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Influence of ICT Infrastructure on School Managers' Utilisation of Educational Management Information Systems in Public Senior Schools in Nakuru County, Kenya

Authors
Winnie M. Kiprono [1]; Lydia K. Kobiah [2]; Joel K. Kiboss [3]
Main author's email: kmilka@kabarak.ac.ke

(1.2.3) Kabarak University, Kenya

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Abstract
This study examined the influence of ICT infrastructure on school managers' utilisation of Education Management Information Systems (EMIS) in public senior schools in Nakuru County, Kenya. Guided by Social Cognitive Theory and the Technology Acceptance Model II (TAM2), the research employed a convergent parallel design. Questionnaires were administered to 62 principals, 152 deputy principals, and 157 class teachers, alongside interviews with 62 principals and 11 sub-county education directors and 1 county education director. Response rate was 100 per cent principals, 79.58 per cent deputy principals and 82.20 per cent for class teachers, overall= 83.56 per cent Regression. Quantitative data were analysed using descriptive statistics and simple linear regression, while qualitative data underwent thematic analysis. Results showed that ICT infrastructure was a significant predictor of EMIS utilisation among deputy principals ($R^2 = .344$, $F (1, 150) = 78.71$, $p < .001$, Cohen's $f^2 = 0.524$), accounting for 34.4 per cent of the variation in use. Qualitative findings revealed persistent challenges, including unreliable electricity, outdated computers, poor internet connectivity, and infrastructural disparities across schools. The findings indicate that sustained EMIS utilisation depends heavily on adequate technological resources. Consequently, the study recommends targeted investments in under-resourced schools, provision of dependable technical support, and data submission monitoring frameworks that account for existing infrastructural disparities.

Key terms: Convergent parallel design, Education Management Information System (EMIS), ICT infrastructure, Kenya, Nakuru County, National Education Management Information System (NEMIS), and utilisation.

INTRODUCTION

Education Management Information Systems (EMIS) are used to collect, process and use data in both ministries of education and in schools to improve education planning, resource allocation and quality of education (Iwogbe et al., 2025). A number of Sub-Saharan countries, including South Africa, Ghana, Nigeria, Tanzania and Kenya, have adopted EMIS in order to enhance accountability and evidence-based policy formulation (Asio et al., 2022). In Kenya, the Basic Education Act 2013, Section 8, mandated the Cabinet Secretary to establish and maintain an integrated EMIS for basic education (Republic of Kenya, 2013). In January 2018, a new EMIS, called the National Education Management Information System (NEMIS), was launched and is used as a central repository for school data on learner enrolment, attendance, personnel and fees, among others (Ministry of Education, 2018).

The government introduced the system because manual records were cumbersome and hampered school management. Even so, use in public senior schools remains limited despite heavy government investment in ICT infrastructure (Wamutoro et al., 2022). A Ministry of Education report to the National Assembly found that learner numbers in EMIS differed from actual enrolment by as much as 50 per cent, a gap attributed to inconsistent data that weakened the allocation of resources to schools (Ministry of Education, 2020). More recent verification work reports that data are still submitted late, incompletely or incorrectly, which makes school records hard to validate (Ministry of Education, 2026). Focusing on capacity building and a culture of digital data use in schools, the ICT in Education and Training Policy gives attention to this (Republic of Kenya, 2021). However, the practical environment for this is not even.

Studies in Kenya correlate low EMIS uptake with the lack of adequate ICT infrastructure, poor training of EMIS users and poor internet connectivity (Mwadulo & Odoyo, 2020). Evidence on infrastructure in Nakuru County is thin. Njeru and Wanjau (2020) found that public senior schools in Nakuru West Sub-County were poorly prepared to integrate ICT into management, but they studied readiness rather than EMIS use. Studies from other counties may not transfer to Nakuru, where schools range from urban to remote rural settings with very different access to electricity, connectivity and technical support. Little empirical work has tested how ICT infrastructure relates to EMIS use among school managers in the county.

Previous studies in Kenya have established a link between school infrastructure and EMIS use, but they differ in scope and methods. For instance, Mwadulo and Odoyo (2020) used a descriptive design in Nairobi County, while Kasimir et al. (2021) surveyed principals in Keiyo North Sub-County. Njeru and Wanjau (2020) focused on general ICT readiness rather than EMIS use in Nakuru West Sub-County. Most of these studies relied on single sub-counties and did not test the relationship statistically. This study addresses this gap by using a mixed-methods design across all school categories in Nakuru County.

