (2008) examined training and communication during ISO 14001 implementation at the University of Gävle in Sweden, providing related process-level evidence from a higher-education setting that differs from the manufacturing context of the present study. Chowdhury et al. (2018), using 328 firms in Australia and New Zealand, linked top-management commitment to implementation of international standards, while Ji et al. (2023) examined CEO sustainability-vision communication and sustainability performance through an Upper Echelons Theory lens. These studies support the relevance of leadership signals, but neither directly tests the present relationship in Kenyan ISO-certified manufacturing firms.

Research in certified manufacturing firms in India also examined green human-resource factors. Lather and Goyal (2015) reported that environmental communication was not significantly associated with perceived environmental performance in their sample, a useful contrast to the positive relationship hypothesised here. African research highlights the role of management practices in embedding environmental requirements. Tayo Tene et al. (2021), drawing on 35 practitioner interviews in Cameroon, Senegal and Côte d'Ivoire, examined whether quality management supports internalisation of environmental practices. Its qualitative focus and different outcome mean that it offers contextual insight rather than a direct test of the communication–effectiveness relationship.

Botchway and Gbedemah (2018) reported a case study of ISO 14001 implementation in a cable-manufacturing company in Ghana, while Mungai et al. (2020) studied voluntary EMSs and waste-management performance among Kenyan firms. Kenyan and regional evidence remains limited for the specific relationship examined here. These studies concern relevant settings and outcomes but do not directly establish whether top leadership communication is associated with perceived EMS implementation effectiveness across certified Kenyan manufacturers.

Critical Synthesis and Research Gap

The literature supports three conclusions. First, certification and substantive implementation are not equivalent (Boiral et al., 2018; Chowdhury et al., 2018). Second, leadership commitment matters, but communication, resource allocation and involvement are related rather than identical behaviours. Third, studies across international and African settings use different samples, methods and outcomes, leaving uncertainty about the specific communication–effectiveness relationship among certified Kenyan manufacturers. This study addresses that gap using firm-level survey data, while accounting for related leadership dimensions and implementation maturity.

Upper Echelons Theory

Upper Echelons Theory (UET; Hambrick & Mason, 1984) proposes that organisational outcomes are partly shaped by senior executives' characteristics, values, experiences and interpretations. Leaders

translate their priorities into strategic choices and organisational signals; these choices can influence which issues receive attention and resources.

UET is relevant because EMS implementation requires sustained strategic attention, cross-functional coordination and employee support. The theory does not imply that communication alone determines effectiveness; rather, communication is one observable route through which senior leaders can signal environmental priorities alongside resource decisions and involvement.

Here, top leadership communication refers to messages about policy, objectives, performance, responsibilities and EMS-related change. Such communication may help employees understand expectations and connect environmental priorities with daily work. It is therefore a plausible mechanism linking leadership priorities with implementation, but the strength and robustness of that association remain empirical questions.

Hypothesis Development

ISO 14001:2015 establishes communication as a leadership responsibility, and prior studies suggest that management signals can influence how standards are implemented. Yet existing evidence does not directly settle whether communication is associated with perceived EMS effectiveness in Kenyan certified manufacturing firms. Because communication can clarify priorities and responsibilities, a positive association is theoretically expected, subject to empirical testing. Accordingly, the study hypothesises that:

H1: Top leadership communication is positively associated with EMS implementation effectiveness in manufacturing firms in Kenya.

