

Research Study Framework: The Critical Role of Research Transformation and Leadership in Higher Education in Africa, Referencing Agenda 2063

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Abstract

Background: The African Union's Agenda 2063 envisions a transformed, prosperous Africa driven by knowledge, innovation, and capable institutions, yet African higher education institutions face persistent challenges in research capacity, productivity, and alignment with continental development priorities, producing less than 1% of global research output despite comprising 17% of world population. Effective research leadership has emerged as a critical yet under-studied factor that could catalyze the research transformation necessary to achieve Agenda 2063's aspirations, particularly given the complex challenges of resource constraints, infrastructure deficits, and the need to balance international research standards with locally relevant agendas.

Objective: The main objective was to examine the critical role of research transformation and leadership in African higher education institutions and their alignment with the African Union's Agenda 2063 development framework.

Methods: This mixed-methods convergent parallel study employed a stratified random sample of 512 research leaders from fifteen African countries across all regional economic communities, with sample size calculated to achieve 80% statistical power for detecting medium effect sizes. Data were collected through structured questionnaires measuring leadership competencies, research transformation indicators, and Agenda 2063 alignment, supplemented by 45 semistructured interviews and documentary analysis.

Results: Structural equation modeling revealed that leadership influenced Agenda 2063 alignment through both direct effects ($\beta=0.389$, accounting for 42% of total effect) and indirect effects mediated by research transformation ($\beta=0.283$, accounting for 58% of total effect), while logistic regression demonstrated that institutions with high transformational leadership had 2.88 times higher odds of achieving strong Agenda 2063 alignment (OR=2.876, 95% CI [1.47, 5.62], $p<0.001$). Critical leadership competencies included strategic vision ($r=0.614$ with research transformation), resource mobilization ($r=0.698$ with external funding), and stakeholder engagement ($r=0.543$ with collaborative networks), with leadership experience significantly moderating these relationships, as leaders with more than ten years of experience achieved 1.99 times higher odds of successful Agenda 2063 alignment compared to less experienced counterparts.

Conclusion: The study conclusively established that research transformation and leadership are critical, interconnected enablers of African higher education institutions' capacity to contribute to Agenda 2063's continental development vision, with transformational leadership competencies, particularly strategic vision and resource mobilization, serving as the primary drivers of research capacity enhancement and alignment with Africa's development priorities. Leadership influences continental development outcomes through both direct strategic positioning (42% of effect) and indirect capacity-building pathways (58% of effect), indicating that achieving Agenda 2063 requires systematic investment in developing transformational research leaders who can navigate resource

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constraints while strategically aligning institutional research agendas with Africa's most pressing challenges in science, technology, health, governance, and industrialization.

Recommendation: African governments, the African Union, and regional economic communities should establish comprehensive research leadership development programs that build transformational competencies among research administrators while creating Agenda 2063-aligned funding mechanisms that incentivize both research excellence and continental development impact.

Keywords: Research transformation, research leadership, higher education, Agenda 2063, African universities, transformational leadership.

Introduction

The African Union's Agenda 2063 represents a transformative blueprint for Africa's socio-economic development, envisioning "an integrated, prosperous and peaceful Africa, driven by its own citizens and representing a dynamic force in the international arena." Central to achieving this vision is the strengthening of higher education institutions and their research capabilities across the continent (Djono et al., 2022; Shin et al., 2023). Higher education institutions serve as the primary engines of knowledge production, innovation, and human capital development necessary for Africa's sustainable transformation. However, the realization of Agenda 2063's aspirations requires a fundamental transformation in how research is conducted, managed, and led within African universities and research institutions (Canterino et al., 2018; Gram-Hanssen, 2021).

Research transformation in African higher education encompasses multiple dimensions: the modernization of research infrastructure, the cultivation of collaborative research networks, the alignment of research priorities with continental development goals, and the enhancement of research impact on policy and practice (Alasiri & AlKubaisy, 2022; Olugboyege, 2022). Leadership plays a pivotal role in orchestrating this transformation, as institutional leaders must navigate complex challenges including limited funding, brain drain, inadequate research infrastructure, and the need to balance global research standards with locally relevant priorities (Gledson et al., 2024; Karakose & Tülübaş, 2023). Effective research leadership requires vision, strategic thinking, and the capacity to mobilize resources while fostering a culture of innovation and excellence that responds to Africa's unique developmental challenges (Mihardjo et al., 2019; Senadjki et al., 2024). This study examines the intersection of research transformation and leadership within the context of African higher education, specifically analyzing how leadership practices influence research capacity building, productivity, and alignment with Agenda 2063's strategic objectives (Abe & Mugobo, 2021). By investigating the experiences, challenges, and strategies employed by research leaders across African institutions, this research seeks to contribute valuable insights that can inform policy, practice, and capacity development initiatives aimed at strengthening Africa's research ecosystem and accelerating progress toward the continental vision of transformation and prosperity.

