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Moderating Effect of Strategic Linkages on Corporate Leadership and Organizational Performance in Kenya Agricultural and Livestock Research Organization (KALRO)

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Abstract

The urgency of securing safe, affordable, reliable, and nutritious food amid a growing global population and shrinking land productivity underscores the pivotal role of corporate leadership in fostering strategic partnerships and organizational performance. This is crucial for organizations like Kenya Agricultural and Livestock Research Organization (KALRO) to enhance performance and drive agricultural innovation that ensure achievement of national targets and mandate. Understanding the dynamics between leadership effectiveness, strategic alliances, and organizational performance is essential for addressing food security challenges and optimizing the impact of agricultural research institutions worldwide. The projected 27% increase in global population by 2050 emphasizes the need for strong corporate leadership and strategic partnerships to ensure balanced diets for over half a billion smallholder farmers. Despite Kenya's higher productivity than East Africa and Africa averages, challenges remain in enhancing food security through effective leadership and strategic alliances, particularly within institutions like KALRO. The study explored the moderating influence of strategic linkages on the relationship between corporate leadership and the performance of KALRO. Rooted in organizational excellence, upper echelons, legitimacy, and stakeholder theories, the research employed a pragmatic philosophy, and mixed methods design to mitigate bias. The target population included 75 management organs, with 60 directors and 188 top leadership units as units of observation. Quantitative analysis, using a composite regression model and ANOVA, revealed a significant impact of strategic linkages on corporate leadership and KALRO's performance. The study verified consistent variances and normality across variables, supporting parametric analyses. Autocorrelation analysis indicated no significant autocorrelation. Multicollinearity tests showed acceptable values, ensuring the reliability of the regression model. No outliers were detected. Cronbach's alpha scores demonstrated strong internal reliability. Significant correlations confirmed associations between variables, aligning with previous research findings. Strategic linkages emerged as enhanced moderator, explaining 69.4% of the variance. In this case, the moderator variable amplified or strengthened the relationship between corporate leadership and organizational performance of KALRO. Rejecting the null hypothesis highlighted the positive impact of strategic linkages on performance. Conditional effects analysis revealed strong corporate leadership influence at low strategic linkages but diminishing at higher levels. Recommendations encompassed gender diversity, inclusive leadership development, regular performance appraisals, enhanced monitoring and evaluation system, and improved linkages. The findings provide valuable guidance for KALRO's leadership amid competing priorities and budgetary constraints.

Keywords

Moderator, Strategic Linkages, Corporate Leadership, Organizational Performance, KALRO

1. Introduction

In today's fast-evolving global landscape and shrinking land productivity and increasing competitive land use options, the importance of securing safe, affordable, reliable, and nutritious food cannot be overstated. As the world's population is projected to surge to 9.9 billion by 2050 [1], there is urgent need for adept corporate leadership and strategic collaborations to support agricultural and livestock research systems to feed the additional 27 percent of people. Corporate leaders, including board members, chief executive officers, divisional, and department directors, are instrumental in shaping the direction, managing resources, resolving conflicts, and fostering an ethical culture within organizations [2].

Results have showed how the war in Ukraine has caused severe disruption to not only national, but global food trade and supplies [3-8]. Among the key war-triggered supply threats and risks are in wheat, maize, and oilseeds [9-12].

The relationship between corporate leadership, strategic partnerships, and organizational performance is crucial for agricultural and livestock research organizations aiming to achieve their national mandate of food security, in organizations like the Kenya Agricultural and Livestock Research Organization (KALRO). Effective corporate leadership is fundamental in setting a clear vision, aligning resources, and fostering a culture of innovation and accountability within these organizations [13]. Leaders skilled in navigating complex challenges can strategically direct research efforts to address critical issues in food security, such as improving crop yields, developing resilient livestock breeds, and optimizing resource management. For instance, Zhang et al. [14] and Zhao et al. [15] emphasized that leadership that prioritized strategic foresight and innovation significantly impacted research outcomes in agriculture and livestock sectors, enabling more effective solutions to food security challenges.

However, while numerous studies have underscored the pivotal role of leadership in optimizing organizational performance [16, 17], there remains a dearth of research examining moderating effect of strategic partnerships on this relationship, particularly within organizations like KALRO. Inasmuch as scholars have established that leadership and partnerships with various entities play a crucial role in enhancing organizational performance [18, 19], application of such strategic linkages within KALRO's context, leading to enhanced performance in achieving national targets and strategic mandate is unclear. While challenges of accessibility to healthy foods persist in Africa due to conflicts and political instability, the moderating effect of strategic linkages on enabling corporate leadership and organizational performance in such countries are limited, hence affecting stimulation of agricultural innovation.

The varying relationships between leadership styles and organizational performance across different contexts, such as Nigeria and Ghana [20, 21] reveal lack of comprehensive understanding of how contextual factors of strategic linkages,

including political interference and economic challenges, influence the effectiveness of corporate leadership and ultimately impact organizational performance. Studies conducted in Kenya have recognized the effectiveness of corporate leadership in state-funded agricultural research institutions [22-24]. However, the nuanced interplay between leadership effectiveness, strategic partnerships, and organizational performance has not been adequately explored. Understanding how these elements interact is crucial for unlocking KALRO's full potential and addressing the pressing challenges of food and nutrition insecurity in Kenya and beyond.

Moreover, while the importance of strategic partnerships with stakeholders is widely acknowledged [25], their specific impact on moderating the relationship between corporate leadership and organizational performance remains under-researched. This study seeks to address this gap by investigating the moderating effect of strategic linkages on KALRO's performance, guided by organizational excellence, upper echelons, and stakeholder theories. By exploring the dynamics between leadership effectiveness, strategic partnerships, and organizational performance within KALRO, this study aims to provide valuable insights for enhancing agricultural research institutions' effectiveness and driving sustainable food security initiatives.

Established by the Government of Kenya through the Kenya Agricultural and Livestock Research (KALR) Act, No. 17 of 2013, KALRO is under the Ministry of Agriculture and Livestock Development and is the principal national organization responsible for research and technology generation on crops, livestock, and soil and water management. The Act established 16 research institutes with full-fledged management organs. It was formed by merging four parastatals: Kenya Agricultural Research Institute, Coffee Research Foundation, Tea Research Foundation of Kenya, and Kenya Sugar Research Foundation with the aim of enhancing food security. Despite this legislative framework, the extent to which strategic alliances are leveraged within KALRO to drive performance and foster agricultural innovation remains unclear.

