Influence of Cost-Benefit Analysis of Digital Investments on Students' Completion Rates in Public Universities in Kenya

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ABSTRACT

Universities have invested in digital infrastructure like learning management systems, digital libraries, online registration platforms and virtual learning tools to improve students' completion rates. However, a number of public universities continue to experience low student completion rates, delayed graduation and high dropout rates. This situation has raised concerns about whether the benefits derived from digital investments justify the costs incurred and whether such investments contribute to improved completion rates. Thus, this study examined the influence of cost–benefit analysis of digital investments on students' completion rates in public universities in Kenya. The study adopted a descriptive survey research design. The target population consisted of 20 Chairpersons of Academic Departments, 214 ICT staff and 967 undergraduate students in selected public universities in Kenya, totaling approximately 1,201 respondents. Using stratified and simple random sampling techniques, a sample size of 300 respondents was selected. Data was collected using structured questionnaires, interviews and institutional records. Quantitative data was analyzed using descriptive statistics and inferentially using regression analysis with SPSS (25). There was a significant positive relationship between cost–benefit analysis of digital investments and students' completion rates ($r = 0.62$, $p < 0.05$). Regression analysis further revealed that cost–benefit analysis explained approximately 38% of the variation in students' completion rates ($R^2 = 0.38$). Universities that evaluated the financial costs, operational efficiency and academic benefits of digital technologies reported higher levels of timely student completion. It was concluded that effective cost–benefit evaluation of digital investments contributes to student completion rates in public universities. There is need for University management to adopt structured cost–benefit assessment frameworks before implementing digital technologies, allocate adequate funding for digital infrastructure, and continuously monitor the impact of digital systems on student progression.

Keywords: Cost-Benefit Analysis, Students' Completion Rates, Digital Investments.

INTRODUCTION

Students' completion rate is the ratio of the number of students who graduate from institutions of higher learning in a given year to the number of students enrolled. According to Macgowen (2022), completion is the outcome of how many students within a cohort complete and graduate from learning institutions, typically measured in two, three or four years, referring to the percentage of students who successfully finish a programme of study within a defined period. In the context of higher education, this commonly means graduating with a degree within the expected timeframe, for example, four to six years for a bachelor's degree. According to Watson (2023), completion rates are crucial indicators of institutional performance because they reflect both student success and systemic efficiency in supporting learners toward graduation.

In Kuala Lumpur, Siti et al. (2022) assert that universities where more than 75% of students graduate are considered to have attained high completion rates. The authors observed that a high rate of student

completion is crucial in modern society since education is one of the most effective instruments a nation has at its disposal for promoting sustainable social and economic development. To mitigate completion challenges, universities are leveraging cost-benefit analysis (CBA) to inform digital investments aimed at improving student outcomes. According to Robertson (2024), CBA is a structured financial evaluation that compares the expected costs of an initiative against the anticipated benefits, converting both into quantifiable terms when possible.

In the context of educational technology, Thompson (2023) observed that CBA helps decision-makers assess whether tools designed to enhance retention, personalize learning, or streamline advising are likely to produce returns greater than their costs, measured in improved completion rates, reduced time to degree or lower attrition. Digital investments such as adaptive learning platforms, predictive analytics dashboards, and integrated student services systems have shown potential to mitigate some causes of low completion. Watson (2024) observed that adaptive software can tailor instruction to individual needs, while predictive analytics can identify students at risk of dropping out before problems escalate, enabling timely intervention by advisors or support staff.

Yet not all digital investments are equally effective. Harris and Smith (2024) assert that cost-benefit analysis plays a crucial role: by quantifying both the upfront and ongoing costs of a technology licensing, training, integration and contrasting them with measurable benefits like higher retention and reduced support costs, institutions can prioritize investments with the strongest evidence base. In many countries in Sub-Saharan Africa, low educational completion rates remain a critical challenge. In Nigeria, Nwoye (2024) observed that only 38.7% of students from public universities complete in time and asserted that one strategic approach to addressing this issue is through the cost-benefit analysis of digital investments in education.