Conceptual Framework

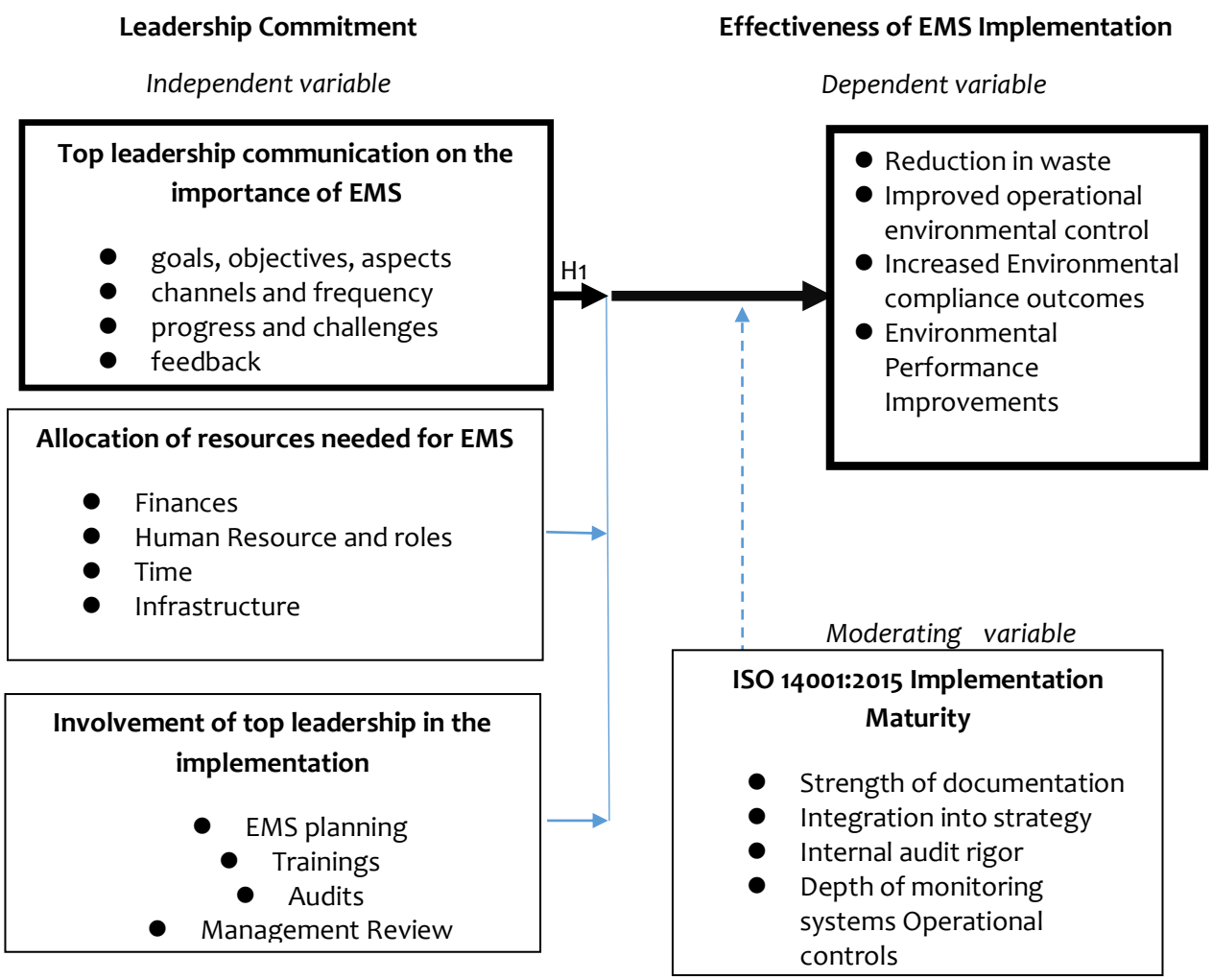

Figure 1: Conceptual Framework and Focal Relationship Examined in the Present Study

Note. The focal relationship is top leadership communication → EMS implementation effectiveness. Resource allocation, leadership involvement and implementation maturity are included as direct predictors in the article model.

The framework treats leadership commitment as a broader construct expressed through communication, resource allocation and involvement, consistent with ISO 14001:2015 Clause 5.1.EMS implementation effectiveness is the perceived extent to which the EMS achieves intended outcomes, including compliance, waste and incident reduction, improved resource efficiency, achieved environmental objectives and continual improvement.

The article focuses on top leadership communication and EMS effectiveness. Resource allocation and leadership involvement remain related predictors, while implementation maturity is included as a direct predictor. The broader study conceptualised leadership commitment as manifested through communication, resource allocation and involvement; this article isolates communication as the focal explanatory construct to estimate its unique association with EMS implementation effectiveness.