1.1. Statement of the Problem

The projected 27% increase in global population by 2050 [26], hence affecting over half a billion smallholder farmers calls for urgent and sustained corporate leadership and reliable strategic linkages that guarantee availability of balanced diets for all. While Kenya's average productivity of 9 tons per hectare [27] surpasses that of East Africa's 6.8 and Africa's 7.1, it still falls below global average of 9.8. Similarly, Kenya's average monthly food consumption per capita of 35 kilograms compared to East Africa's 47, Africa's 44, and the global's 56 is the lowest. Inasmuch as the Kenyan government recognizes the role of corporate leadership in enhancing or-

ganizational performance, hence boosting of food and nutrition security, there is scant evidence of the moderating effect of strategic linkages on the relationship between corporate leadership and organizational performance.

Effective corporate leadership is crucial for organizational success, with authenticity, decisiveness, focus, a hands-on approach, skills, and communication playing pivotal roles. Global conflicts and economic downturns have hindered productivity, affecting millions, particularly in Africa. Despite KALRO's funding and leadership structures, technology application in farmers' fields has stagnated, causing persistent food scarcity. This study addresses gaps, explores role of corporate leadership and the moderating influence of strategic linkages on KALRO's performance. Findings offer insights for KALRO leaders to enhance their effectiveness and address organizational challenges.

1.2. The Objectives of the Study

The main objective of this study was to establish the association between corporate leadership, strategic linkages, and organizational performance of Kenya Agricultural and Livestock Research Organization. The following specific objectives were addressed.
1. To establish the effect of corporate leadership on performance of KALRO.
2. To examine the moderating effect of strategic linkages on the relationship between corporate leadership and performance of KALRO.

1.3. Hypotheses of the Study

To address these objectives, the following hypotheses were expressed, all in the null.
1. There is no significant relationship between corporate leadership and performance of KALRO.
2. There is no significant moderating effect of strategic linkages on the relationship between corporate leadership and performance of KALRO.

1.4. Justification of the Study

In response to current global challenges in agricultural sector, including emerging conflicts, this study provides valuable insights into the role of corporate leadership and strategic linkages in addressing agricultural productivity issues. The findings shall guide top leadership and governments to make informed decisions, fulfil their mandate, and enhance agricultural productivity.

2. Literature Review

A comprehensive literature review was conducted. This included theoretical as well as empirical reviews.

2.1. Theoretical Review/Framework

Four theories offer a comprehensive framework for understanding corporate leadership and organizational performance. The organizational excellence theory coined by Peters [28] focuses on the fact that organizational success relies on inbuilt cultures and policies, linkages and partnerships, as well as effective corporate leadership. It lobbies for involvement of top leadership in giving direction, ensuring policy adoption and implementation, as well as strengthening alliances and strategic linkages. The upper echelons theory by Hambrick [29] supports the fact that top managements' background as a unit instead of individual members of staff influences organizational performance, besides providing policy and sustainable linkages and partnerships, thus supporting both study hypotheses. The legitimacy theory proposed by Lindblom [30] supports strategic linkages by noting that performing organizations generally respect approved norms and social contract by stakeholders, thus supporting the first study hypothesis. Stakeholder theory by Freeman [31] links corporate leadership and strategic linkages by stating that stakeholders have ownership rights and ought to benefit when corporate leaders observe laid-down rules, thus supporting the second study hypothesis.

2.2. Empirical Review

The nexus between corporate leadership and organizational performance has long intrigued scholars and practitioners, including corporate leaders in KALRO. Corporate leadership, embodying decisions and actions of top executives, is recognized as pivotal for organizational success [32-34], with KALRO standing a better chance of benefiting from these findings. Research consistently illustrates profound impact of leadership styles, behaviours, and strategies on various aspects of organizational performance, including financial performance, innovation, employee engagement, and stakeholder satisfaction [35, 36]. However, this relationship is multifaceted and subject to assorted external influences such as strategic linkages, which can moderate its dynamics [37, 38]. This is commonly experienced in KALRO as a result of the government's policy reviews and changes in the annual priorities and development agenda. Generally, strategic linkages encompass partnerships, alliances, and collaborations with external stakeholders to achieve strategic objectives [39-41], some of which are local, sectoral or regional. These connections and strategic linkages have been observed to facilitate skills enhancement, knowledge sharing, peer reviews and assessments, resource access, effective leadership, and risk mitigation in organizations similar to KALRO.

Inasmuch as Iqbal et al. [42] highlighted positive impact of strategic leadership principles on organizational performance, emphasizing a need for management control systems in ASEAN countries, the study did not consider moderating influence of strategic linkages needed to strengthen corporate leadership of organizations. This is what this study set out to

test, with results showing that similar organizations are poised to benefit from the findings of this research. In Indonesia, Gusmão et al.'s [43] exploration of the influence of corporate leadership on organizational performance within the Ministry of Government showed a positive relationship between strategic leadership and organizational behaviour. This study on KALRO shows how strategic linkages moderate the relationship between corporate leadership and organizational performance. It further shows the role of corporate leadership in KALRO in supporting the Kenyan Ministry of Agriculture and Livestock Development in the achievement of the national mandate. Montuori and Donnelly's [44] study on the influence of workplace diversity in selected agencies in the United States emphasized contribution of inclusive leadership and diverse strategies in fostering inclusive organizational performance.

Scholars have further noted that strategic linkages complement corporate leadership by embracing shared policies of partnerships [45-47], and leadership styles [48], but not as a moderating variable to examine whether the relationship between corporate leadership and organizational performance changes depending on the level of this moderator. Assorted research highlights the significance of strategic linkages in shaping the interplay between corporate leadership and organizational performance.

Sohrabi et al. [49] and Kohtamäki et al. [50] demonstrate the positive impact of effective leadership combined with strong strategic alliances in research. This has been observed in this study of KALRO by showing how its diverse strategic partners have contributed to the enhancement of its performance not only in Kenya, but also in the region. Abdulrahman et al. [51] observed that strategic partnerships moderated the relationship between leadership styles and innovation performance in technology firms.

Nyandika et al. [52] observed that organizations in Kenya that applied strategic leadership principles experienced notable enhancements in their performance. Recent research by Nyamota et al. [53] further highlighted that organizations with effective leadership and strategic partnerships were better positioned to implement research findings and achieve significant improvements in agricultural productivity, thus contributing to national food security goals.

Conversely, Mutungi et al. [54] found only partial mediation by succession planning in the relationship between strategic leadership and Kenya Airways' performance, neglecting to consider moderators like strategic linkages. This study underscores the criticality of understanding the moderating effect of strategic linkages, especially for KALRO, which currently operates within intricate ecosystems with diverse stakeholders.

KALRO's corporate leadership effectiveness relies heavily on cultivating and leveraging strategic partnerships to foster research excellence, technology transfer, and agricultural productivity. Investigating the interplay between leadership, strategic linkages, and organizational challenges is pivotal for

enhancing effectiveness. Additionally, KALRO management grapples with unresolved land issues, an ageing workforce, limited partnerships, and financial instability [55], significantly impacting its performance.