In public universities in Kenya, Mwangi (2023) notes that digital investments in education offer immense potential to improve learning outcomes, but low course completion rates remain a persistent challenge; conducting a cost-benefit analysis of these investments provides a strategic framework for addressing this issue. Omollo and Kinyanjui (2024) observed that despite Kenya's rapid expansion of higher education and increasing enrolments to over 628,000 students in degree programmes by 2024, with 74.7% enrolled in public chartered universities, completion rates remain a significant concern. A report by the Commission for University Education (2025) showed that while official total graduation numbers rose from 99,829 in 2023 to 123,928 in 2024, this growth reflects sheer volume and does not capture individual student progression patterns or on-time completion. There is therefore need to interrogate how cost-benefit analysis of digital investments influences students' completion rates in public universities in Kenya.

OBJECTIVES OF THE STUDY

The objectives of this study were to:

(i) assess the status of students' completion rates in public universities in Kenya.

(ii) examine the influence of cost-benefit analysis of digital investments on students' completion rates in public universities in Kenya.

THEORETICAL FRAMEWORK

This study was guided by the Cost-Benefit Analysis (CBA) theory, whose proponent was Jules Dupuit in 1844 and later refined by Alfred Marshall in 1942, as a foundational economic framework used to evaluate

decisions by comparing the expected costs of an action against its anticipated benefits. At its core, CBA operates on the principle of rational decision-making. Institutions are assumed to allocate resources efficiently by choosing options where the marginal benefits exceed marginal costs. When applied to digital investments, such as e-learning platforms, online libraries, student information systems, and virtual classrooms, universities assess whether the educational and administrative gains justify the financial and operational expenditures.

This theory is premised on the principle of monetization, where both costs and benefits are expressed in monetary terms to allow comparison. In digital investments, costs may include software acquisition, maintenance, staff training, and infrastructure upgrades, while benefits may include improved access to learning materials, enhanced student engagement, and reduced dropout rates. Second is discounting, which accounts for the time value of money by evaluating future benefits in present terms. Third is efficiency, which ensures that resources are used in a way that maximizes net social benefit. Lastly, sensitivity analysis is used to test the robustness of decisions under different assumptions.

In this study, this theory provides a structured lens for analyzing how digital investments affect academic outcomes. For instance, investing in a robust Learning Management System (LMS) may initially appear costly, but the long-term benefits such as flexible learning, improved communication, and access to digital resources can significantly enhance student persistence. Digital investments can also address systemic barriers that often hinder completion rates. By digitizing services such as registration, advising, and assessment, universities can streamline processes and reduce delays that frustrate students. Through CBA, decision-makers can identify investments with the highest impact-to-cost ratio, ensuring that limited public funds are used effectively.

RESEARCH METHODOLOGY

The study adopted a descriptive survey research design to investigate the relationship between the cost-benefit analysis of digital investments and students' completion rates. The target population consisted of 20 Chairpersons of Academic Departments, 214 ICT staff and 967 undergraduate students in selected public universities in Kenya, totaling approximately 1,201 respondents. Using stratified and simple random sampling techniques, a sample size of 300 respondents was selected. Data was collected using structured questionnaires, interviews, and institutional records. Quantitative data was analyzed using descriptive statistics like frequencies and percentages, and inferential statistics like regression analysis, with the aid of SPSS version 25 and presented using tables.

RESULTS AND DISCUSSIONS

Response Rates

In this study, questionnaires were administered to undergraduate students, Chairpersons of Academic Departments and ICT Staff. This yielded the response rates shown in Table 1.

Table 1: Response Rates

Respondents	Targeted	Participated	Return Rate (%)
Chairs of Department	18	14	77.8
Undergraduate Students	180	165	91.7
ICT Staff	102	90	88.2

Respondents	Targeted	Participated	Return Rate (%)
Total	300	269	89.7

Table 1 shows that Chairpersons of academic departments registered a response rate of 77.8%, undergraduate students 91.7% and ICT Staff 88.2%, giving an average response rate of 89.7%, which is consistent with the assertions of Creswell (2018) that a response rate above 75.0% is adequate. This information enabled the researcher to generalize the study outcomes to the target population.