METHODOLOGY

The study adopted a positivist philosophy and cross-sectional explanatory survey design to examine theoretically specified relationships and test the statistical significance of the association between top

leadership communication and EMS implementation effectiveness. The study focused on manufacturing firms in Kenya that were KAM members and held active ISO 14001:2015 certification as at 31 December 2024. These criteria established a defined population operating within a common EMS framework, comprising 60 eligible firms.

The target population comprised 60 eligible manufacturing firms. Given the identifiable population, a census approach was adopted, and all 60 firms were invited to participate.

Two knowledgeable respondents were targeted from each firm: the Environmental Manager or equivalent and the Production/Operations Manager. Using two respondents provided different but relevant perspectives and reduced reliance on a single informant; the intended maximum was 120 respondents.

The firm was the unit of analysis, and managers were units of observation. For firms providing two records, within-firm agreement was assessed before aggregation. Firms with one respondent were excluded from primary firm-level inference because agreement could not be evaluated. The primary analytical dataset comprised 37 firms represented by 74 respondents.

Primary data were collected using a structured questionnaire developed from the objectives, conceptual framework, literature and ISO 14001:2015 requirements.

Top leadership communication was operationalised using eight items covering environmental policy, objectives and targets, EMS requirements, performance information, responsibilities, EMS-related changes and employee feedback. These items reflect Clause 5.1(e), while Clauses 7.3 and 7.4 informed the wider communication context.

EMS implementation effectiveness was measured using eight items covering compliance, non-conformities and incidents, waste reduction, resource efficiency, environmental objectives, continual improvement and overall environmental performance. Items used a five-point Likert scale.

A pilot study was conducted among six ISO 14001:2015-certified manufacturing firms outside the main study population. The firms were certified to ISO 14001:2015 and operated in the manufacturing sector, but were not registered with KAM. Two respondents from each firm: the Environmental Management Representative (or equivalent officer) and the Production/Operations Manager. The pilot yielded 12 completed questionnaires and assessed item clarity, relevance, comprehensibility and internal consistency. Feedback informed revisions to the questionnaire introduction to explicitly reference ISO 14001:2015, refinement of the sector-identification question, and rewording of two resource-allocation items concerning employee training and time for assigned EMS responsibilities.

Respondents also recommended using Google Forms to improve the ease of completing and submitting the questionnaire. No items were removed, as the items were considered theoretically important and the reliability analysis indicated acceptable to excellent internal consistency across the five constructs, with Cronbach's alpha coefficients ranging from 0.754 to 0.921. The 6 pilot firms were excluded from the main-study analysis.

Data collection began after ethical and research approvals. Questionnaires were administered to environmental and production/operations managers; participation was voluntary, and confidentiality arrangements were explained.

The researcher had professional experience in ISO management systems. To reduce potential bias, the questionnaire used standardised items and the analysis followed predefined procedures; interpretations remain bounded by the cross-sectional design and self-reported data.

This experience provided contextual understanding but created potential researcher bias. Four safeguards were used: a standardised questionnaire, knowledgeable respondents from each firm, predefined analytical procedures and objective reporting, including findings that did not support expected relationships.

For the 37 firms with two respondents, aggregation followed assessment of within-firm agreement and reliability. The three firms with a single response were

excluded from primary firm-level inference because agreement could not be assessed. The two respondents' responses were averaged at item level to generate one firm-level score. Across the five constructs, (94.6% – 97.3%) of paired firms achieved rwg (J) values of at least 0.70.

The aggregation decision was based on combined agreement evidence, the multi-informant design, similarity of respondent roles and inspection of lower-agreement cases rather than rwg(J) alone. Modest ICC values are acknowledged as a limitation. The use of within-group agreement and interrater reliability indices follows established guidance (Biemann et al., 2012; James et al., 1984).

Aggregation diagnostics were mixed. Mean rwg(J) values ranged from .923 to .953, and (94.6%–97.3%) of paired firms met the .70 reference. Average-measures ICCs ranged from .302 to .458, below the .70 reference, so firm-level aggregation was interpreted cautiously.

