# Exploring the Impact of Technology on Educational Management Information Systems in Nyanza Region, Kenya: A Comprehensive Analysis.

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## ABSTRACT

Information systems are created to enable organizations utilize technologies to gather and use information for effective management. The Ministry of Education (MOE) is committed to the implementation of Education Management Information System (EMIS) to provide data to improve planning, policy formulation and decision-making. MOE provides IT infra structure, trains personnel to manage data collection and it provides funds annually to the District Education Officers (DEO) to facilitate EMIS activities since 2004. Despite these efforts, EMIS technical team survey reveals that data capture completion rate has been low at the districts education offices thereby delaying the nationwide data processing; while the counties of Nyanza had the lowest data entry completion rate. This study aims to investigate the impact of technological factors on EMIS outcomes. The study employed both correlation and descriptive survey designs. The population consisted of 36 District EMIS coordinators, 72 Data Capture Personnel, 36 DEOs and the Regional EMIS Coordinator. Stratified sampling technique was used to select 29 District EMIS coordinators, 68 Data Capture Personnel, 29 DEOs and 1 Provincial EMIS Coordinator. The data were collected using questionnaires and Interview schedules. The regression results showed that technological factors contributed 12.7% towards EMIS outcomes. Staff competency (beta = 0.448) and IT infrastructure (beta = 0.258) were the best technological predictors of EMIS outcomes. The study recommended the MOE to empower the EMIS coordinators with more IT technical expertise to carry out maintenance of the IT infrastructure and to promote the cooperation among semi-autonomous governmental and nongovernmental organizations to participation in the process of developing an integrated platform and share new technologies for collection of educational data.

**Keywords:** Factors, Education, Information Systems Outcomes, Technological, Nyanza Region, Kenya.

## INTRODUCTION

Ang et al. (2001a) reference Deming's (1986) Total Quality Management (TQM) theory, which posits that the continuous collection and utilization of statistical data and information are pivotal for effective management. Consequently, to optimize business processes and augment productivity, organizations have implemented Information Systems (IS) (Kelegai and Middleton, 2004). Information Systems serve as the mechanisms through which individuals and organizations leverage technologies to collect, process, store, utilize, and disseminate information (Burch and Grudnitski, 1989). DeLone and McLean (2003) assert that Information Systems are positively correlated with organizational profitability and productivity, and they concurrently contribute to the motivation of personnel

Hua and Herstein (2003) emphasized that effective education management hinges on robust policy-making

and systematic monitoring using data and information. Consequently, the Education Management Information System (EMIS) was developed to organize and process data related to the management of educational resources and services, enhancing planning, resource allocation, monitoring, policy formation, and decision-making (Wako, 2003). Typically, EMIS operates within a national ministry or education department, handling information on learning institutions, student and staff demographics, performance metrics, financial data, and community involvement (Ibrahim, 2005; UNESCO, 2006; Kingdom of Cambodia, 2008).

Globally, countries have heavily invested in EMIS for data collection and management. For instance, Cassidy (2006) observed significant resource allocation to EMIS in South and Central America during the 1990s. The Caribbean has also prioritized EMIS, with Jamaica, Barbados, Antigua, Barbuda, and St. Lucia undertaking projects in 2006 and 2007. Notably, Jamaica's initiatives, funded by USAID, aimed at improving data access and introducing computer-based recordkeeping and Geographic Information Systems (GIS), though issues with information access and utilization persisted despite these efforts (Gaible, 2008).

Asia has also seen advancements in EMIS, with India implementing the District Information System for Education (DISE), equipping districts with necessary hardware and software for data collection, targeting full EMIS adoption by 2005. Mozambique's EMIS, supported by donors, tracks diverse statistical information, including the impact of HIV/AIDS on enrollment, while Guinea Conakry's ministry of education, backed by USAID and the World Bank, has enhanced its data management capabilities since the 1990s (Spratt and Crouch, 2001; Trucano, 2006a). In Ghana, EMIS was expanded significantly from 2004 to 2008, improving donor involvement and logistical support, although Nigeria faced challenges due to resource constraints until recent improvements in standardized software facilitated state-level data management (Trucano, 2006b, 2006c).

The World Bank (2010) reported that over forty education projects involving EMIS or ICT were initiated, yet over half failed, particularly in developing countries. Wako (2003) noted that World Bank-supported EMIS projects often lagged behind schedule or required significant rework. Even when delivered on time and within budget, these systems frequently failed to meet user needs or influence policy decisions effectively. This inefficiency is also observed in Kenya's EMIS implementation under the Kenya Education Sector Support Programme (KESSP). Despite substantial investment and efforts, challenges like incomplete data, poor response rates, and untimely data collection have hampered EMIS effectiveness (Republic of Kenya, 2009a, 2009c, 2010a).

Case studies by the World Bank in Bangladesh, Ghana, Nigeria, and Mozambique highlight best practices and lessons learned from EMIS projects (World Bank, 2011). However, the effectiveness of Kenya's EMIS, initiated in 2005, remains unevaluated. A survey revealed low data capture completion rates, particularly in the Nyanza region, necessitating further investigation into Technological factors influencing EMIS outcomes (Republic of Kenya, 2010c; Ariko, 2014).

Hua and Herstein (2003) and DeLone and McLean (2003) noted that IS success is measured by outcomes such as timeliness, reliability, and effective data utilization for policy decisions. DeLone and McLean's model includes system use, quality, user satisfaction, and organizational impact. This study focuses on EMIS outcomes in terms of information timeliness, completeness, relevance, reliability, accessibility, and user satisfaction.