This study therefore examines the influence of ICT infrastructure on school managers' utilisation of EMIS in public senior schools in Nakuru County. It tests the null hypothesis that ICT infrastructure has no significant influence on EMIS utilisation and uses interviews to explain the pattern found. The findings will provide a county-specific estimate of the relationship between infrastructure and utilisation. This evidence will help the Ministry of Education target resource allocation to under-resourced schools and guide policy on infrastructure investment.

Theoretical Framework

EMIS use depends on the person and on the setting. Managers need skills, confidence and a favourable view of the system, but they also need the equipment and support to act on them. The study therefore draws on Social Cognitive Theory (SCT) and the Technology Acceptance Model 2 (TAM2).

Social Cognitive Theory

Bandura (1986) explained behaviour as the outcome of continuing interaction between personal factors, behaviour and the environment. Self-efficacy, a person's belief that they can organise and carry out the actions needed to reach a given result, is central to the theory. For EMIS, it covers the confidence to enter, retrieve, verify and interpret data, to produce reports and to resolve technical problems. The environment is represented here by ICT infrastructure: computers, software, internet connectivity and electricity. A

manager with high self-efficacy still has little opportunity to use EMIS if these are missing, whereas adequate infrastructure gives capable managers room to apply their skills. SCT does not, however, explain how users come to form attitudes towards an information system.

Technology Acceptance Model 2

Davis (1989) proposed that acceptance of a technology depends on perceived usefulness, the belief that the system will improve one's work, and perceived ease of use, the belief that it will be free of effort. These beliefs shape attitude, intention and actual use. Venkatesh and Davis (2000) extended the model because it said little about how perceived usefulness is formed. TAM2 adds social influence processes (subjective norm, voluntariness and image) and cognitive instrumental processes (job relevance, output quality and result demonstrability). Subjective norm is the pressure a person feels from important others to use the system; voluntariness is whether use is seen as optional. Image is the standing that use is expected to bring within the organisation. School managers are therefore more likely to use EMIS if they see it as relevant to their work, reliable, capable of producing useful reports and easy to operate, and if the Ministry and colleagues expect them to use it.

TAM2 has limits of its own. It concentrates on perceptions and intention and says little about users' confidence in performing technology tasks. It also treats the wider context, including electricity, internet access and technical support, only indirectly, although favourable attitudes do not lead to use where such conditions are absent. This matters in public senior schools, where resources differ widely. Used together, SCT supplies the environmental and capability perspective and TAM2 the acceptance perspective. SCT informs the independent variable by defining ICT infrastructure as the environmental condition that enables or limits EMIS use. TAM2 provides the contextual interpretation for the dependent variable by explaining how users form attitudes toward the system. The combined framework is used as a heuristic lens rather than a single testable model.

Conceptual Framework

Figure 1 presents the conceptual framework guiding this study. The independent variable is ICT infrastructure, which is defined by the availability and reliability of hardware, software, connectivity, electricity, and technical support. The dependent variable is the effective utilisation of EMIS, measured by the timeliness, accuracy, and use of data for school management tasks. As indicated by the framework, the expected relationship is positive: improvements in ICT infrastructure are expected to lead to higher levels of EMIS utilisation.

