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Research Grants and Financial Sustainability of Public Universities in Kenya: The Moderating Role of Institutional Capacity

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Abstract: Objectives: This article examines the relationship between research grants and financial sustainability of public universities in Kenya and tests whether institutional capacity moderates that relationship. **Prior Work:** Previous studies link external funding and revenue diversification to university finances, but rarely test whether organisational capacity changes the contribution of research grants. **Approach:** A quantitative explanatory cross-sectional design distributed 210 questionnaires within a 35-university recruitment frame; 195 usable respondent-level observations were analysed (92.9%). Descriptive statistics, correlation, ordinary least squares regression and hierarchical moderated regression were used. **Results:** Research funding was positively associated with financial sustainability (beta = 0.446, $p < 0.001$; R-squared = 0.199). Adding interaction terms increased explained variance from 59.3% to 63.7% (change in R-squared = 0.045, $p < 0.001$). Only research funding x institutional capacity was individually significant (beta = 0.127, $p = 0.016$); the other three funding-channel interactions were not significant. **Implications:** Universities should strengthen grant administration, compliance, financial reporting and indirect-cost recovery. **Value:** Research funding was the only funding channel for which significant moderation by institutional capacity was established.

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1. Introduction

Public universities are expected to sustain teaching, research, innovation and public-service mandates while operating within increasingly constrained and uncertain financing environments. Financial sustainability therefore extends beyond the amount of revenue received in a particular year. It concerns whether an institution can meet current obligations, preserve essential academic functions, manage costs and debt, and retain sufficient capacity to invest in its long-term mission. In Kenya, these questions are especially important because public universities combine public financing with tuition-related income, research funding and internally generated revenues, yet many continue to experience persistent financial pressure.

Research funds and grants are strategically important within this financing mix. Unlike borrowing, grant income does not normally create a repayment obligation, and unlike tuition, it does not depend directly on the capacity of students and households to pay. Research funding can support laboratories, equipment, specialist personnel, postgraduate training, networks and institutional visibility, while also creating opportunities for indirect-cost recovery and future partnerships. However, grants are frequently restricted to project purposes and generate compliance, procurement, reporting and administrative demands. Consequently, a university can attract substantial research funding without necessarily translating that funding into wider institutional financial resilience.

This distinction is central to the Kenyan public university context. The underlying study found that research funding was positively associated with financial sustainability, but the descriptive evidence also pointed to uneven research-administration capacity. Respondents were moderately positive about research-grant activity overall, while the lowest-rated research-funding item concerned the availability of dedicated personnel to identify and apply for grants. This pattern suggests that the financial value of grants may depend not simply on access to external money but also on the systems through which universities identify opportunities, develop proposals, administer awards, recover legitimate indirect costs, manage compliance and reinvest institutional benefits.

Existing research provides partial support for this argument. Kobugabe and Rwakihembo (2022) found that financial resource mobilisation strategies were associated with financial sustainability among Ugandan private universities, demonstrating the value of diversified internal and external funding. Wekullo and Musoba (2020) similarly showed that alternative funding strategies are related to institutional financial health in public research universities. In Kenya, Kimathi and Irungu (2024) found that revenue diversification was associated with financial sustainability, although the direction differed by the financial-sustainability measure used. Ramzan, Naeem and Younas (2025) further emphasised research infrastructure, university-industry linkages and research-commercialisation capabilities. These studies establish the importance of alternative resources, but they do not isolate whether institutional capacity changes the relationship between a specific funding channel - research grants - and financial sustainability in Kenyan public universities.

The underlying study addressed this gap by examining four funding channels and the moderating role of institutional capacity across Kenyan public universities. This article narrows that broader analysis to the research-funding pathway. Its primary objective is to determine the statistical relationship between research funds and grants and the financial sustainability of public universities in Kenya, while retaining the dissertation's original objective framing. It gives particular attention to the significant individual interaction between research funding and institutional capacity. The research gap is therefore specific: previous studies have examined grants, alternative funding and revenue diversification, but have not established whether stronger institutional capacity changes the research-grant-financial-sustainability relationship in this setting.