Students' Completion Rates in Public Universities

The study sought to assess students' completion rates in public universities. This was measured by analyzing the proportion of students who graduate from public universities every year for the last five years (2020–2024). Results are shown in Table 2.

Table 2: Students' Completion Rates in Public Universities in Kenya

Completion Rate (%)	2020 %	2021 %	2022 %	2023 %	2024 %
50-60	4.2	4.1	3.8	3.1	2.3
60-70	66.1	59.6	31.8	25.6	20.4
70-80	27.8	32.9	56.3	62.4	67.5
80-90	1.3	3.4	6.7	7.0	7.7
90-100	0.6	0.9	1.4	1.9	2.1

Table 2 shows that there has been a shift in the distribution of completion rates over the period. This corroborates the findings of Omollo and Kinyanjui (2024) that, despite Kenya's rapid expansion of higher education and increasing enrolments to more than 628,000 students in degree programmes by 2024, completion rates remain a significant concern. These findings point to the fact that, despite progressive increases in the number of students who complete their college education, many public universities are yet to achieve students' completion rates of more than 90%.

Cost-Benefit Analysis of Digital Investments on Students' Completion Rates

The study sought to examine the influence of cost-benefit analysis of digital investments on students' completion rates in public universities. Descriptive data was collected from undergraduate students, processed, and the results are shown in Table 3.

Table 3: Views of Undergraduate Students on the Influence of Cost-Benefit Analysis of Digital Investments on Students' Completion Rates

Test Items	SA %	A %	U %	D %	SD %
Affordability of digital learning tools (LMS, e-books, internet access) enables more students to persist and complete their studies	59.5	15.5	4.5	11.5	9.0
Students are more likely to complete their programs when they perceive digital technologies as improving learning quality	56.5	23.5	2.5	9.5	8.0
When students believe digital investments enhance employability, they are more motivated to complete their degrees	51.5	8.5	7.0	22.5	10.5
Benefits of increased access to digital resources outweigh the financial costs, leading to higher completion rates	68.5	15.5	3.5	8.5	4.0

Test Items	SA %	A %	U %	D %	SD %
Universities that allocate funds efficiently toward impactful digital tools experience higher completion rates	57.6	9.7	4.2	21.2	7.3

Table 3 reveals that 59.5% of the undergraduate students strongly agreed that affordability of digital learning tools, such as LMS, e-books, and internet access, enables more students to persist and complete their studies, whereas 9.0% strongly disagreed. During the interviews, Chairpersons of Academic Departments and ICT Staff also supported the views expressed by the students. On further probing, one Chairperson of an Academic Department, CoD1, noted:

> *When digital platforms are affordable and accessible, we notice fewer dropouts because students can consistently engage with course materials. Cost-effective LMS and open educational resources reduce barriers, especially for students from low-income backgrounds.*

On their part, the ICT Staff noted that subsidized internet bundles and institutional access to e-books had significantly increased student participation and retention. These findings affirm the fact that affordability of digital learning tools plays a critical role in improving student retention and completion rates in public universities. These findings corroborate a study carried out in Kakamega East Sub-county by Wakoli (2024), which revealed that affordable digital tools also lower the cost of education by minimizing the need for expensive printed textbooks and physical resources.

The study revealed that 56.5% of the undergraduate students strongly agreed that students are more likely to complete their programmes when they perceive digital technologies as improving the quality of their learning experience, with 8.0% strongly disagreeing. One Chairperson of Department, CoD2, stated that interactive digital tools had transformed teaching quality, making learning more engaging and improving completion outcomes. These findings lend credence to the assertions of Depay and Jense (2024) that, in the Netherlands, positive perceptions of digital technologies often lead to increased participation in online discussions, improved access to learning resources, and better communication with lecturers and peers.