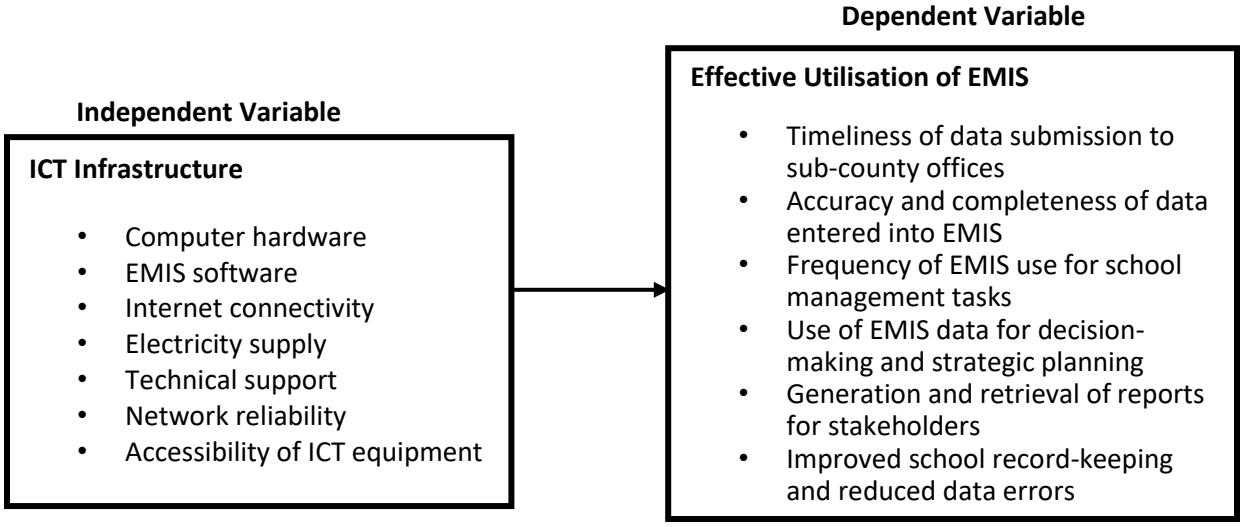


Figure 1: Conceptual Framework

LITERATURE REVIEW

UNESCO (2022) reports that EMIS are now common across the Arab States, Asia and the Pacific, Latin America and Sub-Saharan Africa. About 80 per cent of countries have developed their own systems, and others use platforms such as StatEduc and OpenEMIS or Excel-based solutions (Shailendra, 2022). Whatever the platform, effective use requires enough computers, software, electricity, connectivity, system compatibility and technical support (Van Wyk & Crouch, 2020). Where infrastructure is weak and user support limited, EMIS functionality suffers, and the high cost of hardware and software keeps investment low in many schools (Bariu, 2020; Van Wyk & Crouch, 2020). Tulowitzki et al. (2022) found that school principals use ICT for management tasks but face barriers of limited competence and support.

Studies on this topic vary in design. Mbawala et al. (2024) used qualitative interviews with five principals in Dodoma, while Andollo et al. (2023) used a quantitative survey in Kenyan universities. The qualitative studies highlight practical barriers, such as power outages and poor connectivity, while the quantitative studies measure the strength of associations. For example, Andollo et al. (2023)

reported a significant association between infrastructure and system use, but the study was limited to distance-learning institutions.

In Sub-Saharan Africa, EMIS are promoted to monitor progress on Sustainable Development Goal 4 (Shailendra, 2022), yet governments face resource limits that hinder service delivery (Jallow & Sanner, 2023). Infrastructure problems are often severe, including unreliable electricity, poor connectivity, inadequate hardware, limited technical support and limited funding. Studies in Tanzania, Ghana and South Africa report that schools with better infrastructure, regular training and supportive leadership use EMIS more than those without them. However, human capacity and system management remain problems (Tigere, 2020). Harerimana (2020) identified weak internet connectivity as a main obstacle in Rwanda. Mwenda and Mwasandube (2024) evaluated the Primary School Records Management System (PReM), a locally developed EMIS in Tanzania. They concluded that such systems improve data management, transparency and accountability where power, internet access, user competence, training and technical support are in place. Edim et al. (2024) reported low utilisation of management information systems among school managers in Ogoja Education Zone, Nigeria.

Mbawala et al. (2024) interviewed five principals in Dodoma City, Tanzania. The principals relied on EMIS as a repository for school data and for attendance, enrolment, finance and communication. Still, they described a shortage of ICT experts, inadequate internet connectivity, limited budgets, frequent power outages, software that was hard to use, and problems of integration. The study was qualitative, confined to urban schools, and did not use a model such as TAM2 to explain use.

Kenya has invested heavily in ICT infrastructure and has a functioning EMIS, but use is uneven. Kasimiri et al. (2021) reported that technical skills influence EMIS use in Keiyo North Sub-County, that some schools are technologically advanced and have technical assistance while others do not, and that school leaders differ widely in confidence and readiness. Urban schools tend to use EMIS for tracking attendance and performance, whereas rural schools struggle with outdated equipment, poor connectivity and limited training (Wamutoro et al., 2022). Mwadulo and Odoyo (2020) found inadequate ICT infrastructure and limited training capacity among NEMIS users in Nairobi County.