Data were screened for completeness, duplicates, missing values, inconsistencies and entry errors, then coded in Excel and transferred to IBM SPSS Statistics for screening and descriptive analysis. Pearson correlations were examined as preliminary evidence of associations and predictor overlap. The primary analysis used PLS-SEM in SmartPLS because the model involved reflective latent constructs, a prediction-oriented explanatory purpose, simultaneous measurement and structural estimation, and a relatively small firm-level sample. The choice was based on model structure and analytical purpose rather than sample size alone (Hair et al., 2019).

Reflective measurement properties were assessed using outer loadings, Cronbach's alpha, rho_A, composite reliability, AVE and HTMT following established PLS-SEM procedures (Hair et al., 2019; Henseler et al., 2015). Bootstrapping with 10,000 subsamples supported inference; structural results were evaluated using path coefficients, t-values, p-values and bootstrap intervals.

The focal model entered top leadership communication alongside resource allocation, leadership involvement and implementation maturity to estimate the unique contribution of communication. Resource allocation and leadership involvement represented related leadership dimensions, while implementation maturity was retained as a theoretically relevant contextual predictor because certified firms may differ in the depth to which EMS practices are embedded in organisational processes.

Diagnostic screening considered normality, predictor overlap, linearity, heteroscedasticity and influential observations as complementary information rather than conventional OLS assumptions. All five constructs were negatively skewed with significant Shapiro–Wilk results, indicating upper-end concentration. These characteristics were retained without transformation or case deletion.

The strongest predictor correlation was between communication and involvement ($r = .896$); VIF and tolerance statistics were then used to assess the extent of overlap in the multivariate model. Quadratic diagnostics suggested possible curvature for Communication ($p = .007$), Resources ($p = .025$) and Involvement ($p = .004$), but not Maturity ($p = .165$). These checks caution against assuming that all relationships are strictly linear.

Common method bias was considered because constructs were measured using the same questionnaire and Likert response format. Procedural safeguards and diagnostic checks were used, but the design cannot eliminate all common-method concerns. It contains six sections, including firm/respondent background and five substantive constructs, each measured with eight five-point Likert items.

Ethical approval for the study was obtained from the Kabarak University Research Ethics Committee (KUREC), approval no. KUREC-200726, valid from 28 July 2026 to 28 July 2027. The study was also conducted under a research licence issued by the National Commission for Science, Technology and Innovation (NACOSTI), Licence No. NACOSTI/P/26/4194632, issued on 6 August 2026 and valid through 6 August 2027. Informed consent was sought from all participants before completion of the questionnaire. Participation was voluntary, and respondents were informed of the study's purpose,

the confidentiality of their responses, and their right to decline participation.

FINDINGS AND DISCUSSION

The results are presented at the firm level because the manufacturing firm was the unit of analysis. The analysis proceeds from the final analytical sample and descriptive patterns to diagnostic screening, measurement-model assessment and the structural model used to examine the contribution of top leadership communication to EMS implementation effectiveness.

Analytical Sample

The study invited all 60 eligible firms and sought two respondents per firm, giving a target of 120 questionnaires. Seventy-seven completed questionnaires were received from 40 firms. Thirty-seven firms provided two responses each (74 questionnaires), while three firms provided one response each.

The three single-response firms were retained in descriptive reporting but excluded from the primary firm-level inferential analysis because within-firm agreement could not be assessed. The final analytical dataset therefore comprised 37 firm-level observations, created by aggregating the paired responses from 37 firms.

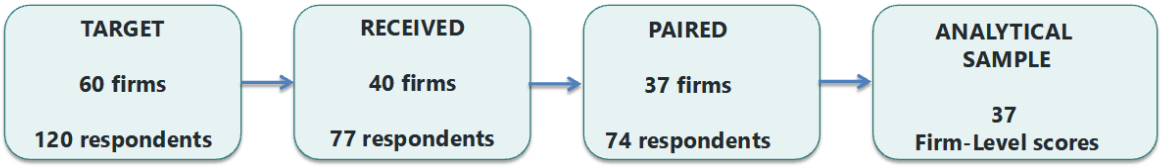

Figure 2: Response Process and Analytical Sample

Note. All 60 eligible firms were invited to participate. Forty firms provided at least one response, yielding 77 completed questionnaires. Of these, 37 firms supplied paired responses (74 questionnaires); the three firms with a single response were retained for descriptive reporting but excluded from primary firm-level inferential analysis because within-firm agreement could not be assessed.