This study is very helpful in understanding how corporate leadership and strategic linkages could help fix the problems caused by a decrease in the productivity of key crops and livestock in Kenya and other countries. The findings serve to equip top leadership at various levels, including KALRO Headquarters, its affiliate parastatals, agriculture-based universities, the Council of Governors, the Parliamentary Committee on Agriculture, the Senate Standing Committee on Agriculture, and the Ministry of Agriculture, Livestock, Fisheries, and Cooperatives with implementation mechanisms that support balanced, diversified, and sustained food production by, and effective feedback systems with, stakeholders. This knowledge is instrumental in addressing issues related to limited stakeholder access to research products and services, fluctuating stakeholder satisfaction with research goods and outcomes, constrained social capital, and unstable financial viability of KALRO. The study offers critical information that researchers, corporate leaders at all levels, policy makers, and members of parliament can utilize in further research, drafting of policies, providing policy directions, and informing Departmental Committee on Agriculture and Livestock of the Kenya National Assembly in their budgeting, and National Commission for Science and Technology Innovation (NACOSTI) in their regulation of KALRO.

# 3. Framework, Generalizability, and Variable Operationalization

3.1. Conceptual Framework

As guided by the aforementioned theoretical foundations, the research focused on a conceptual framework that included three variables: corporate leadership, strategic linkages, and organizational performance of KALRO (Figure 1). In this conceptual framework, it was anticipated that corporate leadership (independent variable, X) would influence organizational performance of KALRO (dependent variable, Y) through strategic linkages (moderating variable, M). Corporate leadership was expected to shape key indicators of corporate leadership such as strategic decisions and initiatives, which in turn would affect the effectiveness of organizational strategies. These indicators of strategic linkages were anticipated to moderate the relationship by translating leadership decisions into actionable strategies that impacted overall performance.

Thus, while corporate leadership was expected to directly affect organizational performance of KALRO (shown by the directions of the arrows, and tested using the first hypothesis, H_{01}), its impact was anticipated to be channeled through KALRO's strategic linkages, herein taken as a moderating factor. In this diagram, strategic linkages (moderating variable,

M), measured using the second hypothesis (H_{02}) was assumed to be influenced by both internal and external factors within KALRO. The direction of the arrow of the moderating varia-ble shows its expected contribution in either enhancing or diminishing the effect of corporate leadership (X) on the performance of KALRO (Y).
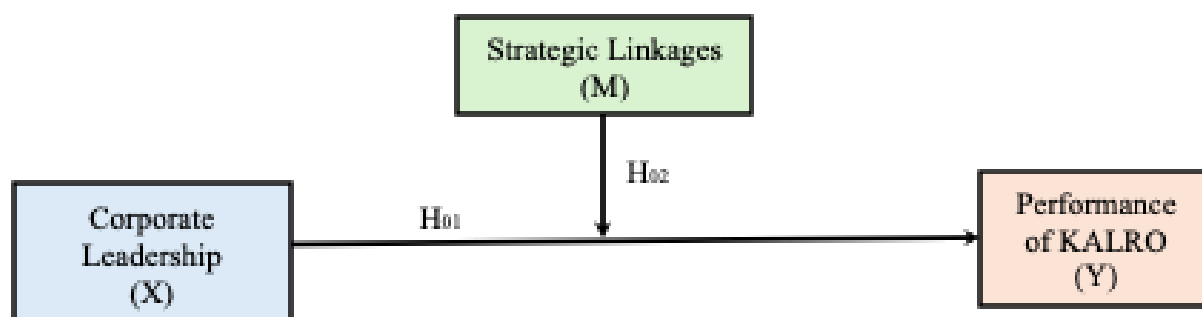
Source: Researcher's survey (2024)

Figure 1. Conceptual Framework.

3.2. Potential Generalizability of Study Results

The study did not investigate the entire corporate leadership and organizational performance of Kenyan agriculture sector or any affiliate parastatals. The unit of observation was KALRO's top leadership, excluding all cadres of personnel. The study was restricted to three variables: corporate leadership, strategic linkages, and organizational performance of KALRO. Therefore, generalizability of the study results should be objectively applied in further academic contexts.

3.3. Operationalization of Variables

In this study, operationalizing research variables played a pivotal role in transforming abstract concepts into measurable factors and observable phenomena. Serving as the crucial link between theory and empirical investigation, this process translated theoretical constructs into specific, quantifiable terms and actions that could be observed, measured, and analyzed. Its implementation ensured the reliability and validity of research findings.

Through operationalizing the selected study variables (Table 1), clarity and precision were attained, facilitating effective data collection and the derivation of meaningful conclusions. This comprehensive process encompassed identifying indicators and proxies that accurately represented the underlying constructs, devising measurement instruments, and establishing criteria for categorization and scoring.

Table 1. Operationalization of Variables.

Variable	Indicators	Measurement Scale	Tools of Analysis
Independent Variable: Corporate Leadership	1) Strategic direction 2) Clarity of goals & mandate 3) Human capital 4) Corporate culture	Interval	1) Descriptive statistics 2) Inferential statistics 3) Multivariate analysis 4) Thematic analysis 5) Content analysis
Moderating Variable: Strategic Linkages	1) Social linkages with donors 2) Political links with government 3) Economic linkages with markets 4) Institutional links with academia 5) Engagement with media	Interval	1) Descriptive statistics 2) Inferential statistics 3) Multivariate analysis 4) Thematic analysis 5) Content analysis
Dependent Variable: Performance of KALRO	1) Stakeholder access to services 2) Stakeholder satisfaction	Interval	1) Descriptive statistics 2) Inferential statistics

Variable	Indicators	Measurement Scale	Tools of Analysis
	3) Social capital		3) Multivariate analysis
	4) Financial viability		4) Thematic analysis
			5) Content analysis

Source: Own computation, 2024.

4. Research Methodology

4.1. Research Philosophy and Design

Pragmatic research philosophy prioritizes practical utility of research outcomes in addressing real-world issues. This approach facilitated the study in navigating research complexities and aligning methodological choices with objectives. Employing a mixed-methods approach, which integrates quantitative and qualitative methods, allowed for nuanced insights that transcend the limitations of individual methodologies, enriching research outcomes. The mixed methods approach was used as it offers a comprehensive understanding by combining quantitative and qualitative data, enabling triangulation, exploration, and confirmation of findings, enhancing validity, addressing diverse stakeholders' needs, and fostering flexibility and innovation in research design and data collection.

Concurrent triangulation, involving simultaneous data collection and analysis of both types of data, enhanced validity and reliability by converging multiple data sources and methods. Cross-sectional survey with a structured questionnaire captured data from diverse samples, offering insights into prevalence, distribution, and correlates of study facts within the target population. Interpretive phenomenological analysis explored lived experiences and subjective meanings attributed by respondents within the study context.