They argued that owning equipment is not enough: schools must also maintain it, prepare staff to use digital tools and have leaders who understand EMIS. In Turbo Sub-County, Kosgei et al. (2022) found progress in record management and monitoring, held back by weak internet and inadequate funding. Andollo et al. (2023) found a significant association between the availability of ICT infrastructure and the use of a student management information system in distance-learning teacher education at selected Kenyan universities ($\chi^2 = 62.609$, $p < 0.05$).

In Nakuru County, Njeru and Wanjau (2020) reported low ICT readiness in public senior schools in Nakuru West Sub-County, linked to poor infrastructure, weak internet connectivity and limited ICT skills among

managers. Readiness to use ICT does not show how far infrastructure affects the use of EMIS specifically, and none of the studies reviewed tested that relationship in the county.

Summary

The reviewed studies highlight infrastructure as a key factor in EMIS use, but they differ in scope and methods. For instance, Mwadulo and Odoyo (2020) used a descriptive survey in Nairobi County, while Kosgei et al. (2022) focused on a single sub-county in Turbo. Njeru and Wanjau (2020) examined general ICT readiness in Nakuru West rather than EMIS use specifically. These studies are mostly limited to single sub-counties, rely on descriptive statistics, and do not test the statistical relationship between infrastructure and utilisation. This study addresses these limitations by using a mixed-methods design across multiple school categories in Nakuru County, providing a broader and statistically tested account of the infrastructure-utilisation relationship.

METHODOLOGY

A convergent parallel mixed-methods design was adopted (Creswell & Creswell, 2022). Quantitative and qualitative data were collected concurrently, analysed separately, and compared for convergence, divergence, and complementarity (Creswell & Clark, 2017). The study was conducted in Nakuru County, Kenya, which had approximately 2.16 million residents in the 2019 census (KNBS, 2019).

The accessible population comprised 384 public senior schools and 1,558 respondents, including education directors, principals, deputy principals, and class teachers. Nassiuma's (2000) formula yielded sample sizes of 142 principals, 143 deputy principals, and 174 class teachers. The deputy principal and teacher samples were increased to 191 each to accommodate anticipated non-response (Mugenda & Mugenda, 2003).

Stratified random sampling covered national, extra-county, county, and sub-county schools. Principals and deputy principals from selected schools were included, alongside one randomly selected Form Three class teacher per school. The County Director and 11 Sub-County Directors of Education were purposively selected for oversight roles. Questionnaires and interview schedules were used, with items rated on a five-point Likert scale. Validity was assessed through expert review and pretesting in five schools outside the study area. The ICT infrastructure scale achieved a Cronbach's alpha of 0.877, indicating acceptable reliability.

Ethical approval was obtained from KUREC, and a NACOSTI permit was secured. Informed consent, voluntary participation, confidentiality, and anonymisation were maintained. Quantitative data were analysed using descriptive statistics and simple linear regression, with Cohen's f^2 measuring effect size. Data underwent thematic analysis following Braun and Clarke's (2006) six phases. Findings were integrated to assess convergence, divergence, and complementarity.

FINDINGS AND DISCUSSION

Demographic Characteristics of Respondents

Among class teachers, 61.1 per cent were male and 38.9 per cent female; 49.7 per cent were aged 25 to 34 and 40.1 per cent aged 35 to 44, and 43.9 per cent had one to five years of teaching experience (29.9% had six to ten). Deputy principals were 51.3 per cent male and 48.7 per cent female; 69.7 per cent were aged 45 to 54 and 21.1 per cent aged 35 to 44, and 49.3 per cent had more than 15 years of experience (43.4% had 11 to 15). Principals were 56.5 per cent male and 43.5 per cent female; 58.1 per cent were aged 45 to 54 and 37.1 per cent were 55 or older, and 85.5 per cent had more than 15 years of teaching experience.

Descriptive Statistics

Table 2 gives the ratings of the three questionnaire groups on ICT infrastructure and EMIS use.

