



HIGHER EDUCATION FUNDING AND INSTITUTIONAL SUSTAINABILITY OF THE ASSOCIATION FOR AFRICAN HIGHER EDUCATION FINANCING AGENCIES

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Abstract

Higher education funding is central to expanding access to education and sustaining student funding institutions. However, as African governments face increasing fiscal constraints, the sustainability of higher education financing agencies has become critical for expanding access and supporting human capital development. This study investigates how higher education funding, agency governance, and macroeconomic characteristics jointly influence institutional sustainability among member agencies of the Association of African Higher Education Financing Agencies (AAHEFA). Guided by a positivist research philosophy and a longitudinal panel

design, the study utilizes secondary data from eleven AAHEFA agencies over the period 2015–2024. Institutional sustainability is measured using a Data Envelopment Analysis (DEA)-based efficiency score, while higher education funding is disaggregated into appropriation-in-aid (AIA), budgetary allocation (BA), and public–private partnership (PPP) inflows. Data were analyzed using descriptive statistics, panel regression, mediation, and moderation analyses, with model specification guided by the Hausman test. The findings show that AIA and BA have positive and statistically significant effects on institutional sustainability ($\beta = 0.4276$, $t = 3.63$, $p = 0.000$; $\beta = 0.3624$, $t = 4.15$, $p = 0.000$), while PPP has no significant direct effect ($\beta = 0.0431$, $t = 1.21$, $p = 0.228$). The study concludes that institutional sustainability of higher education funding agencies is a system-level outcome shaped by funding structure, governance capacity, and macroeconomic context. The study recommends strengthening predictable public funding frameworks and improving internally generated revenue systems, particularly loan recovery mechanisms, to support sustainable higher education financing in Africa.

Keywords: Higher education funding, appropriation-in-aid, budgetary allocation, public–private partnership inflow, institutional sustainability, Association for African Higher Education Financing Agencies

INTRODUCTION

Higher education financing systems operate within complex institutional and economic environments where the structure, composition, and stability of funding are central to organizational survival and performance. In many countries, institutions responsible for financing higher education must continuously adapt their funding arrangements in response to changing fiscal conditions, increasing enrolment pressures, and growing demands for equitable access to education (Yende, 2021). Within this context, sustainable financing has increasingly become an important concern, particularly in developing countries where public resources are limited and higher education systems face persistent funding gaps. Stable and predictable financing systems are therefore essential for supporting institutional continuity, operational efficiency, and long-term sustainability of higher education financing agencies.

Globally, demand for tertiary education has expanded rapidly, yet growth in enrolment has not been matched by corresponding increases in public funding (Bank, 2018). As governments continue to face fiscal constraints, many countries have adopted alternative funding mechanisms aimed at supporting access to higher education while ensuring continuity of institutional operations. In response to these pressures, student financing agencies have emerged as important institutional mechanisms for supporting higher education through loans,

scholarships, and bursaries while also mobilizing resources to sustain operations (Mokaya et al., 2020). However, the sustainability of these agencies has increasingly come under pressure due to growing operational demands, rising enrolment, and inefficiencies in financing systems.

Higher education funding encompasses multiple financing streams, including government budgetary allocations, internally generated revenues, donor support, and private sector participation. These funding sources are expected to support institutional operations, improve access, and enhance sustainability, although their adequacy and reliability vary significantly across countries and institutions (Johansson & Lundborg, 2021). In many African countries, overreliance on government funding has contributed to chronic underfunding, infrastructure deficits, and weak institutional capacity (Mukhwana et al., 2020). At the same time, inefficiencies in internally generated revenue systems, particularly those related to loan recovery, have constrained the sustainability of financing agencies (Mokaya et al., 2020). Consequently, many institutions have increasingly explored diversified funding approaches that combine public financing with internally generated revenues and partnership-based financing arrangements.

Despite these efforts, effectiveness of different funding mechanisms in promoting institutional sustainability has remained uneven. Government funding mechanisms often provide relatively stable support but are frequently insufficient to meet increasing demand, while internally generated revenues depend heavily on effective loan recovery systems that are not always efficient in practice. Similarly, partnership-based financing arrangements have increasingly been promoted as alternative sources of support, although such arrangements are often externally driven and project-based in nature. These challenges have further been intensified by high loan default rates and weak recovery systems, which reduce the ability of student financing schemes to operate as sustainable revolving funds (African Development Bank, 2021). In addition, labour market constraints and macroeconomic pressures continue to undermine repayment capacity and limit the effectiveness of internally generated funding systems (Ridwan, 2022).

The AAHEFA provides an important regional framework for examining these challenges within a multi-country context. The association brings together institutions responsible for financing higher education across several African countries, including Kenya, Tanzania, Rwanda, Uganda, Ghana, Malawi, Zambia, Lesotho, Namibia, Botswana, and South Africa. These agencies operate under relatively similar mandates of promoting access to higher education through sustainable financing mechanisms, although they differ considerably in terms of funding structures, resource mobilization capacity, and operational performance (Awotwe et al., 2020). In some countries, financing systems remain heavily dependent on government allocations, while in others weak loan recovery systems and limited diversification of funding sources constrain institutional sustainability (Muweesi, 2021).

The broader African higher education financing landscape therefore remains characterized by persistent funding gaps, structural inefficiencies, and uneven resource distribution. Public funding has generally failed to keep pace with rising enrolment, leading to increased reliance on alternative financing mechanisms that are often unstable or insufficiently integrated into institutional systems (Nwosu et al., 2024). These constraints undermine not only the sustainability of financing agencies but also the broader objective of promoting equitable access to higher education (Salmi & D'Addio, 2021). Existing studies have largely focused on higher education funding in relation to access and financial adequacy, with limited attention given to how different funding components influence institutional sustainability across multiple institutional contexts.