The article contributes in three ways. First, it isolates research funding from the broader university revenue portfolio and estimates its direct association with financial sustainability. Second, it distinguishes the statistically significant overall interaction block from the individual funding-channel interactions. Third, it develops an institutional explanation for why research grants may be more capacity-dependent than government capitation, tuition income or income-generating activities.

2. Literature Review and Theoretical Framework

2.1. Research Grants and Financial Sustainability

Research grants occupy an unusual position in university finance. They are external funds, yet their financial characteristics differ from debt and conventional commercial income. Grants can expand a university's resource base without requiring repayment, but their use is normally governed by sponsor rules, project budgets and specified deliverables. Their contribution to institutional sustainability therefore depends on both the volume of funding secured and the share of grant-supported activity that strengthens durable institutional assets, skills, systems and cost recovery.

Kobugabe and Rwakihembo (2022) examined resource mobilisation and financial sustainability in Ugandan private universities using a positivist, cross-sectional design. Their findings showed that combined resource-mobilisation strategies explained 32% of variation in financial sustainability. The study supports diversification beyond tuition dependence, but its private-university setting and aggregate treatment of funding strategies do not show whether research-grant effectiveness varies with organisational capability. Wekullo and Musoba (2020) likewise found that alternative funding sources were associated with the financial health of public research universities, reinforcing the proposition that the composition of institutional revenue matters.

Kenyan evidence also points to the importance of diversification but does not fully explain the research-grant mechanism. Kimathi and Irungu (2024) analysed public universities using secondary financial data and found that revenue diversification had different effects depending on whether financial sustainability was assessed using gearing or sustainability ratios. Their study demonstrates that diversified income can influence financial health, but it does not capture the internal research-management processes through which external grants are mobilised and converted into institutional benefit. The present study adds administrator-level evidence on grant acquisition, funding partnerships and collaboration while directly testing the research-funding relationship.

The research-focused review by Ramzan et al. (2025) identified insufficient research infrastructure, weak university-industry connections and limited commercialisation capability as barriers to financial sustainability. African evidence on research costs further shows why grant volume alone may be an incomplete indicator of

institutional benefit. Fonn et al. (2020), analysing the Consortium for Advanced Research Training in Africa, estimated that participating institutions made substantial unremunerated in-kind contributions and noted that limited indirect-cost allowances may fail to recover the institutional resources required to implement donor-funded programmes. Together, these findings shift attention from access to external funding towards the capability to cost, administer and recover the full institutional costs of research.

The literature therefore supports a two-part expectation. First, research funds should be positively related to financial sustainability because they diversify resources and finance activities that would otherwise draw on unrestricted institutional income. Second, the size of that benefit should depend on the university's capacity to attract, administer and strategically leverage grants. The second expectation is the more distinctive contribution of the present article.

2.2. Pecking Order Theory and the Role of Institutional Capacity

Pecking Order Theory, developed by Myers and Majluf (1984), explains financing choices as a hierarchy shaped by the relative cost and risk of alternative sources. In its original corporate form, organisations prefer internally generated funds, then debt, and finally equity. Public universities differ from commercial firms because they have no conventional equity shareholders, face constraints on borrowing and operate under public-interest mandates. Even so, the theory remains useful because it directs attention to the relative financial burden attached to different funding sources.

Within this adapted hierarchy, research grants are attractive because they provide external resources without the debt-service obligations associated with borrowing. Their attractiveness is nevertheless conditional. External sponsors can impose restrictions, reporting obligations and transaction costs; grants may also fail to cover the full indirect costs borne by the institution. The financial advantage predicted by Pecking Order Theory is therefore realised only when the university has sufficient research-administration and financial-management capability to prevent project funding from generating hidden institutional costs.