Background of the Study

Africa's higher education landscape has undergone significant evolution over the past six decades, from the postcolonial era's focus on establishing national universities to the contemporary emphasis on research excellence and

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global competitiveness. However, African universities continue to face substantial challenges in research productivity and impact. According to UNESCO data, Africa produces less than 1% of global research output despite comprising approximately 17% of the world's population, highlighting a significant research capacity deficit that impedes the continent's development trajectory (Cui et al., 2022; Yao et al., 2024).

The African Union's Agenda 2063, adopted in 2013, provides a comprehensive framework for Africa's transformation over the next fifty years. The agenda's seven aspirations include goals for inclusive growth, well-educated citizens supported by science, technology and innovation, and institutions that are capable of driving sustainable development. Within this framework, Aspiration 1 specifically emphasizes the need for "well-educated citizens and skills revolution underpinned by science, technology and innovation," recognizing higher education and research as critical enablers of continental transformation. The Science, Technology and Innovation Strategy for Africa (STISA-2024) further operationalizes these aspirations by setting targets for increased research and development investment, enhanced research capacity, and improved knowledge generation relevant to African challenges (Sow & Aborbie, 2018; VargasPinedo et al., 2022). Despite these policy frameworks, African higher education institutions face persistent challenges that limit their research transformation. These include chronic underfunding, with many African countries investing less than 0.5% of GDP in research and development compared to the global benchmark of 2-3%. Brain drain continues to deplete the continent's research talent, with significant numbers of African scholars working in institutions outside the continent. Infrastructure deficits, limited access to digital resources, weak linkages between universities and industry, and inadequate research management systems further constrain research productivity (Feliciano-Cestero et al., 2023; Karakose et al., 2021).

Leadership has emerged as a critical factor in determining institutional research success. Research demonstrates that effective leadership can mobilize resources, build collaborative networks, create enabling environments for research excellence, and strategically align institutional priorities with national and continental development agendas (KLEIN, 2020; Kristensen & Andersen, 2023). However, there is limited empirical understanding of how research leadership is practiced in African contexts, what competencies and strategies are most effective, and how leadership influences research transformation in alignment with Agenda 2063's objectives. This study addresses this knowledge gap by examining research leadership practices and their impact on transforming research ecosystems in African higher education (Hung et al., 2023; Weber, Krehl, et al., 2022).

Statement of the Problem

While Agenda 2063 articulates ambitious goals for Africa's transformation through science, technology, and innovation, African higher education institutions continue to struggle with limited research capacity, low productivity, and minimal impact on addressing continental development challenges. The research output from African institutions remains marginal in global terms, and much of the research conducted fails to adequately address Africa's priority areas such as food security, health, climate adaptation, industrialization, and governance—key focus areas of Agenda 2063 (Singh et al., 2023; Weber, Büttgen, et al., 2022; Yusuf et al., 2023). A critical gap exists in understanding how research leadership influences the transformation of research ecosystems in African higher education institutions. Existing literature on research leadership predominantly reflects Western contexts and may not adequately capture the unique challenges, opportunities, and leadership approaches relevant to African settings. African research leaders

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operate in environments characterized by resource constraints, competing institutional priorities, complex governance structures, and the need to balance international research standards with locally relevant research agendas (Carvalho et al., 2022; Kokot et al., 2023; Türk, 2023).

Furthermore, there is insufficient empirical evidence on the specific leadership competencies, strategies, and practices that effectively drive research transformation in African contexts, particularly in relation to Agenda 2063's objectives. Without this understanding, capacity development initiatives, policy interventions, and institutional reforms may fail to adequately support research leaders in catalyzing the transformation necessary for African universities to contribute meaningfully to continental development goals (Fritsch et al., 2023; Siangchokyoo et al., 2020). This study therefore seeks to investigate how research leadership influences research transformation in African higher education institutions, identify the critical leadership competencies and practices that enable successful research transformation, and explore how research leadership can be strengthened to align institutional research agendas with Agenda 2063's aspirations. Addressing this problem is essential for developing evidence-based strategies to enhance Africa's research capacity and accelerate progress toward the continent's vision for sustainable and inclusive development (O'Donoghue & van der Werff, 2022).

Main Objective of the Study

To examine the critical role of research transformation and leadership in African higher education institutions and their alignment with the African Union's Agenda 2063 development framework.

Specific Objectives

1. To assess the current state of research transformation in African higher education institutions and identify the key drivers and barriers influencing research capacity development in the context of Agenda 2063 priorities.
2. To analyze the leadership competencies, strategies, and practices that research leaders employ to drive research transformation and enhance institutional research productivity in African universities.
3. To evaluate the extent to which research leadership practices align institutional research agendas with Agenda 2063's strategic objectives and contribute to addressing Africa's development challenges.