The persistence of these challenges suggests that institutional sustainability among higher education financing agencies may depend not only on the availability of financial resources but also on the structure, predictability, and integration of financing mechanisms within institutional systems. Stable and institutionally embedded funding arrangements are more likely to support operational continuity and long-term sustainability than irregular and externally driven financing mechanisms. Consequently, there remains limited empirical understanding of how different higher education funding components influence institutional sustainability among higher education financing agencies operating within diverse and resource-constrained African contexts. Against this background, the present study sought to examine the influence of higher education funding on institutional sustainability among AAHEFA member countries by focusing on key funding components, namely budgetary allocation, appropriation-in-aid, and public-private partnership financing. The study was guided by the argument that higher education funding structures shape the capacity of financing agencies to sustain operations, maintain efficiency, and fulfill their mandate of expanding equitable access to higher education over time.

LITERATURE REVIEW

Higher education financing has attracted increasing scholarly attention because of the rapid growth in enrolment, constrained public budgets, and pressure on financing institutions to sustain access to education. Across Africa, higher education systems continue to depend substantially on government funding, although public allocations have generally not increased at the same rate as student enrolment and institutional expenditure requirements. Mukhwana et al. (2020) observed that inadequate and unpredictable public funding has contributed to infrastructure deficits and institutional capacity constraints in African higher education. Similarly, Yende (2021) established that higher education institutions in South Africa faced persistent funding challenges despite the existence of government support and alternative financing

opportunities. These findings indicate that the amount, predictability, and composition of funding are central to the sustainability of higher education institutions and financing agencies.

Budgetary allocation constitutes one of the principal sources of funding for higher education financing agencies. Government allocations support student loans, scholarships, bursaries, administrative operations, and the expansion of financing programmes. Predictable budgetary allocations enable agencies to plan their activities, meet disbursement obligations, and maintain operational continuity. However, dependence on government allocations can expose agencies to fiscal pressures, political priorities, and delays in the release of approved funds. Moyo and McKenna (2021) established that funding constraints limited the ability of higher education institutions to improve teaching and learning outcomes. Gbesoevi et al. (2025) similarly found that differences in the stability and coordination of education funding policies influenced education outcomes across sub-Saharan Africa. These findings suggest that the sustainability contribution of budgetary allocation depends not only on the amount approved but also on its adequacy, predictability, and timely disbursement.

Appropriation-in-aid provides an additional source of funding through internally generated revenue, including student loan recoveries, service fees, investment income, and other institutional receipts. For student financing agencies, loan recoveries are particularly important because they replenish revolving funds and reduce exclusive dependence on government allocations. Mokaya et al. (2020) found that budgetary allocation and loan recovery were important components of sustainable student loan schemes. Evidence from Uganda also shows that the management and recovery of student loan funds influence the continuity of higher education financing programmes (Muweesi, 2021). Nevertheless, the contribution of appropriation-in-aid may be constrained by graduate unemployment, weak beneficiary-tracking systems, repayment defaults, and inadequate enforcement mechanisms. Improving internally generated revenue therefore requires effective loan-recovery systems, reliable beneficiary information, and appropriate accountability arrangements.

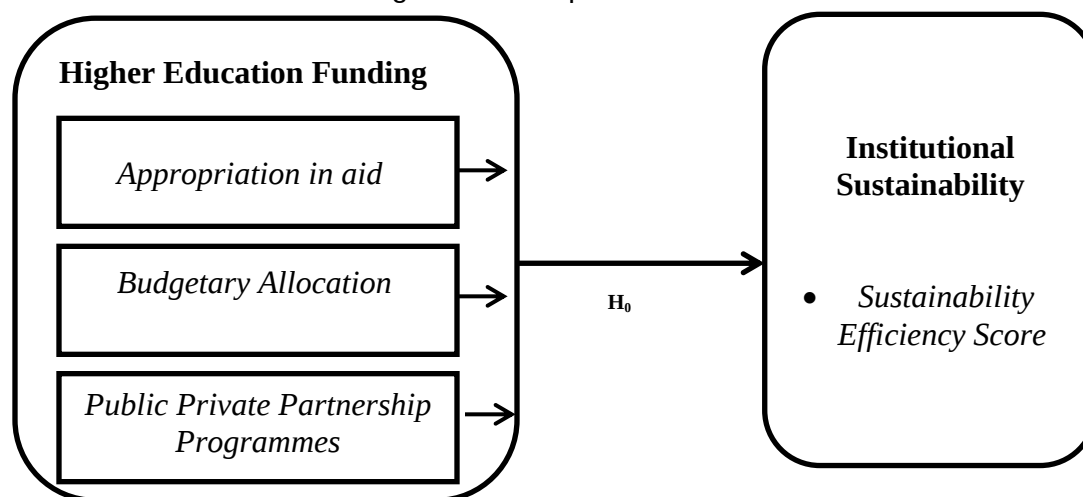
Public–private partnerships have also emerged as alternative mechanisms for mobilizing resources for higher education. Such partnerships may involve private firms, development partners, foundations, financial institutions, and other non-state actors supporting scholarships, infrastructure, technology, research, or institutional capacity development. Wanjara and Ogembo (2024) found that PPPs could contribute to the implementation of higher education programmes, while Hassan and Ahmed (2024) emphasized that institutional readiness was essential for the successful implementation of PPPs. However, partnership funding is frequently project-specific, conditional, and less predictable than regular government financing.

Consequently, its contribution to institutional sustainability may depend on whether it is incorporated into the agency's core financial and operational systems.

Institutional sustainability refers to the ability of an organization to maintain its operations, efficiently use available resources, and continue fulfilling its mandate over time. In higher education financing agencies, sustainability involves more than the availability of funds; it also concerns the capacity to convert financial resources into student disbursements, expanded beneficiary coverage, timely service delivery, and continued institutional operations. Chang and Chang (2024) demonstrated that the allocation and strategic targeting of financial resources influenced sustainability-related efficiency in higher education. Son-Turan (2021) similarly showed that the relationship between higher education funding and sustainability depends on how financing arrangements are aligned with institutional objectives. These studies support an efficiency-oriented assessment of sustainability, in which agencies are evaluated according to their ability to transform financial and administrative inputs into measurable outputs.