Institutional capacity provides this conditioning mechanism. In the underlying study, institutional capacity was operationalised through working-capital management, governance structures and management practices. The Institutional Logics Perspective helps explain how these dimensions may shape grant outcomes:

institutional rules and accepted routines influence who is authorised to make financial decisions, how budgets are developed and monitored, how compliance responsibilities are allocated, how strategic priorities guide proposal selection, and how recovered resources are reinvested (Friedland & Alford, 1991; Thornton & Ocasio, 1999). Stronger governance and planning systems can therefore support proposal development, realistic costing, contract review, financial reporting, sponsor compliance, indirect-cost recovery and strategic use of grant-related benefits.

Governance evidence supports this interpretation. Boateng et al. (2024) emphasised the importance of governance in managing university finances under turbulent conditions, while Ombui et al. (2024) found that working-capital management is relevant to the financial performance of Kenyan public universities. Together, these studies suggest that funding availability and institutional capability should not be treated as independent explanations of sustainability. The present article tests whether the research-grant effect is stronger when institutional capacity is higher.

2.3. Study Hypotheses

Consistent with the study objective, the first null hypothesis was: H01: Research funds and grants have no statistically significant effect on the financial sustainability of public universities in Kenya.

For the focused article, the study's broader institutional-capacity moderation hypothesis is examined through the research-funding interaction: H02: Institutional capacity does not significantly moderate the relationship between research funds and grants and the financial sustainability of public universities in Kenya.

3. Methodology

3.1. Research Design, Population and Respondents

The study was grounded in a positivist paradigm and used a quantitative explanatory cross-sectional design. This design was appropriate because the research sought to measure statistical relationships among funding channels, institutional capacity and financial sustainability at a single point in time and to estimate direct and interaction terms using inferential statistics (Creswell & Creswell, 2018; Saunders, Lewis & Thornhill, 2019). Because the data are cross-sectional, the regression estimates are

interpreted as associations and predictive relationships rather than evidence of temporal causation.

The recruitment frame comprised 35 public universities in Kenya. A census recruitment approach was used at the institutional level, with six informed respondents targeted in each university: two finance officers, two research officers and two officers responsible for consultancy or related income-generating functions. This produced 210 distributed questionnaires. Purposive sampling was used at respondent level to select officers with direct knowledge of university financing, research funding and institutional resource management. The target sample exceeded conventional requirements for detecting medium effects in multiple regression (Cohen, 1988).

Of the 210 questionnaires distributed, 195 were returned and usable for analysis, while 15 were not returned, giving a usable response rate of 92.9%. The 195 respondents comprised 115 research officers, 54 finance officers and 26 consultancy-related officers. The recruitment frame covered all 35 public universities, but the analysis was based on the returned questionnaires and did not require a balanced six respondents per institution.

The substantive unit of analysis was the public university because the study concerned institutional financial sustainability. The statistical unit of observation, however, remained the individual respondent. Each of the 195 usable questionnaires was retained as a separate respondent-level case; responses were not aggregated into university-level means before regression. Accordingly, the reported coefficients represent associations among respondents' assessments of their institutions. Because multiple respondents were nested within the same universities and the models did not explicitly adjust standard errors for university-level clustering, the results should not be interpreted as university-level causal estimates.

3.2. Measurement, Validity and Reliability

Primary data were collected using a semi-structured questionnaire (Ponto, 2015) combining open-ended questions with five-point Likert-scale items ranging from strongly disagree to strongly agree. Research funds and grants were measured using 12 perceptual items covering grant acquisition, partnerships with funding organisations and industry, international and public-private partnerships, multi-institutional research, cross-disciplinary collaboration and external-researcher

collaboration. Institutional capacity was measured using 24 perceptual items covering working-capital management, governance structures and management practices. Financial sustainability was measured using 12 perceptual items covering financial liquidity, financial solvency and operational efficiency. Thus, the dependent variable represents respondents' assessments of institutional financial sustainability rather than financial ratios calculated directly from audited statements.

The questionnaire was piloted with 21 senior administrators from Kenyan private universities that were excluded from the main analysis. Content validity was assessed through expert review, while construct validity was examined using factor analysis (Hair et al., 2010). For the research-funding construct, the Kaiser-Meyer-Olkin value was 0.801 and Bartlett's test was statistically significant ($p < 0.001$), supporting factorability. Internal consistency was assessed using Cronbach's alpha (Tavakol & Dennick, 2011): 0.691 for research funds, 0.942 for institutional capacity and 0.819 for financial sustainability. Respondent-level composite scores were calculated from the constituent Likert items for each construct, with higher scores representing stronger perceived levels of the construct.