Non-response bias was assessed using the 60-firm sampling frame. Responding and non-responding firms were compared on KAM Region and Sector using chi-square tests with Monte Carlo significance estimates because of sparse expected frequencies. No significant differences were detected for Region (χ^2 = 5.266, p = .420) or Sector (χ^2 = 14.893, p = .110). This does not rule out differences on unobserved characteristics.

Within-firm agreement supported aggregation on rwg (J), although ICC values were below the .70 reference. This mixed evidence is acknowledged when interpreting firm-level estimates.

Descriptive Results

Firm-level assessments were generally favourable: Leadership Communication had a mean of 4.316 (SD = .458), and EMS Implementation Effectiveness had a mean of 4.413 (SD = .426); all remaining constructs also exceeded 4.00.

Table 1: Firm-Level Descriptive Statistics

Construct	N	Mean	SD	Minimum	Maximum
Leadership Communication	37	4.316	.458	2.625	5.000
Resource Allocation	37	4.341	.422	2.938	5.000
Leadership Involvement	37	4.352	.485	2.500	5.000
EMS Implementation Maturity	37	4.264	.522	2.625	5.000
EMS Implementation Effectiveness	37	4.413	.426	2.625	5.000

Top Leadership Communication

Table 2. Item-Level Descriptive Statistics for Top Leadership Communication

Item	Statement	Respondent Mean (N=74)	Respondent SD	Firm Mean (N=37)	Firm SD
C1	Top leadership clearly communicates the organization's environmental policy to employees.	4.446	0.644	4.446	0.497
C2	Top leadership communicates environmental objectives and targets to relevant employees.	4.432	0.684	4.432	0.502
C3	Top leadership communicates the implications of failing to comply with EMS requirements.	4.446	0.743	4.446	0.587
C4	Top leadership regularly communicates regarding the firm's environmental performance results.	4.23	0.82	4.23	0.652
C5	Top leadership communicates significant environmental aspects and impacts relevant to employees' work.	4.284	0.712	4.284	0.479
C6	Top leadership clearly communicates employees' EMS roles and responsibilities.	4.243	0.737	4.243	0.522
C7	Top leadership promptly communicates changes affecting EMS.	4.122	0.776	4.122	0.594
C8	Top leadership encourages employees to provide feedback and suggestions on environmental management issues.	4.324	0.878	4.324	0.729

Formal and directive communication items received relatively favourable ratings, while lower-rated items suggest that translating broad environmental messages into consistent operational guidance may be less uniform. These descriptive differences are not tests of statistically significant item-level differences.

EMS Implementation Effectiveness

Table 3. Item-Level Descriptive Statistics for EMS Implementation Effectiveness

Item	Statement	Respondent Mean (N=74)	Respondent SD	Firm Mean (N=37)	Firm SD
E1	Compliance with applicable legal environmental and other requirements has improved since EMS implementation.	4.622	0.59	4.622	0.492
E2	Environmental non-conformities identified during audits have reduced over time.	4.581	0.619	4.581	0.433
E3	Environmental incidents have reduced since implementing EMS.	4.581	0.619	4.581	0.417
E4	Waste generation has reduced as a result of implementing EMS.	4.27	0.849	4.27	0.619
E5	Resource utilization efficiency has improved through EMS.	4.311	0.72	4.311	0.557
E6	Environmental objectives and targets are consistently achieved.	4.027	0.816	4.027	0.666
E7	Environmental performance demonstrates continual improvement over time.	4.378	0.735	4.378	0.582
E8	The EMS has improved the organization's overall environmental performance.	4.527	0.646	4.527	0.513

Compliance improvement (E1) received the highest perceived-effectiveness rating, while lower-rated outcomes indicate that perceived progress is not uniform across all EMS objectives. Diagnostic screening was supplementary rather than a set of requirements that would invalidate PLS-SEM when classical regression assumptions were not fully met.