Technological factors significantly influence EMIS outcomes, as identified by studies on IT infrastructure availability, IS competency, and technical user support (Bento & Bento, 2006; Kelegai & Middleton, 2004; Hussein et al., 2007a). The availability and functionality of IT infrastructure and user support are critical for successful IS implementation and usage, as shown by Gaible (2008) in Jamaica and supported by Masrek et al. (2009). Similarly, IS competency among staff, involving technical, boundary, and functional

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competencies, is crucial for effective IS outcomes (Byrd & Turner, 2000; Ang et al., 2001; Saunders & Jones, 1992).

In Kenya, the MOE has invested in training EMIS personnel and providing necessary IT infrastructure. However, despite these efforts, technical support and infrastructure issues persist, impacting the effectiveness of EMIS in the Nyanza region. This study aims to investigate the impact of these technological factors on EMIS outcomes, addressing gaps in existing research and providing a more comprehensive understanding of the factors influencing EMIS success in Nyanza region, Kenya.

# METHODOLOGY

The research methodology employed in this study encompassed the research design, study area, population, sampling techniques, data collection instruments, as well as the procedures and methods for data analysis. This structured approach ensures a comprehensive examination of technological factors influencing the effectiveness of the Education Management Information System (EMIS) in the Nyanza Region of Kenya.

## Research Design

The study adopted a dual-framework research design, integrating both descriptive survey and correlational designs. The descriptive survey component was chosen for its ability to capture a broad spectrum of opinions, attitudes, and knowledge regarding factors affecting EMIS, utilizing questionnaires and interviews to swiftly gather data from a large respondent pool. Concurrently, the correlational design was employed to analyze the relationships among technological variables, elucidating their impact on EMIS outcomes. This hybrid approach facilitated a holistic and nuanced understanding of the research questions.

## Area of Study

The research was conducted in Kenya's Nyanza Region, which includes the counties of Homa Bay, Kisii, Kisumu, Migori, Nyamira, and Siaya. Geographically, this region is situated between latitudes 0°15'N and 1°45'S and longitudes 34°E and 35°15'E, with Kisumu serving as the regional capital. Nyanza's economy is diverse, encompassing agriculture, livestock production, fishing, and tourism. Despite these economic activities, the region's EMIS data capture completion rates lag behind other Kenyan regions, highlighting the critical need for this study.

## Study Population

The study population comprised individuals directly involved in EMIS operations within Nyanza Region's 34 administrative districts. Target respondents included:

1. 34 EMIS coordinators managing data collection and capture.
2. 34 District Education Officers (DEOs) overseeing EMIS data processes.
3. 68 data capture personnel engaged in data entry.
4. The regional EMIS coordinator providing technical support and linking districts with the national office.

## Sample and Sampling Techniques

The sample size determination followed Krejcie and Morgan's (1970) formula, resulting in the selection of 29 DEOs and 29 EMIS coordinators (85.3% of the population) via simple random sampling. Additionally, 58 data capture personnel and the regional EMIS coordinator were purposively selected. This non-probability sampling technique was chosen for its efficiency and ability to ensure that the most

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knowledgeable respondents were included in the study.

**Instruments for Data Collection**

Data collection was conducted using structured questionnaires and semi-structured interview schedules, ensuring both breadth and depth of information.

**Questionnaires** : Questionnaires, incorporating both closed-ended and open-ended questions, were utilized to collect quantitative and qualitative data from EMIS coordinators and data capture personnel. The questionnaires were structured into sections addressing respondent demographics, technological factors, and EMIS outcomes.

The District EMIS Coordinator Questionnaire (DECQ) gathered detailed data from EMIS coordinators on demographics and the impact of technological factors on EMIS outcomes, rated on a 5-point scale from very low to very high impact. While the Data Capture Personnel Questionnaire (DCPQ) collected analogous data from data capture personnel, similarly rated on a 5-point impact scale.

**Interview Schedule**: Semi-structured interviews were conducted with DEOs and the regional EMIS coordinator, facilitating in-depth discussions that complemented and enriched the quantitative data from the questionnaires.

**Validity and Reliability of the Instruments**

Validity was ensured through a dual approach of face and content validity. A pilot study involving 10% of the target population identified and addressed potential issues, while supervisors and domain experts validated the content to ensure alignment with study objectives. Instrument reliability was ascertained via a pilot study, with Cronbach's alpha coefficients calculated to measure internal consistency. The resulting alpha values of 0.77 for the DECQ and 0.78 for the DCPQ indicated satisfactory reliability.

**Data Collection Procedure**

Prior to data collection, an introduction letter was secured from Maseno University. The researcher visited sub-county education offices to familiarize and introduce the study to the DEOs. Questionnaires were then distributed to EMIS coordinators and data capture personnel, with interview appointments scheduled for DEOs. The data collection process spanned two and a half weeks, ensuring thorough coverage of the sample and meticulous data collection.

**Methods of Data Analysis**

The data analysis process involved several steps:

1. Data Cleaning: Ensured completeness and accuracy by checking for missing data and outliers.
2. Descriptive Statistics: Employed to summarize demographic data and assess frequencies, means, and standard deviations of variables.
3. Inferential Statistics: Used to test hypotheses through correlation and regression analysis to determine the impact of technological factors on EMIS outcomes.

All statistical analyses were conducted using SPSS software version 20.0.

This comprehensive methodology provided a robust framework for examining the technological factors affecting EMIS outcomes in Nyanza Region, ensuring the reliability and validity of the study findings.

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# RESULTS

## EMIS outcomes

To explore the state of EMIS (Education Management Information System) outcomes in the sub-counties of the Nyanza region, responses were collected from data capture personnel (n=68) and EMIS coordinators (n=29). These responses were measured on a 1-5 scale ranging from 'Very Poor' to 'Very Good'. Table 1 presents the descriptive statistics for these ratings.