3.3. Data Analysis and Model Specification

Descriptive statistics were used to summarise respondent assessments of research funding. Pearson correlation assessed the bivariate association with financial sustainability. A simple ordinary least squares regression estimated the research-funding predictive relationship with financial sustainability. Statistical significance was assessed at the 5% level. Because all measures were respondent-reported, coefficients are interpreted as relationships among perceived institutional conditions rather than changes in audited financial outcomes.

To examine institutional capacity, moderated multiple regression was estimated hierarchically. In the first step, government capitation, research funds, tuition fees, income-generating activities and institutional capacity were entered as main effects. In the second step, four funding-channel-by-institutional-capacity interaction terms were added. Predictor variables were mean-centred before creating the interaction products to reduce non-essential collinearity (Cohen, Cohen, West & Aiken, 2003). The focal interaction for this article is research funds x institutional capacity. A significant change in R-squared assessed whether the interaction block improved

model fit, while the coefficient and p-value of each interaction term determined whether moderation was established for a specific funding channel.

Regression assumptions were assessed before interpreting the models. The SPSS syntax confirms that all five main-effect predictors were mean-centred before the four interaction terms were created. In the final centred interaction model, tolerance values ranged from 0.710 to 0.866 and VIF values from 1.155 to 1.409, indicating no problematic multicollinearity. Specifically, the research-funding x institutional-capacity interaction had tolerance = 0.715 and VIF = 1.398; the research-funding main effect had tolerance = 0.866 and VIF = 1.155, while institutional capacity had tolerance = 0.803 and VIF = 1.245. Approximate normality of the study constructs was assessed using skewness, kurtosis and Q-Q plots. The Ramsey RESET test did not indicate misspecification or non-linearity in the primary cross-sectional model ($F = 1.847$, $p = 0.161$), and the Breusch-Pagan test was non-significant (chi-square = 2.341, $p = 0.126$), supporting homoscedasticity. Normality was assessed at construct level rather than through a separately reported residual-normality statistic; accordingly, the normality evidence should be interpreted as a construct-level diagnostic.

4. Results and Discussion

4.1. Descriptive Results for Research Funds and Grants

The research-funding construct recorded an overall mean of 2.977 (standard deviation = 0.688), indicating moderate respondent assessments of research-funding practices and their contribution to financial sustainability. The highest-rated item was the existence of effective partnerships with research funding organisations (mean = 3.07), while the lowest was the presence of dedicated personnel for identifying and applying for research grants (mean = 2.92). The narrow spread of item means around the scale midpoint suggests uneven rather than uniformly strong research-funding capability across respondents' institutions.

Several patterns are visible in Table 1. Respondents rated active grant application and the contribution of grants to financial sustainability at 2.99. Support for ongoing research infrastructure was lower at 2.93. Public-private and industry partnerships were close to the midpoint, while collaborative and cross-disciplinary research items remained below 3.00. These results are best interpreted descriptively: respondents

reported moderate grant-development and collaboration practices, with dedicated grant personnel emerging as a comparatively weaker area.

Table 1. Descriptive Statistics for Research Funds and Grants

Statement	Mean	Std. Dev.
Actively applies for and secures research grants	2.99	1.008
Research grants contribute to financial sustainability	2.99	0.933
Research grants support research infrastructure and activities	2.93	0.955
Dedicated personnel identify and apply for grants	2.92	1.010
Effective partnerships with research funding organisations	3.07	0.985
Industry partnerships provide substantial research funding	3.00	0.925
International collaborations enhance access to research funding	2.96	1.002
Public-private partnerships contribute to research funding	3.01	1.018
Collaborative research initiatives improve funding sustainability	2.94	0.956
Participates in multi-institutional projects to access funding	2.98	0.987
Cross-disciplinary collaborations enhance funding opportunities	2.95	0.973
External researcher collaborations increase grant success	2.98	0.902
Overall research-funding construct	2.977	0.688

Source: Authors' analysis of survey data (2026)

4.2. Relationship between Research Grants and Financial Sustainability

Pearson correlation showed a positive, statistically significant association between research funds and financial sustainability ($r = 0.446$, $p < 0.001$). Respondents who reported stronger grant acquisition, partnerships and research collaboration also tended to report stronger financial sustainability. The association was moderate rather than dominant, consistent with financial sustainability reflecting a wider combination of revenue and management conditions.