Table 4: Diagnostic Assessment Results

Diagnostic	Key result	Decision / implication
Normality	All five constructs negatively skewed; Shapiro–Wilk $p \leq .007$; Effectiveness skewness = −2.261, excess kurtosis = 7.718	Upper-end concentration retained; bootstrapping used for inference
Multicollinearity	Communication–Involvement $r = .896$; VIF = 5.716 and 7.401 respectively	Elevated overlap acknowledged; constructs retained on theoretical grounds and checked through sensitivity analysis
Linearity	Quadratic improvement significant for Communication ($p = .007$), Resources ($p = .025$) and Involvement ($p = .004$)	Possible curvature noted; theoretical linear specification retained
Heteroscedasticity	Breusch–Pagan significant (LM = 12.061, $p = .007$; $F = 5.320$, $p = .004$); White non-significant ($p \geq .124$)	Mixed evidence; treated as diagnostic caution
Influence	Firm 21: Cook's D = 1.083; DFFITS = −2.237; max |DFBETA| = 2.053	Case inspected and retained as a plausible firm-level observation

The strongest diagnostic concern was overlap between Communication and Involvement ($r = .896$;

VIFs = 5.716 and 7.401). The elevated values indicate close empirical association and warrant cautious interpretation of individual coefficients.

Reflective Measurement Model

Table 5: Reflective Measurement Model Assessment

Construct	Items	Cronbach's α	rho_A	rho_C	AVE
Leadership Communication	8	.918	.939	.934	.646
Resource Allocation	8	.901	.918	.921	.596
Leadership Involvement	8	.945	.956	.954	.723
EMS Implementation Maturity	8	.938	.948	.949	.700
EMS Implementation Effectiveness	8	.914	.929	.931	.633

The five lower-order constructs were modelled reflectively and showed strong internal consistency and convergent validity. Cronbach's alpha ranged from .901 to .945, composite reliability (rho_C) from .921 to .954, and exceeded the recommended threshold of .70. All AVE values exceeded .50.These results indicate that the measurement model demonstrated acceptable reliability and convergent validity.

Discriminant Validity

Table 6: HTMT Discriminant Validity Results

Construct pair	HTMT
Maturity – Effectiveness	.895
Maturity – Communication	.813
Maturity – Involvement	.850
Maturity – Resources	.776
Effectiveness – Communication	.860
Effectiveness – Involvement	.832
Effectiveness – Resources	.721
Communication – Involvement	.954
Communication – Resources	.789
Involvement – Resources	.820

Discriminant validity was satisfactory for most construct pairs under the .90 screening criterion, but Communication–Involvement required caution (HTMT = .954; 95% bootstrap interval [.817, 1.014]). The constructs were retained separately because communication concerns transmission of environmental priorities and information, whereas involvement concerns participation, follow-up, decision-making and support.

Removing Leadership Involvement changed the Communication coefficient only from β = .375 to β = .378, indicating that the focal estimate was not materially altered by excluding the overlapping construct. Maturity–Effectiveness also showed a relatively high HTMT (.895; 95% bootstrap interval [.812, .993]), reflecting the related but distinct concepts of implementation depth and perceived outcomes. The structural model estimated Communication, Resource Allocation, Leadership Involvement and Implementation Maturity simultaneously, with inference based on 10,000 bootstrap subsamples. Because the focal hypothesis specified a positive direction a priori, the primary test was one-tailed at α = .05; the corresponding two-tailed result is also reported.

Structural Model and Hypothesis Testing

The model explained 78.3 per cent of the variance in EMS Implementation Effectiveness (R^2 = .783; adjusted R^2 = .756). Communication had β = .375 (t = 1.873, p = .031, one-tailed; f^2 = .114). Its (5%–95%) one-tailed

bootstrap interval was [.011, .666], while the two-tailed p-value was .061 with a 95% interval [−.058, .732].