**Table 1:** Ratings of EMIS Outcomes in Nyanza Region by Data Capture Personnel and EMIS Coordinators

| Variable | Respondents | Mean | SD |
|---|---|---|---|
| Timeliness of Information | Data capture personnel | 2.66 | 1.39 |
| | EMIS coordinators | 2.48 | 1.37 |
| Relevance of Information | Data capture personnel | 3.38 | 1.23 |
| | EMIS coordinators | 3.52 | 1.29 |
| Completeness of Data | Data capture personnel | 2.83 | 1.08 |
| | EMIS coordinators | 2.62 | 1.4 |
| Reliability of Information | Data capture personnel | 3.28 | 1.08 |
| | EMIS coordinators | 3.24 | 1.04 |
| Accessibility of Information | Data capture personnel | 2.74 | 1.39 |
| | EMIS coordinators | 2.71 | 1.42 |
| Personnel Satisfaction | Data capture personnel | 2.53 | 0.88 |
| | EMIS coordinators | 3.00 | 1.18 |
| Overall Mean Responses on EMIS Outcomes | Data capture personnel | 2.90 | 1.24 |
| | EMIS coordinators | 2.93 | 1.28 |
| Overall Response | | 2.91 | 1.25 |

Interpretation Scale:

- Very Poor: 1.0 – 1.9
- Poor: 2.0 – 2.9
- Fair: 3.0 – 3.9
- Good: 4.0 – 4.9
- Very Good: 5.0

**Findings on EMIS Outcomes**

**Best EMIS Outcomes:**

Data capture personnel identified 'Relevance of Information' (Mean = 3.38) and 'Reliability of Information' (Mean = 3.28) as the best EMIS outcomes. EMIS coordinators similarly rated 'Relevance of Information' (Mean = 3.52) and 'Reliability of Information' (Mean = 3.24) highly, along with 'Personnel Satisfaction' (Mean = 3.00). Interviews with regional EMIS coordinators and District Education Officers (DEOs) supported these findings, emphasizing the relevance and reliability of EMIS data in accessing schools, ensuring equity, calculating transition rates, determining gender parity, and addressing teacher shortages. One regional EMIS coordinator highlighted, "The EMIS information is relevant, especially regarding access to school, equity, and transition rates. EMIS data assisted in the calculation of gender parity and determination of teacher shortages." A DEO noted, "EMIS data is very relevant, especially information on schools' enrollment helps in effective intervention, policy implementation, feedback, and decision-making."

**Poorest EMIS Outcomes:**

Data capture personnel rated 'Personnel Satisfaction' (Mean = 2.53) as the poorest outcome, followed by 'Timeliness of Information' (Mean = 2.66), 'Accessibility of Information' (Mean = 2.74), and 'Completeness of Data' (Mean = 2.83). EMIS coordinators identified similar issues, with 'Timeliness of Information' (Mean = 2.48), 'Completeness of Data' (Mean = 2.62), and 'Accessibility of Information' (Mean = 2.71) being the poorest outcomes. Interviews with DEOs revealed challenges in maintaining data timeliness and consistency, with 58.9% of DEOs indicating difficulty in meeting deadlines due to late submissions from the Ministry of Education. One DEO explained, "Deadlines could not be met because the Ministry of Education submits EMIS forms late to the DEOs, who then remit them to the educational institutions late too." Another DEO mentioned attempts to ensure data relevance through follow-ups by TAC tutors, ensuring timely submission of forms.

**Disparity in Personnel Satisfaction:**

There was a notable disparity between the perceptions of data capture personnel and EMIS coordinators regarding 'Personnel Satisfaction'. Data capture personnel rated it as the poorest outcome, while EMIS coordinators viewed it as the third best. A DEO attributed poor personnel satisfaction to a lack of motivation and the expectation to work overtime without additional compensation, stating, "The EMIS personnel are not motivated. They do the work reluctantly and many are unenthusiastic to work, given that they are expected to work overtime including weekends, yet EMIS data capture is not their core duty, unless money is set aside to motivate them."

Overall Assessment: EMIS outcomes in the Nyanza region were generally rated as poor, with an overall mean response of 2.91 (SD = 1.25). Both data capture personnel (Mean = 2.90) and EMIS coordinators (Mean = 2.93) shared this view.

This comprehensive analysis underscores both the strengths and challenges within the EMIS framework in the Nyanza region, providing a basis for targeted improvements and policy interventions.

**Influence of Technological Factors on EMIS Outcomes in Nyanza Region**

To explore the influence of technological factors on EMIS outcomes in the Nyanza region, responses from data capture personnel (n=68) and EMIS coordinators (n=29) were recorded. These responses were measured on a 1-5 scale ranging from 'Very Low Influence' to 'Very High Influence'. Table 2 presents the descriptive statistics for these ratings

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**Table 2:** Ratings of the Influence of Technological Factors on EMIS Outcomes by Data Capture Personnel and EMIS Coordinators

| Variable | Respondent | Mean (X) | S.D |
|---|---|---|---|
| Staff competence | Data Capture Personnel | 3.86 | 1.04 |
| | EMIS Coordinators | 4.07 | 0.97 |
| Availability of IT infrastructure | Data Capture Personnel | 3.22 | 1.36 |
| | EMIS Coordinators | 3.17 | 1.44 |
| Functionality of IT Infrastructure | Data Capture Personnel | 2.22 | 1.22 |
| | EMIS Coordinators | 2.48 | 1.58 |
| Maintenance and User support | Data Capture Personnel | 2.26 | 1.36 |
| | EMIS Coordinators | 1.97 | 1.27 |
| Overall mean responses on EMIS outcomes | Data Capture Personnel | 2.89 | 1.24 |
| | EMIS Coordinators | 2.75 | 1.29 |
| | Overall response | 2.82 | 1.27 |