Research Questions

1. What is the current state of research transformation in African higher education institutions, and what are the key drivers and barriers that influence research capacity development in alignment with Agenda 2063 priorities?
2. What leadership competencies, strategies, and practices do research leaders employ to drive research transformation and enhance institutional research productivity in African universities?
3. To what extent do research leadership practices align institutional research agendas with Agenda 2063's strategic objectives, and how do they contribute to addressing Africa's development challenges?

Methodology

This study employed a mixed-methods convergent parallel design to examine the critical role of research transformation and leadership in African higher education institutions in alignment with Agenda 2063. The research

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was conducted across fifteen African countries representing all five regional economic communities (North, West, East, Southern, and Central Africa) to ensure continental representation and diversity in institutional contexts. The target population comprised research leaders including vice-chancellors, deputy vice-chancellors for research, deans of graduate schools, research directors, and heads of research centers and institutes in both public and private universities. Using a stratified random sampling technique, institutions were first stratified by region and institutional type (research-intensive, comprehensive, and specialized universities), and then research leaders were randomly selected from each stratum. A sample size of 385 participants was calculated using Cochran's formula for infinite populations with a 95% confidence level and 5% margin of error; however, to achieve 80% statistical power for detecting medium effect sizes (Cohen's $d = 0.5$) in comparative analyses and to account for potential non-response (estimated at 25%), the sample was increased to 512 research leaders.

Data collection involved a structured questionnaire with validated scales measuring research leadership competencies (adapted from the Research Leadership Competency Framework), research transformation indicators (including research output metrics, infrastructure development, collaborative networks, and funding acquisition), and Agenda 2063 alignment (assessed through institutional research priority alignment with the seven aspirations). Additionally, semi-structured interviews were conducted with 45 purposively selected research leaders who had demonstrated exceptional success in research transformation to gain deeper insights into leadership strategies and contextual factors. Documentary analysis of institutional strategic plans, research policies, and performance reports complemented the primary data. Quantitative data were analyzed using SPSS version 28.0 and STATA version 17. Univariate statistical methods included descriptive statistics (frequencies, percentages, means, standard deviations, and ranges) to characterize the demographic profiles of research leaders, current state of research transformation, and distribution of leadership competencies across institutions. Bivariate statistical methods were employed to examine relationships between variables: Pearson correlation coefficients were calculated to assess linear relationships between continuous variables such as leadership effectiveness scores and research output indicators; independent samples t-tests compared research transformation levels between institutional types; one-way ANOVA with post-hoc Tukey tests examined differences in research productivity across regional economic communities; and chi-square tests analyzed associations between categorical variables including leadership approaches and Agenda 2063 alignment categories (Nelson et al., 2022, 2023).

For multivariate analysis, multiple linear regression models were constructed to predict research transformation outcomes (dependent variable) from leadership competencies, institutional factors, and contextual variables (independent variables). Model assumptions were rigorously tested: normality was assessed using Shapiro-Wilk tests and visual inspection of Q-Q plots; homoscedasticity was evaluated through Breusch-Pagan tests and residual plots; multicollinearity was examined using variance inflation factors ($VIF < 5$) and tolerance statistics; and independence of errors was verified using Durbin-Watson statistics. Structural equation modeling (SEM) using AMOS version 26 was employed to test the hypothesized relationships between latent constructs including transformational leadership, research transformation, and Agenda 2063 alignment, with model fit assessed using multiple indices ($CFI > 0.95$, $TLI > 0.95$, $RMSEA < 0.06$, and $SRMR < 0.08$). Hierarchical multiple regression was used to determine the incremental

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variance explained by different sets of predictors, with institutional factors entered in the first block, leadership competencies in the second block, and contextual variables in the third block. Logistic regression models were constructed to predict binary outcomes such as high versus low Agenda 2063 alignment, with model fit evaluated using Hosmer-Lemeshow goodness-of-fit tests and classification accuracy.

Results Table 1: Descriptive Statistics and Univariate Analysis of Research Transformation Indicators and Leadership Competencies (N=512)

Variable	Mean	SD	Min	Max	Skewness	Kurtosis
Research Transformation Indicators						
Annual research output (publications)	12.47	8.32	0	45	1.23	1.67
Research infrastructure index (0-100)	48.23	18.45	10	92	0.15	-0.68
Collaborative networks score (0-50)	28.34	11.76	5	50	-0.34	-0.52
External research funding (USD thousands)	87.65	62.34	0	315	1.45	2.13
Research capacity development score (0-100)	54.12	19.88	12	95	0.08	-0.71
Leadership Competencies						
Strategic vision score (0-50)	35.67	9.23	12	50	-0.45	-0.29
Resource mobilization score (0-50)	29.45	10.87	8	49	0.12	-0.74
Stakeholder engagement score (0-50)	32.78	9.65	10	50	-0.28	-0.55
Transformational leadership score (0-100)	68.34	15.76	25	98	-0.38	-0.42
Research management effectiveness (0-100)	61.23	17.45	18	96	-0.15	-0.58
Agenda 2063 Alignment						
Aspiration 1 alignment (education/STI) (0-20)	14.56	4.32	3	20	-0.52	-0.35
Aspiration 2 alignment (governance) (0-20)	11.23	5.67	2	20	0.23	-0.88
Aspiration 3 alignment (health/wellbeing) (0-20)	12.89	4.98	1	20	-0.18	-0.72
Overall Agenda 2063 alignment (0-100)	56.78	18.92	15	95	-0.12	-0.65
Institutional Characteristics						
	Frequency	Percentage				
Region: North Africa	87	17.0%				
Region: West Africa	134	26.2%				
Region: East Africa	118	23.0%				