Table 7: Structural Model and Hypothesis Testing Results

Predictor	β	t	f^2	p (one-tailed)	p (two-tailed)	95% two-tailed bootstrap CI
Leadership Communication	.375	1.873	.114	.031	.061	[−.058, .732]
Resource Allocation	.006	.045	.000	.482	.964	[−.224, .280]
Leadership Involvement	.004	.021	.000	.492	.983	[−.449, .376]
EMS Implementation Maturity	.554	3.209	.436	.001	.001	[.304, .957]

Note: Primary hypothesis testing used prespecified one-tailed tests (α = .05). Two-tailed p-values and 95 per cent two-tailed bootstrap intervals are shown for transparency. f^2 values indicate each predictor's unique contribution. Model R^2 = .783; adjusted R^2 = .756.

H1 proposed a positive association between top leadership communication and EMS implementation effectiveness. The full-sample estimate was positive (β = .375, t = 1.873, p = .031 one-tailed; p = .061 two-tailed), so it does not meet the conventional .05 two-tailed criterion.

Communication and Involvement overlapped substantially (r = .896; HTMT = .954; 95% bootstrap interval [.817, 1.014]). This limits claims that the constructs are empirically distinct and requires interpreting the Communication coefficient as model-specific.

Implementation Maturity showed a positive association with Effectiveness (β = .554, t = 3.209, p = .001, f^2 = .436). This was a non-hypothesised main effect reported to clarify the structural model. Resource Allocation and Leadership Involvement were not statistically significant and had negligible effect sizes.

Sensitivity analyses temper the full-sample result. Removing item C5 increased β from .375 to .425 but did not resolve construct overlap; removing Involvement changed β only to .378. Excluding Firm 21 reduced β to .252 and the result was not significant (t = 1.258, p = .104 one-tailed). Thus, the communication estimate is sensitive to this firm and should be treated as preliminary.

Sensitivity Analyses

Table 8: Sensitivity Analysis for the Focal Leadership Communication Path

Specification	β	t	p (one-tailed)	5%–95% bootstrap interval
Full model, n = 37	.375	1.873	.031	[.011, .666]
Firm 21 excluded, n = 36	.252	1.258	.104	[−.054, .596]

Discussion

This study examined whether top leadership communication makes a distinct contribution to EMS implementation effectiveness among ISO 14001:2015-certified manufacturing firms in Kenya. In the full sample, Communication showed a positive unique association (β = .375, t = 1.873, p = .031, one-tailed; f^2 = .114) after the other predictors were considered simultaneously. The one-tailed result provides directional support because the hypothesis was prespecified. However, the two-tailed p-value was .061 and excluding Firm 21 reduced β to .252 and rendered it non-significant (p = .104, one-tailed). The finding is therefore preliminary evidence rather than a stable or causal effect.

Top Leadership Communication as a Distinct Leadership Mechanism

The result shifts attention from general leadership commitment to communication as a specific

behaviour, but evidence for a robust unique association remains limited by the two-tailed result, construct overlap and sensitivity to Firm 21.

The full-sample estimate is compatible with communication being relevant to EMS implementation, but the sensitivity analysis does not support a strong or definitive conclusion. ISO 14001:2015 identifies communication as a leadership responsibility; the present data do not establish that communication causes effectiveness.

Interpretation Through Upper Echelons Theory

The result is consistent with UET's proposition that organisational outcomes partly reflect how senior executives interpret issues and translate priorities into choices (Hambrick & Mason, 1984). Here, communication is one possible signal of those priorities, not a demonstrated causal pathway.

UET provides a rationale for examining observable leadership behaviour: messages can signal priorities, but their effect depends on operational processes, resources and employee response. The present cross-sectional data test an association rather than the full mechanism.

Ji et al. (2023) provide a useful parallel: using UET, the authors found CEO sustainability-vision communication associated with sustainability performance through organisational change.

The present study extends this reasoning to ISO 14001:2015 implementation effectiveness while treating top leadership communication as a distinct leadership manifestation.

Communication, Implementation and the Certification–Effectiveness Distinction

The result should be read alongside evidence that certification can coexist with different levels of substantive implementation (Boiral et al., 2018; Chowdhury et al., 2018).

Communication may support implementation, but certification alone and communication alone cannot establish that intended outcomes have been achieved.

Communication and Closely Related Leadership Behaviours

Communication and Involvement were conceptually distinguished but showed high empirical overlap ($r = .896$; HTMT = .954). The focal coefficient should therefore be interpreted as a model-specific unique association rather than evidence that the behaviours operate independently.