The simple regression produced the same standardised coefficient because research funding was the sole predictor. Research grants explained 19.9% of the respondent-

level variance in perceived financial sustainability (R-squared = 0.199; adjusted R-squared = 0.195). The overall regression was significant ($F = 47.994$, $p < 0.001$). The unstandardised coefficient was 0.441 (standard error = 0.064; $t = 6.928$; $p < 0.001$; 95% confidence interval 0.315 to 0.566), and the standardised coefficient was 0.446. The null hypothesis of no statistically significant research-funding relationship was therefore rejected.

Substantively, the result indicates that stronger reported research-funding conditions are associated with stronger perceived financial sustainability. The 19.9% explained variance also shows that research grants alone account for only part of the variation in sustainability. Expanding research funding may therefore contribute to a broader sustainability strategy, but the cross-sectional estimates do not establish that additional grant income by itself causes improved financial outcomes.

Table 2. Research Funds and Grants as a Predictor of Financial Sustainability

Statistic	Value/B	R^2/Beta	F/t	p	95% CI for B
Correlation	0.446	-	-	<0.001	-
Regression model	0.446	0.199	47.994	<0.001	-
Research funds coefficient	0.441	0.446	6.928	<0.001	0.315–0.566

Source: Authors' analysis of survey data (2026)

4.3. Institutional Capacity and the Research-Funding Interaction

The more distinctive result emerges from the hierarchical moderated regression. The main-effects model, which included the four funding channels and institutional capacity, explained 59.3% of the respondent-level variance in financial sustainability (adjusted R-squared = 0.582; $F(5, 189) = 54.981$, $p < 0.001$). Research funds remained independently associated with financial sustainability in this multivariate model ($B = 0.251$; standardised coefficient = 0.254; $t = 5.151$; $p < 0.001$), showing that the research-funding relationship persisted after accounting for the other funding channels and institutional capacity.

Adding the four interaction terms increased explained variance to 63.7% (adjusted R-squared = 0.620). The full interaction model was statistically significant, $F(9, 185) = 36.122$, $p < 0.001$, and the increase of 4.5 percentage points in explained variance was significant, change in R-squared = 0.045, F change$(4, 185) = 5.705$, $p < 0.001$.

This establishes a significant overall interaction block. At the individual interaction level, however, only research funding x institutional capacity was statistically significant: B = 0.167, standardised coefficient = 0.127, t = 2.423, p = 0.016, 95% confidence interval 0.031 to 0.303. The positive interaction indicates that the association between research funding and financial sustainability is stronger at higher levels of institutional capacity. The interactions involving government capitation (beta = 0.080, p = 0.131), tuition fees (beta = 0.059, p = 0.254) and income-generating activities (beta = 0.027, p = 0.600) were not statistically significant.

This result distinguishes access to external funding from the organisational capability to convert that funding into sustained institutional benefit. A plausible interpretation is that universities with stronger financial management, governance and research-administration systems are better positioned to identify opportunities, prepare competitive and realistically costed proposals, administer awards, meet sponsor requirements and recover legitimate indirect costs. These mechanisms were not separately tested in the regression, so they should be understood as explanations consistent with the observed interaction rather than as independently established causal pathways.

The interaction should not be interpreted as evidence that institutional capacity significantly moderates every funding channel. The overall interaction block was significant, but only the research-funding interaction reached statistical significance individually. Significant moderation was not established for government capitation, tuition fees or income-generating activities. Research funding is therefore the channel for which this study provides specific evidence that the strength of the funding-sustainability relationship varies with institutional capacity.