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Region: Southern Africa	103	20.1%				
Region: Central Africa	70	13.7%				
Institution type: Research-intensive	156	30.5%				
Institution type: Comprehensive	267	52.1%				
Institution type: Specialized	89	17.4%				
Leadership experience: <5 years	189	36.9%				
Leadership experience: 5-10 years	213	41.6%				
Leadership experience: >10 years	110	21.5%				

The descriptive statistics revealed substantial variation in research transformation indicators across African higher education institutions, with research leaders reporting moderate levels of research output ($M=12.47$, $SD=8.32$ publications annually) and research infrastructure development ($M=48.23$, $SD=18.45$ on a 0-100 scale), suggesting that most institutions operated below optimal capacity for research production. The positive skewness observed in annual research output (1.23) and external research funding (1.45) with elevated kurtosis values (1.67 and 2.13 respectively) indicated that the distribution was right-skewed, meaning a small proportion of institutions achieved exceptionally high research productivity and funding levels while the majority clustered at lower performance levels, reflecting significant inequalities in research capacity across the continent.

Leadership competency scores demonstrated relatively higher performance, with transformational leadership averaging 68.34 ($SD=15.76$) out of 100, and strategic vision scoring 35.67 ($SD=9.23$) out of 50, indicating that research leaders possessed moderate to strong leadership capabilities despite operating in resource-constrained environments. The near-zero skewness values for most leadership variables (-0.45 to 0.12) and negative kurtosis values (-0.74 to -0.29) suggested approximately normal distributions, which satisfied assumptions for subsequent parametric statistical analyses. Regarding Agenda 2063 alignment, institutions demonstrated strongest alignment with Aspiration 1 focusing on education, science, technology and innovation ($M=14.56$, $SD=4.32$ out of 20), which was consistent with the core mandate of higher education institutions, while alignment with governance-related research (Aspiration 2) was notably lower ($M=11.23$, $SD=5.67$), suggesting that research agendas prioritized technical and scientific domains over social and political sciences.

The overall Agenda 2063 alignment score of 56.78 ($SD=18.92$) out of 100 indicated moderate integration of continental development priorities into institutional research agendas, revealing substantial room for improvement in strategically aligning research activities with Africa's transformation blueprint. The distribution of institutions across regions showed reasonable representation, with West Africa contributing the largest proportion (26.2%) and Central Africa the smallest (13.7%), reflecting the actual distribution of higher education institutions across the continent, while the predominance of comprehensive universities (52.1%) in the sample accurately represented the African

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higher education landscape where multi-disciplinary institutions outnumbered specialized research universities. The leadership experience distribution indicated that the majority of research leaders (78.5%) had accumulated between less than five to ten years of experience, suggesting a relatively young cohort of research leaders who may benefit from targeted capacity development interventions to enhance their effectiveness in driving research transformation aligned with Agenda 2063's ambitious goals.

Table 2: Bivariate Analysis - Correlations, Group Comparisons, and Associations (N=512)

Analysis Type	Variables	Statistical Test	Test Value	p-value	Effect Size
Pearson Correlations			r		
	Leadership effectiveness × Research output	Pearson correlation	0.624***	<0.001	Large
	Leadership effectiveness × Infrastructure index	Pearson correlation	0.558***	<0.001	Large
	Leadership effectiveness ×	Pearson	0.487***	<0.001	Medium
	Collaborative networks	correlation			
	Leadership effectiveness × External funding	Pearson correlation	0.591***	<0.001	Large
	Transformational leadership × Agenda 2063 alignment	Pearson correlation	0.672***	<0.001	Large
	Strategic vision × Research transformation	Pearson correlation	0.614***	<0.001	Large
	Resource mobilization × External funding	Pearson correlation	0.698***	<0.001	Large
	Stakeholder engagement × Collaborative networks	Pearson correlation	0.543***	<0.001	Large
	Research transformation × Agenda 2063 alignment	Pearson correlation	0.689***	<0.001	Large
Independent t-tests			t		Cohen's d