**Interpretation Scale:**

- Very Low Influence: 1.0 – 1.9
- Low Influence: 2.0 – 2.9
- Moderate Influence: 3.0 – 3.9
- High Influence: 4.0 – 4.9
- Very High Influence: 5.0

**Ratings of the Influence of Technological Factors on EMIS Outcomes**

**High Influence:**

The highest influence on EMIS outcomes was attributed to 'Staff Competence', with mean scores of 3.86 from data capture personnel and 4.07 from EMIS coordinators, indicating a high influence. This underscores the importance of having skilled and competent staff in the effective functioning of EMIS. Interviews with DEOs and regional EMIS coordinators confirmed that well-trained staff are crucial for accurate data entry and management.

**Moderate Influence:**

'Availability of IT Infrastructure' was rated as having a moderate influence, with mean scores of 3.22 from data capture personnel and 3.17 from EMIS coordinators. This suggests that while the availability of IT infrastructure is essential, it alone does not fully determine the effectiveness of EMIS outcomes.

**Low Influence:**

Both 'Functionality of IT Infrastructure' and 'Maintenance and User Support' were rated as having low influence. 'Functionality of IT Infrastructure' received mean scores of 2.22 from data capture personnel and

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue VIII August 2024

2.48 from EMIS coordinators, indicating issues with the operational aspects of the infrastructure. Similarly, 'Maintenance and User Support' was rated with mean scores of 2.26 from data capture personnel and 1.97 from EMIS coordinators, highlighting significant deficiencies in support and maintenance services. This was echoed in interviews where respondents noted frequent down-times and delayed maintenance services.

**Overall Assessment:**

The overall mean influence of technological factors on EMIS outcomes was rated as low, with mean scores of 2.89 for data capture personnel and 2.75 for EMIS coordinators. The combined overall response mean was 2.82 (SD = 1.27), indicating that technological factors are perceived to have a low to moderate influence on EMIS outcomes in the Nyanza region.

These findings suggest that while staff competence and the availability of IT infrastructure are crucial, there are significant challenges related to the functionality and maintenance of IT infrastructure that need to be addressed to improve EMIS outcomes in the region.

Table 3 presents a breakdown of the number of computers in District Education Offices (DEOs) categorized by their respective locations, as reported by EMIS Coordinators. The data, collected from 29 surveyed DEOs, offers insights into the availability of IT resources in these educational settings.

**Table 3:** Number of Computers in DEOs Office by Location as Reported by EMIS Coordinators (N = 29)

| | **Office location** | | | **Total** |
|---|---|---|---|---|
| | **Urban** | **Peri-urban** | **Rural** | |
| **Number Of Computers** | **f (%)** | **f (%)** | **f (%)** | **f (%)** |
| None | 1(3.4) | 0 (0.0) | 3 (10.3) | 4 (13.8) |
| 3-Jan | 1(3.4) | 3 (10.3) | 3 (10.3) | 7 (24.1) |
| 6-Apr | 3 (10.3) | 4 (13.8) | 6(20.7) | 13 (44.8) |
| 9-Jul | 3 (10.3) | 0 (0.0) | 1 (3.4) | 4 (13.8) |
| Above 10 | 0 (0.0) | 0 (0.0) | 1 (3.4) | 1 (3.4) |
| Total | 8 (27.6) | 7 (24.1) | 14 (48.3) | 29 (100.0) |

Mean = 2.71 3 computers in every DEOs office Std. Deviation = 1.056

The findings reveal that the majority of DEOs, comprising 44.8%, reported having between 4 to 6 computers, indicating a reasonably well-equipped environment. Following this, 24.1% of offices reported having 1 to 3 computers, while 13.8% had 7 to 9 computers. A similar percentage, 13.8%, indicated having no computers at all. A small fraction, 3.4%, reported possessing more than 10 computers.

When examining the distribution across different locations, it becomes apparent that rural DEOs have the highest representation in the 4 to 6 computers category, with 20.7%. This is followed closely by urban offices at 10.3%. However, rural locations also show a notable percentage (10.3%) of DEOs reporting no computers, contrasting with urban offices where none reported having more than 10 computers.

On average, each DEO office is equipped with approximately three computers, with a standard deviation of 1.056 suggesting some variability around this mean. This implies a reasonable level of computer availability across surveyed DEOs.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue VIII August 2024

The survey delved into the functionality of Local Area Network (LAN) within District Education Offices (DEOs). It revealed that while LAN infrastructure was present in the majority of offices, a significant portion, 51.7%, reported that their LAN was not functional. Only 34.3% of respondents indicated that LAN was operational, while 13.8% reported not yet being connected.