Table 1: Respondents' Ratings of ICT Infrastructure and EMIS Utilisation

Statement	SD	D	N	A	SA	M	Std. dev.
Class teachers (n = 157)							
1. Digital records are accessible and more durable than manual records	0 (0.0)	6 (3.8)	25 (15.9)	76 (48.4)	50 (31.8)	4.08	0.79
2. Students' marks stored in a computer are easily accumulated for decision-making on promotion	0 (0.0)	6 (3.8)	46 (29.3)	62 (39.5)	43 (27.4)	3.90	0.85
3. EMIS software helps follow learners' progress from one class to the next	1 (0.6)	8 (5.1)	45 (28.7)	61 (38.9)	42 (26.8)	3.86	0.89
4. The school has no stable electricity for EMIS utilisation†	30 (19.1)	48 (30.6)	50 (31.8)	22 (14.0)	7 (4.5)	2.54	1.09
5. EMIS software is installed on the principal's computer only, not on all computers	28 (17.8)	42 (26.8)	41 (26.1)	35 (22.3)	11 (7.0)	2.74	1.19
Deputy principals (n = 152)							
1. ICT infrastructure supports secure storage and preservation of EMIS data	0 (0.0)	4 (2.6)	24 (15.8)	68 (44.7)	56 (36.8)	4.16	0.78
2. Computerised records in EMIS are accessible to EMIS users	0 (0.0)	4 (2.6)	33 (21.7)	67 (44.1)	48 (31.6)	4.05	0.80
3. Electricity is sufficiently reliable for continuous EMIS use	1 (0.7)	10 (6.6)	30 (19.7)	64 (42.1)	47 (30.9)	3.96	0.91
4. The available hardware and software adequately support EMIS functions	1 (0.7)	15 (9.9)	41 (27.0)	60 (39.5)	35 (23.0)	3.74	0.95
5. Stable internet connectivity makes it easier for EMIS utilisation	7 (4.6)	22 (14.5)	41 (27.0)	50 (32.9)	32 (21.1)	3.51	1.12
Principals (n = 62)							
1. Computer hardware helps prevent loss of school records	0 (0.0)	1 (1.6)	11 (17.7)	22 (35.5)	28 (45.2)	4.24	0.80
2. Students' marks stored electronically are easy to process for decision-making	0 (0.0)	3 (4.8)	11 (17.7)	27 (43.5)	21 (33.9)	4.06	0.85
3. Computerised records are more durable and secure than paper records	0 (0.0)	2 (3.2)	15 (24.2)	29 (46.8)	16 (25.8)	3.95	0.80
4. The school allocates funds to upgrade ICT facilities for EMIS	10 (16.1)	16 (25.8)	15 (24.2)	18 (29.0)	3 (4.8)	2.81	1.17

Note: Cells show count (%). SD = strongly disagree, D = disagree, N = neutral, A = agree, SA = strongly agree. †Negatively worded item; a low mean indicates that electricity was stable.

Class teachers rated the value of digital records most favourably. 'Digital records are accessible and more durable than manual records' had the highest mean (*M* = 4.08, *SD* = 0.79), with 80.3 per cent agreeing or strongly agreeing. Marks stored on computers for

promotion decisions (M = 3.90) and tracking learners' progress (M = 3.86) also scored well. The item on unstable electricity was negatively worded, so its mean of 2.54 (SD = 1.09) means that most teachers reported stable power: 49.7 per cent disagreed or strongly disagreed that it was unstable and 18.5 per cent agreed. The spread of responses suggests that experience differed between schools. On EMIS being installed only on the principal's computer, 29.3 per cent agreed (M = 2.74, SD = 1.19), so in most schools the software was available on more than one machine.

Deputy principals gave the highest mean to secure storage and preservation of EMIS data (M = 4.16, 81.6% agreement), followed by accessibility of records (M = 4.05, 75.7%) and reliable electricity (M = 3.96, 73.0%). Hardware and software (M = 3.74) and stable internet connectivity (M = 3.51, SD = 1.12) scored lowest, which suggests that even where electricity is available, unstable internet access can undermine EMIS use in some schools.

Principals gave high means to the role of hardware in preventing loss of records (M = 4.24, 80.6% agreement), the ease of processing marks electronically (M = 4.06, 77.4%) and the durability and security of computerised records (M = 3.95, 72.6%). In contrast, the statement that the school allocates funds to upgrade ICT facilities for EMIS had a low mean (M = 2.81, SD = 1.17), with only 33.9 per cent agreeing and 41.9 per cent disagreeing or strongly disagreeing. Principals valued computerised records, but financial constraints at the school level appear to limit investment in the infrastructure that supports them.