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	Research output: Research-intensive vs Others	Independent t-test	8.45***	<0.001	0.89
	Leadership effectiveness: >10 years vs <5 years	Independent t-test	6.73***	<0.001	0.76
	Agenda 2063 alignment: High vs Low leadership	Independent t-test	9.28***	<0.001	0.95
One-way ANOVA			F		η^2
	Research transformation across regions	One-way ANOVA	12.34***	<0.001	0.088
	Post-hoc (Tukey): Southern > Central			<0.001	
	Post-hoc (Tukey): North > Central			0.003	
	Post-hoc (Tukey): East > Central			0.012	
	Leadership competencies across institution types	One-way ANOVA	15.67***	<0.001	0.108
	Post-hoc (Tukey): Research-intensive > Specialized			<0.001	
	Post-hoc (Tukey): Research-intensive > Comprehensive			0.002	
	Agenda 2063 alignment across experience levels	One-way ANOVA	18.92***	<0.001	0.127
	Post-hoc (Tukey): >10 years > <5 years			<0.001	
	Post-hoc (Tukey): 5-10 years > <5 years			0.001	
Chi-square tests			χ^2		Cramér's V
	Leadership approach × Agenda 2063 alignment category	Chi-square	47.83***	<0.001	0.306

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Institution type × Research productivity category	Chi-square	38.56***	<0.001	0.275
Region × Resource mobilization success	Chi-square	32.47***	<0.001	0.252

***p < 0.001; **p < 0.01; *p < 0.05

The bivariate analyses revealed strong and statistically significant relationships between research leadership effectiveness and multiple dimensions of research transformation in African higher education institutions, providing robust empirical support for the critical role of leadership in driving institutional research capacity. The correlation analysis demonstrated large positive associations between leadership effectiveness and research output ($r=0.624$, $p<0.001$), infrastructure development ($r=0.558$, $p<0.001$), and external funding acquisition ($r=0.591$, $p<0.001$), indicating that institutions led by more effective research leaders achieved substantially higher levels of research productivity and resource mobilization, with approximately 39% of the variance in research output explained by leadership effectiveness alone. Particularly noteworthy was the exceptionally strong correlation between transformational leadership and Agenda 2063 alignment ($r=0.672$, $p<0.001$), suggesting that research leaders who employed transformational approaches—characterized by inspirational vision, intellectual stimulation, and individualized consideration—were significantly more successful in strategically aligning their institutional research agendas with continental development priorities, explaining approximately 45% of the variance in Agenda 2063 alignment. The correlation between resource mobilization competencies and external funding ($r=0.698$, $p<0.001$) was the strongest observed, demonstrating that leaders who possessed strong skills in grant writing, partnership development, and stakeholder engagement secured nearly 49% more external funding than their less competent counterparts, highlighting resource mobilization as a critical leadership competency for research transformation in resource-constrained African contexts. The independent t-tests revealed significant differences in research outcomes based on institutional characteristics and leadership profiles, with research-intensive universities producing substantially more research output than comprehensive and specialized institutions ($t=8.45$, $p<0.001$, Cohen's $d=0.89$), representing a large effect size that underscored the concentration of research productivity in a subset of elite institutions. Research leaders with more than ten years of experience demonstrated significantly higher leadership effectiveness compared to those with less than five years ($t=6.73$, $p<0.001$, Cohen's $d=0.76$), suggesting that leadership expertise in research administration accumulated substantially over time and supporting the need for leadership development pathways and mentorship programs for early-career research administrators. The comparison between high and low leadership effectiveness groups on Agenda 2063 alignment yielded the largest effect size ($t=9.28$, $p<0.001$, Cohen's $d=0.95$), indicating that effective research leadership was not merely associated with increased research output but was fundamentally linked to the strategic orientation of research toward addressing Africa's development priorities. The one-way ANOVA results revealed significant regional variations in research transformation ($F=12.34$, $p<0.001$, $\eta^2=0.088$), with post-hoc Tukey tests identifying Southern African institutions as significantly outperforming Central African institutions, likely reflecting differences in research infrastructure

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investment, political stability, and historical research capacity development across regions. The significant differences in leadership competencies across institution types ($F=15.67, p<0.001, \eta^2=0.108$) demonstrated that research-intensive universities attracted or developed research leaders with superior competencies, creating a potential virtuous cycle where strong leadership attracted resources and talent, which in turn enhanced leadership capacity. The analysis of Agenda 2063 alignment across leadership experience levels ($F=18.92, p<0.001, \eta^2=0.127$) showed that more experienced leaders achieved significantly better alignment, with the effect size of 0.127 indicating that leadership experience explained approximately 13% of the variance in how well institutions integrated continental priorities into their research agendas. The chi-square analyses revealed significant associations between categorical variables, with the relationship between leadership approach and Agenda 2063 alignment category ($\chi^2=47.83, p<0.001, \text{Cramér's } V=0.306$) demonstrating a moderate to strong association, indicating that transformational leadership approaches were disproportionately represented among institutions with high Agenda 2063 alignment while transactional approaches predominated in low-alignment institutions. The association between institution type and research productivity category ($\chi^2=38.56, p<0.001, \text{Cramér's } V=0.275$) confirmed that research-intensive universities were significantly more likely to fall into high productivity categories, while specialized institutions were overrepresented in moderate productivity categories, reflecting mission differentiation across the African higher education landscape. These bivariate findings collectively provided strong preliminary evidence supporting the study's hypotheses and justified proceeding to multivariate analyses to examine the independent and combined effects of multiple predictors on research transformation and Agenda 2063 alignment while controlling for potential confounding variables.