Table 3. Hierarchical Moderated Regression Results

Model/term	R^2	Adj. R^2	B	Beta	t	p
Model 1: main effects	0.593	0.582	-	-	-	-
Research funds - Model 1	-	-	0.251	0.254	5.151	<0.001
Institutional capacity - Model 1	-	-	0.258	0.264	5.199	<0.001
Model 2: main effects + interactions	0.637	0.620	-	-	-	<0.001 *
Research funds - Model 2	-	-	0.249	0.252	5.304	<0.001

Model/term	R^2	Adj. R^2	B	Beta	t	p
Institutional capacity - Model 2	-	-	0.235	0.241	4.868	<0.001
Research funds × institutional capacity	-	-	0.167	0.127	2.423	0.016
Government capitation x institutional capacity	-	-	0.094	0.080	1.516	0.131
Tuition fees x institutional capacity	-	-	0.083	0.059	1.144	0.254
Income-generating activities x institutional capacity	-	-	0.039	0.027	0.526	0.600

Note: For Model 2, the interaction block produced a change in R-squared of 0.045, F change(4, 185) = 5.705, p < 0.001. In the final centred model, tolerance ranged from 0.710 to 0.866 and VIF from 1.155 to 1.409; for research funds x institutional capacity, tolerance = 0.715 and VIF = 1.398. Of the four individual interactions, only research funds x institutional capacity was statistically significant.

Source: Authors' analysis of survey data (2026)

4.4. Discussion

The direct result supports the view that research grants are a meaningful component of financial sustainability in public universities, while the cross-sectional design requires the relationship to be interpreted as associative rather than causal. The finding is consistent with the resource-mobilisation evidence of Kobugabe and Rwakihembo (2022) and the broader funding-health relationship identified by Wekullo and Musoba (2020). It also complements Kimathi and Irungu (2024), whose Kenyan evidence shows that the structure and diversification of revenue are related to financial sustainability. The present study adds specificity by isolating research funding and estimating its respondent-level association directly.

The findings also refine the application of Pecking Order Theory to public universities. Research grants are attractive because they bring external resources without conventional debt-service obligations, yet they are not costless. Grant acquisition requires specialised staff time, proposal development and partnership building, while awards generate procurement, financial reporting, compliance, audit support and sometimes co-investment requirements. Fonn et al. (2020) showed in an African research-capacity programme that institutions can make substantial unremunerated contributions and that limited indirect-cost allowances may fail to

cover institutional inputs. The significant research-funding interaction in the present study is consistent with the proposition that internal capability matters to whether sponsored research strengthens rather than strains institutional finances.

The descriptive evidence reinforces this interpretation without establishing the mechanisms directly. Dedicated grant personnel received the lowest mean among research-funding indicators, whereas partnerships with research funding organisations received the highest. Respondents therefore reported comparatively stronger external relationships than internal grant-development staffing. Ramzan et al. (2025) similarly emphasise research infrastructure and research-commercialisation capability as constraints on university financial sustainability. Taken together, these patterns support closer attention to the organisational processes that connect grant acquisition to financial outcomes.

The moderation finding is also consistent with governance and working-capital perspectives. Boateng et al. (2024) emphasise governance arrangements in university financial management, while Ombui et al. (2024) report a relationship between working-capital management and financial performance in Kenyan public universities. The present findings connect these broader institutional capabilities to a specific funding channel. Rather than assuming that a given amount of grant income has the same financial meaning everywhere, the results suggest that the grant-sustainability relationship varies with the systems used to plan, govern and administer resources.

The absence of significant individual moderation for government capitation, tuition fees and income-generating activities also deserves interpretation. One plausible explanation is that these channels are shaped by different external or market mechanisms. Government capitation is strongly conditioned by public allocation and disbursement rules; tuition income depends heavily on enrolment, approved fee structures, affordability and collection; and income-generating activities are exposed to market demand and commercial-unit performance. Institutional capacity may still be positively associated with financial sustainability, but this dataset did not establish that it significantly changed the slope of these three funding-sustainability relationships. This contrast strengthens the channel-specific interpretation of the research-grant result.