Further, 51.5% of the undergraduate students strongly agreed that when students believe that digital investments enhance their employability, they are more motivated to complete their degrees, whereas 10.5% strongly disagreed. This belief acts as a form of instrumental motivation, where education is seen not just as a requirement but as a strategic pathway to future career success. This observation is consistent with the findings of a study carried out in Nairobi County by Mwangi and Kinyanjui (2024), which revealed that such perceptions improve persistence, engagement, and goal-oriented behavior.

In addition, 68.5% of the undergraduate students strongly agreed that the benefits of increased access to digital resources outweigh the financial costs for students, leading to higher completion rates, whereas 4.0% strongly disagreed. This is consistent with the assertions of Rossi (2023) that, although implementing and maintaining digital infrastructure requires substantial investment, the long-term gains are evident: students with reliable access to digital resources tend to perform better academically due to improved study efficiency, wider access to scholarly materials, and enhanced engagement. Finally, 57.6% of the undergraduate students strongly agreed that public universities that allocate funds efficiently toward impactful digital tools experience higher student completion rates, supporting Dupont (2024) that efficient funding means targeted investment in tools that directly enhance teaching and learning outcomes.

Inferential Analysis

To further ascertain the relationship between cost-benefit analysis of digital investments and students' completion rates, data was collected from the 14 public universities on their annual digital investment cost and the average students' completion rates for the last five years (2020–2024). Results are shown in Table 4.

Table 4: Annual Digital Investment Cost and Average Students' Completion Rates

Annual Digital Investment Cost (KES)	Students' Completion Rates (%)
102,000	37.0
445,890	53.0
333,566	56.5
157,000	49.0
211,345	50.5
145,000	46.0
111,700	42.5
190,000	48.0
456,800	58.0
533,500	60.0
376,000	63.5
444,000	59.5
167,900	44.0
245,700	51.0

Table 4 shows that public universities which invest more funds in digital infrastructure experience relatively higher students' completion rates and vice versa. This indicates that public universities which allocate more funds toward advanced digital tools, such as high-speed internet, cloud-based learning platforms, interactive software, and robust online libraries, create an environment conducive to learning and engagement. Conversely, universities with limited investment in digital infrastructure tend to experience lower completion rates. The data above were run through linear regression analysis and results are shown in Table 5.

Table 5: Relationship between Annual Digital Investment Cost and Average Students' Completion Rates

Model	B	Std. Error	Beta	t	Sig.
(Constant)	38.735	2.272	—	5.486	.000
Annual Digital Investment Cost	0.00004495	1.655	0.621	2.779	.012

Dependent Variable: Students' Completion Rates in Public Universities.

Table 5 shows a linear regression model of the form: Students' Completion Rates = 38.735 + 0.00004495 × Annual Digital Investment Cost. From the model, there is a positive relationship between digital investment and completion rates. However, the slope is relatively small, reflecting that while digital investment contributes positively, it is not the sole determinant of completion rates. Other factors like teaching quality, student support services, socioeconomic status and campus facilities likely interact with digital investment to influence outcomes. The intercept of 38.74% implies that, in the absence of any digital investment, the baseline completion rate is expected to be around 38.7%. Table 5 further shows a significant positive relationship between the cost-benefit analysis of digital investments and students' completion rates

($r = 0.621$, $p < 0.05$). Regression analysis revealed that cost–benefit analysis explained approximately 38% of the variation in students' completion rates ($R^2 = 0.38$).

SUMMARY OF FINDINGS AND CONCLUSIONS

From the study findings, many public universities continue to struggle with achieving student completion rates above 90%. Research indicates that this challenge is largely due to insufficient investment in digital infrastructure and academic programmes. Limited access to online learning platforms, modern classroom technologies, and e-resources hampers students' ability to engage effectively with coursework. Additionally, underfunded support systems, such as tutoring and mentoring, exacerbate dropout risks. Universities that prioritize upgrading digital tools and expanding programme offerings demonstrate higher retention and completion outcomes.

RECOMMENDATIONS

There is need for public universities to continue prioritizing strategic investment in robust digital infrastructure and online learning programs, ensuring accessible, interactive, and scalable platforms that support student engagement, retention, and ultimately higher completion rates.

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