Table 3: Multivariate Analysis - Multiple Regression, Structural Equation Modeling, and Logistic Regression Results

Analysis	Variables/Parameters	β/B	SE	t/z	pvalue	95% CI	VIF/Fit
Multiple Linear Regression: Research Transformation ($R^2=0.673, \text{Adjusted } R^2=0.665, F=87.34, p<0.001$)							
	Constant	8.234	3.456	2.38	0.017	[1.45, 15.02]	-
	Transformational leadership	0.487***	0.064	7.61	<0.001	[0.36, 0.61]	1.87
	Strategic vision	0.312***	0.078	4.00	<0.001	[0.16, 0.47]	2.14
	Resource mobilization	0.268***	0.071	3.77	<0.001	[0.13, 0.41]	1.92
	Leadership experience (years)	0.156**	0.053	2.94	0.003	[0.05, 0.26]	1.45

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	Institution type (research-intensive)	0.189**	0.067	2.82	0.005	[0.06, 0.32]	1.58
	Regional location (reference: Central)	0.134*	0.059	2.27	0.024	[0.02, 0.25]	1.36
	Infrastructure investment	0.221***	0.055	4.02	<0.001	[0.11, 0.33]	1.73
	Durbin-Watson statistic						1.98
	Breusch-Pagan test			$\chi^2=3.45$	0.178		
	Shapiro-Wilk test (residuals)			W=0.993	0.086		
Hierarchical Regression: Agenda 2063 Alignment							
	Model 1 (Institutional factors): R ² =0.234			F=41.23	<0.001		
	Model 2 (+ Leadership competencies): R ² =0.587, $\Delta R^2=0.353$ ***			F=98.67	<0.001		
	Model 3 (+ Contextual variables): R ² =0.624, $\Delta R^2=0.037$ **			F=89.45	<0.001		
	Final Model predictors:						
	Transformational leadership	0.542***	0.071	7.63	<0.001	[0.40, 0.68]	2.03
	Research transformation	0.327***	0.068	4.81	<0.001	[0.19, 0.46]	1.95
	Stakeholder engagement	0.198**	0.074	2.68	0.008	[0.05, 0.35]	1.88
Structural Equation Model: Leadership → Transformation → Agenda 2063							
	Direct effect: Leadership → Transformation	0.672***	0.048	14.00	<0.001	[0.58, 0.77]	
	Direct effect: Leadership → Agenda 2063	0.389***	0.063	6.17	<0.001	[0.27, 0.51]	

Direct effect: Transformation → Agenda 2063	0.421***	0.058	7.26	<0.001	[0.31, 0.53]	
Indirect effect: Leadership → Transformation → Agenda 2063	0.283***	0.041	6.90	<0.001	[0.20, 0.36]	
Total effect: Leadership → Agenda 2063	0.672***	0.052	12.92	<0.001	[0.57, 0.77]	

Model fit indices:						
CFI (Comparative Fit Index)						0.968
TLI (Tucker-Lewis Index)						0.961
RMSEA (Root Mean Square Error)						0.047
SRMR (Standardized Root Mean Residual)						0.042

Logistic Regression: High Agenda 2063 Alignment (Nagelkerke R²=0.587, χ^2 =247.83, p<0.001)

Transformational leadership (high vs low)	2.876***	0.342	8.41	<0.001	[1.47, 5.62]	OR
Research transformation (high vs low)	2.234***	0.298	7.50	<0.001	[1.25, 3.99]	OR
Leadership experience (>10 years)	1.987**	0.287	6.92	<0.001	[1.13, 3.49]	OR
Resource mobilization (high vs low)	1.756**	0.265	6.63	<0.001	[1.05, 2.93]	OR
Hosmer-Lemeshow test			$\chi^2=6.73$	0.566		
Classification accuracy						84.2%

***p < 0.001; **p < 0.01; *p < 0.05; VIF = Variance Inflation Factor; OR = Odds Ratio; CI = Confidence Interval

The multivariate analyses provided robust evidence for the complex relationships between research leadership, research transformation, and Agenda 2063 alignment while controlling for multiple confounding variables and satisfying key statistical assumptions. The multiple linear regression model predicting research transformation was highly significant (F=87.34, p<0.001) and explained 67.3% of the variance (adjusted R²=0.665), indicating that the combination of leadership competencies, institutional characteristics, and contextual factors accounted for more than two-thirds of the variation in research transformation outcomes across African higher education institutions.

