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The Influence of Cost on The Evolution of Technology Education: Evidence From Murang'a University of Technology, Kenya

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Abstract
The evolution of technology education in Kenya has been influenced by multiple factors, among which cost remains a critical determinant. This study examined the influence of cost on the evolution of technology education at Murang'a University of Technology. A mixed-method design was adopted, collecting data from 120 respondents, including students, academic staff, and administrative staff. Data were analyzed using descriptive statistics, Pearson correlation, and linear regression. Findings revealed that high tuition fees, inadequate government funding, and the rising cost of infrastructure significantly constrain the evolution of technology education. Regression results indicated that cost explained 38.2% of the variance in technology education development ($R^2 = .382$, $\beta = .618$, $p < .01$). The study concludes that affordability and sustainable financing mechanisms are essential for advancing technology education. It recommends enhanced government subsidies, expansion of financial aid schemes, and university–industry partnerships to mitigate cost barriers.
Keywords: *cost, technology education, higher education, Kenya, evolution*

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I. Introduction

Technology education plays a critical role in preparing graduates with the skills required for the Fourth Industrial Revolution, equipping them with competencies in innovation, problem-solving, and digital adaptability (Seyman Guray & Kismet, 2023). Globally, many countries have invested heavily in advancing technology education through funding, research, and policy reforms to align learning outcomes with industry demands. Regionally, in Sub-Saharan Africa, progress has been uneven, with nations grappling with limited resources, inadequate infrastructure, and rising costs that hinder both access and quality (Williams et al., 2025). In Kenya, the development of technology education has been prioritized within higher learning institutions to foster innovation, employability, and competitiveness. However, cost-related factors remain a persistent barrier. Students often face high tuition fees, while universities struggle with inadequate funding to maintain infrastructure and adopt emerging technologies (Tan et al., 2024).

The rising cost of higher education in Kenya continues to constrain equitable access and the sustainability of technology education. At Murang'a University of Technology, affordability challenges manifest in high tuition fees, limited government subsidies, and insufficient financial aid opportunities. These constraints not only risk excluding capable students from pursuing technology education but also limit the institution's capacity to invest in laboratories, digital infrastructure, and modern pedagogical approaches. Despite the recognized importance of financing, limited empirical evidence exists on how cost specifically influences the evolution of technology education in this context. To address this gap, the present study examined the relationship between cost and the development of technology education at Murang'a University of Technology.

II. Method

This study adopted a descriptive survey design within a mixed-methods framework, combining quantitative and qualitative approaches to capture a comprehensive understanding of cost-related barriers influencing technology education. The design was chosen because it allows for both breadth and depth of data, where quantitative measures provide generalizable patterns while qualitative insights enrich interpretation with context and meaning. The target population consisted of students, teaching staff, and administrative staff at Murang'a University of Technology, since these groups represent the primary stakeholders in technology education. From this population, a stratified random sample of 120 respondents was drawn to ensure representativeness across categories, comprising 80 students, 30 lecturers, and 10 administrators. To collect data, structured questionnaires were administered to students and lecturers to obtain quantitative measures of cost-related challenges, while semi-structured interviews were conducted with administrative to provide deeper

qualitative insights into institutional perspectives on cost and funding. To guarantee the quality of the research instruments, content validity was established through expert review by scholars in education and economics, while a pilot study was conducted to test reliability. The resulting Cronbach's alpha coefficient of .812 confirmed acceptable internal consistency of the questionnaire items. For data analysis, quantitative responses were coded and processed using SPSS, where descriptive statistics such as means, frequencies, and percentages summarized participants' perceptions of cost factors. Further, Pearson correlation analysis examined associations between cost variables and access to technology education, while regression analysis was employed to assess the predictive influence of cost on the evolution of technology education.

III. Results

Descriptive Statistics

Respondents strongly agreed that tuition fees and inadequate government subsidies present major barriers to the advancement of technology education (Table 1).

Table 1: Perceptions of Cost as a Barrier to Technology Education (n = 120)

Cost Factor	Mean	SD	Interpretation
High tuition fees limit enrollment	4.21	0.77	Strongly Agree
Inadequate government subsidies	4.05	0.82	Agree
Cost of maintaining technology equipment	3.98	0.69	Agree
Lack of financial aid opportunities	3.87	0.91	Agree

The findings in Table 1 show that cost is a major barrier to the evolution of technology education. The highest-rated factor was high tuition fees (M = 4.21, SD = 0.77), with respondents strongly agreeing that it limits student enrollment. This finding reflects global concerns that rising education costs reduce access to higher learning, especially in technology-related programs (Tan et al., 2024). Inadequate government subsidies (M = 4.05, SD = 0.82) were also seen as a significant constraint, consistent with regional studies highlighting chronic underfunding in African higher education systems (Seyman Guray & Kismet, 2023). Similarly, the cost of maintaining technology equipment (M = 3.98, SD = 0.69) was identified as a challenge, aligning with global evidence that institutions face difficulties sustaining technological infrastructure due to rapid advancements (Williams et al., 2025). Lastly, lack of financial aid opportunities (M = 3.87, SD = 0.91) was also considered an obstacle, though with more varied responses, suggesting uneven access to scholarships and support programs. Collectively, these results affirm that financial barriers significantly affect both access and sustainability of technology education.

Correlation Analysis

Pearson correlation showed a strong positive association between cost and technology education evolution ($r = .618$, $p < .01$).