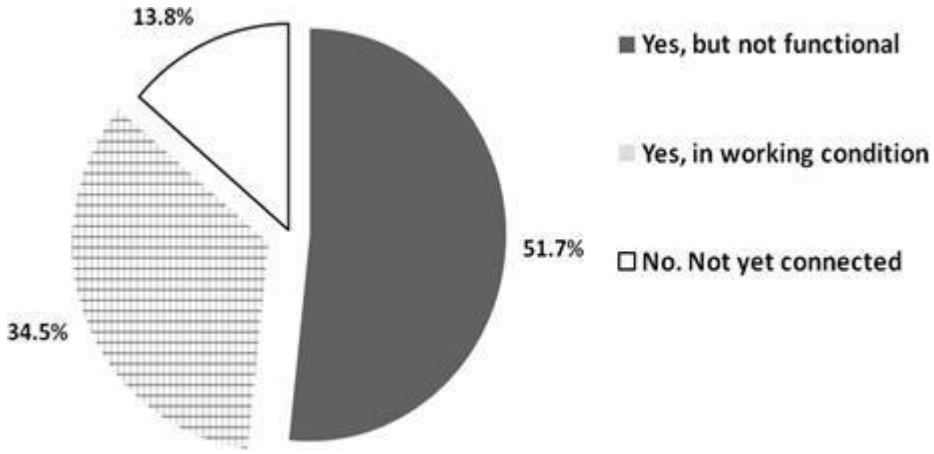


**Figure 1.** Availability and Functionality of Local Area Network (LAN), at the DEO's offices n = 29

These findings shed light on the challenges surrounding the functionality of IT infrastructure, particularly LAN, within DEOs. The high percentage of non-functional LAN systems suggests potential issues with maintenance and user support, which could hinder the effective utilization of technology for Education Management Information Systems (EMIS) purposes.

Figure 1 provides insights into the internet accessibility within District Education Offices (DEOs), corroborating previous findings on the availability of IT infrastructure. The data indicates that internet access was prevalent in more than 90% of DEOs, aligning with earlier observations regarding IT infrastructure availability.

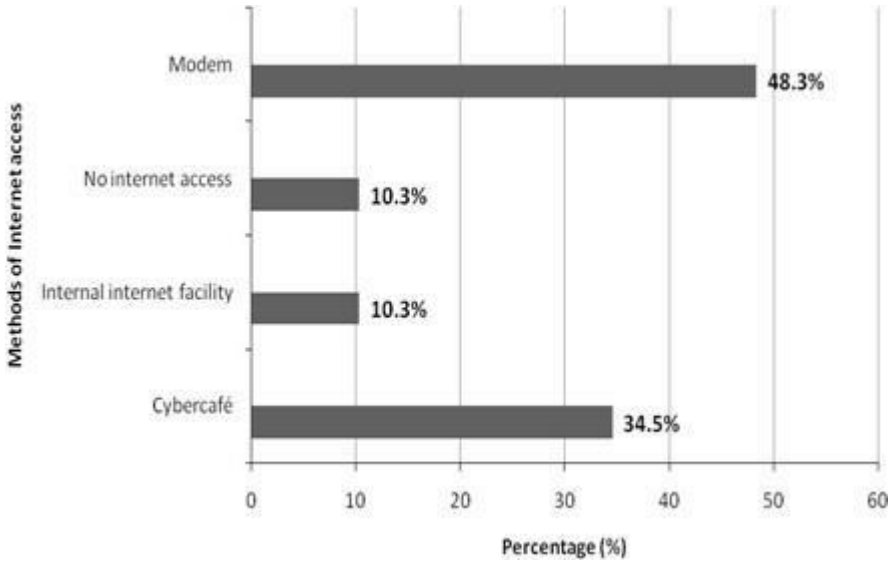


**Figure 2:** Internet access at the DEOs ) Office (n = 29)

The figure further illustrates the variability in the modes of internet access utilized by DEOs. Nearly half of

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue VIII August 2024

the sub-counties (48.3%) relied on modems to access the internet, while 34.5% accessed it through cybercafés. Additionally, 10.3% of sub-counties had internal internet facilities, indicating a direct connection within the office environment. However, a minority of sub-counties, accounting for 10.3%, reported having no access to internet facilities at all.

These findings underscore the diverse strategies employed by DEOs to facilitate internet access, reflecting the adaptability and resourcefulness within the education administration sector.

This study in Table 4 examined the link between the location of District Education Officers' (DEO) offices and the availability of technology resources. The researchers looked at three factors: the number of working computers, internet accessibility, and the presence of a local area network (LAN).

**Table 4:** Chi Square Tests of Location of DEOs' office and Technological Factors. (n = 29)

| Technological factors | Chi-Square | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Number of working computers | 5.662[a] | 8 | 0.685 |
| Internet accessibility | 7.170[a] | 6 | 0.035 |
| Availability of local area network | 1.139[a] | 4 | 0.488 |

The results from Table 4 indicate that the Chi-square test did not reveal any significant association between the location of District Education Offices (DEOs) and the number of working computers (Chi-square (8) = 0.152, P = 0.697)or the availability of a Local Area Network (LAN) (Chi-square (6) = 0.152, P = 0.697).. This lack of association implies that the availability of IT infrastructure, such as computers and LAN, was evenly spread across sub-counties, irrespective of the DEO office's location.

Further analysis of the data revealed interesting insights. The number of working computers showed no correlation with the office's location, whether rural, peri-urban, or urban. This suggests that DEO offices in different locations had a similar number of computers at their disposal.

However, the availability of internet access exhibited a statistically significant connection with location. Urban or peri-urban offices were more likely to have better internet access compared to rural offices. This discrepancy in internet availability highlights potential disparities in technology infrastructure based on geographical location.

Additionally, the study found no significant association between office location and the presence of a LAN. Whether an office was situated in a rural, peri-urban, or urban area did not seem to affect the existence of a local network.

Overall, the Chi-square test results provide reassurance by indicating that the location of a DEO's office did not significantly impact the number of working computers or the availability of a LAN. This suggests a relatively equitable distribution of these IT resources across sub-counties, ensuring

Similarly, this view was evident when the Regional EMIS Coordinator said that:

"Computers are available in almost all the sub counties especially the old districts, each has at least 5 computers donated by Ministry of Education, internet connectivity is as about 60% though usage is very irregular".