Although existing studies have examined government funding, loan recovery, internally generated income, and partnerships, several gaps remain. First, much of the literature focuses on universities and national higher education systems rather than the specialized agencies responsible for administering student financing. Second, studies generally examine funding adequacy, access, or financial performance without evaluating institutional sustainability through an efficiency-based measure. Third, the available evidence is largely country-specific and does not adequately compare financing agencies operating across different African institutional and macroeconomic environments. The present study addressed these gaps by examining eleven AAHEFA member agencies, disaggregating higher education funding into appropriation-in-aid, budgetary allocation, and PPP inflows, and measuring institutional sustainability using a DEA-based efficiency score.

Figure 1 Conceptual Framework



The configuration of variables and relationships adopted in this study is justified on both theoretical and empirical grounds. Based on the reviewed theoretical and empirical literature, the study conceptualized higher education funding in terms of budgetary allocation, appropriation-in-aid, and public–private partnership inflows. These funding channels represent the principal financing structures available to higher education financing agencies operating in resource-constrained environments. The conceptual framework therefore proposes that each funding component may independently influence institutional sustainability, measured through the agency's efficiency in transforming financial and administrative inputs into operational outputs.

RESEARCH METHODOLOGY

The study adopted a positivist research philosophy, which assumes that reality is objective and measurable through observable and quantifiable indicators using empirical methods (Ugwu et al., 2021). This philosophical orientation was appropriate because the study sought to examine and quantify the relationship between higher education funding and institutional sustainability among AAHEFA member agencies using standardized secondary data and statistical analysis. Guided by this approach, the study employed a descriptive correlational longitudinal research design based on panel data covering the period 2015–2024. The ten-year period was selected because it provided a sufficiently long and relatively recent timeframe for observing changes in funding structures and institutional sustainability across the agencies. It also reflected a period during which agency-level annual reports, government budget records, loan-recovery information, beneficiary statistics, and other variables required for the DEA and panel regression analyses were comparatively available and could be harmonized across the participating countries. Furthermore, the period captured variations in fiscal conditions, enrolment pressures, financing reforms, and the operational disruptions associated with the COVID-19 pandemic, thereby providing adequate temporal variation for evaluating the resilience and sustainability of the agencies. Limiting the analysis to 2024 ensured that the study used the most recent year for which sufficiently complete and comparable agency-level information was available at the time of data compilation. The longitudinal panel framework therefore enabled the study to capture both cross-sectional and time-series variations across AAHEFA member agencies while examining how changes in higher education funding were associated with institutional sustainability over time (Wooldridge, 2023).

The study population comprised all eleven operational higher education financing agencies within AAHEFA member countries, namely Kenya, Uganda, Tanzania, Rwanda, Ghana, South Africa, Namibia, Malawi, Zambia, Botswana, and Lesotho. Given the relatively

small and policy-relevant population, the study adopted a census approach in which all agencies were included. However, due to occasional gaps in agency-year reporting, the resulting dataset was unbalanced, allowing agencies to remain in the panel only for years in which the minimum information required to compute institutional sustainability scores and funding indicators was available.

The study relied exclusively on secondary quantitative data collected from annual reports and statistical bulletins of financing agencies, AAHEFA secretariat submissions, ministries of education and finance, government budget estimates, and auditor-general reports covering the period 2015–2024. To enhance comparability across countries, monetary variables were deflated to constant prices, converted into a common currency where necessary, and expressed as ratios or percentages to minimize scale distortions. Higher education funding was operationalized using three non-composite indicators measured at the agency-year level: appropriation-in-aid, budgetary allocation, and public–private partnerships. Appropriation-in-aid captured internally generated revenue such as loan recoveries and service fees relative to total institutional income, while budgetary allocation measured government funding support relative to approved institutional budgets. Public–private partnerships reflected private sector and development partner contributions relative to total institutional income. Retaining these indicators separately enabled the study to assess their independent influence on institutional sustainability.

Institutional sustainability, which constituted the dependent variable, was operationalized using a Data Envelopment Analysis (DEA)-based Institutional Sustainability Score (SES). DEA is a non-parametric efficiency measurement approach that evaluates the ability of decision-making units to transform multiple inputs into outputs without imposing a predefined functional relationship (Esmaeeli et al., 2023). The study employed an input-oriented variable returns-to-scale (VRS) DEA model to account for differences in agency size and operating environments across countries. Inputs included total available funds, operating costs, and administrative costs, while outputs comprised total disbursements, number of beneficiaries funded, and on-time disbursement rates. The resulting efficiency scores ranged between 0 and 1, with values closer to 1 indicating higher levels of institutional sustainability and operational efficiency.

Data analysis involved both descriptive and inferential statistical techniques. Descriptive statistics including means, standard deviations, minima, and maxima were used to summarize trends and variations in funding and sustainability indicators across agencies and over time. Diagnostic tests including Fisher-type panel unit root tests, variance inflation factors, Modified Wald tests for heteroscedasticity, Wooldridge tests for autocorrelation, and the Hausman

specification test were conducted to assess model suitability and determine the appropriate panel estimator. To ensure robust inference, cluster-robust standard errors at the agency level were applied to correct for heteroscedasticity and serial correlation. To examine the relationship between higher education funding and institutional sustainability, panel regression models were estimated separately for each funding component as follows:

$$SES_{it} = \alpha + \beta_1 AIA_{it} + \varepsilon_{it} \dots\dots\dots (1)$$

$$SES_{it} = \alpha + \beta_2 BA_{it} + \varepsilon_{it} \dots\dots\dots (2)$$

$$SES_{it} = \alpha + \beta_3 PPP_{it} + \varepsilon_{it} \dots\dots\dots (3)$$

Where:

SES_{it} = Institutional sustainability of agency i at time t , measured by efficiency score of sustainability that was computed via DEA model; α = Intercept or constant; $\beta_1, \beta_2, \beta_3$ = regression coefficients; AIA = Appropriation in aid; BA = Budgetary allocation; PPP = Public-Private Partnerships, and ε = The error term, which accounts for the unexplained variations

The estimated coefficients were interpreted based on their magnitude, direction, and statistical significance. A positive and statistically significant coefficient implied that an increase in the respective funding component was associated with an improvement in institutional sustainability, while a negative coefficient indicated that increases in the funding variable reduced institutional sustainability. The magnitude of each coefficient reflected the extent to which a unit change in the funding variable was associated with a corresponding change in the institutional sustainability score, holding other factors constant. Statistical significance was evaluated at the 5% level, where p-values less than 0.05 indicated sufficient evidence to reject the null hypothesis and conclude that the respective funding component had a significant relationship with institutional sustainability among AAHEFA member agencies.

RESULTS AND DISCUSSIONS

The study reported descriptive statistics for the DEA-based Institutional Sustainability Score (SES) and the higher education funding variables, namely appropriation-in-aid (AIA), budgetary allocation (BA), and public-private partnerships (PPP), in order to assess variability and provide preliminary insights into the behaviour of the data. The study reported the mean, standard deviation, minimum, and maximum values for the DEA-based Institutional Sustainability Score (SES), and higher education financing components (appropriation-in-aid (AIA), budgetary allocation (BA), and public-private partnerships (PPP)). These descriptive statistics help to assess variability, detect potential outliers, and provide preliminary insights into the structure and behaviour of the data.

Table 1 Descriptive Statistics
of the Variables

Variable	Observations	Mean	Std. Dev.	Min	Max
SES	110	0.1487	0.0442	0.07	0.40
AIA	110	0.0608	0.0721	0.00	0.36
BA	110	0.4528	0.0854	0.36	0.73
PPP	110	4.3428	3.0114	0.04	23.60

The findings in Table 1 indicated that institutional sustainability recorded a relatively low mean score (Mean = 0.149; SD = 0.044), suggesting that most AAHEFA member agencies operated at modest efficiency levels relative to the best-practice frontier, although variations across agencies remained moderate. Among the financing variables, appropriation-in-aid recorded a low mean value (Mean = 0.061) but exhibited substantial variability across agencies, indicating significant differences in internally generated revenue capacity and financial autonomy. Budgetary allocation recorded the highest and relatively more stable mean value (Mean = 0.453; SD = 0.085), implying that government funding remained the dominant and comparatively stable source of financing for most agencies. In contrast, public–private partnership financing showed considerable variation across countries (Mean = 4.343; SD = 3.011), suggesting uneven adoption and dependence on country-specific institutional and economic conditions. The descriptive patterns therefore revealed notable disparities in financing structures among AAHEFA member agencies, particularly with respect to internally generated revenues and partnership-based financing mechanisms.

The study further conducted graphical trend analysis for institutional sustainability and the higher education funding variables over the period 2015–2024. Trend analysis complemented the descriptive statistics by illustrating temporal movements and variations across agencies and over time. To improve comparability among variables measured on different scales, all trend series were standardized using z-scores. The graphical trends provided preliminary insights into the direction, volatility, and co-movement of institutional sustainability and funding variables prior to diagnostic testing and inferential analysis. Overall, the observed trends suggested that higher education financing patterns and institutional sustainability outcomes varied considerably across AAHEFA member agencies over the study period.

Figure 2 Trend of Institutional Sustainability (SES)
and Higher Education Funding