Removing Involvement produced only a small change in β (.375 to .378), whereas removing Firm 21 reduced it to .252 and eliminated statistical significance. The focal relationship is therefore more sensitive to the influential observation than to inclusion of the related leadership dimension.

The Direct Role of Implementation Maturity

Implementation Maturity showed a positive direct association with EMS effectiveness ($\beta = .554$, $t = 3.209$, $p = .001$, $f^2 = .436$). This suggests that deeper integration of EMS requirements may be relevant to perceived effectiveness, although the cross-sectional design does not establish causality.

This contextual finding reinforces the distinction between certification and substantive implementation. Certified firms may differ in the extent to which environmental objectives are integrated into strategy, monitoring, decision-making, employee responsibilities and continual improvement.

The study makes a focused contribution by examining top leadership communication alongside related leadership behaviours and implementation maturity. The principal contribution is a more specific empirical examination of communication as a leadership behaviour associated with EMS implementation effectiveness, while recognising that the observed association warrants further testing.

Theoretical Implication

The study applies UET to EMS research by examining communication as an observable signal through which senior-management priorities may be conveyed.

The evidence supports investigating this mechanism, but construct overlap and sensitivity mean the focal association is not robustly established.

Managerial Implications
Managers may review how leadership communicates environmental priorities, objectives, responsibilities and performance expectations. Such communication can be linked to existing management meetings, training and operational reviews; this study did not test any specific intervention.

Industry and Policy Implications
Industry bodies could complement certification guidance with support on post-certification implementation, including peer learning, benchmarking and guidance on embedding environmental objectives into routine decisions. These are options for consideration, not interventions validated by this study.

Limitations and Future Research
The cross-sectional design limits conclusions about temporal order and causality, and 37 firm-level observations limit precision. Effectiveness was assessed through respondents' perceptions rather than independently measured environmental outcomes. Communication and Involvement overlapped, aggregation diagnostics were mixed, quadratic checks suggested possible nonlinearity for several predictors, and the communication coefficient was sensitive to Firm 21. Replication with larger samples, longitudinal designs and objective environmental indicators is warranted.

CONCLUSION AND RECOMMENDATIONS
Conclusion: In the 37-firm model, Communication had a positive coefficient (β = .375, t = 1.873, p = .031 one-tailed; p = .061 two-tailed). The result is not significant under the conventional .05 two-tailed criterion, and excluding Firm 21 reduced the coefficient to .252 (t = 1.258, p = .104 one-tailed). The evidence therefore suggests a possible positive association but does not establish a robust relationship.

The article contributes by examining communication separately from other leadership behaviours and by distinguishing certification from perceived implementation effectiveness. Implementation Maturity also showed a positive direct association (β = .554, p = .001), underscoring the relevance of implementation depth. These findings are associational and should be interpreted cautiously.

The conclusions are bounded by the small firm-level sample, cross-sectional design, construct overlap, mixed aggregation diagnostics and sensitivity to Firm 21. Further study is needed before drawing firm conclusions about the independent role of communication.

Overall, the results warrant continued investigation of leadership communication, not a claim that it independently or causally improves EMS effectiveness.

Recommendations*:* Strengthen strategic environmental communication: Manufacturing firms may review how leaders communicate environmental priorities, objectives, responsibilities and performance expectations. Linking messages to existing meetings, training and operational reviews may help clarify expectations, although this study did not test an intervention.

Strengthen EMS implementation maturity beyond certification: Firms may also review how deeply EMS requirements are embedded in strategy, routine decisions, monitoring and employee responsibilities, rather than relying on certification status alone.

Integrate leadership communication with implementation processes: Communication should be considered alongside resource decisions, leadership follow-through, monitoring and corrective action. The model did not identify statistically significant unique associations for all related leadership dimensions, so managers should avoid assuming communication alone is sufficient.

Strengthen post-certification industry guidance: Industry and professional bodies could consider peer learning, benchmarking and practical guidance on embedding EMS requirements after certification. These are evidence-informed options for further consideration, not validated interventions.

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