4.2. Sampling and Data Collection

The target population consisted of 264 respondents, including 60 directors and 204 top leaders, who formed the unit of observation for this study. Of these, 16 individuals participated in a pilot study, leaving 248 respondents who were ultimately interviewed. The 264 respondents were selected from all 75 divisions and departments of KALRO, which include one Board of Management, one Consolidated Directorate, one Coordinated Secretariat, 17 research insti-

tutes, and 55 research centres and sub-centres. Given this finite target population and the readily identifiable units of analysis, a census approach was deemed appropriate. Questionnaires were distributed to the 248 respondents, comprising seven Board members, three top directors, 17 senior officials at the Secretariat, and 64 top leaders at the institutes, as well as 157 top leaders at the centres and sub-centres.

The questionnaire consisted of six sections. Sections 1 to 5 were designed for completion by 241 corporate leaders, while all seven board members were targeted to respond to questions in Sections 1 to 5, along with addressing the open-ended questions in Section 6.

Primary data collection utilized an online structured questionnaire and focus group discussions. Quantitative data, predominantly perceptions, were assessed using Likert scale, while qualitative data from focus group discussions, mainly targeting board members was used to validate quantitative findings.

The measurement scale utilized the five-point Likert Scale. This scale covered the following range: 1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; and 5 = Strongly Agree.

4.3. Diagnostic Tests

Diagnostic tests encompassed Levene's test for variance equality, revealing unequal variances ($p < .05$) with no violations, hence no transformation required. Normality was confirmed via t-tests, ANOVA, and regression, supplemented by probability charts, despite insignificant Kolmogorov-Smirnov results. Autocorrelation was examined through residual scatterplots and Durbin-Watson statistics, with acceptable Mahalanobis distance.

Multicollinearity was assessed through zero-order correlations ($\geq .30$), Tolerance ($> .1$), and VIF (< 10), indicating acceptable levels. Factor structure was evaluated via Confirmatory Factor Analysis, KMO, Bartlett's Test, and PCA, yielding significant results. Reliability ($\alpha \geq .700$) and content, construct, and criterion validity generated significant outcomes (Tables 2 and 3).

Table 2. Reliability Statistics for Variables.

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	Cronbach's Alpha of Item Deleted	Number of Items
Corporate Leadership	.931	.934	.816	22
Strategic Linkages	.919	.922	.806	19
Organizational Performance	.933	.938	.782	17

Source: Researchers' survey result, 2024.

Kitonga's [22] study found a correlation of R=.283 between strategic leadership practices and development partners in non-profit organizations. Based on the empirical findings, it is evident that all the calculated R-values in this study exceeded the threshold of .700, indicating a strong alignment. Table 3 presents the validity assessment of various variables through different indices. Cronbach's alpha (α), a measure of internal consistency, fluctuated between .526 and .834, indicating varying degrees of reliability across the considered variables. McDonald's omega coefficients (ω_1, ω_2, ω_3), alternative indicators of reliability, ranged from .571 to .847. Moreover, Average Variance Extracted (AVE) values, assessing convergent validity ranged from of .259 to .577, providing insights into consistency and convergence of the variables under consideration.

Table 3. Reliability Indices.

Variable	α	ω_1	ω_2	ω_3	AVE
OP_C	0.834	0.842	0.842	0.847	0.577
SL_C	0.526	0.571	0.571	0.570	0.259
CL_C	0.722	0.776	0.776	0.781	0.507

Source: Researchers' survey result, 2024.

4.4. Data Processing and Analysis

A mixed-methods approach was utilized for a thorough data analysis. Quantitative data were analyzed with SPSS version 29, while qualitative data were processed using NVivo version 12. Initially, completed questionnaires were reviewed for completeness, coded for data entry, and analyzed. Descriptive statistics, including mean, median, and standard deviation, were calculated, and inferential statistics like cross-tabulation, Pearson correlation coefficients, and regression analyses were performed. Advanced techniques included multivariate analysis, principal component analysis using Monte Carlo simulations, confirmatory factor analysis, and structural equation modeling (SEM).

Qualitative data from focus group discussions with the KALRO Board of Management were analyzed through thematic and content analysis. A matrix analysis was employed, cross-matching study objectives with board members' responses, aiding in data reduction, synthesis, and comparative assessment. Responses for each matrix cell was succinctly summarized in bullet points, facilitating cross-referencing across variables and respondents.

ANOVA assessed differences among three or more groups, evaluating within-group and between-group variances to determine statistically significant differences, with a p-value threshold of 0.05.

AMOS 16.0 was used for SEM, analyzing covariance matrices to estimate structural model parameters. Model fit was evaluated using indices like chi-square, comparative fit index (CFI), and Tucker-Lewis Index (TLI). Scores from the Likert scale was transformed into indexed measures for use in SEM through AMOS computer program.

Covariance-based structural equation modeling was adopted by combining factor analysis and linear regression to simultaneously determine the nature and strength of relationships among the study's measured and latent variables. These latent variables were considered to include phenomena such as the perceptions and attitudes of respondents, their satisfaction with diverse products and services, and their influence on KALRO's performance.

Diagnostic tests ensured unbiased estimates, and Hayes' PROCESS Macro via SEM gauged the moderating effect, meeting assumptions for multiple regression.

4.5. Hypothesis Testing

Hypothesis testing is a fundamental statistical method used to make inferences about population parameters based on sample data. In this study that involves linear and multiple regression, as well as multivariate analysis, it assesses the relationships between independent variable (X), the moderator (M), and dependent variable (Y).

Covariance-based structural equation modeling (SEM) extended this test by examining complex relationships between observed and latent variables. It integrated factor analysis and linear regression, concurrently ascertaining the nature and strength of relationships among the measured and latent variables within the study. These latent variables encompassed phenomena such as respondents' perceptions and attitudes, their satisfaction with diverse products and services, and their impact on KALRO's performance.

Confirmatory factor analysis (CFA), a component of SEM was tested to validate measurement models by assessing the relationships between observed variables and their underlying constructs.

In these hypothesis testing, the acceptable level of significance, allowable as a threshold for rejecting the null hypothesis was $\alpha = 0.05$, indicating a 5% chance of observing the data if the null hypothesis were true. In cases where the calculated p-value was lower than the chosen alpha level, the null hypothesis was rejected, suggesting that the observed results were statistically significant and not likely due to chance. In this study, two specific objectives, along with their corresponding hypotheses, were articulated and analyzed.

These hypotheses tests checked the presence or absence of the effect of corporate leadership (independent variable, X) on KALRO's performance (dependent variable, Y), and the moderating effect of strategic linkages (M) on the relationship between corporate leadership and organizational performance of KALRO.