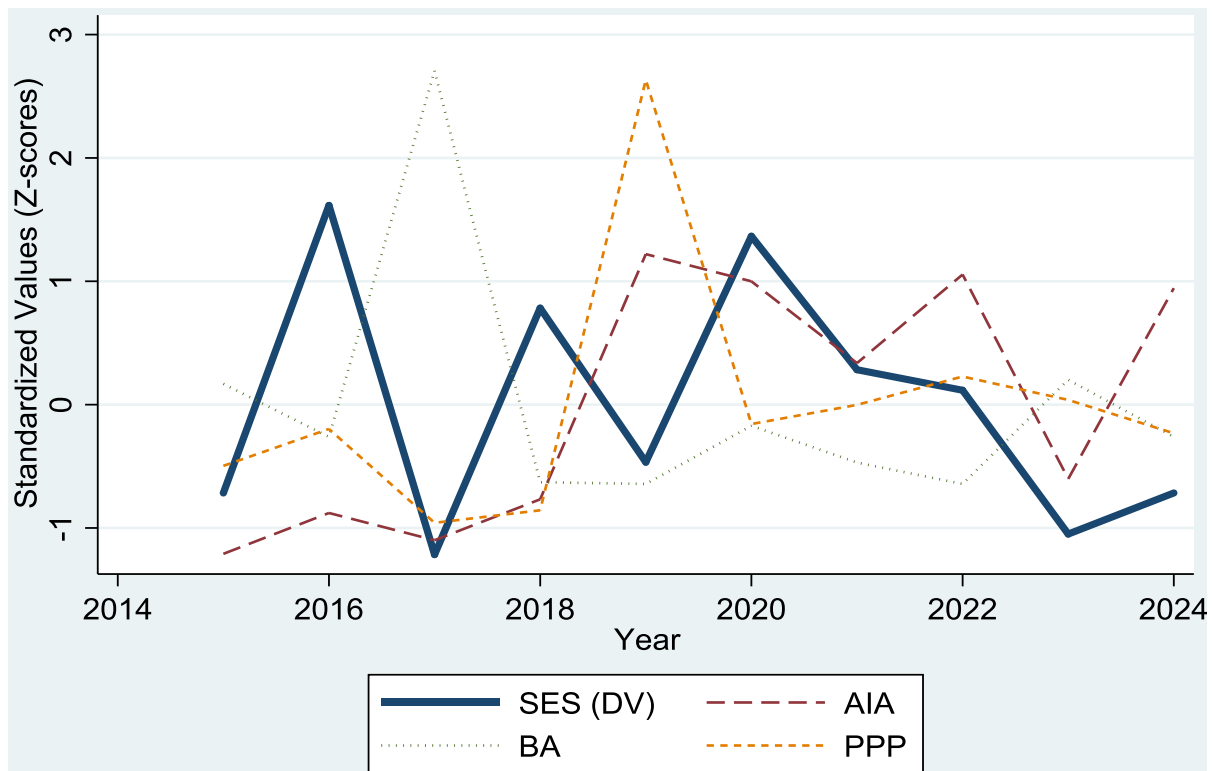


Figure 2 illustrates the trend of institutional sustainability (SES) alongside higher education funding components. SES exhibits noticeable year-to-year fluctuations, with periods of improvement around 2016, 2019–2020, and relative declines around 2017 and 2023. These fluctuations suggest that agencies' efficiency in converting financial resources into sustainable outputs is not constant over time and may be influenced by changes in funding structure and external conditions.

Public–private partnerships, however, exhibit pronounced volatility, with sharp spikes and troughs that do not consistently align with SES movements. This lack of systematic co-movement suggests that PPP inflows may be episodic and less integrated into core operational frameworks, limiting their immediate contribution to sustainability. Therefore, the divergence observed between PPP and SES, relative to the closer alignment between BA and SES, provides preliminary support for the hypothesis that stable and routinised funding sources are more strongly associated with institutional sustainability than irregular or externally driven funding streams.

Table 1 Summary of Panel Data Suitability and Diagnostic Test Results

Diagnostic Test	Purpose	Test/ Statistic Used	Key Results	Interpretation/Decision
Panel Unit Root Test	To assess stationarity of panel variables and avoid spurious regression results	Fisher-type panel unit-root test	SES ($\chi^2=44.0381$, $p=0.0035$), AIA ($\chi^2=106.4429$, $p=0.0000$), BA ($\chi^2=126.2605$, $p=0.0001$), PPP ($\chi^2=55.9556$, $p=0.0000$) became stationary after first differencing.	Majority of variables were stationary after first differencing, confirming suitability for panel regression analysis.
Normality Test	To assess whether variables followed a normal distribution	Shapiro–Wilk Test	SES ($W=0.81492$, $p=0.0000$), AIA ($W=0.71749$, $p=0.0000$), BA ($W=0.72159$, $p=0.0000$), PPP ($W=0.69008$, $p=0.0000$).	Variables deviated from normality, indicating skewness and kurtosis; however, robust estimation techniques were applied to ensure valid inference.
Skewness/Kurtosis Test	To further confirm departures from normality	Skewness–Kurtosis Test	SES (Adj $\chi^2=57.88$, $p=0.0000$), AIA (Adj $\chi^2=50.17$, $p=0.0000$), BA (Adj $\chi^2=34.33$, $p=0.0000$).	Financial and sustainability variables exhibited significant skewness and heavy tails, confirming non-normality.
Multicollinearity Test	To examine correlation among explanatory variables	Variance Inflation Factor (VIF)	BA=1.33, AIA=1.23, PPP=1.21; Mean VIF=1.33.	All VIF values were far below the threshold of 10, indicating absence of serious multicollinearity.
Heteroscedasticity Test	To determine whether error variances were constant across panels	Modified Wald Test	$\chi^2(11)=9.63$, $p=0.562$.	The null hypothesis of homoscedasticity was not rejected, indicating constant error variance across panel units.
Autocorrelation Test	To assess presence of serial correlation in panel residuals	Wooldridge Test for Autocorrelation	$F(10,10)=13.21$, $p=0.0002$.	Presence of first-order autocorrelation was confirmed, justifying use of cluster-robust standard errors.

The diagnostic test results in Table 2 confirmed the suitability of the panel dataset for regression analysis. The unit root results established stationarity of the variables after first differencing, while multicollinearity tests indicated weak linear dependence among explanatory variables. Although the normality tests revealed departures from normal distribution, the use of robust estimation techniques minimized potential bias in statistical inference. In addition, the heteroscedasticity test confirmed constant error variance across panel units, whereas the Wooldridge test detected the presence of serial correlation, thereby justifying the application of cluster-robust standard errors in the panel regression models.

Table 3 presents the Pearson pairwise correlation coefficients among the study variables. Institutional sustainability exhibited weak and statistically insignificant relationships with appropriation-in-aid ($r = -0.0590$), budgetary allocation ($r = 0.1371$), and public-private partnership inflows ($r = 0.0003$), suggesting that the effect of higher education funding on institutional sustainability may not be directly observable at the bivariate level and may require multivariate analysis to account for additional institutional dynamics. Among the funding variables, public-private partnership inflows were positively and significantly correlated with appropriation-in-aid ($r = 0.1944$, $p < 0.05$), implying some degree of complementarity between internally generated revenues and partnership-based financing mechanisms. However, the relationships between budgetary allocation and the other funding variables remained weak and statistically insignificant. Importantly, all correlation coefficients were substantially below the commonly accepted multicollinearity threshold of 0.8, confirming the absence of serious multicollinearity concerns and supporting the inclusion of the variables in the subsequent panel regression models.

Table 2 Pearsons' Correlation Matrix

Variables	SES	AIA	BA	PPP
SES	1.0000			
AIA	-0.0590	1.0000		
BA	0.1371	-0.0632	1.0000	
PPP	0.0003	0.1944*	-0.0442	1.0000

* Correlation is significant at the 0.05 level (2-tailed).