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Transformational leadership emerged as the strongest predictor ($\beta=0.487$, $p<0.001$), demonstrating that for every one standard deviation increase in transformational leadership scores, research transformation increased by approximately 0.49 standard deviations while holding all other variables constant, which translated to substantial practical significance given that transformational leaders achieved nearly 50% higher research transformation outcomes than transactional leaders. Strategic vision ($\beta=0.312$, $p<0.001$) and resource mobilization ($\beta=0.268$, $p<0.001$) also contributed significantly and independently to research transformation, suggesting these specific leadership competencies represented distinct pathways through which leaders influenced institutional research capacity, with strategic vision enabling long-term planning and priority setting while resource mobilization directly addressed the funding constraints that consistently impeded African research productivity. The model's assumptions were adequately satisfied, with VIF values ranging from 1.36 to 2.14 (all below the threshold of 5), indicating no problematic multicollinearity among predictors; the Durbin-Watson statistic of 1.98 confirmed independence of errors (acceptable range 1.5-2.5); the non-significant Breusch-Pagan test ($\chi^2=3.45$, $p=0.178$) indicated homoscedasticity of residuals; and the Shapiro-Wilk test ($W=0.993$, $p=0.086$) suggested that residuals approximated a normal distribution, collectively validating the appropriateness of the linear regression approach.

The hierarchical regression analysis for Agenda 2063 alignment revealed that institutional factors alone explained 23.4% of variance (Model 1), but the addition of leadership competencies in Model 2 increased explained variance to 58.7%, representing a substantial and highly significant increment ($\Delta R^2=0.353$, $p<0.001$) that demonstrated leadership variables contributed more than institutional characteristics in determining how well institutions aligned with continental development priorities. The final model ($R^2=0.624$) showed that transformational leadership ($\beta=0.542$, $p<0.001$) was the strongest predictor of Agenda 2063 alignment, while research transformation itself ($\beta=0.327$, $p<0.001$) and stakeholder engagement ($\beta=0.198$, $p<0.01$) made significant independent contributions, suggesting that alignment occurred through both direct leadership influence on strategic direction and indirect pathways mediated by enhanced research capacity and external partnerships.

The structural equation modeling analysis provided sophisticated insights into the mediation mechanisms underlying these relationships, revealing that research leadership exerted both direct effects on Agenda 2063 alignment ($\beta=0.389$, $p<0.001$) and indirect effects mediated through research transformation ($\beta=0.283$, $p<0.001$), with the mediated pathway accounting for approximately 42% of the total effect ($0.283/0.672$), indicating that nearly half of leadership's influence on Agenda 2063 alignment operated through the enhancement of research capacity, infrastructure, and productivity.

The exceptionally strong direct effect of leadership on research transformation ($\beta=0.672$, $p<0.001$) confirmed that effective research leadership was the primary driver of institutional research capacity development, while the significant path from research transformation to Agenda 2063 alignment ($\beta=0.421$, $p<0.001$) demonstrated that institutions with stronger research capacity were better positioned to address continental priorities, creating a cascading effect where leadership investment yielded both immediate strategic benefits and longer-term capacity

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enhancement. The SEM model fit indices exceeded conventional thresholds for good fit (CFI=0.968, TLI=0.961, both >0.95; RMSEA=0.047, SRMR=0.042, both <0.06), providing strong evidence that the hypothesized theoretical model accurately represented the relationships among constructs in the data. The logistic regression analysis examining predictors of high Agenda 2063 alignment (dichotomized at the median) demonstrated that institutions with high transformational leadership were 2.88 times more likely to achieve high Agenda 2063 alignment compared to those with low transformational leadership (OR=2.876, 95% CI [1.47, 5.62], $p < 0.001$), even after controlling for research transformation and other factors, which represented a substantial odds ratio with practical significance for policy and practice.

Similarly, institutions with high research transformation were 2.23 times more likely to demonstrate high Agenda 2063 alignment (OR=2.234, $p < 0.001$), while those led by research leaders with more than ten years of experience showed nearly twice the odds of high alignment (OR=1.987, $p < 0.001$), underscoring the cumulative advantage of experienced leadership in navigating the complex task of aligning institutional agendas with continental priorities.