The first hypothesis, aiming to establish evidence of a significant relationship between corporate leadership and KALRO's performance, was tested using a simple linear regression model. Interpretation of results relied on generated p-values, correlation coefficients, F-tests, T-tests, as well as variance inflation factor (VIF) and tolerance levels for multicollinearity tests.

The second hypothesis, examining the presence of a significant moderating effect of strategic linkages on the relationship between corporate leadership and KALRO's performance, was tested using stepwise regression analysis for moderation, following Baron and Kenny's guidelines and specified in Hayes PROCESS Procedure 1. Interpretation of results included consideration of p-values, correlation coefficients, F-tests, T-tests, as well as variance inflation factor (VIF) and tolerance levels for multicollinearity tests.

The study used models with composite indicators to assess statistically significant relationships between variables. A composite indicator, consolidating diverse dimensions into a single measure, was created using weighted linear aggregation rule. Normalization and weighting were conducted for comparability, employing Min-Max scaler.

5. Results and Discussion

5.1. Analysis of Response Rate

A high response rate strengthens the statistical power of collected data and facilitates the reliable implementation of recommendations. The findings demonstrate that 212 out of 248 questionnaires were satisfactorily filled out, resulting in a response rate of 85.5% (Table 4). All submitted surveys were completed in their entirety, as the online survey instrument mandated that respondents provide answers to every question before submitting.

This response rate exceeds the recommended threshold of 50% for studies of this nature [56]. The high survey response rate is crucial as it enhances the reliability and validity of the study, bolstering credibility, generalizability, statistical power, external validity, and confidence. It mitigates non-response bias and supports ethical considerations, ensuring meaningful insights from the target population.

Notably, with a unit of observation of 248 and a response rate of 85.5%, the study aligns with the recommendation of key researchers such as Kumar and Choudhary [57], and Luo [58] of having a study target population ranging from 30 to 500 for scientific research. This unit of observation also meets the requirement for structural equation modeling (SEM), which necessitates at least 100 participants [56, 59] which this study exceeded.

Table 4. Response Rate.

Management Division	Sample	Received	Response Rate (%)
Board of Management	7	5	71.4
Directorate	3	2	66.7
Secretariat	17	15	88.2
Institutes	64	59	92.2

Management Division	Sample	Received	Response Rate (%)
Centres & Sub-Centres	157	131	83.4
Total	248	212	85.5

Source: Own computation, 2024.

5.2. Demographic Characteristics

KALRO's top leadership exhibited a notable male majority at 67.9%, meeting the two-thirds gender rule. The ANOVA results indicated that age group of the leader had a statistically significant effect on KALRO's performance (F = 5.518; p = .020). This suggests differences in leadership style, experience, or approach across different age groups, which can also impact organization's effectiveness. The study shows that KALRO is very likely to benefit from considering the age group of its leaders in its strategic planning processes and leadership development to optimize performance and harness the strengths of different age groups. This finding is supported by the observations of Sohrabi et al. [49] and Abdulrahman et al. [51] when they noted that the younger generation, especially the Millennials would become effective leaders if they were adequately mentored and inducted into leadership at the earlier stages of their appointment. Similarly, 62% of leaders were aged 45 or older, revealing a mentoring gap for those under 25 (Table 5). The leadership structure included 48.6% managers and technical theme leaders, 30.6% in the directorate group, and 18.4% in junior/middle-level roles.

Table 5. Demographics of Respondents.

Profile	Category	Frequency	Percentage
Gender	Male	144	67.92
	Female	68	32.08
	Below 25	2	.94
	25 – 34	28	13.21
Age	35 – 44	50	23.58
	45 – 54	68	32.08
	55 and above	64	30.19
	Board member	5	2.36
	Director	65	30.66
Position	Manager	103	48.58
	Officers	39	18.40

Source: Own computation (2024)

5.3. Descriptive Statistics of Study Variables

A review of KALRO's corporate leadership showed a solid strategic orientation and a generally positive outlook supported by over 74% of respondents expressing favorable perceptions (M = 3.79; SD = .493). This suggests that the top leadership at KALRO has a high level of appreciation for the current corporate leadership structures and the implementation of existing policies and strategies. This positive response may also stem from the fact that these leaders have gained valuable insights through experience about what effectively enhances organizational performance.

Regarding efforts to develop talents within KALRO, concerns centred around human capital evaluation (M = 3.02; SD = .689). Succession plan issues ranked high as needing attention, while feedback on management of corporate culture varied by age, with young scientists demanding for support and inclusion in management. Policy implementation of strategic linkage regulations and procedures via performance monitoring recorded consensus (M = 3.72; SD = 0.951), thus calling for robust framework for tracking and evaluating outcomes. This observation aligns with the findings of Hermanto et al. [41], and Gusmão et al. [43] who observed that regular monitoring of implementation of strategies contributed to enhanced organizational performance. Resource availability challenges were evident (M = 3.02; SD = 0.689), constraining implementation of policies, while implementation of identified policy barriers was not regular (M = 2.90; SD = .823).

Inasmuch as strategic linkages and effective collaboration with international organizations was reasonable (M = 3.73; SD = .622), there were calls to initiate joint research projects. This move was appreciated as a quicker approach of enhancing engagement with diverse professionals from other affiliated institutions. This finding was supported by Kumar et al. [38] and Dreier et al. [48] who noted a significant positive relationship between joint programming approaches by selected strategic partners and organizational performance. Efforts leading to political linkages evoked neutral response, while effectiveness of fund remittance and budget increases were dissatisfying, mainly from governmental bodies. However, positive feedback on institutional linkages (M = 3.80; SD = .674) and impactful media engagement (M = 3.84; SD = .596) underscored importance of strengthening strategic connections to enhance visibility and outreach efforts. Stakeholders also expressed satisfaction with organizational performance (M = 4.13; SD = .513) and effectiveness of innovation platforms (M

= 4.11; SD = .764), notwithstanding need for improvements in communication and collaborative efforts.

5.4. Inferential Statistics

The study confirmed consistent variances across variables (corporate leadership: p = .935, strategic linkages: p = .843, organizational performance: p = .652). Normality tests showed no significant deviations from normal distribution (corporate leadership: p = .181, strategic linkages: p = .325, organizational performance: p = .273), supporting parametric analyses. Autocorrelation analysis revealed a strong positive association (R = .826, p < .001), indicating no significant autocorrelation. Multicollinearity tests demonstrated acceptable Tolerance (corporate leadership: T = .501, strategic linkages: T = .681)

and VIF values (corporate leadership: VIF = 1.995, strategic linkages: VIF = 1.469) (all p < .001), ensuring the reliability of the regression model. Additionally, no outliers were detected (Max = 17.507, Critical = 16.27). These findings affirm the robustness of the statistical analyses and support the suitability of the data for further interpretation. Similar results reported by Wulandari et al. [60] on leadership, work motivation, and work environment reinforce the confidence in the normality and reliability of the examined variables.