The main goal of the study was to establish the relationship between higher education funding and institutional sustainability of AAHEFA member agencies measured by the DEA Institutional sustainability Score (SES). The corresponding null hypothesis (H_0) and sub hypotheses stated that: H_0 : *There is no significant relationship between higher education*

funding and institutional sustainability of AAHEFA member agencies. While sub hypotheses as following;

H_{1a}: The relationship between higher education appropriation-in-aid and institutional sustainability of AAHEFA member agencies is not significant.

H_{1b}: The relationship between higher education budgetary allocation and institutional sustainability of AAHEFA member agencies is not significant.

H_{1c}: The relationship between higher education public-private partnership and institutional sustainability of AAHEFA member agencies is not significant.

Table 4 Panel Regression Analysis between Higher Education Funding and Institutional Sustainability of AAHEFA Member Agencies

Robust Models	Model 1 (AIA & SES)		Model 2 (BA & SES)		Model 3 (PPP & SES)		Joint Model 4 (AIA, BA, PPP & SES)	
Variable	β	P-Value	β	P-Value	β	P-Value	B	P-Value
Appropriation-In-Aid (AIA)	0.4276 (3.63)	0.000	-	-	-	-	0.3012 (2.85)	0.005
Budgetary Allocation (BA)	-	-	0.3624 (4.15)	0.000	-	-	0.2487 (2.64)	0.009
Public-Private Partnership (PPP)	-	-	-	-	0.0431 (1.21)	0.228	0.1185 (1.78)	0.078
Constant	-1.742 (-3.68)	0.000	-1.806 (-4.51)	0.000	0.215 (1.17)	0.243	-1.2864 (-3.12)	0.002
Model selection statistics	Hausman $\chi^2=1.32$ Prob> $\chi^2=0.251$		Hausman $\chi^2=0.94$ Prob> $\chi^2=0.333$		Hausman $\chi^2=3.98$ Prob> $\chi^2=0.046$		Hausman $\chi^2=0.94$ Prob> $\chi^2=0.333$	
	Random-effects GLS regression		Random-effects GLS regression		Fixed-effects (within) regression		Random-effects GLS regression	
Model Fitness statistics	Number of obs = 106 R-squared: 0.1135 Wald χ^2 (1) = 5.384 Prob> χ^2 = 0.0011		Number of obs = 106 R-squared: 0.0771 Wald χ^2 (1) = 12.15 Prob> χ^2 = 0.0000		Number of obs = 102 R-squared: 0.0824 F (1,98) = 0.83 Prob > F = 0.3213		Number of obs = 101 R-squared: 0.0771 Wald χ^2 (1) = 12.15 Prob> χ^2 = 0.0000	

t-statistic – Values in parenthesis

A panel regression model was estimated to determine the effect of the funding indicators on institutional sustainability across countries and over time. Both fixed-effects and random-effects models were fitted, and the appropriate specification was selected using the Hausman

test, which compares consistency and efficiency of estimators. Three single-predictor panel models were estimated in line with the study design. Estimator choice for each model followed the Hausman test and inference used cluster-robust errors at the agency level. The findings are as shown in Table 4

Model 1 examined the association between higher education Appropriation-In-Aid (AIA) and SES. The Hausman statistic supported the random-effects specification (*Chi-square* = 1.32, $p = 0.251$). The AIA coefficient was positive and statistically significant ($\beta = 0.4276$, $t = 3.63$, $p = 0.000$). The model showed acceptable fitness for purpose with Wald $\chi^2(1) = 5.384$, $p = 0.0011$, $R^2 = 0.1135$. The result indicates that larger AIA receipts are associated with higher technical efficiency in converting inputs to timely student disbursements. On the hand, model 2 related higher education Budgetary Allocation (BA) to SES. The Hausman test again favored random effects (*Chi-square* = 0.94, $p = 0.333$). The BA coefficient was positive and statistically significant ($\beta = 0.3624$, $t = 4.15$, $p = 0.000$). Overall fit was strong with Wald $\chi^2(1) = 12.15$, $p = 0.0000$, $R^2 = 0.0771$, and 106 observations. This implies that predictable and adequate exchequer releases are linked to better agency efficiency along the DEA frontier.

Further, model 3 assessed higher education Public-Private Partnership (PPP) inflows. The Hausman test pointed to a fixed-effects estimator (*Chi-square* = 3.98, $p = 0.046$). The PPP coefficient was small and not statistically significant ($\beta = 0.0431$, $t = 1.21$, $p = 0.228$). The model did not reach significance at the five percent level, with $F(1,38) = 0.83$, $p = 0.3213$, $R^2 = 0.0824$. This suggests that partnership inflows, which are often earmarked and volatile, did not translate into measurable gains in the efficiency score during the period reviewed. Model 4 presents the joint estimation of higher education funding components, incorporating appropriation-in-aid (AIA), budgetary allocation (BA), and public-private partnership (PPP) inflows simultaneously. The results indicate that both AIA ($\beta = 0.3012$, $p = 0.005$) and BA ($\beta = 0.2487$, $p = 0.009$) remain positive and statistically significant determinants of institutional sustainability, confirming the central role of stable government funding in enhancing efficiency.

Public-private partnership (PPP) inflows exhibit weak statistical significance at the 10 percent level ($\beta = 0.1185$, $p = 0.078$), suggesting a limited but emerging contribution to institutional sustainability when considered alongside other funding sources. The relatively smaller magnitude of the PPP coefficient indicates that such funding mechanisms are complementary rather than primary drivers of institutional efficiency. The constant term is negative and statistically significant ($\beta = -1.2864$, $p = 0.002$), implying that in the absence of funding inputs, institutional sustainability would be substantially low, thereby underscoring the critical importance of sustained financial inflows. The Hausman test results indicate that the random-effects model is appropriate for Models 1, 2, and 4 ($p > 0.05$), suggesting that

unobserved heterogeneity is not correlated with the explanatory variables. However, Model 3 (PPP) favours the fixed-effects specification ($p < 0.05$), indicating that PPP effects may be influenced by time-invariant agency-specific factors. Robust standard errors were applied to address potential heteroscedasticity and autocorrelation.