Regression Analysis

Regression used the responses of deputy principals (n = 152), the main school-level users who are required to submit, verify and report EMIS data. ICT infrastructure was the predictor and EMIS utilisation the outcome (Table 3).

Table 2: Simple Linear Regression of EMIS Utilisation on ICT Infrastructure

Predictor	*B*	*SE*	β	*t*	*p*	95% CI for *B*
Constant	−1.544	0.576	–	−2.681	.008	[−2.682, −0.406]
ICT infrastructure (13-item composite mean)	1.392	0.157	0.587	8.872	< .001	[1.082, 1.703]

Note: R = 0.587, R^2 = 0.344, adjusted R^2 = 0.340, standard error of the estimate = 0.561; F (1, 150) = 78.705, p < .001. Dependent variable: EMIS utilisation.

The model was statistically significant, F (1, 150) = 78.705, p < 0.001. ICT infrastructure explained 34.4 per cent of the variance in EMIS utilisation (R^2 = 0.344; adjusted R^2 = 0.340). The fitted equation was $Y = -1.544 + 1.392X_1$. The intercept has no practical meaning because the scale contains no zero and was not interpreted. The slope (B = 1.392, 95% CI [1.082, 1.703], p < 0.001) indicates that each one-point rise in the ICT infrastructure composite on the five-point scale was associated with a 1.392-point rise in EMIS utilisation. The standardised coefficient (β = 0.587) means that a one-standard-deviation increase in infrastructure was associated with a 0.587-standard-deviation increase in utilisation.

Cohen's effect size was $f^2 = R^2 / (1 - R^2) = 0.344 / 0.656 = 0.524$. Cohen (1988) treats values of 0.02, 0.15 and 0.35 as small, medium and large, so the effect was large. The null hypothesis was rejected.

Interview Findings

Interviewees are identified by role and sequence number (P = principal, SCDE = Sub-County Director of Education, CDE = County Director of Education). Interviews were held with the County Director of Education, all 11 Sub-County Directors of Education and principals from the sampled schools. Responses were recorded in an interview book during each session; the interviews were not audio-recorded or transcribed. Thematic analysis produced four sub-themes: electricity supply, computer hardware, internet connectivity, and disparities between schools.

Electricity supply

Interviewees identified unreliable electricity as a barrier to EMIS work, especially in the rainy season. A Sub-County Director linked it to ageing equipment:

> *We have schools here that were allocated computers through various government programmes ten years ago, but those machines are now obsolete. They cannot run the NEMIS platform efficiently. And when the power goes out, which happens often during the rainy season, no work can be done at all* (SCDE-01).

One principal explained the cost of coping with outages:

> *When the power goes out, which happened three times last month alone, we cannot use the computer. We have a small generator, but fuel is expensive, and the school budget cannot afford to run it for more than an hour at a time. If the power is out for a full day, we lose a full day of EMIS work* (P-01).

A principal from a national school had avoided the problem:

> *We installed solar panels on the administration block two years ago. The power the computers and the internet router during the day, and we have battery storage that lasts through most evenings. Power outages no longer affect our EMIS work because we have a backup system* (P-05).

The contrast suggests that schools with more money can protect themselves against power failure, while poorer schools remain exposed.

Computer hardware

Some schools depended on a single computer for all EMIS tasks, so a breakdown stopped the work:

> *We have one computer in the deputy's office that we use for all EMIS data entry. When that computer breaks down, which happened three times last term, we cannot submit our reports until it is repaired. The technician from the sub-county office came after two weeks. During that time, we fell behind on all our data submission deadlines* (P-01).

A Sub-County Director pointed out that averages hide the differences between schools:

> *In my sub-county, the average number of computers per school is about eight. But that average hides the reality. Some schools have twenty computers. Others have two. And of those two, only one might be functional. The schools with one functional computer are the ones that miss deadlines most frequently* (SCDE-01).

The County Director described the origin of the problem:

> *Schools that invested in computer labs during the Digital Literacy Programme are better off. But many schools did not receive computers, or received outdated ones. The government has not provided a replacement cycle, so schools are stuck with ten-year-old machines that run slowly and crash frequently* (CDE-01).