For university leaders, the implication is practical and directly linked to the observed research-funding pattern. Because dedicated grant personnel recorded the lowest research-funding mean (2.92), a research-income strategy should extend beyond

numerical grant targets to professional research-administration capacity: systematic funding searches, proposal-development support, full-cost budgeting, contract review, sponsor compliance, post-award financial reporting and audit readiness. Transparent indirect-cost policies are particularly important because unrecovered project costs can erode the institutional benefit of external awards. Where overheads are recovered, universities should consider reinvesting a defined share in shared research infrastructure and future grant-development capacity.

For government and research-funding agencies, the findings support attention to the institutional costs of sponsored research. Funding frameworks that recognise legitimate indirect costs and allow realistic project-management provisions can reduce the risk that universities subsidise external projects from unrestricted resources. Capacity-building for research administrators, finance teams and principal investigators can also improve proposal costing, compliance and reporting. These recommendations are most strongly supported for research funding; the study did not establish significant channel-specific moderation for government capitation, tuition fees or income-generating activities.

5. Conclusion and Recommendations

This article examined the relationship between research funds and grants and the financial sustainability of public universities in Kenya, together with the moderating role of institutional capacity. Research funding was positively and statistically associated with perceived financial sustainability. In the simple regression, research grants explained 19.9% of the respondent-level variance, with a standardised coefficient of 0.446 ($p < 0.001$). The evidence therefore rejects the null hypothesis of no statistically significant research-funding relationship, while the cross-sectional design does not establish a temporal causal effect.

The more consequential result is the channel-specific moderation finding. Adding the four interaction terms increased explained variance from 59.3% to 63.7% (change in R-squared = 0.045, $p < 0.001$), indicating a significant overall interaction block. However, only research funding x institutional capacity was individually significant (beta = 0.127, $p = 0.016$). Significant moderation was not established for government capitation, tuition fees or income-generating activities. The findings therefore support a precise conclusion: institutional capacity is positively associated

with financial sustainability and the research-funding-sustainability relationship is significantly stronger at higher levels of institutional capacity.

The findings support a shift in emphasis from grant acquisition alone to grant capability. Kenyan public universities should strengthen dedicated grants offices, proposal and partnership development, full-cost budgeting, post-award administration, compliance, financial reporting and indirect-cost recovery. Research funders and higher-education agencies should similarly recognise legitimate institutional research costs and support the professionalisation of grant administration. These recommendations follow directly from the significant research-funding interaction and should not be generalised to imply statistically significant moderation of all university funding channels.

5.1. Limitations and Further Research

The study has several limitations that define the boundaries of interpretation. First, the cross-sectional design cannot establish temporal causality. Second, research funding, institutional capacity and financial sustainability were measured primarily through respondents' perceptions rather than audited grant receipts, project-level cost-recovery records or objective financial ratios. Third, the 195 observations remained at respondent level and multiple respondents were nested within universities; responses were not aggregated and the regression did not explicitly model university-level clustering. The coefficients should therefore be interpreted as respondent-level associations rather than independent university-level estimates. Fourth, the research-funding scale had a Cronbach's alpha of 0.691, close to but slightly below the conventional 0.70 benchmark. Finally, institutional capacity was modelled as a composite construct, so the significant interaction does not identify which specific capacity dimension produces the moderation.

Further research should use longitudinal and grant-level financial data to trace how awards affect institutional cash flows, indirect-cost recovery, research infrastructure and unrestricted resources over time. Multilevel models or cluster-robust standard errors would help separate respondent-level perceptions from university-level effects where multiple informants are sampled within institutions. Institutional capacity should also be disaggregated into grant-management expertise, financial management, governance quality, research infrastructure, administrative efficiency and research networks. Comparative analysis between research-intensive and

predominantly teaching-oriented universities could establish whether the interaction differs by institutional mission and maturity. These extensions would clarify not only whether research grants are associated with financial sustainability, but which organisational capabilities convert sponsored research into durable institutional value.

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