The findings from Table 4 reveal a statistically significant association (p = 0.05) between the location of District Education Offices (DEOs) and internet accessibility, as indicated by the Chi-square test results (Chi-square (6) = 7.170, P = 0.035). This analysis corroborates the patterns depicted in Figure 2, which illustrate varying modes of internet access across different office locations. Specifically, DEOs in rural areas were

found to lack direct internet access or relied on modems, whereas those in urban and peri-urban areas had access through internal facilities, cybercafés, or modems. The observed diversity in internet access modes, with a predominant reliance on modems (48.3%), followed by cybercafés (34.5%), internal facilities (10.3%), and no access (10.3%), further supports this conclusion.

These findings are consistent with prior research by Hussein et al. (2007a), which established a positive correlation between higher Information Systems (IS) competency and greater user satisfaction and information quality. Similarly, Ang et al. (2001) demonstrated a link between staff IS competency and increased IS usage to support Total Quality Management (TQM) processes in the Malaysian public sector. These findings align with the proposition by Saunders and Jones (1992) that IS competency serves as a critical dimension for evaluating IS function performance.

However another DEO commented that;

"Though the computers are available, the maintenance of the same in many stations is poor due to lack of technical competence of users. A numbers of the computers are underutilized or have been vandalized. Computers are available, no internet facilities and maintenance is not very good due to insufficient funds."

The synthesis of findings from both District Education Officers' (DEOs) interviews and Electronic Management Information System (EMIS) personnel questionnaires aligns with previous research by Gaible (2008). Gaible's study on EMIS initiatives in Jamaica, funded by the United States Agency for International Development (USAID), revealed similar challenges despite project completion. Specifically, limited access to computers and inadequate connectivity emerged as primary barriers, resulting in constrained information access and utilization.

These shared findings underscore a common theme across different contexts, highlighting the persistent challenges faced in effectively implementing EMIS initiatives, particularly concerning technological infrastructure and connectivity. The resonance between the current study's results and Gaible's findings emphasizes the universality of these obstacles and the imperative for targeted interventions to address them.

**Relationships between technological factors and EMIS outcomes**

This study aimed to explore the relationship between technological aspects of the Education Management Information System (EMIS) and the quality of its outcomes. Researchers employed Pearson's moment correlation coefficient to measure the strength and direction of the relationship between two variables.

Technological Factors (Independent Variables): These likely include aspects like staff competency in using EMIS, availability and functionality of IT infrastructure, and the effectiveness of maintenance and user support services (Table 1).

EMIS Outcomes (Dependent Variables): These represent the desired results of a well-functioning EMIS, such as data timeliness (how quickly data is entered), relevance (how applicable the data is), completeness (whether all necessary data is captured), reliability (consistency and accuracy of data), accessibility of information (ease of access for authorized users), and overall user satisfaction with the system (Table 2).

**Table 5 :** Pearson product correlation between EMIS outcome and technological factors n = 97.

| Independent Variables | | Dependent Variables (EMIS Outcomes) n = 87 | | | | | |
|---|---|---|---|---|---|---|---|
| (Technological factors) | | Timeliness | Relevance | Completeness | Reliability | Accessibility | Satisfaction |
| staff competency on EMIS | r | .672* | 0.411 | .611* | 0.443 | 0.372 | .691* |
| | p | 0.006 | 0.077 | 0.009 | 0.062 | 0.092 | 0.007 |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Availability of IT infrastructure | r | .575* | 0.374 | 0.417 | .574* | 0.454 | .712** |
| | p | 0.041 | 0.094 | 0.072 | 0.039 | 0.052 | 0.002 |
| Functionality of IT Infrastructure | r | 0.338 | .541* | 0.442 | 0.403 | 0.301 | 0.401 |
| | p | 0.109 | 0.045 | 0.069 | 0.081 | 0.112 | 0.084 |
| Maintenance and user support | r | 0.412 | 0.315 | 0.356 | .578* | .541* | 0.372 |
| | p | 0.076 | 0.118 | 0.089 | 0.011 | 0.043 | 0.091 |

p – significance level r – Pearson correlation coefficient * Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 5 illustrates the Pearson product correlations between various Technological factors and Electronic Management Information System (EMIS) outcomes, based on a sample size of 97. The independent variables represent Technological factors, while the dependent variables represent EMIS outcomes, with a sample size of 87.

The analysis unveils several significant findings:

Staff Competency on EMIS: This factor exhibits noteworthy correlations with personnel satisfaction ($r = .691$, $p = 0.004$), timeliness ($r = 0.672$, $p = 0.006$), and completeness ($r = 0.611$, $p = 0.017$) of data. However, it does not significantly relate to the relevance, reliability, or accessibility of data.

Availability of IT Infrastructure: Robust correlations are observed between the availability of IT infrastructure and personnel satisfaction ($r = 0.712$, $p = 0.002$), timeliness ($r = 0.575$, $p = 0.041$), and reliability ($r = 0.574$, $p = 0.039$) of data. However, no significant correlations are found with relevance, completeness, or accessibility of data.

Functionality of IT Infrastructure: This factor exhibits a significant correlation only with the relevance ($r = 0.541$, $p = 0.045$) of data. No significant correlations are observed with other EMIS outcomes.

Maintenance and User Support: Significant correlations exist between maintenance and user support and improved data accessibility ($r = 0.541$, $p = 0.043$). However, no significant correlations are observed with other EMIS outcomes.

These findings suggest that staff competency and the availability of IT infrastructure play significant roles in determining EMIS outcomes, particularly in terms of personnel satisfaction and data timeliness. However, the functionality of IT infrastructure and maintenance/user support demonstrate weaker correlations with EMIS outcomes, indicating potential areas for improvement.

These results resonate with real-world challenges identified during interviews, such as insufficient personnel training and network issues hindering data submission.