Internet Connectivity

Schools with fibre connections generally reported reliable service, while those relying on mobile broadband reported frequent disruption. A Sub-County Director described the divide:

> *Fibre is available in Nakuru town and along the main highway, but once you go into Kuresoi or Subukia, the fibre network does not reach. Schools there must use mobile broadband, which is expensive and unreliable. When the network is congested, which happens every evening, the EMIS portal takes minutes to load a single page* (SCDE-02).

A principal from an extra-county school, which had paid for fibre from its own budget, reported the opposite experience:

> *We invested in fibre optic internet two years ago through the school's own*

> *budget. We have 20 functional computers networked throughout the administration block, and a dedicated ICT technician on staff. This means our EMIS data entry is smooth. We have never missed a submission deadline, and we can access the system from any computer on the school network* (P-03).

Disparities Between Schools

Interviewees consistently described gaps between urban and rural schools, between national or extra-county schools and sub-county schools. The County Director said:

> *The difference is like night and day. Our national and extra-county schools are generally well housed, as they receive higher capitation and are allowed to supplement the government's contributions with parents' contributions. But in sub-county schools, especially those in hard-to-reach places, the difference in infrastructure is huge. This establishes a kind of two-tier system, opening the EMIS window for some schools to use the system effectively while others are staring at the login screen* (CDE-01).

A Sub-County Director and a principal raised the question of fairness in monitoring:

> *Schools in Nakuru town have fibre internet, modern computers, and stable electricity. Schools in Kuresoi do not have any of these. Yet both types of schools are required to submit the same reports by the same deadlines. The playing field is not level, and the Ministry never considers these differences when it punishes schools for submitting late* (SCDE-04).

The sub-county director compares our submission rates with schools around Nakuru town. But these schools have ICT teachers, special computer labs, and fibre internet. We have one computer, mobile broadband and spotty electricity. It is not a fair comparison and it demoralises my staff (P-02).

Integration of Quantitative and Qualitative Findings

Table 3: Comparison of Quantitative and Qualitative Findings on ICT Infrastructure

Quantitative finding	Qualitative finding	Result
ICT infrastructure predicted EMIS utilisation ($R^2 = 0.344$, $\beta = 0.587$, $p < 0.001$; $f^2 = 0.524$)	Schools with fibre, backup power and enough computers reported smooth EMIS work; others missed deadlines.	Convergence
Principals' funding item: $M = 2.81$, 33.9% agreement	Schools could not afford to run generators or replace ageing computers	Convergence
Deputy principals rated internet connectivity lowest ($M = 3.51$)	Mobile broadband was slow and unreliable outside towns; fibre schools had few problems	Convergence
Electricity rated reliable by most deputy principals ($M = 3.96$) and class teachers ($M = 2.54$ on the negative item)	Outages frequent in rural and under-resourced schools; well-resourced schools had backup power.	Partial convergence: a favourable overall picture that hides uneven experience
High means for the benefits of digital records ($M = 3.86$ to 4.24)	Delays and idle EMIS time when equipment or power failed	Complementary: schools valued digital records but did not have equal means to use them

Note: Quantitative findings are from Tables 2 and 3; qualitative findings are from the interviews reported in findings section.

The two strands mostly converged. The regression showed that infrastructure and utilisation are strongly associated, and the interviews described how schools with unreliable power, few or ageing computers and poor connectivity lost time and missed deadlines. In

contrast, schools with fibre, backup power and enough machines worked smoothly. The one qualification concerns electricity. Survey means were favourable overall, whereas interviewees stressed outages in rural and under-resourced schools, so the average appears to conceal a minority of schools with serious problems.

Discussion

This study tested whether ICT infrastructure influences school managers' utilisation of EMIS in public senior schools in Nakuru County. The null hypothesis was

rejected: infrastructure significantly predicted utilisation and accounted for 34.4% of its variance, a large effect by Cohen's (1988) conventions. The interviews explained how this happens. Where power

fails, computers are old, or there are few and connectivity is weak, EMIS work stops or is delayed, and deadlines are missed. Where schools had fibre, backup power and enough machines, work ran smoothly.