All Cronbach's alpha scores indicate strong internal reliability (Table 6). Significant correlations at p < .05 level (2-tailed) reject the null hypothesis, confirming associations between variables. Moderate positive correlations are observed, with organizational performance significantly associated with corporate leadership (r = .613), and strategic linkages (r = .798).

Table 6. Pearson's Correlation Coefficient of Variables.

		Corporate Leadership	Strategic Linkages	Organization Performance
Corporate Leadership	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	212		
Strategic Linkages	Pearson Correlation	.544**	1	
	Sig. (2-tailed)	<.001		
	N	212	212	
Organization Performance	Pearson Correlation	.613**	.798**	1
	Sig. (2-tailed)	<.001	<.001	
	N	212	212	212

**. Correlation is significant at the 0.01 level (2-tailed).
Source: Researcher's survey result, 2024

Okech et al. [24] demonstrated robust correlation of .69 between leadership style and development partners, mirroring Kitonga's [22] findings of R = .283 between strategic leadership and nonprofit development partners. This supports study findings of role of moderator in KALRO's performance.

5.5. Moderation Analysis

Moderation occurs when the relationship between two variables is influenced by a third variable, known as the moderator. The moderator variable affects the strength or direction of the relationship between an independent variable (corporate leadership) and a dependent variable (organizational performance of KALRO). In this study, it is suspected that strategic linkages (moderator) changes the relationship corporate leadership and organizational performance of KALRO.

On the other hand, the interaction effect in moderation analysis refers to the situation where the effect of one variable

on an outcome depends on the level of another variable. It is the statistical term used to describe how the relationship between the predictor and the outcome variable changes at different levels of the moderator variable. In this study, if strategic linkages moderates the effect of corporate leadership on organizational performance of KALRO, the interaction effect would capture how the relationship between corporate leadership and organizational performance of KALRO differs depending on the level of strategic linkages.

The moderation analysis showed stronger coefficients for corporate leadership and strategic linkages, alongside a negative coefficient for the interaction term, signifying a diminished moderation effect. A diminished moderation effect refers to a situation in which the impact of a moderating variable on the relationship between an independent variable and a dependent variable weakens over time or under certain conditions.

The study adopted hierarchical multiple regression to estimate the effect of moderation variable. This involved assessing

significance of interaction effect between corporate leadership (CL) and strategic linkages (SL) in predicting organizational performance (OP).

Moderation is noted when the slope to predict the dependent variable (KALRO's performance) from independent variable (corporate leadership) differs across values of the moderator (strategic linkages). This analysis was applied to test the null hypothesis of no significant moderating effect of strategic linkages on the relationship between corporate leadership and KALRO's performance. Requisite diagnostic tests exempted the variables from normality and linearity issues. Using a two-step multiple regression, backed by structural equation modelling, the analysis upheld the null hypothesis, indicating significant interaction (CL*SL) and enhanced moderation, as evidenced by a larger $R^2 = .694$.

The first step incorporated two antecedents, the independent variable (corporate leadership) and the moderator (strategic linkages), predicting the dependent variable (KALRO's performance) expressed as:

$$OP = \beta_b + \beta_1 CL + \beta_2 SL + \varepsilon_2 \qquad (1)$$

This model yielded a statistically significant effect fitted as follows:

$$\widetilde{OP} = .847 + .228*CL + .631*SL \qquad (2)$$

The unstandardized β_1 (.228) represents anticipated change in KALRO's performance for a unit increase in corporate leadership, while β_2 (.631) presents any change in KALRO's performance for a change in strategic linkages. The score of β_b (.847) shows the anticipated score of KALRO's performance when both corporate leadership and strategic linkages are equal to zero.

The second step introduced an interaction term (CL*SL), assessing the combined impact of corporate leadership and strategic linkages, as shown:

$$OP = \beta_b + \beta_1 CL + \beta_2 SL + \beta_3 (CL * SL) + e_3 \qquad (3)$$

Where β_3 estimates magnitude of change in β_1 for a unit increase in SL. It also represents how β_2 changes across values of CL. This model yielded a statistically significant effect fitted in the statistical diagram (Figure 2) and the following model:

$$\widetilde{OP} = 4.027 + .205*CL + .619*SL - .124(CL*SL) \qquad (4)$$

Since the value of β_3 is not zero, results showed that the CL→OP relationship changed across levels of SL, hence showing an enhanced moderating effect. In this case, the moderator variable amplified or strengthened the relationship between corporate leadership and organizational performance of KALRO.

The presented models (2 and 4) offer insights into the moderation effect of strategic linkages on the relationship between corporate leadership and the performance of KALRO. Model 2 initially explained 68.2% of the variance in organizational performance, with an adjusted R Square of 67.9%. This indicated that the model accounted for 68.2% of the differences in organizational performance based on the factors included. The adjusted R^2, slightly lower than the initial R^2, provided a more accurate measure by adjusting for the number of predictors in the model and the sample size. This close alignment between the initial and adjusted R^2 suggested that the model was robust and that the number of predictors did not excessively inflate the explanatory power.

Model 4, incorporating the interaction term (CL*SL), increased the R Square to 69.4%, and the adjusted R Square to 69%. This indicates that Model 4, with the moderation effect, slightly improved the model's explanatory power by 1.1 percentage units. The increase in both R^2 and adjusted R^2 showed that the interaction term contributed valuable additional information, enhancing the model's ability to explain variations in organizational performance while accounting for the added complexity.

Regarding Std. Error of the Estimate, Model 2 had a value of 0.312 compared to Model 4 marginally lower standard error at 0.307, suggesting a slightly better fit in predicting organizational performance. Although the F Change decreased from 223.70 (Model 2) to 157.29 (Model 4), it remained statistically significant, emphasizing the relevance of moderation effect, and signifying that the moderation effect is not due to chance. Regression results are shown in Table 7.
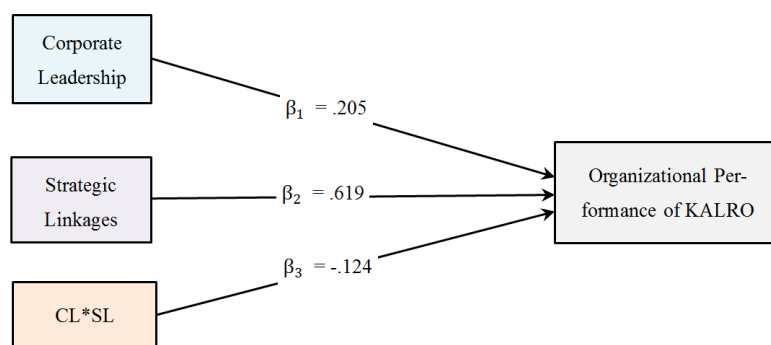
Source: Researchers' survey result, 2024.