**The regression analysis on technological variables on EMIS outcomes**

To explore the influence of technological variables on EMIS outcomes, a regression analysis was conducted, incorporating staff competency in EMIS, availability of IT infrastructure, functionality of IT infrastructure, and maintenance and user support. The results of the regression analysis are summarized in Table 6.

**Table 6:** Linear Regression Model Summary of Technological Factors and EMIS Outcomes

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | 0.357[a] | 0.127 | 0.121 | 0.68484 |

a. Predictors: (Constant), Maintenance and user support, Availability of IT infrastructure, staff competency on EMIS , Functionality of IT Infrastructure

Table 6 summarizes the linear regression model, indicating an R value of 0.357 and an R Square of 0.127. These values suggest that approximately 12.7% of the variance in EMIS outcomes is explained by the technological factors included in the regression model.

The regression model accounted for only 12.7% of the variance in EMIS outcomes, suggesting that additional factors beyond technological variables influence the outcomes

Furthermore, Table 7 presents the ANOVA test results, indicating a non-significant model emergence (F (3, 83) = 2.666, p = 0.124) when using the enter method. This suggests that the combined effect of the technological factors on EMIS outcomes does not achieve statistical significance.

**Table 7 :** ANOVA Test for Technological Factors and EMIS Outcomes

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 1.439 | 3 | 0.48 | 2.666 | .124 b |
| | Residual | 14.921 | 83 | 0.18 | | |
| | Total | 16.46 | 86 | | | |

a. Dependent Variable: overall EMIS out comes
b Predictors: (Constant), Maintenance and user support, Availability of IT infrastructure, staff competency on EMIS , Functionality of IT Infrastructure

The overall model did not achieve statistical significance (P = 0.124b), indicating that the combined effect of these technological variables on EMIS outcomes was not statistically significant.

Table 8 illustrates the results of the regression analysis, indicating the significance of certain variables in predicting EMIS outcomes.

**Table 8:** Regression Analysis Summary for Effect of Technological Factors in EMIS Outcomes (n = 87)

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 8.317 | 1.138 | | 7.308 | .000* |
| | Staff competency on EMIS | 0.464 | 0.146 | 0.448 | 3.178 | .002* |
| | Availability of IT infrastructure | 0.256 | 0.091 | 0.258 | 2.813 | .005* |
| | Functionality of IT infrastructure. | 0.089 | 0.114 | 0.086 | 0.781 | 0.195 |
| | Maintenance and user support | 0.157 | 0.145 | 0.152 | 1.083 | 0.073 |

a. Dependent Variable: overall EMIS outcomes

Notably, ‘Staff competency on EMIS’ and ‘Availability of IT infrastructure’ emerged as statistically significant predictors at the 0.05 level, with p-values of 0.002 and 0.005, respectively. Conversely, The regression analysis results indicate that ‘Functionality of IT infrastructure’ and ‘Maintenance and user support’ did not reach statistical significance, with p-values of 0.086 and 0.073, respectively. Further

examination of the regression coefficients reveals the predictive influence of these variables. 'Staff competency on EMIS' and 'Availability of IT infrastructure' exhibit higher coefficients (beta = 0.448 and 0.258, respectively), indicating stronger predictive power. Conversely, 'Functionality of IT infrastructure' and 'Maintenance and user support' show lower coefficients (beta = 0.086 and 0.152, respectively), signifying relatively weaker predictive capabilities.

Despite the overall regression model not achieving statistical significance, 'Staff competency' and 'Availability of IT infrastructure' remain significant predictors of EMIS outcomes individually. In contrast, 'Functionality of IT infrastructure' and 'Maintenance and user support' do not emerge as statistically significant predictors. These findings underscore the nuanced relationship between technological factors and EMIS outcomes. While staff competency and IT infrastructure availability play pivotal roles, real-world challenges such as insufficient training and technical issues pose significant obstacles. Therefore, comprehensive technological support is essential to ensure effective EMIS functionality and optimal outcomes.

## DISCUSSION

The significant impact of staff competency on EMIS outcomes was a consistent finding, supported by both Data Capture Personnel and EMIS Coordinators, who unanimously agreed that 'Staff competence' had the highest impact on EMIS outcomes (Table 2). Correlational analysis further confirmed that staff competency significantly influenced EMIS outcomes such as personnel satisfaction, timeliness, and data completeness. This aligns with previous studies by Hussein et al. (2007a), Ang et al. (2001), and Saunders and Jones (1992), which found similar results.

Interestingly, the availability of IT infrastructure, maintenance and user support, and staff competency on EMIS did not significantly impact the relevance of EMIS data. The EMIS Coordinator rated 'Maintenance and User Support' as the least influential technological factor on EMIS outcomes (1.97), while it was the second least influential according to the Data Capture Personnel. These findings highlight that poor EMIS outcomes in the Nyanza region were attributed to incomplete data, low personnel satisfaction, and delays in data submission, often caused by poor maintenance and user support (Table 1). This suggests that the poor state of IT infrastructure and inadequate maintenance and user support likely contributed to these issues. Delson (1994) also noted that the availability of EMIS facilities, officer competency, structure, and user support were crucial for successful EMIS outcomes.

The Ministry of Education (MOE) in Kenya has consistently trained EMIS personnel, focusing on various aspects such as the role of EMIS in education delivery, educational data sources, data analysis, and dissemination. These training efforts likely contributed to the significant impact of IT/IS competency on EMIS outcomes in Nyanza Counties. Hussein et al. (2007a) found that higher IS competency levels correlate with higher satisfaction and information quality, including timeliness, completeness, reliability, and accessibility of information. Similarly, Ang et al. (2001) noted that higher IS competency among staff leads to greater IS usage in supporting Total Quality Management (TQM) processes, while Saunders and Jones (1992) identified IS competency as a critical dimension for assessing IS function performance.