The result fits Social Cognitive Theory, which treats the environment as a condition that enables or limits what capable people can do (Bandura, 1986). Managers in poorly equipped schools can hardly apply their skills, whatever their confidence. It also supports the reservation about TAM2 noted earlier. Respondents in

all three groups valued digital records highly (means of 3.86 to 4.24 on the benefit items), yet the interviews showed that favourable views did not remove practical barriers. These items describe perceptions of digital records rather than TAM2 constructs, so the study cannot test acceptance directly. Infrastructure explained about a third of the variance, which leaves the rest to other influences such as training, technical support and user attitudes.

The findings agree with earlier work linking EMIS use to power, internet access and equipment. Mbawala et al. (2024) reported frequent outages, poor connectivity and limited budgets among principals in Dodoma, and Harerimana (2020) found weak connectivity to be a main obstacle in Rwanda. Mwenda and Mwasandube (2024) and Njeru and Wanjau (2020) reached similar conclusions in Tanzania and in Nakuru West. Bariu (2020) attributes low ICT investment in schools to the high cost of hardware and software. That fits the low agreement among principals that their schools set aside money for upgrading ICT (M = 2.81) and the fact that principals could run a generator for only an hour at a time. Andollo et al. (2023) likewise found a significant association between infrastructure and the use of a student information system in Kenyan universities. The present study adds a quantified estimate for public senior schools and evidence of variation within one county.

The interviews also revealed a two-tier pattern. National and extra-county schools, which the County Director said receive higher capitation and may add parental contributions, were better equipped than sub-county schools in remote areas. This echoes the urban–rural gap reported by Wamutoro et al. (2022) and shows that the gap exists inside a single county. Interviewees added a point about accountability: schools with very different infrastructure face the same deadlines and are compared with one another, which one principal said demoralised staff. If timely submission is used to judge schools, unequal infrastructure will penalise those least able to comply.

Other studies emphasise training and attitudes. In Ghanaian senior high schools, most teachers viewed EMIS training positively, yet implementation problems persisted (Ibrahim et al., 2025). Al-Balah (2025) found that technological, organisational and environmental factors all influence adoption of EMIS. UNESCO (2022) and the Global Partnership for Education (2024) name inadequate training, limited technical support and system-related problems as barriers in Sub-Saharan Africa.

The present data are consistent with this wider picture. The two-week wait for a sub-county technician described by one principal is a support problem as much as a hardware one. Interventions aimed at training or attitudes are unlikely to succeed fully without adequate infrastructure and support.

Limitations

First, the cross-sectional design supports association, not causation. Second, the regression used deputy principals' self-reports for both the predictor and the outcome, which raises the risk of common-method bias, and it excluded principals' and teachers' data. Third, ICT infrastructure was the only predictor, so its estimated effect may partly reflect correlated factors such as training or managers' efficacy, which were not measured. Fourth, only 43.7 per cent of the principals originally contacted took part, so the principal sample may not represent all principals. Fifth, the study covered a single county, and findings may not apply elsewhere.

CONCLUSION AND RECOMMENDATIONS

Conclusion: ICT infrastructure significantly predicts for 34.4 per cent of the variance with a large effect size. Qualitative findings confirm that EMIS use is stronger in schools equipped with more computers, reliable internet, and stable electricity. However, these resources remain unevenly distributed, with national and extra-county schools outperforming sub-county schools, particularly in remote areas like Kuresoi and Subukia. Effective EMIS adoption therefore hinges on adequate and equitable infrastructure.

Recommendations: To address these disparities, the Ministry of Education and the Ministry responsible for ICT should prioritise stable electricity, functional computers, and reliable internet in sub-county and remote schools such as Kuresoi North, Kuresoi South, and Subukia, while establishing a formal replacement cycle for obsolete equipment. They should appoint at least one dedicated ICT officer per sub-county to support EMIS, leverage ICT-trained teachers as frontline school support, and account for infrastructural differences when evaluating submission deadlines and performance metrics.

Meanwhile, school management should install EMIS across multiple computers rather than relying on a single workstation, maintain a dedicated budget line for hardware maintenance and system upgrades, and invest in backup power solutions like solar panels.

Finally, future research should employ longitudinal studies spanning two to three years to track cause-and-effect relationships as infrastructure improves. Subsequent models should simultaneously evaluate infrastructure, staff training, managerial efficacy, and user acceptance, while cross-county comparative studies and inquiries into student learning outcomes will help determine whether these Nakuru findings hold more broadly.

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