Figure 2. *Statistical Diagram of Moderation.*

Table 7. Summary of Strategic Linkages and Performance of KALRO.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
2	.826[a]	.682	.679	.312	.682	223.70	2	209	<.001
4	.833[b]	.694	.690	.307	.694	157.29	3	208	<.001

[a] Dependent Variable: (Constant), Corporate Leadership, Strategic Linkages
[b] Predictors: (Constant), Corporate Leadership, Strategic Linkages, CL*SL interaction
(Source: Researcher's survey result, 2024)

Table 8. ANOVA[a] for Moderated Regression Analysis.

Model[a]		Sum of Squares	df	Mean Square	F	Sig.
2	Regression	43.686	2	21.843	223.697	<.001[b]
	Residual	20.408	209	.098		
	Total	64.095	211			
4	Regression	44.485	3	14.828	157.289	<.001[c]
	Residual	19.609	208	.094		
	Total	64.095	211			

a Dependent Variable: Organizational Performance
b Dependent Variable: (Constant), Corporate Leadership, Strategic Linkages
c Predictors: (Constant), Corporate Leadership, Strategic Linkages, CL*SL interaction
Source: Researcher's survey result, 2024

The analysis of variance (ANOVA) for the moderated regression analysis is presented in Table 8. The ANOVA results indicate that both Model 2 and Model 4 were statistically significant, as evidenced by the low p-values (p < .001). This suggests that the models, encompassing corporate leadership, strategic linkages, and their interaction, significantly contributed to explaining the variance in organizational performance. In Model 2, the regression accounted for 21.843 units of variance in organizational performance, as indicated by the mean square value. The subsequent analysis (Model 4) expanded the model to incorporate the interaction term (CL*SL), resulting in a mean square of 14.828, demonstrating a slightly reduced but still substantial explanatory power. Sohrabi et al.'s [49] observation that strategic alliances influence organizational per-

formance when supported by leaders support the study.

The moderated regression analysis reveals significant effects of corporate leadership and strategic linkages on KALRO's performance (Table 9). The constant term indicates an expected value of 4.027 (SE = .023, p < 0.001) when all predictors are zero. Both corporate leadership and strategic linkages have significant positive effects on KALRO's performance, with coefficients of .205 (SE = .042, p < 0.001) and .619 (SE = .044, p < 0.001) respectively. However, a significant negative interaction effect was noticed between corporate leadership and strategic linkages (CL*SL), with a coefficient of -0.124 (SE = .043, p = .004), indicating that the relationship between corporate leadership and KALRO's performance depends on the level of strategic linkages.

Table 9. Coefficients for Moderated Regression Analysis.

Coefficient	Coeff	SE	T	P	LLCI	ULCI
Constant	.847	.155	5.478	.000	.542	1.151
Corporate Leadership	.228	.042	5.462	.000	.146	.311

Coefficient	Coeff	SE	T	P	LLCI	ULCI
Strategic Linkages	.631	.044	14.176	.000	.543	.718
Constant	4.027	.023	178.139	.000	3.982	4.072
Corporate Leadership	.205	.042	4.895	.000	.122	.287
Strategic Linkages	.619	.044	14.091	.000	.532	.705
CL*SL Interaction	-.124	.043	-2.911	.004	-.208	-.040

(Source: Researcher's survey result, 2024)

The simple slope (Figure 3) was fixed to estimate the effect of predictor variable (corporate leadership) on the dependent variable (KALRO's performance) across different levels of the moderator variable (strategic linkages). At the average level of the moderator, there was a significant positive relationship between corporate leadership and KALRO's performance, with an estimate of .205 (p < .001). However, this relationship strengthens when the moderator is at a low level (-1SD), with the estimate increasing to .276 (p < .001), indicating a stronger positive association between corporate leadership and KALRO's performance.
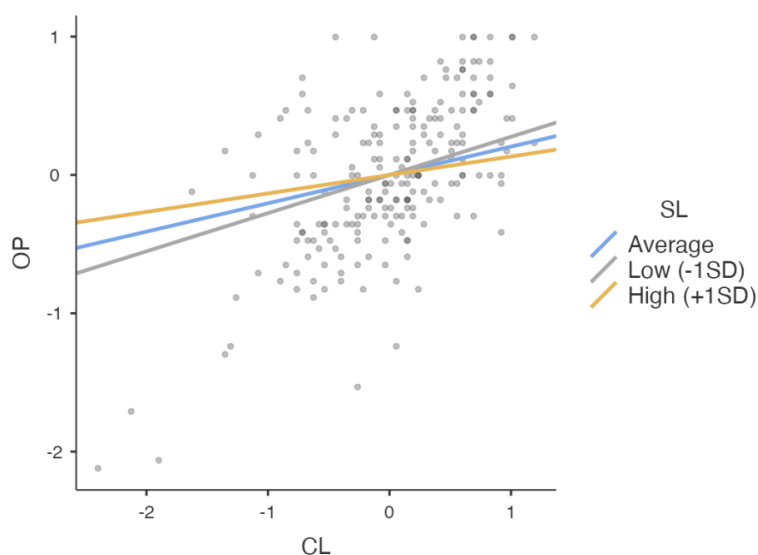
Source: Researcher's survey result, 2024

Figure 3. Simple Slop Plot.

Conversely, when the moderator is at a high level (+1SD), the estimate decreases to .134 (p = .009), suggesting a weaker positive relationship between corporate leadership and KALRO's performance. These findings underscore the importance of considering the moderating influence of strategic linkages in understanding the relationship between corporate leadership and KALRO's performance, providing valuable insights for tailored interventions or strategies aimed at optimizing the impact of corporate leadership on performance across different conditions or contexts.

These results showed that strategic partnerships and linkages established by KALRO enhanced the effectiveness of its agricultural and livestock research agenda by leveraging external expertise, resources, and networks. KALRO's collaborations with academic institutions, government agencies, international organizations, and the private sector provided access to advanced technologies, funding opportunities, and valuable data. These partnerships facilitated the development of innovative solutions and the dissemination of research findings. These findings match with that of Smith and Johnson [61] who discussed how partnerships between research institutions and industry stakeholders led to breakthroughs in pest-resistant crop varieties and efficient livestock management practices, thus demonstrating the critical role of collaborative efforts in advancing food security.