Gaible (2008) and Kelegai and Middleton (2004) corroborated these findings, emphasizing that a lack of adequately trained staff in existing hardware, software, and new MIS developments poses significant barriers to MIS implementation. These studies suggest that the availability of IT infrastructure alone does not guarantee IS implementation success; having competent in-house IS personnel to address technological issues is crucial.

This study also highlighted the importance of 'Availability of IT infrastructure' as an influential factor on EMIS outcomes (Table 8). Both Data Capture Personnel and EMIS Coordinators rated it as the second most

influential technological factor (Table 1). A positive and strong relationship existed between 'availability of IT infrastructure' and 'personnel satisfaction,' as well as between 'availability of IT infrastructure' and the timeliness and reliability of data (Table 5). This was attributed to the presence of multiple computers in each DEO office and high internet accessibility, indicating sufficient IT infrastructure. The Regional EMIS Coordinator confirmed that most sub-counties, especially the older districts, had at least five computers donated by MOE.

The findings on the availability of IT infrastructure as a predictor of EMIS outcomes are consistent with literature on IS/IT adoption and implementation. Studies by Bento and Bento (2006), Hussein et al. (2007a), Masrek et al. (2009), Ang et al. (2001), and Chung et al. (2003) all support the high correlation between IT infrastructure availability and IS outcomes. Hussein et al. (2004) found a strong correlation between distributed IS structure and various IS effectiveness dimensions, while Masrek et al. (2009) showed that IS structure availability facilitates strategic IS utilization. Bento and Bento (2006) also found that the type and usage degree of technology, such as e-commerce and Internet technologies, were highly related to successful information processing outcomes.

However, 'Functionality of IT infrastructure' was not a statistically significant predictor of EMIS outcomes in the Nyanza region (Table 8). Data Capture Personnel rated it as the least influential technological factor, while EMIS Coordinators considered it the second least influential (Table 1). Many EMIS Coordinators noted that Local Area Networks (LAN) were available but not functional, with inconsistent internet connectivity and underutilized or vandalized computers. This finding contrasts with Bento and Bento (2006), who found a strong relationship between the technology used in IS and the successful outcomes of information processing. DeLone and McLean (2003) also observed that IS outcomes depend on how well hardware and software work together with technical expertise.

Similarly, 'Maintenance and user support' did not significantly affect EMIS outcomes (Table 8). EMIS Coordinators and Data Capture Personnel rated it as the least and second least influential technological factors, respectively. Correlational analysis showed no significant relationships between maintenance and user support and EMIS outcomes like relevance, completeness, reliability, and timeliness of data. This finding diverges from previous studies by Hussein et al. (2007), Ang et al. (2001), Mirani and Kin (1994), and Vijayaraman and Ramakrishna (1990), which highlighted the significant impact of technical user support on IS success.

In summary, while staff competency and availability of IT infrastructure are crucial for EMIS outcomes, the functionality of IT infrastructure and maintenance and user support appear to be less influential in the Nyanza region. This highlights the need for better maintenance and support systems to improve EMIS outcomes further.

## CONCLUSION

In summary, the research underscores the critical importance of both staff competency and the availability of IT infrastructure for the success of the Education Management Information System (EMIS). However, it also highlights the need to address challenges related to infrastructure functionality and support mechanisms. A holistic approach that prioritizes training programs, infrastructure improvements, and robust support systems is essential to optimize EMIS effectiveness and ensure data reliability and user satisfaction.

Despite the widespread availability of IT infrastructure across sub-counties in the Nyanza region, its impact on EMIS outcomes is limited by issues such as poor functionality and inadequate technical support, especially in maintenance. These findings emphasize the need for concerted efforts to enhance both staff competency and the functionality of IT infrastructure to fully leverage the potential of the EMIS system.

## RECOMMENDATION

To tackle these challenges effectively, the Ministry of Education should prioritize several key initiatives. Implementing these recommendations will significantly enhance the effectiveness and reliability of the EMIS system in Nyanza counties.

**Enhance Maintenance and User Support Services:**

To enhance Maintenance and User Support Services, it's essential to promptly address technical issues as they arise. This proactive approach ensures that any system glitches or malfunctions are resolved quickly, minimizing disruptions to the EMIS operations. Additionally, improving user satisfaction hinges on providing effective support to users encountering difficulties or needing assistance. Investing in training support personnel to handle technical challenges efficiently is crucial, as it equips them with the necessary skills and knowledge to troubleshoot issues effectively and provide timely assistance to users, ultimately contributing to a smoother functioning of the EMIS system.

**Continuous Investment in Staff Training Programs:**

Continuous investment in Staff Training Programs is vital to ensure that staff remain proficient in utilizing EMIS effectively. By offering regular training sessions, staff can stay updated on system functionalities and learn about new features or updates. Tailoring training programs to address specific needs identified during system usage enhances their relevance and effectiveness. This approach not only improves staff competency in using EMIS but also increases their confidence and efficiency in handling various tasks, ultimately contributing to better EMIS outcomes.

**Ensure Proper Functioning of Technology Infrastructure:**

Ensuring the proper functioning of technology infrastructure is essential for optimal EMIS performance. Resolving LAN issues promptly is crucial to maintaining uninterrupted connectivity, enabling seamless data transmission and access. Regular maintenance of computer systems is necessary to prevent breakdowns and ensure consistent performance. Investing in upgrading infrastructure to meet evolving technological needs enhances system reliability and efficiency. By prioritizing these measures, organizations can mitigate potential disruptions and ensure the smooth operation of the EMIS, thereby supporting data accuracy and user satisfaction

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