The model's classification accuracy of 84.2% indicated that the predictor variables correctly classified institutions into high or low Agenda 2063 alignment categories in more than four out of five cases, demonstrating strong predictive validity, while the non-significant Hosmer-Lemeshow test ($\chi^2=6.73$, $p=0.566$) confirmed adequate model fit for the logistic regression. Collectively, these multivariate findings provided compelling evidence supporting all three study hypotheses: H1 was strongly supported by the significant positive relationships between leadership effectiveness and research transformation across multiple analytical approaches; H2 was confirmed by the consistently superior performance of transformational leadership approaches compared to transactional approaches in predicting Agenda 2063 alignment, with transformational leaders demonstrating 2.88 times higher odds of achieving high alignment; and H3 was validated by the logistic regression showing that institutions with stronger research leadership frameworks achieved significantly higher contribution to Agenda 2063 priorities with an odds ratio of 2.23. The mediation analysis through SEM added theoretical depth by revealing that leadership influenced continental development alignment through both direct strategic influence (42% of total effect) and indirect capacity-building pathways (58% of total effect), suggesting that effective research leadership in African contexts required both visionary strategic positioning and sustained investment in institutional research infrastructure, collaborative networks, and human capital development to successfully align higher education research with the transformative aspirations articulated in Agenda 2063.

Conclusion

This study conclusively demonstrated that research transformation and leadership played critical and interconnected roles in advancing African higher education institutions' capacity to contribute to Agenda 2063's continental development aspirations. Regarding the first objective, the assessment of the current state of research transformation revealed that African higher education institutions operated at moderate capacity levels, with research output averaging 12.47 publications annually and research infrastructure scoring 48.23 out of 100, while key drivers included leadership effectiveness, institutional resources, and regional collaboration networks, and primary barriers encompassed chronic

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underfunding (with institutions securing only \$87,650 in external funding on average), infrastructure deficits, limited collaborative networks, and inadequate alignment of research priorities with Agenda 2063's seven aspirations, particularly in governance and policy-oriented research domains. Concerning the second objective, the analysis identified transformational leadership as the most effective leadership approach, with transformational leaders demonstrating significantly superior outcomes ($\beta=0.487$, $p<0.001$) compared to transactional approaches, and revealed that critical leadership competencies included strategic vision ($r=0.614$ with research transformation), resource mobilization capabilities ($r=0.698$ with external funding), and stakeholder engagement skills ($r=0.543$ with collaborative networks), while effective strategies employed by successful research leaders encompassed long-term institutional planning aligned with continental priorities, proactive partnership development with government and industry stakeholders, investment in research infrastructure and human capital development, and the cultivation of collaborative regional and international research networks that enhanced institutional capacity and visibility. Addressing the third objective, the study established that research leadership practices significantly influenced Agenda 2063 alignment, with transformational leadership explaining 45% of variance in continental priority alignment ($r=0.672$, $p<0.001$), and institutions led by highly effective research leaders demonstrated 2.88 times higher odds of achieving strong Agenda 2063 alignment while contributing substantially more to addressing Africa's development challenges in science, technology, innovation, health, and food security domains. The structural equation modeling revealed that leadership influenced Agenda 2063 outcomes through both direct strategic pathways (accounting for 42% of total effect with $\beta=0.389$) and indirect routes mediated by research transformation (accounting for 58% of total effect with $\beta=0.283$), indicating that effective research leadership simultaneously shaped institutional strategic direction toward continental priorities while building the research capacity necessary to meaningfully address Africa's complex development challenges. The multivariate analyses confirmed all three study hypotheses, demonstrating significant positive relationships between leadership effectiveness and research transformation (supporting H1), superior performance of transformational leadership competencies in achieving Agenda 2063 alignment compared to transactional approaches (supporting H2), and significantly higher contributions to continental development priorities among institutions with stronger research leadership structures (supporting H3). These findings underscored that achieving Agenda 2063's vision for an integrated, prosperous, and knowledge-driven Africa required strategic investment in developing transformational research leaders who possessed the vision, competencies, and institutional support necessary to navigate resource constraints, build collaborative networks, mobilize funding, and strategically align institutional research agendas with the continent's most pressing development priorities, ultimately positioning African higher education institutions as central engines of innovation, knowledge production, and sustainable transformation.

Recommendations

Establish Continental and Regional Research Leadership Development Programs: African governments, the African Union, and regional economic communities should collaboratively establish comprehensive research leadership academies and fellowship programs specifically designed to develop transformational leadership competencies among current and aspiring research leaders in higher education institutions.

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Create Agenda 2063-Aligned Research Funding Mechanisms with Leadership Incentives: The African Union, African Development Bank, and national governments should establish dedicated research funding instruments specifically structured to support Agenda 2063-aligned research priorities while simultaneously incentivizing transformational research leadership practices.

Institutionalize Research Transformation Frameworks and Agenda 2063 Integration Mechanisms: African higher education institutions should develop and institutionalize comprehensive research transformation frameworks that explicitly integrate Agenda 2063 aspirations into institutional strategic plans, research policies, performance management systems, and academic promotion criteria. These frameworks should establish dedicated institutional structures such as Agenda 2063

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