The model fitness statistics further support the reliability of the findings. Models 1 and 2 are statistically significant overall, as indicated by the Wald Chi-square tests ($p < 0.01$), confirming the explanatory power of AIA and BA in influencing institutional sustainability. In contrast, Model 3 is not statistically significant ($Prob > F = 0.3213$), reinforcing the limited role of PPP inflows when considered independently. The joint Model 4 is statistically significant ($Prob > Chi2 < 0.01$), indicating that the combined funding components jointly explain variations in institutional sustainability among AAHEFA member agencies.

The findings indicate that increases in higher education funding components, particularly appropriation-in-aid and budgetary allocation, significantly enhance institutional sustainability among AAHEFA member agencies. Based on the finding, the study rejected the third sub-hypothesis (H1c) which stated that *the relationship between higher education public-private partnership and institutional sustainability of AAHEFA member agencies is not significant*. In testing the first sub-hypothesis, the study assessed the relationship between higher education Appropriation-In-Aid (AIA) and institutional sustainability. As per the findings, Model 1 shows a positive and statistically significant association between AIA and the Institutional sustainability Score ($\beta = 0.4276$, $p = 0.000$). The estimated model is;

$$SES_{it} = -1.742 + 0.4276AIA_{it} \dots\dots\dots (4)$$

This implies that a one-unit rise in AIA is associated with a 0.4276-point increase in SES, holding other factors constant. The study therefore rejects H_{1a} and concludes that higher education Appropriation-In-Aid significantly relates to institutional sustainability. To assess the second sub-hypothesis, the study examined the relationship between higher education Budgetary Allocation (BA) and institutional sustainability. Model 2 indicates a positive and statistically significant effect ($\beta = 0.3624$, $p = 0.000$). The estimated model is;

$$SES_{it} = -1.806 + 0.3624BA_{it} \dots\dots\dots (5)$$

The finding implies that a one-unit increase in BA is associated with a 0.3624-point rise in SES, ceteris paribus. The study rejects H_{1b} and concludes that higher education Budgetary Allocation significantly relates to institutional sustainability. Further, to assess the third sub-hypothesis, the study analyzed the relationship between higher education Public-Private Partnership (PPP) inflows and institutional sustainability. In Model 3 the coefficient on PPP is positive but not statistically significant ($\beta = 0.0431$, $p = 0.228$). The estimated model is;

$$SES_{it} = 0.215 + 0.0431PPP_{it} \dots\dots\dots (6)$$

This indicates that variations in PPP inflows did not translate into measurable changes in SES over the study period. The study does not reject H_{1c} and infers that higher education public-private partnership inflows are not significantly related to institutional sustainability. To further examine the combined effect of higher education funding components on institutional sustainability, a joint panel regression model was estimated incorporating appropriation-in-aid (AIA), budgetary allocation (BA), and public-private partnership (PPP) inflows simultaneously. This model allows for the assessment of the relative contribution of each funding source while controlling for the influence of the others.

$$SES_{it} = -1.2864 + 0.3012AIA_{it} + 0.2487BA_{it} + 0.1185PPP_{it} \dots\dots\dots (7)$$

The joint model results indicate that appropriation-in-aid (AIA) and budgetary allocation (BA) remain positive and statistically significant determinants of institutional sustainability. Specifically, a one-unit increase in AIA is associated with a 0.3012 increase in SES ($p = 0.005$), while a one-unit increase in BA leads to a 0.2487 increase in SES ($p = 0.009$), holding other factors constant.

Public-private partnership (PPP) inflows exhibit weak statistical significance at the 10 percent level ($\beta = 0.1185$, $p = 0.078$), suggesting a modest but emerging contribution to institutional sustainability when considered jointly with other funding sources. This indicates that PPP inflows may play a complementary role rather than serving as a primary driver of efficiency. On the other hand, the constant term is negative and statistically significant ($\beta = -1.2864$, $p = 0.002$), implying that in the absence of funding inputs, institutional sustainability would be substantially low. This underscores the critical importance of sustained financial inflows in supporting the efficiency of higher education financing agencies.

The joint estimation further highlights the relative importance of funding sources, with appropriation-in-aid exerting the strongest influence, followed by budgetary allocation, while PPP inflows contribute marginally. These findings reinforce the central role of stable and predictable public funding in enhancing institutional sustainability, compared to externally driven or project-based financing mechanisms. These findings provide robust evidence supporting the combined effect of higher education funding mechanisms on institutional sustainability and offer a more comprehensive understanding of their relative contributions.

The observed dominance of appropriation-in-aid and budgetary allocation in driving institutional sustainability can be interpreted through the lens of resource dependence dynamics, as reflected in recent empirical studies on higher education financing in Africa. Contemporary evidence shows that higher education financing institutions operate within constrained fiscal environments where government funding remains the most reliable and predictable source of support (Moyo & McKenna, 2021; Abuselidze, 2022). In this context,

agencies tend to align their operational strategies with the availability and stability of public resources. The strong and significant influence of AIA and budgetary allocation observed in this study therefore reflects the stabilizing role of government-controlled funding streams, which reduce uncertainty and enable more efficient planning and disbursement. In contrast, PPP inflows, which are often externally driven and less predictable, exhibit weaker effects, consistent with findings that externally sourced funding in African higher education systems is frequently fragmented and conditional, limiting its impact on core institutional performance (Zumeta et al., 2021).

The findings further highlight the importance of governance and accountability mechanisms in shaping how financial resources translate into institutional outcomes. Recent studies on public sector governance emphasize that the effectiveness of funding depends not only on its volume but also on the strength of oversight, monitoring, and incentive structures within implementing agencies (Mizrahi, 2021; Kaye, 2021). In the context of AAHEFA agencies, government funding is typically accompanied by structured accountability frameworks, which enhance transparency and reduce inefficiencies in resource utilization. This helps explain why budgetary allocation and appropriation-in-aid demonstrate strong and consistent effects on institutional sustainability. Conversely, PPP arrangements often involve multiple stakeholders with differing objectives and weaker coordination mechanisms, which can create inefficiencies and limit their contribution to measurable performance outcomes.