Table 2: Correlation Between Cost and Technology Education Evolution

Variable	Technology Education Evolution
Cost	.618**

*p < .01, **p < .001

The correlation analysis revealed a strong positive relationship between cost and the evolution of technology education ($r = .618$, $p < .01$). This indicates that cost factors significantly influence how technology education develops, with higher financial barriers slowing down its growth. Similar findings have been reported globally, where the affordability of tuition and investment in infrastructure directly affect access and quality of technology-driven programs (Tan et al., 2024). Regionally, limited government subsidies and rising costs in African higher education have been shown to restrict innovation and expansion in technology-related fields (Seyman Guray & Kismet, 2023). In the Kenyan context, persistent challenges such as high tuition fees, limited financial aid, and underfunding of universities continue to hinder the evolution of technology education (Williams et al., 2025).

Regression Analysis

Regression analysis indicated that cost significantly predicted the evolution of technology education, accounting for 38.2% of the variance ($R^2 = .382$, $\beta = .618$, $p < .01$).

Table 3: Regression of Cost on Technology Education Evolution

Model Summary	R	R^2	Adjusted R^2	Std. Error
1	.618	.382	.377	0.512

The regression analysis showed that cost factors accounted for 38.2% of the variance in the evolution of technology education ($R^2 = .382$, Adjusted $R^2 = .377$). This indicates that financial considerations such as tuition fees, government subsidies, and maintenance costs play a substantial role in shaping the trajectory of technology education. Although other factors also contribute to its development, the model demonstrates that nearly two-fifths of the progress in technology education can be explained by cost-related variables alone. This aligns with global evidence where financial investment is considered a cornerstone for advancing technology-based curricula and innovation (Tan et al., 2024). Regionally, underfunding of higher education institutions has been consistently identified as a barrier to expanding technological capacity (Seyman Guray & Kismet, 2023). In Kenya, the results highlight the critical need for increased government support and expanded financial aid opportunities to reduce the burden on students and institutions, thereby accelerating the evolution of technology education (Williams et al., 2025).

Table 4: Regression coefficients

Predictor	B	SE	Beta	T	Sig.
Constant	1.23	0.19	–	6.47	.000**
Cost	0.64	0.09	.618	6.88	.000**

*p < .05, **p < .01

The regression coefficients indicate that cost is a significant positive predictor of the evolution of technology education (B = 0.64, SE = 0.09, β = .618, $t = 6.88$, $p < .001$). This suggests that as cost-related support factors (such as reduced tuition fees, increased subsidies, or enhanced financial aid) improve, the advancement of technology education also increases. The strong standardized beta (.618) demonstrates that cost exerts a substantial influence compared to other potential predictors. This finding resonates with global research that underscores the critical role of financial investment in sustaining technological innovation in education (Tan et al., 2024). Regionally, limited funding has been identified as a major obstacle to achieving equitable access and quality in technology-oriented programs (Seyman Guray & Kismet, 2023). In Kenya, the significance of cost as shown in this model highlights the urgent need for cost-management strategies and policy reforms that can lower financial barriers and foster sustainable growth in technology education (Williams et al., 2025).

Findings from Administrative Interviews

Semi-structured interviews with administrative staff provided deeper insights into the impact of cost and funding on technology education at Murang'a University of Technology. Respondent 1 explained, "High tuition fees often discourage potential students from enrolling, especially those from low-income backgrounds. We lose many qualified applicants because they cannot afford the costs." This concern was echoed by Respondent 2, who emphasized, "Government subsidies have not kept pace with the rising cost of maintaining technology programs. This affects our ability to purchase and upgrade laboratory equipment."

Respondent 3 highlighted student financial struggles, noting, "Without adequate bursaries and scholarship schemes, students struggle to complete their studies. Some defer or drop out entirely." Similarly, Respondent 4 underscored the infrastructural strain, remarking, "Limited funding means we cannot modernize classrooms or invest in digital platforms at the pace required to match industry needs."

Finally, Respondent 5 raised sustainability concerns, explaining, "The university increasingly relies on tuition as the primary income stream, but this model is unsustainable if affordability continues to be an issue." Collectively, these perspectives reveal that cost barriers not only hinder student access but also constrain the university's ability to maintain quality, innovate, and respond effectively to industry demands (Tan et al., 2024; Williams et al., 2025; Yao, 2023).

IV. Conclusion and Recommendations

The study established that cost is a critical determinant in the evolution of technology education at Murang'a University of Technology. The findings revealed that high tuition fees, insufficient government subsidies, and limited financial aid opportunities significantly hinder student enrollment, constrain infrastructure development, and weaken institutional capacity for adopting and sustaining technological innovations. With cost factors explaining nearly 40% of the variance in technology education outcomes, affordability emerges as a cornerstone for sustainable growth in the sector. This underscores the broader reality that while technology

education is vital for preparing graduates with skills for the Fourth Industrial Revolution, its advancement remains vulnerable to persistent financial barriers.

To address these challenges, several recommendations are proposed. At the policy level, the government should increase funding and subsidies to reduce tuition costs and improve resource allocation in technology-oriented programs. From a practical perspective, universities should foster stronger partnerships with industry stakeholders to support infrastructure development, resource mobilization, and the acquisition of modern technological tools. In terms of student support, institutions need to expand scholarships, bursaries, and loan schemes to ensure equitable access, particularly for learners from disadvantaged backgrounds. Finally, future research should focus on longitudinal and multi-university studies to examine the long-term cost implications for technology education across Kenya, providing deeper insights that can guide evidence-based decision-making.

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