Similarly, organizational performance of KALRO was significantly influenced by how well agricultural and livestock research institutes managed corporate leadership and strategic partnerships at the county and local level. High-performing institutes that integrated these elements

effectively translated research into practical solutions for food security issues. This supported the findings of Muthimi and Kilika [62] who noted that maintaining robust leadership and fostering strong strategic linkages improved organizational efficiency and adaptability to emerging challenges.

5.6. Qualitative Data Analysis

The NVivo analysis systematically coded, queried, visualized, and interpreted data, uncovering key themes, relationships, and patterns that supported the quantitative findings. Deductive coding of board members' responses from focus group discussions revealed interconnections across strategic activities, policy coordination, and oversight. Positive ratings on the effectiveness of the previous five years of government support were noted, with recommendations targeting policy streamlining, capacity strengthening of personnel, strategic partnerships, and engaging Millennials in leadership. Results showed KALRO's success in research dissemination, policy formulation, resource mobilization, technology dissemination, and policy reviews, particularly in funding security and collaboration. Themes from focus group discussion included strategic planning, dealing with collaboration challenges, and identification of opportunities for innovation within KALRO. The board members stressed the importance of forming strategic linkages with government and development partners to enhance resource mobilization and generation of user-friendly technologies, as well as the need for continuous leadership training and knowledge-sharing. These qualitative findings significantly supported quantitative results generated from non-board members not targeted in the focus group discussion.

6. Conclusions

The study findings revealed a significant impact of corporate leadership on KALRO's performance, with a rejection of the null hypothesis suggesting a substantial relationship. Utilizing a composite indicator approach and weighted regression model, the analysis demonstrated that corporate leadership accounted for 39.3% of the variance in KALRO's performance, showing high precision. The beta coefficient of .613 indicated that a one-unit increase in corporate leadership led to a .613-unit increase in performance. Strategic direction, organizational goals, human capital, and corporate culture were considered in the assessment, with no indication of multicollinearity. Furthermore, the study explored the moderating role of strategic linkages in the corporate leadership and performance relationship. The results indicated a significant moderating effect, explaining 69.4% of the variance. Strategic linkages moderated the relationship between corporate leadership and organizational performance, evidenced by model coefficients highlighting nuanced connections. The study ruled out antagonistic moderation, while instances of enhanced moderation was observed. Qualitative data analysis involved interpretive phenomenological, dis-

course, and narrative analyses from board responses, thereby explaining the quantitative results and helping in hypothesis testing. The Board appreciated KALRO's efforts, but suggested more action on market-driven research, resource optimization, and innovative revenue generation.

7. Recommendations

KALRO management should focus on enhancing gender diversity in leadership to meet the two-thirds gender rule by adopting inclusive policies and establishing targeted mentorship programs. To ensure institutional continuity and preserve organizational memory, it is recommended to introduce five-year leadership contracts. Additionally, investing in continuous staff training will foster a culture of shared responsibility and improve overall effectiveness. Regular performance appraisals should be conducted to refine personnel assessment and succession planning, while strategic leadership training in communication, decision-making, and conflict resolution will further support leadership development.

To implement these improvements, organizations must strengthen their monitoring and evaluation systems and collaborate closely with development partners to boost research and networking opportunities. Effective management of resources and advocacy for timely government funding are crucial for sustaining progress. Enhancing infrastructure, engaging in proactive media relations, and continually adapting strategies based on assessments will contribute to organizational success. By prioritizing these strategies, KALRO can ensure strategic alignment, foster leadership effectiveness, and drive overall success.

8. Implications for Practice

The findings of this study have significant implications not only for the corporate leadership and managers of KALRO but also for top leaders across various organizations aiming to enhance performance and strategic linkages both locally and internationally. The study reveals that agricultural and livestock research organizations can improve their performance and delivery of national and regional agricultural and livestock-based public goods by focusing on strategic linkages and strengthening corporate leadership.

From a policy perspective, understanding the impact of strategic linkages and corporate leadership on organizational performance offers valuable opportunities for top leaders to develop strategic policies, strategies, and systems that boost performance. Practically, the findings provide actionable insights for corporate leadership and managers, enabling KALRO and similar organizations to better achieve their objectives and mandates. Emphasizing strategic linkages and effective corporate leadership is expected to significantly enhance organizational performance.

Abbreviations

ANOVA	Analysis of Variance
df	Degree of Freedom
R	Correlation Coefficient
NARS	National Agricultural Research System
SF	Strategic Foresight
CE	Corporate Efficiency
LC	Leadership Commitment
LLCI	Lower Limit Confidence Interval
ULCI	Upper Limit Confidence Interval

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Domeniter Naomi Kathula: Methodology, Project administration, Software, Supervision, Validation, Visualization, Writing – review & editing

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Data Availability Statement

The data is available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

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Biography

Enock Warinda practices as a development measurements and evaluation specialist as well as an agricultural economist with over 27 years of multi-disciplinary work experience in agriculture, impact evaluation, leadership and management, strategic planning, knowledge management, applied statistics, rural development, mixed methods research, and public and private sector policy research, reforms and management. He holds a PhD in agricultural economics, MA in monitoring and evaluation, Master of Philosophy in forestry economics and management, and BSc in forestry. He is currently engaged in private agricultural business that focuses on the application of organic farming technologies and innovation.

Domeniter Naomi Kathula holds a PhD in Educational Administration and Planning from Catholic University of Eastern Africa, Master of Education in Educational Administration and Planning from University of Nairobi, and a Bachelor of Science in Agricultural Education and Extension from Egerton University. Dr. Kathula has widely published research papers in high impact peered review journals, book chapters, and participated in research scientific conferences annually. She is a member of the Association of Academic Registrars of Universities in Kenya (AARUK), the Kenya Universities Quality Assurance Network (KUQAN) and Associate member Kenya Institute of Management (KIM). Dr. Kathula has supervised many post-graduate students.

Michael Orucho Ngala is a lecturer and Acting Assistant Registrar of Academics at the Co-operative University of Kenya, Department of Entrepreneurship and Economics. He holds a PhD in Strategic Management, Master of Business Administration and Bachelor of Arts in Education. Dr. Ngala served as a tutorial fellow and dean, School of Management and Leadership at the Management University of Africa. He has published widely in peer reviewed journals, besides presenting at international conferences. He teaches Strategic Management, Change Management, Principles and Practice of Management, Organisational Development, and Business Statistics. He has supervised assorted post-graduate students.

Research Field

Enock Warinda: Agricultural economics, econometrics, applied statistics, measurements and evaluation, policy analysis, corporate leadership, programme management, corporate social responsibility.

Domeniter Naomi Kathula: Agricultural extension, organizational development, practice of management, business statistics, change management, strategic management, corporate governance, human resources management.

Michael Orucho Ngala: Strategic management, principles of management, corporate governance, practice of management, organizational development, change management, business statistics.