From a broader institutional and public management perspective, the results reflect the continued influence of policy environments and performance-oriented reforms in shaping higher education financing systems. Recent analyses indicate that higher education institutions and financing agencies in Africa increasingly operate under frameworks that emphasize accountability, efficiency, and measurable outcomes, often aligned with national and international development agendas (Gbesoevi et al., 2025; Imolong et al., 2025). The positive relationship between stable funding sources and DEA-based efficiency scores observed in this study suggests that agencies are better able to achieve performance targets when funding is predictable and aligned with institutional processes. At the same time, variations in the effectiveness of different funding sources highlight the importance of aligning financial mechanisms with institutional capacity and governance structures to achieve sustainable outcomes.

The results further demonstrate that the effectiveness of funding is not determined solely by volume, but by its structure and integration into institutional processes. This aligns with recent empirical evidence showing that funding must be strategically aligned to institutional objectives to generate sustainability outcomes. For instance, Chang and Chang (2024) found

that targeted and strategically designed funding, rather than aggregate funding levels, is what drives sustainability performance in higher education institutions. Similarly, Son-Turan (2021) reported that specific funding streams, particularly those aligned with institutional priorities, are more strongly associated with sustainability outcomes than generalized funding.

Within SSA, the findings are consistent with evidence that emphasizes the importance of structured and predictable public financing systems. Gbesoevi et al. (2025) demonstrated that countries with more stable and coordinated education funding frameworks tend to achieve better education outcomes, particularly in terms of access and infrastructure. Extending this perspective, the present study shows that such structured funding systems also enhance institutional sustainability at the agency level, particularly when evaluated through efficiency-based measures.

The insignificant effect of PPP inflows observed in this study provides an important nuance to existing literature. While studies such as Wanjara and Ogembo (2024), and Hassan and Ahmed (2024) highlight the potential of PPPs to enhance institutional capacity and resource mobilization, their conclusions are largely based on descriptive or qualitative evidence. The present findings suggest that although PPPs may support specific projects or infrastructure development, they do not necessarily improve the efficiency with which agencies convert financial inputs into operational outputs. This indicates that PPP effectiveness is highly dependent on its integration into core institutional systems, rather than its standalone contribution.

Evidence from Kenya further supports these conclusions. Chumba (2023) found that diversified funding strategies, including internally generated income and partnerships, positively influence financial sustainability in universities. However, the current findings refine this argument by demonstrating that not all funding streams contribute equally to sustainability when efficiency is considered. In particular, appropriation-in-aid plays a critical buffering role by providing flexible and internally managed resources that support continuous operations. Similarly, Oladele (2023) found that donor funding contributes to financial sustainability, but their analysis did not assess how such funding interacts with other funding streams to influence institutional efficiency. The present study addresses this gap by showing that routine public funding channels have a more direct and measurable impact on sustainability outcomes than externally driven funding mechanisms.

CONCLUSIONS AND RECOMMENDATIONS

The study concluded that higher education funding significantly influenced institutional sustainability among AAHEFA member agencies, although the magnitude and effectiveness of this influence varied across funding components. The findings established that appropriation-in-

aid and budgetary allocation positively contributed to institutional sustainability, implying that stable, predictable, and internally managed public funding mechanisms enhanced the operational efficiency and long-term viability of higher education financing agencies. In contrast, public–private partnership inflows did not demonstrate a statistically significant direct effect on institutional sustainability, suggesting that externally driven and project-based financing arrangements were not reliable independent drivers of sustainability within the AAHEFA context.

The study further concluded that institutional sustainability among higher education financing agencies depended not only on the availability of financial resources but also on the structure, predictability, and stability of funding systems. Agencies that relied on more stable and institutionally embedded funding mechanisms were more likely to achieve sustainable operational performance compared to those dependent on irregular and externally driven financing arrangements.

The study therefore, recommended that governments and higher education policymakers should strengthen stable and predictable funding mechanisms, particularly budgetary allocations and appropriation-in-aid frameworks, since these funding components demonstrated positive and significant relationships with institutional sustainability among AAHEFA member agencies. This could be achieved through enhancing medium-term financing frameworks, improving timeliness of government disbursements, and strengthening internally generated revenue systems such as loan recovery mechanisms and service-based income streams. In particular, financing agencies should invest in more efficient loan tracking, repayment enforcement, and digital recovery systems to improve appropriation-in-aid performance and reduce dependence on uncertain external funding sources.

The study further recommended that policymakers and agency managers should reconsider the design and operational integration of public–private partnership financing arrangements, given the absence of a statistically significant direct relationship between PPP inflows and institutional sustainability. Rather than relying on PPPs as standalone financing solutions, partnership arrangements should be aligned with core institutional financing strategies and long-term sustainability objectives. In addition, AAHEFA member agencies should prioritize strengthening institutional financial planning and resource diversification strategies that promote stable and sustainable financing structures capable of supporting long-term operational efficiency and continuity.

Future research should extend the temporal and institutional coverage of panel datasets to provide deeper insights into long-term sustainability dynamics of higher education financing agencies, particularly during periods of policy transition and macroeconomic volatility. In addition, subsequent studies should explore alternative and complementary approaches for

measuring institutional sustainability, including stochastic frontier analysis and composite sustainability indices that capture financial, operational, and equity dimensions simultaneously. Future studies should also adopt mixed-method approaches incorporating qualitative techniques such as case studies, institutional diagnostics, and key informant interviews to provide richer understanding of governance practices and institutional dynamics. Finally, research may also broaden the scope of macroeconomic analysis by incorporating additional macro-fiscal indicators such as exchange-rate volatility, sovereign risk, and public debt dynamics.

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